Imports and Labour Market Imperfections: Firm-Level Evidence from France*

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Abstract

This paper examines the presence of labour market imperfections in France, that lead to market power on the side of either firms or their workforce, and investigates the role of import competition as a possible discipline device. Using information on a large panel of French manufacturing firms, we find that Chinese competition lowers the positive gap between actual wages and the level that would prevail under perfect competition, thus strengthening firms' position. This adjustment does not take place via a fall in wages, but rather through an increase in productivity. Finally, import competition compresses price-cost margins and induces quality upgrading among French manufacturers.

Keywords: market power, labour market, market imperfections, China, import competition

JEL Classification: F14; F16; J42; L13

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1 Introduction

In recent years, the evolution of market power and concentration has been subject to intense scrutiny, triggering discussions that have moved beyond academic circles (The Economist 2018). We contribute to this debate by documenting the presence of imperfections in the French labour market, that lead to market power on the side of either firms or their workforce, and by investigating how they respond to international competition. To do so, we exploit information on a large panel of French manufacturing firms and use the emergence of China as a major exporter to assess the role of import competition as a possible discipline device that reduces market power.

Building on De Loecker & Warzynski (2012), Dobbelaere & Mairesse (2013) and Mertens (2019, 2020), we define labour market imperfections as the ratio between the average wage paid by each firm and the wage that would prevail under perfect competition (that is, the marginal revenue product of labour). Furthermore, we propose a decomposition of this ratio into four fundamental dimensions: observed wages, the price-cost margin, the marginal product of labour, and prices, and investigate the impact of foreign competition on market imperfections and their components. Thus, we document the channels through which Chinese imports affect labour market frictions in France. Importantly, the decomposition analysis is performed both in the presence or absence of direct information on firm-level prices and quantities.

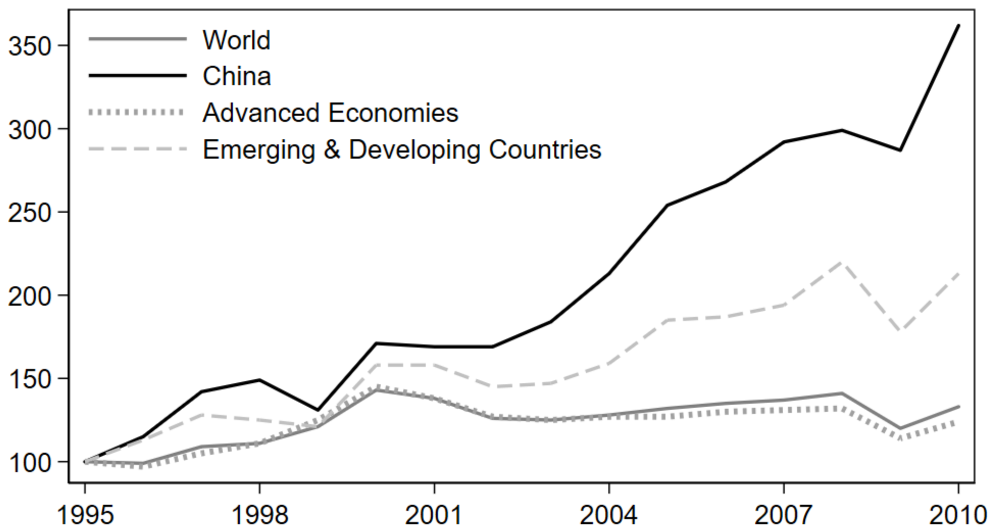
We find that Chinese competition acts as a discipline device as it reduces both markups and the wedge between observed and competitive wages. This impact is asymmetric though, as firms acting as monopsonists in the labour market do not experience a reduction in their market power. Importantly, the reduction in labour market imperfections does not operate through a fall in wages, but rather through an increase in labour productivity. Moreover, the fall in the gap between actual and competitive wages is stronger for firms having experienced a drop in markups in the previous year, pointing to a link between market power in the product and labour market, whereby shrinking margins are associated with an incentive not to match productivity increases with a proportional pay rise.

These findings are robust to different assumptions about labour in the estimation of the production function, as well as to accounting for firm-level price heterogeneity, the inclusion of additional control variables and the use of alternative measures of import competition. Results point towards a "virtuous" effect of international competition, which acts as a discipline device on the product market (reducing price-cost margins) and on the labour market (by forcing firms to increase labour productivity). Such conclusion is corroborated by evidence that Chinese competition triggers quality and total factor productivity upgrading, in line with analogous results by Fernandes & Paunov (2013) and Bloom et al. (2016).

The paper connects to a large number of studies that analyse the impact of globalisation on firms and workers. From a methodological point of view, the closest examples are two recent contributions that examine the effect of international trade on factor markets. Morlacco (2019) focuses on intermediate inputs and the presence of buyer power in international markets. She documents substantial monopsony power by French firms in foreign input markets, and shows that this leads to distortions in the domestic economy, such as lower output and productivity, and higher prices. On the other hand, Mertens (2020) studies the impact of trade shocks on the labour market using German firm-level data and finds that import competition from China only exerts market discipline when firms have monopsony power, a result that differs from our own findings about France.

We, too, use the emergence of China as a major player in world markets as our main shock to the competitive environment facing manufacturing firms. Figure 1 shows that while the ratio of French imports to GDP increased in the late 1990s and has remained substantially stable afterwards (alongside imports from advanced economies), imports from China have continued to soar, reaching values that are more than three times larger than those registered 20 years earlier. In fact, the increase in China's role as a major source of French imports comes after its entry into the WTO, a period during which Chinese imports grow much faster than imports from other emerging economies.

Figure 1: Evolution of Imports over GDP for France: Selected countries (1995–2010)



Authors' calculations based on data from the IMF World Economic Outlook Database and Direction of Trade Statistics.

The rise of China and its impact on OECD firms and workers has attracted a lot of attention in the past two decades, adding to a large literature that has investigated the labour market outcome of globalisation and trade integration. By and large, these studies find that import competition lowers wages, employment, and the bargaining power of workers, although differences in methodologies, geographic coverage, units of analysis and time periods make results not always easy to compare. If we restrict our attention to papers using French data, Malgouyres (2017) shows that Chinese competition lowers the level of employment and wages, especially for unskilled workers in nontraded sectors, while Carluccio et al. (2015) find that firms with collective bargaining agreements display higher elasticity of wages with respect to export and offshoring, so that decentralized bargaining enhances rent sharing between firms and workers. Looking at Belgium, which has labour-market characteristics similar to France, Abraham et al. (2009) show that import competition puts pressure on both markups and union bargaining power, implying that globalisation acts as discipline device on both the output and the labour market, while Mion & Zhu (2013) find that Chinese competition reduces firm employment growth and induces skill upgrading in low-tech manufacturing industries. These findings resonate with our own results, as they suggest a link between market power in the output and labour markets, as well as a push towards skill acquisition and upgrading to escape competition.

The paper offers several contributions to the existing literature. First, it documents the presence of substantial firm-level heterogeneity in the degree of imperfections and market power in the French labour market, above and beyond what is explained by industry-level structural features. Second, to the best of our knowledge, this study is the first to decompose labour market imperfections into four fundamental building blocks and to examine the channels through which the pro-competitive effect of Chinese imports operates. Moreover, the decomposition establishes a link between market power in the output and in the labour market, showing that a fall in markups is associated with a lower gap between observed and competitive wages. Last, the empirical analysis indicates that within-firm adjustment to foreign competition mainly operates through productivity and quality upgrading, rather than through a reduction in employment or wages.

The remainder of the paper is organised as follows. Section 2 describes the analytical framework, the empirical strategy and the data used in the analysis. The main results are presented in Section 3. Section 4 envisages the impact of Chinese competition to other firms characteristics such as the level of employment, total factor productivity and quality upgrading and provides a discussion of the main findings, while Section 5 concludes the paper.

2 Analytical Framework

2.1 Empirical Setting

In order to estimate the effects of Chinese competition on imperfections in the labour market, we use the following regression model:

$$\log(\phi_{it}) = \gamma_0 + \gamma_1 \text{Imp}^{Chn}_{i,t-1} + \nu_i + \rho_{kt} + e_{it}. \tag{1}$$

Here ϕ_{it} is a measure of labour market imperfections for firm i at year t, and $\text{Imp}^{Chn}_{i,t-1}$ represents import competition from China. The regression includes firm (ν_i) and sector-year (ρ_{kt}) fixed effects to account for idiosyncratic differences across firms and for possible shocks common to all companies operating in the same industry. In what follows, we first define the dependent variable ϕ_{it} and decompose it into four factors, then show how to calculate the explanatory variable $\text{Imp}^{Chn}_{i,t-1}$.

Following Mertens (2019, 2020), we define our measure of labour market imperfections as the ratio between the observed wage P^L_{it} and the competitive wage, which corresponds to the marginal revenue product of labour MRP^L_{it}. Hence, ϕ_{it} measures the wedge between the cost of an additional unit of labour and the revenue it generates (both in nominal terms). If $\phi_{it} = 1$, then the labour market is competitive, whereas any departure from unity signals frictions stemming from the existence of monopsony power by firms (resulting in $\phi_{it} < 1$) or some degree of market power by workers ($\phi_{it} > 1$) due to the existence of hiring and firing costs, of a minimum wage, unionisation or other factors that lead the actual wage to exceed the competitive benchmark given by MRP_{it}^L.

The measure of labour market imperfection ϕ_{it} can be decomposed into four fundamental dimensions: observed wages, the price-cost margin, the marginal product of labour, and prices. To see this, notice that MRP_{it}^L is the marginal product of labour MP_{it}^L multiplied by the marginal revenue MR_{it}. Given that, in equilibrium, the latter equals marginal costs ($MR_{it} = MC_{it}$), and exploiting the definition of the markup as the ratio between price and marginal cost ($\mu_{it} = {}^{P_{it}}/_{MC_{it}}$), it is straightforward to show that ϕ_{it} can be written as (see Appendix A for details):

$$\phi_{it} = \frac{P_{it}^L}{MRP_{it}^L} = \frac{P_{it}^L \cdot \mu_{it}}{P_{it} \cdot MP_{it}^L}, \tag{2}$$

where P_{it} denotes firm-year specific prices on the product market. Exploiting equation (2), one can thus examine various channels through which import competition affects labour market imperfections.

To estimate ϕ_{it} we exploit the definition of $MP_{it}^L = \theta_{it}^L \cdot \frac{Q_{it}}{L_{it}}$, with θ_{it}^L being the output elasticity of labour, Q_{it} the quantity produced and L_{it} the amount of labour employed, to write:

$$\phi_{it} = \frac{\mu_{it}}{\theta_{it}^L} \frac{P_{it}^L L_{it}}{P_{it} Q_{it}} = \mu_{it} \frac{\alpha_{it}^L}{\theta_{it}^L}, \tag{3}$$

where α_{it}^L represents the revenue share of labour. Finally, the markup μ_{it} is obtained following De Loecker & Warzynski (2012), who show that the price-cost margin can be written as

$$\mu_{it} = \frac{\theta_{it}^M}{\alpha_{it}^M}, \tag{4}$$

with θ_{it}^M and α_{it}^M being the output elasticity and revenue share of intermediate materials (see Appendix A for the complete derivation). We can now express labour market imperfections as:

$$\phi_{it} = \frac{\theta_{it}^M / \alpha_{it}^M}{\theta_{it}^L / \alpha_{it}^L}. \tag{5}$$

The assumptions behind equation (5) are fairly simple, and imply that firms minimise variable costs and are price takers in the market for intermediate inputs, which are treated as a static input and the competitive benchmark.[1] Importantly, no specific assumption is required for labour, which can be modelled either as a flexible input, albeit not fully flexible, or as quasi-fixed, like capital.[2]

[1] Throughout the paper we use the terms materials and intermediate inputs as synonyms.

[2] Note that it is not necessary to consider labour as a fully flexible input. Rather, it is sufficient that it is treated as a variable cost by firms, which are able to adjust the labour input each period (e.g., via a change in hours worked, or using fixed term contracts), although the choice is made before the productivity shock arrives and thus before the quantity of intermediate inputs is defined. See Section 3 (Robustness check I) for a discussion, while

In order to compute ϕ_{it}, it is thus necessary to estimate the output elasticities of materials and labour (θ_{it}^M and θ_{it}^L), while the corresponding revenue shares (α_{it}^M and α_{it}^L) can be derived directly from standard firm-level data.[3] Recovering output elasticities requires the estimation of a production function, which we model as a translog. The estimation is complicated by the correlation of the static inputs with productivity, which is known by the entrepreneur but not by the econometrician. The resulting endogeneity of inputs yields inconsistent estimates of the production function parameters. To overcome this well-known issue, we use the control function approach originally developed by Olley & Pakes (1996) and extended by Levinsohn & Petrin (2003) and Ackerberg et al. (2015). Among the different estimators that are available, we follow the procedure derived by Wooldridge (2009) and implemented by Petrin & Levinsohn (2012). This approach uses intermediate inputs to control for unobserved productivity shocks and addresses endogeneity by introducing lagged values of specific inputs as proxies for productivity.[4]

When it comes to decomposing ϕ_{it} into its components, absent direct information on firm-level prices and quantities, the terms P_{it} and MP_{it}^L in equation (2) are not available. The workaround, which we adopt in our baseline analysis, is to deflate revenues ($Q_{it}P_{it}$) by means of an industry price index (P_t^D) and use them as a proxy for physical output. The drawback is that in this case it is no longer possible to separately identify productivity and price effects. To see this, let us define the *value* of the marginal product of labour as

$$PMP_{it}^L = \theta_{it}^L \frac{Q_{it}}{L_{it}} \frac{P_{it}}{P_t^D} = MP_{it}^L \frac{P_{it}}{P_t^D}. \tag{6}$$

Substituting for $P_{it} \cdot MP_{it}^L$ in equation (2) yields

$$\phi_{it} = \frac{P_{it}^L \cdot \mu_{it}}{PMP_{it}^L \cdot P_t^D}, \tag{7}$$

in which all the elements of equation (7) are now measurable.

Taking logs of equation (7) yields a simple linear expression that decomposes $\log(\phi_{it})$ into four additive terms:

$$\log(\phi_{it}) = \log(P_{it}^L) + \log(\mu_{it}) - \log(PMP_{it}^L) - \log(P_t^D). \tag{8}$$

In our baseline analysis, we exploit equation (8) to examine the contribution of the various components of ϕ_{it} in determining the overall effect of import competition on labour market imperfections. In a robustness check, we proxy for firm prices using export unit values and are able to separately identify the impact of P_{it} and MP_{it}^L on ϕ_{it}.[5]

Appendix A provides a full derivation of labour market imperfections in the case labour is treated as a flexible input.

[3] As detailed in Appendix B.1, in our estimation procedure, the revenue shares are adjusted to screen out the pure error term in output and markups.

[4] Further details on the production function estimation can be found in Appendix B.

[5] In this case, having proxies for firm-level prices and quantities, we rely on the log-linear decomposition of equation (2) that reads as $\log(\phi_{it}) = \log(P_{it}^L) + \log(\mu_{it}) - \log(MP_{it}^L) - \log(P_{it})$. Appendix B.2 provides the details

Our main explanatory variable is Chinese import competition (Imp^{Chn}). We measure it using the lagged import share for China and compute it at the firm-year level by making use of firm sales by industry at the four-digit ISIC level that are available in our data:

$$\text{Imp}_{it}^{Chn} = \sum_k \left(\frac{S_{ikt_0}}{S_{it_0}} \cdot \frac{IM_{kt}^{Chn}}{IM_{kt}} \right), \tag{9}$$

where k identifies all the different industrial sectors in which firm i is active, S_{ikt_0} represents their individual sales in 1994 (the year before our analysis starts, or in the first year in which the firm enters the sample), S_{it_0} are total sales of firm i in the same year (across all sectors), IM_{kt}^{Chn} denotes imports from China in sector k at time t, while IM_{kt} corresponds to imports from all countries.

Hence, the import competition measure features firm-level heterogeneity that comes from the portfolio of activities of each firm (defined before the analysis starts), whereas its variation over time depends on industry-level import shares. Regarding the portfolio of products, lumping together imports of intermediate and final goods may be problematic. Indeed, importing intermediate goods may actually be beneficial to French firms since they source inputs at lower prices. Hence, we only consider final goods (as identified in the BEC classification, plus passenger cars) in our measure of imports, even if this may imply that we are missing the impact of foreign competition on French producers of intermediate inputs.[6]

In order to correctly identify the effect of Chinese competition on labour market imperfections, we need to take into account other potential channels through which imports may be correlated with market imperfections. For instance, a negative supply shock to French firms may lead to both an adverse effect on ϕ, as profits shrink and firms are less willing to share part of them with workers, and to an increase in imports replacing French products. Alternatively, French firms may decide which goods to manufacture based on the competitive pressure they face from China. In both cases, we would have an issue of endogeneity. To account for this, we make use of fixed weights based on firms' initial product mix in equation (9) and a lagged measure of Chinese import share in our baseline estimating equation (1).

In all these cases, OLS estimates would be downward biased as there is a negative correlation between labour market imperfections and our measure of Chinese import competition. Thus, in order to address such endogeneity issues caused by omitted variables, we follow the recent identification strategy developed by Autor et al. (2013) and later applied at the firm level by Caselli et al. (2018) and Caselli & Schiavo (2020). This strategy is based on a shift-share instrumental variable (IV) approach. The construction of the instrument combines industry-level exports from China to seven countries outside the eurozone (to avoid common shocks driven

of our procedure. In a nutshell, we exploit detailed information on export unit values to derive a firm-level price index for the subsample of exporters.

[6] We check for the robustness of results when we simultaneously introduce import penetration for consumption and non-consumption goods.

by the exchange rate and deep integration), with the firm-level fixed weights used to construct the Chinese import share, which represent the portfolio of activities for each manufacturing firm.[7] This approach is meant to capture the exogenous and "supply-driven" component of the rise in Chinese imports determined, for instance, by the lowering of multilateral trade barriers (as China was admitted to the WTO at the end of 2001) or by the increase in Chinese firms' productivity.[8]

2.2 Data Description

We use data on a large panel of French manufacturing firms covering the period 1994–2007. The information comes from an annual survey of companies (*EAE*) led by the statistical department of the French Ministry of Industry. The survey covers all firms with at least 20 employees in the manufacturing sectors (excluding food and beverages), and the data provide information about their income statement and balance sheet, from which we retrieve data regarding sales (corrected for stock variations), value added, labour costs, the number of employees and hours worked, capital stock, investment, and intermediate inputs. Rather than using the book value of the capital stock in the estimation of the production function, we compute it using the perpetual inventory method combining pre-sample information on the book value of capital, the book value of tangible investment, and industry-specific depreciation rates.

The EAE also reports some details about the different activities performed by firms; specifically, it provides us with a list of the 4-digit industry codes in which each firm is active, together with the corresponding number of employees, sales and exports. We use this information to derive the relative importance of each activity within the firm; by linking these weights to data on imports retrieved from the CEPII-BACI dataset (Gaulier & Zignago 2010), we obtain a firm-specific measure of import competition. Since trade data are reported according to the HS classification, whereas the EAE is based on the French industrial classification system (NAF), we develop a crosswalk between HS and NAF codes that works through CPA (Classification of Products by Activity) and NACE.[9]

Because we do not observe prices in the EAE data, we have to rely on industry-wide deflators and thus cannot control for firm-level price heterogeneity (De Loecker et al. 2016).[10] If the pass-through of factor prices into output prices is not complete, this may generate bias in the estimation of the production function, both in terms of productivity, and in terms of estimated elasticities. To check the robustness of our results, we exploit detailed information on export activities of French firms collected by French Customs. These data contain information on the

[7]The countries included in the instrument group are Australia, Canada, Japan, New Zealand, Norway, Switzerland and the UK.

[8]It should be noted that some papers have lately questioned the assumptions needed for the validity of shift-share instruments (Adão et al. 2018, Borusyak et al. 2018). Such criticisms highlight that the way in which such instrument aggregates the different industries may be problematic if it assigns too much weight on specific industries. As the French manufacturing sector is composed of hundreds of four-digit sectors, these criticisms are less likely to be relevant for applications at the firm level, such as the current one, than in studies using data at higher levels of aggregation, such as sectors and local labour markets.

[9]First we move from HS(1992) to HS(2007), then use CPA(2008) to link trade data to NACE(rev.2), which corresponds to NAF(rev.2). Then we use NAF concordances to link back to NAF(1993).

[10]Labour is measured in physical units (hours worked) and thus is not subject to this problem.

Table 1: Descriptive Statistics for Firms on the *EAE* Sample

	mean	std. dev	p_1	p_{25}	p_{50}	p_{75}	p_{99}
revenues*	27,234	323,666	869	3,029	5,690	13,741	326,958
employees	157	822	20	34	50	113	1,670
hours worked†	250	1,283	32	55	81	181	2,688
capital*	9,111	135,905	68	551	1,273	3,606	117,793
materials*	18,288	258,491	164	1,598	3,425	8,718	219,702
capital per employee*	35	44	2	12	23	42	204
average hourly cost per employee+	20.53	6.51	9.49	16.13	19.48	23.73	41.69
imports from China#	4.93	8.17	0.00	0.00	0.12	6.93	34.48

The statistics refer to the final sample used in the regression analysis; the number of observations is 141,710.
p stands for percentile.
* In thousands constant euros (Base year: 2000).
+ In constant euros (Base year: 2000).
† In thousands.
# In percentages.

value and quantity of each product (defined at the 8-digit Combined Nomenclature) exported by French firms to all destinations (see Bergounhon et al. 2018, for a detailed description of the dataset). Hence, we derive, for the subsample of exporting firms, a firm-level price index based on the unit values of exported products (see Appendix B for details). The same data are also used to compute a measure of product quality (see Appendix D for details) for exporting firms, which is employed in the empirical analysis to link Chinese competition, imperfections in the labour market, and firms' strategy.

2.3 Descriptive Statistics

In the following section, we provide some descriptive statistics for our main data sources and our estimates of the production function and market imperfections. Table 1 shows mean, standard deviation and specific percentiles (including median) for several firm-level variables.

The firms in our sample are of medium-to-large size (the average number of employees is 157), but there is a large degree of heterogeneity in all the relevant variables. More important for our empirical strategy is the substantial variability in the exposure to Chinese competition experienced by French firms. The average value of 4.93% masks substantial firm-level variation, with values ranging from zero to almost 35%.

Table 2 presents the average revenue shares for labour L and materials M. It also reports estimated output elasticities from a translog production function by two-digit industry, using the Wooldridge (2009) methodology. The estimation sample contains 141,000 observations pertaining to more than 17,000 manufacturing firms with at least 20 employees. The factor shares conform to the usual manufacturing characteristics that materials represent most of the costs (61% of total sales for all manufacturing), whereas labour costs represent on average one-third of total sales (34% for all manufacturing). The estimated factor elasticities $\hat{\theta}_{it}^{M}$ and $\hat{\theta}_{it}^{L}$ amount to 0.67 and 0.26, respectively. Overall, manufacturing firms operate near constant returns to scale, as the sum of factor elasticities $\hat{\lambda} = 0.985$.

There is substantial heterogeneity across industries in the parameter estimates. The average capital elasticity $\hat{\theta}_{it}^{K}$ ranges between 0.02 in *Printing and publishing* to 0.09 in *Mineral industries*. These values are both reasonable and in line with the existing literature (De Loecker et al. 2016, Caselli et al. 2017). The values for $\hat{\theta}_{it}^{M}$ range between 0.55 (*Clothing and footwear*) and 0.85 (*Pharmaceuticals*), $\hat{\theta}_{it}^{L}$ takes values ranging between a minimum of 0.16 (*Pharmaceuticals*) and a maximum of 0.39 (*Clothing and footwear*). Returns to scale are very close to unity for most of the sectors, with values ranging between 0.96 (*Automobile* and *Metallurgy, iron & steel*) and 1.05 (*Pharmaceuticals*).

Table 2 also reports mean values of the two market imperfections parameters of interest, $\hat{\mu}$ and $\hat{\phi}$, for the whole manufacturing sector and by two-digit industry. The average markup is 13.4%, in line with results by Dobbelaere & Mairesse (2013) and Bellone et al. (2016), who report 15% and 14.8% respectively, with large differences across industries and within them. The *Textile* and *Automobile* industries exhibit the lowest average values (4.3% and 6.5%, respectively), whereas at the other end of the spectrum, *Pharmaceuticals* features a markup amounting to 30%. As for labour market imperfections, observed hourly wages exceed competitive wages by 56.4% on average. With an average value of 1.299, *Textile* displays the lowest ratio, whereas observed wages in *Pharmaceuticals* amount to more than twice competitive wages ($\hat{\phi} = 2.028$). These sharp cross-sectoral differences primarily reflect heterogeneity in the skill composition of labour.[11]

Finally, Figure 2 displays the evolution of labour market imperfections between 1995 and 2007. The solid, black line displayed in both panels shows the dynamics of the average values of ϕ_{it} weighted by firms' employment shares. We observe an 18% overall growth in ϕ in the sample period, although this increase stagnates after 2004. In the left panel, we decompose the dynamics of labour market imperfections according to whether these variations occur within or between firm. Applying Foster et al.'s (2001) decomposition (henceforth FHK decomposition[12]), we divide the overall growth into four different components: (i) within-firm changes in the labour market imperfections; (ii) between-firm changes in firms' employment share, capturing a composition effect; (iii) the effect of new firms in the industry; and (iv) the impact of firm exit. The key finding is that the within component, which grows by over 20%, drives the overall growth in ϕ_{it}, whereas the between-firm effect has a negative contribution. The effect of firm churning, whether entering or exiting the market, is substantially more limited.

The right panel of Figure 2 decomposes the overall dynamics of (the log of) ϕ into the evolution of each of its components P^{L}, μ, PMP_{L} and P^{D}, as per equation (8). The main message from the figure is that the post-2001 increase in labour market imperfections is driven by a 30% increase in nominal wages. Although substantial, this corresponds to a 7.3% increase in real wages when deflated by the consumer price index and is consistent with Amar et al. (2009). The dynamics of markups conform to Bellone et al. (2016), and exhibit an overall decrease in firm market power. This is consistent with the introduction of the euro in 1999 and the entry of China in the WTO in 2001 having a pro-competitive effect on French firms. The rise in

[11] In Appendix C we describe how to classify observations into different labour market regimes. Table C1 indicates the presence of substantial heterogeneity within sectors.

[12] Appendix E presents the details of the decomposition applied to the log-transformed value of ϕ_{it}.

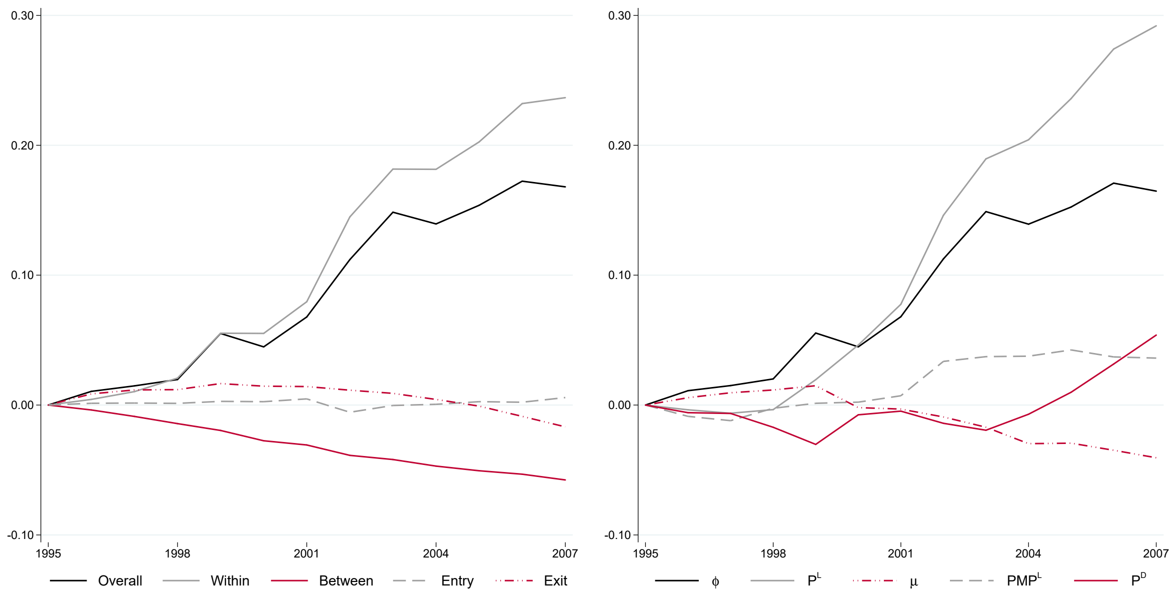
Table 2: Factor shares and output elasticities by sector

			shares		output elasticities			scale	imperfections	
Industry	#obs.	#firms	α^L	α^M	$\hat{\theta}^K$	$\hat{\theta}^L$	$\hat{\theta}^M$	$\hat{\lambda}$	$\hat{\mu}$	$\hat{\phi}$
All manufacturing	141,710	17,275	0.337	0.605	0.056	0.258	0.671	0.985	1.134	1.564
Automobile	4,359	516	0.263	0.699	0.052	0.187	0.719	0.958	1.043	1.492
Chemicals	16,296	1,938	0.266	0.674	0.081	0.189	0.721	0.990	1.088	1.568
Clothing & footwear	7,889	1,147	0.491	0.472	0.048	0.393	0.547	0.987	1.236	1.695
Electric & electronic comp.	6,391	769	0.332	0.608	0.060	0.226	0.700	0.986	1.169	1.849
Electric & electronic eq.	7,784	965	0.374	0.576	0.026	0.260	0.687	0.973	1.218	1.851
House eq. & furnishings	9,650	1,210	0.342	0.627	0.037	0.237	0.736	1.010	1.202	1.817
Machinery & mechanical eq.	26,414	3,150	0.339	0.607	0.046	0.271	0.666	0.984	1.105	1.481
Metallurgy, iron & steel	20,998	2,467	0.363	0.566	0.075	0.277	0.606	0.958	1.098	1.454
Mineral industries	6,500	787	0.322	0.621	0.086	0.252	0.654	0.992	1.078	1.435
Pharmaceuticals	3,493	445	0.241	0.670	0.049	0.158	0.848	1.054	1.303	2.028
Printing & publishing	12,298	1,433	0.348	0.573	0.022	0.272	0.708	1.003	1.261	1.637
Textile	8,191	1,039	0.345	0.593	0.066	0.289	0.614	0.969	1.065	1.299
Transportation machinery	2,262	272	0.343	0.602	0.079	0.288	0.637	1.004	1.086	1.367
Wood & paper	9,185	1,137	0.285	0.657	0.062	0.245	0.683	0.990	1.047	1.361

All estimations executed by industry. $\hat{\mu}$ is the estimated price-cost margin; $\hat{\phi}$ is the ratio between observed and competitive wages: $\phi = P^L/MRP^L$.

PMP_L, the value of the marginal product of labour, combines various aspects ranging from skill upgrading by firms, mere technical change and the decrease in the overall manufacturing labour force.

Figure 2: Decomposition of the evolution of the labour market imperfections parameter ϕ and its main components (1995 = 0).



The left panel displays the FHK decomposition of the aggregate labour market imperfections parameter Φ. The right panel decomposes Φ into its components P^L, μ, PMP_L and P^D. See Appendix E for details.

3 Results

Table 3 reports the results from the estimation of our baseline specification (1) with the labour market imperfections parameter, ϕ_{it}, and its components, μ_{it}^M, PMP_{it}^L and P_{it}^L, as dependent variables.[13] The table reports both the fixed effects (FE) and the fixed effects with instrumental variable (FE-IV) estimates. All standard errors are clustered at the firm level.

The results exhibit a negative association between Chinese import competition on the product market and labour market imperfections ϕ_{it}. This decrease in ϕ_{it} implies a shift of labour market power away from workers and towards firms. The point estimates differ across specifications, increasing markedly in the IV regressions. The larger coefficient is in line with the rest of the literature using similar instruments and suggests that endogeneity issues caused by omitted variables bias, in particular due to the unobserved supply and demand factors mentioned earlier, are relevant and lead to lower OLS estimates in this case. Given that the Kleibergen-Paap

[13]As we do not directly observe firm-level prices and P_t^D does not vary across firms within an industry, the price component of ϕ_{it} is missing from our baseline regressions. Below, we provide a robustness check that takes into account the potential presence of firm-level prices, not only in the production function estimation, but also in the decomposition of ϕ_{it}.

Table 3: Import Competition and Market Imperfections

	$\log(\phi_{it})$		$\log(\mu_{it})$		$\log(PMP_{it}^L)$		$\log(P_{it}^L)$	
	FE	FE-IV	FE	FE-IV	FE	FE-IV	FE	FE-IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\text{Imp}_{i,t-1}^{Chn}$	-0.062*	-0.170***	0.003	-0.049**	0.089***	0.172***	-0.019	-0.002
	(0.033)	(0.056)	(0.016)	(0.024)	(0.021)	(0.034)	(0.028)	(0.048)
Observations	141,710	141,710	141,710	141,710	141,710	141,710	141,710	141,710
F stat. (2nd stage)	3.486	9.281	0.024	4.235	18.855	25.330	0.453	0.003
Kleibergen-Paap		4,739		4,739		4,739		4,739

All regressions include firm and sector-year fixed effects. Standard errors clustered at the firm-level in parentheses. Significance: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$. The F stat. (2nd stage) tests the joint significance of regressors in the FE regressions and the joint significance of regressors in the second stage in the FE-IV regressions. The endogenous variable $\text{Imp}_{i,t-1}^{Chn}$ is instrumented using total imports from China by seven countries outside the eurozone (Australia, Canada, Japan, New Zealand, Norway, Switzerland and the UK). The critical value for the Kleibergen-Paap statistic based on the Stock-Yogo weak instrument test with a size distortion of maximum 5% and one just-identified endogenous variable is 16.38.

statistic is much larger than the relevant Stock-Yogo weak instrument test critical values (16.38 for a size distortion of maximum 5%), suggesting that our IV approach is highly informative, we focus on the IV estimates in the remainder of the analysis.

In order to understand the mechanisms behind this decrease in the labour market imperfections parameter, we examine the effect of imports on each component, namely firm markups, the value of the marginal product of labour, and observed wages. In line with previous literature on French firms (Caselli & Schiavo 2020), we find a negative and statistically significant effect of Chinese import competition on product market power.[14] This effect is consistent with the decrease in worker-side labour market power due to the decrease in labour market imperfections. Indeed, fiercer foreign competition renders domestic firms less profitable, lowering the rent that is available to be shared with employees.

Another important component that helps to explain the decrease in worker-side labour market power is the value of the marginal product of labour. We find that an increase in Chinese import competition is associated with a rise in PMP^L. Although we cannot distinguish between price and productivity effects, this positive effect implies that the value of workers' production goes up, which leads to an increase in their competitive wage. However, we find no effect of Chinese import competition on workers' wages, a sign that the rise in PMP^L does not translate into higher compensations. Thus, the increase in Chinese competition puts pressure on workers not via lower wages, but rather by increasing the value of labour productivity. Given that margins are squeezed, at least part of the effect is likely to come from higher physical productivity. Indeed in Table 6 below we provide evidence supporting the notion that the effect on PMP^L occurs not through output prices, but rather via adjustments in productivity.

Based on the results from Table 3, a four-percentage-point increase in the Chinese import share, approximately equal to the change observed during the sample period, decreases ϕ_{it} by

[14] This result is also consistent with other contributions looking at the relationship between foreign competition and markups in other countries. See, for example, Abraham et al. (2009, for Belgium), Boulhol et al. (2011, for the UK), or Moreno & Rodriguez (2011, for Spain).

Table 4: Baseline regressions by labour market regime

	$EB_{t-1} = 1$				$MO_{t-1} = 1$			
	$\log(\phi_{it})$	$\log(\mu_{it})$	$\log(PMP^L_{it})$	$\log(P^L_{it})$	$\log(\phi_{it})$	$\log(\mu_{it})$	$\log(PMP^L_{it})$	$\log(P^L_{it})$
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\text{Imp}^{Chn}_{i,t-1}$	-0.153***	-0.068**	0.157***	0.002	0.006	0.136	0.205	0.141
	(0.057)	(0.027)	(0.035)	(0.051)	(0.224)	(0.108)	(0.149)	(0.239)
Observations	116,900	116,900	116,900	116,900	4,866	4,866	4,866	4,866
F stat. (2nd stage)	7.234	6.564	20.16	0.002	<0.001	1.589	1.883	0.350
Kleibergen-Paap	3,890	3,890	3,890	3,890	275.2	275.2	275.2	275.2

Fixed effect IV specifications including firm and sector-year fixed effects. Standard errors clustered at the firm-level in parentheses. Significance: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$. The F stat. (2nd stage) tests the joint significance of regressors in the second stage. The endogenous variable $\text{Imp}^{Chn}_{i,t-1}$ is instrumented using total imports from China by seven countries outside the eurozone (Australia, Canada, Japan, New Zealand, Norway, Switzerland and the UK). The critical value for the Kleibergen-Paap statistic based on the Stock-Yogo weak instrument test with a size distortion of maximum 5% and one just-identified endogenous variable is 16.38. EB: efficient bargaining firms. MO: monopsonist firms. (Cols 1–4) $EB_{t-1} = 1$, i.e. $\hat{\phi}_{it}$ significantly > 1. (Cols 5–8) $MO_{t-1} = 1$, i.e. $\hat{\phi}_{it}$ significantly < 1. See Appendix C for an explanation of the classification strategy.

0.7%. Given the definition of ϕ_{it} as the wedge between wages and the marginal revenue product of labour, this value also represents the decrease in wages relative to the competitive wage due to the increase in Chinese competition. Back of the envelope computations based on average wages and hours worked imply a forgone gain of around 265 euros per worker/year due to uncompensated increases in PMP^L. In terms of Figure 2, these results imply that, absent any change in the Chinese import share, the black solid line representing the aggregate labour market imperfection would be slightly higher than what we actually observe.

Table 4 displays results by discriminating among firms enjoying monopsony power (or MO firms, where $\phi_{it} < 1$) and those paying wages above their competitive level (Efficient Bargaining firms, or EB, as defined by Dobbelaere & Mairesse 2013, where $\phi_{it} > 1$). Efficient bargaining concerns the vast majority of firms (83.8%) in the sample, as documented in Table C1 of Appendix C. Table 4 shows that the effect of import penetration on labour market frictions is highly asymmetric. Chinese competition lowers ϕ for EB firms only, suggesting that the role of imports as a discipline device only works when workers have market power. Chinese competition puts pressure on firms to edge down the gap between actual and competitive wages. This result differs from the one reported by Mertens (2020), who finds that, in the case of Germany, Chinese competition exacerbates distortions only for EB firms. Interestingly, the result carries over to μ and PMP^L as well, suggesting that most of the action documented in Table 3 takes place in the case of firms paying wages above the competitive level, whereas monopsonists experience no significant effect.

Next, we discuss additional regressions, in which we check the robustness of the baseline results. First, we explore the sensitivity of our results under the assumption that labour is a quasi-fixed input. This assumption has important implications for the estimation of the production function. Recall that in the baseline specification, we assume that labour is a flexible input and, thus, part of firms' variable costs. This does not mean that labour is *fully* flexible. Following Ackerberg et al. (2015), labour is chosen *some time* between $t - 1$ (the time in which quasi-fixed inputs, such as capital, are chosen), and t (the time in which productivity shocks occur and fully flexible inputs, such as materials, are chosen). This makes labour "less flexible" than materials, without making it a quasi-fixed input. The assumption behind the timing of the inputs is reflected in the estimation procedure of the production function and, in particular, the information set used to proxy for productivity and the set of instrumental variables included in the estimation (see Appendix B.1).[15]

Table 5: Robustness check I. Regressions based on production function estimates considering labour as a quasi-fixed factor

	$\log(\phi_{it})$ (1)	$\log(\mu_{it})$ (2)	$\log(PMP^L_{it})$ (3)	$\log(P^L_{it})$ (4)
$\text{Imp}^{Chn}_{i,t-1}$	-0.167***	-0.050**	0.190***	0.014
	(0.057)	(0.024)	(0.037)	(0.048)
Observations	139,720	139,720	139,720	139,720
F stat. (2nd stage)	8.460	4.178	26.045	0.088
Kleibergen-Paap	4,627	4,627	4,627	4,627

All models are fixed effect instrumental variable (FE-IV) specifications, including firm and sector-year fixed effects. Standard errors clustered at the firm-level in parentheses. Significance: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$. The F stat. (2nd stage) tests the joint significance of regressors in the second stage. The endogenous variable $\text{Imp}^{Chn}_{i,t-1}$ is instrumented using total imports from China by seven countries outside the eurozone (Australia, Canada, Japan, New Zealand, Norway, Switzerland and the UK). The critical value for the Kleibergen-Paap statistic based on the Stock-Yogo weak instrument test with a size distortion of maximum 5% and one just-identified endogenous variable is 16.38.

Alternatively, it is possible to assume that labour is a quasi-fixed input, such as capital, and that it does not enter among firms' variable costs (Mertens 2019, 2020). In this case, labour is chosen at time $t-1$ and the estimation procedure of the production function needs to be adjusted as described in Appendix B.1. The advantage of this approach is that treating labour as predetermined is consistent with the presence of frictions in the labour market (such as hiring and firing costs), which result in worker-side labour market power. However, treating labour as exogenous excludes the possibility of accounting for endogeneity issues related to labour in the estimation of the production function. Indeed, it is harder to assume that hours worked are not flexible at all than to assume that they are partially adjusted.

Table 5 displays the results, which are strikingly similar to those where we assume labour to be flexible in the short run. Qualitatively, the signs and significance of all estimated coefficients are confirmed, meaning that higher Chinese import competition leads to a decrease in worker-side labour market power, in firms' product market power and an increase in the value of the marginal product of labour. Quantitatively, the coefficients display a magnitude very close to those found in Table 3. This shows that our results are robust to the different assumptions

[15] The advantage of treating labour as a flexible input is that it renders our estimation consistent with the most common procedures found in the literature. This implies that we consider the possibility of some form of endogeneity of labour in the production function, which is particularly important when the number of hours worked (typically more flexible than the number of workers) are used as the labour input, as in our case. In addition, our assumption regarding the flexibility of labour is also consistent with the presence of labour market frictions giving rise to worker-side market power because we still assume that labour is chosen before the productivity shock arises and, thus, before the fully flexible inputs are chosen.

Table 6: Robustness check II. Regressions based on production function estimates accounting for firm-level price heterogeneity

	$\log(\phi_{it})$ (1)	$\log(\mu_{it})$ (2)	$\log(MP_{it}^L)$ (3)	$\log(P_{it}^L)$ (4)	$\log(P_{it})$ (5)
$\text{Imp}_{i,t-1}^{Chn}$	-0.344**	-0.121**	0.593**	-0.024	-0.323
	(0.144)	(0.060)	(0.275)	(0.076)	(0.209)
Observations	42,685	42,685	42,685	42,685	42,685
F stat. (2nd stage)	5.699	4.085	4.643	0.100	2.391
Kleibergen-Paap	2,340	2,340	2,340	2,340	2,340

All models are fixed effect instrumental variable (FE-IV) specifications, including firm and sector-year fixed effects. Standard errors clustered at the firm-level in parentheses. Significance: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$. The F stat. (2nd stage) tests the joint significance of regressors in the second stage. The endogenous variable $\text{Imp}_{i,t-1}^{Chn}$ is instrumented using total imports from China by seven countries outside the eurozone (Australia, Canada, Japan, New Zealand, Norway, Switzerland and the UK). The critical value for the Kleibergen-Paap statistic based on the Stock-Yogo weak instrument test with a size distortion of maximum 5% and one just-identified endogenous variable is 16.38. We restrict the sample to firms that export at least 5% of their sales.

about the timing of labour.

Second, we check the robustness of our results controlling for unobserved firm-level prices (De Loecker et al. 2016). Indeed, the presence of unobserved input and output price heterogeneity may introduce yet another source of bias. If output prices vary by firm and they are correlated with firm inputs, such variation would be captured in the error term and the production function coefficients would be biased. This is likely to occur, for instance, if larger firms also tend to acquire better quality, and thus relatively higher-priced, inputs. While we lack direct information on firm-level prices, our data contain information on both values and quantities sold abroad by exporting firms. Following the methodology described in Appendix B.2, we construct a proxy for firm-level prices based on export unit values, assuming that they accurately reflect domestic prices, and exploit such data to address the problem of price heterogeneity. We restrict the sample used in the regression analysis to firms exporting more than 5% of their sales, in order to ensure that export unit values provide us with a more accurate representation of firm-specific prices.

Having a proxy for firm-level prices and quantities, we can separately identify the impact of Chinese competition on P_{it} and MP_{it}^L. In fact, we can refer back to equation (2) and write the corresponding log linear decomposition of ϕ_{it} as: $\log(\phi_{it}) = \log(P_{it}^L) + \log(\mu_{it}) - \log(MP_{it}^L) - \log(P_{it})$. Therefore, Table 6, which reports the results accounting for firm-level price heterogeneity, features an additional column displaying the effect of import competition on firm-level prices.

Due to the need of restricting the sample to exporters, the number of observations reduces greatly. Despite the lower number of observations, results in Table 6 confirm the patterns found in our baseline specification. Thus, an increase in Chinese import competition leads to an increase in firms' labour market power, a decrease in markups and an increase in workers' productivity, measured by their marginal product, while no significant effect is found for wages.

Because we now identify output prices, we can discriminate between productivity and price effects. The effect of import competition on firm prices is negative but not significant at standard confidence levels ($p-$value $= 0.122$). Therefore, the reaction of prices cannot explain the positive impact of Chinese imports on PMP^L we have presented in Table 3: if anything, prices move in the opposite direction. Table 6 thus strengthens the notion that Chinese competition affects labour market imperfections mainly through an increase in the marginal product of labour MP^L and, to a lesser extent, a decrease in price cost margins μ.

Table 7: Robustness check III. Inclusion of additional control variables

	$\log(\phi_{it})$ (1)	$\log(\mu_{it})$ (2)	$\log(PMP^L_{it})$ (3)	$\log(P^L_{it})$ (4)
$\text{Imp}^{Chn}_{i,t-1}$	-0.175***	-0.046*	0.175***	-0.007
	(0.056)	(0.024)	(0.034)	(0.048)
$\log(empl.)_{i,t-1}$	-0.051***	-0.006***	0.026***	-0.021***
	(0.004)	(0.002)	(0.003)	(0.003)
local empl. growth$_{t-1}$	0.002	0.004***	0.002	0.001
	(0.004)	(0.001)	(0.002)	(0.003)
$\log(K/L)_{i,t-1}$	-0.010***	0.006***	0.035***	0.019***
	(0.003)	(0.001)	(0.002)	(0.002)
share of labour$_{i,t-1}$	-0.001	0.001	0.002	0.001
	(0.004)	(0.002)	(0.003)	(0.004)
offshoring$_{i,t-1}$	0.006**	-0.002**	-0.016***	-0.009***
	(0.003)	(0.001)	(0.003)	(0.002)
$M^{Chn}_{i,t-1}$	0.007***	-0.002*	-0.003	0.002
	(0.003)	(0.001)	(0.002)	(0.002)
exp int$_{i,t-1}$	0.012*	0.005	-0.003	0.014***
	(0.007)	(0.003)	(0.004)	(0.005)
Observations	135,211	135,211	135,211	135,211
F stat. (2nd stage)	22.29	11.21	60.21	19.36
Kleibergen-Paap	4,563	4,563	4,563	4,563

All models are fixed effect instrumental variable (FE-IV) specifications, including firm and sector-year fixed effects. Standard errors clustered at the firm-level in parentheses. Significance: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$. The F stat. (2nd stage) tests the joint significance of regressors in the second stage. The endogenous variable $\text{Imp}^{Chn}_{i,t-1}$ is instrumented using total imports from China by seven countries outside the eurozone (Australia, Canada, Japan, New Zealand, Norway, Switzerland and the UK). The critical value for the Kleibergen-Paap statistic based on the Stock-Yogo weak instrument test with a size distortion of maximum 5% and one just-identified endogenous variable is 16.38. Employment growth is computed by local labour market area, the share of labour reflects the weight of the firm in the local labour market (by department and sector), offshoring is measured as imports of materials over labour costs, $M^{Chn}_{i,t-1}$ is an indicator that equals 1 if the firm imports intermediate goods from China.

An additional robustness check is to augment the baseline specification (1) with additional controls including lagged size in terms of employment (in logs); lagged capital intensity ($\ln(K/L)_{t-1}$) to control for the production technology; lagged offshoring activities measured as the ratio of imported material over total labour costs; a dummy variable set to unity if a firm imports intermediate goods from China, and zero otherwise; lagged export intensity measured as the share of exports in sales; lagged employment growth in the employment area; a measure of the firm's share in labour within its employment area and the two-digit sector. These last two variables control for local labour market conditions. The results are reported in Table 7.

Table 8: Robustness check IV. Regressions using different types of imports

Type of imports	$\log(\phi_{it})$ (1)	$\log(\mu_{it})$ (2)	$\log(PMP_{it}^L)$ (3)	$\log(P_{it}^L)$ (4)
Consumption	-0.132**	-0.042*	0.148***	0.011
	(0.058)	(0.025)	(0.036)	(0.050)
Non-Consumption	-0.374***	-0.088*	0.238***	-0.130
	(0.129)	(0.049)	(0.078)	(0.105)
Observations	141,709	141,709	141,709	141,709
F stat. (2nd stage)	8.981	4.019	16.73	0.782
Kleibergen-Paap	242.5	242.5	242.5	242.5
F-test (equal coeff.)	2.467	0.592	0.934	1.187
$p-$value	0.116	0.442	0.334	0.276

All models are fixed effect instrumental variable (FE-IV) specifications, including firm and sector-year fixed effects. Standard errors clustered at the firm-level in parentheses. Significance: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$. The F stat. (2nd stage) tests the joint significance of regressors in the second stage. The endogenous variables are instrumented using total imports (of consumption and non-consumption goods) from China by seven countries outside the eurozone (Australia, Canada, Japan, New Zealand, Norway, Switzerland and the UK). The critical value for the Kleibergen-Paap statistic based on the Stock-Yogo weak instrument test with a size distortion of maximum 5% and two just-identified endogenous variables is 7.03. The F-test for the equality of coefficients tests the null hypothesis that the coefficients on imports of Consumption and Non-Consumption goods are equal.

In terms of sign and overall statistical significance, the results remain unchanged compared to our baseline results. Hence, our findings are robust to the exclusion of the above regressors. Moreover, the point estimates are close and not statistically different from those in the baseline regressions in Table 3.

As for the control variables, capital intensity diminishes labour market imperfections and worker-side labour market power. This should be expected as the capital-labour ratio acts as a proxy for labour substitution with capital. Moreover, firms with higher capital-labour ratios exhibit higher markups, marginal product of labour and wages. Firm size is also associated with a smaller labour market imperfections parameter and, thus, lower worker-side labour market power. This seems surprising given that increased size often comes with more structured labour unions. However, the estimated effect is conditional on several other variables, which may also proxy firm size, such as capital-labour intensity and export intensity. On the other hand, importing intermediates from China, offshoring and export intensity are associated with greater labour market imperfections. In the case of export intensity, this is possibly due to the fact that exporting firms pay higher wages and, thus, feature a larger gap between actual wages and the competitive wage. In the case of importing intermediates from China and offshoring, this is due to firms exhibiting a lower marginal product of labour. Finally, there does not seem to be any significant relationships between labour market imperfections and firms' employment share within their employment areas and local employment growth.

Finally, we check the robustness of our results to the inclusion of an alternative measure of import competition, whereby we distinguish between consumption and non-consumption goods.[16] Results in Table 8 are in line with the baseline regressions; moreover, a test for the equality of the coefficients on the two types of imports cannot reject the null hypothesis, so that despite the different point estimates, imports of consumption and non-consumption goods have the same impact on labour market imperfections and their components.

4 Discussion

This Section takes stock of the previous results, namely that Chinese competition increases labour market discipline, and examines several potential explanations for the phenomenon.

To explore the link between market power in the product and labour market, the left panel of Table 9 distinguishes firms according to past changes in their markups, interacting the (lagged) import competition measure with a dummy variable taking value one if the firm had experienced a reduction in μ_{it} between $t-2$ and $t-1$. Column (1) of Table 9 shows that the impact of Chinese imports on labour market imperfections is much stronger for firms whose markups had gone down. Once again, we see that the effect does not occur through a reduction in wages, but rather via an increase in the value of labour productivity, that is stronger for firms facing pressure on their price-cost margins. In column (3), the test for equality of the coefficients corresponding to the two groups of firms rejects the null with a $p-$value$= 0.081$.

While not providing conclusive evidence about the direction of causality, these results confirm the existence of a complex interaction between product and labour market power. Whether lower profit margins trigger adjustments in productivity and compensations, or whether the direction of causality runs the other way is an open question: either way, Table 9 suggests that firms whose markups have declined feature a higher increase in labour productivity that is not matched by a corresponding pay rise. One way to interpret these results is that firms experiencing a compression in their markups due to foreign competition pass this effect on to their workers by increasing the marginal product of labour, thereby narrowing the gap between observed and competitive wages. An alternative reading is that import penetration induces firms to compete on quality (as shown in Table 10), leading to an upward adjustment in the marginal product of labour. However, Chinese competition limits the scope for price rises and forces firms to absorb part of the cost increase into lower markups and, at the same time, not to compensate workers for the productivity gains.

The analysis proceeds by discriminating firms on the basis of their internationalisation strategy, defining as "global" those firms that import intermediate inputs from China, and whose average export intensity over the sample period is above the 75^{th} percentile of the distribution (which implies exporting at least 25% of sales in our sample). Firms more heavily embedded in international trade (around 5% of the sample according to the above definition) may actually benefit from the rise of China (for example by purchasing materials from there) and thus react differently from the rest. Indeed, we observe that the labour market imperfections parameter

[16] To perform this exercise we re-estimate the production function including both measures of import competition in the control function, and thus re-compute the values of ϕ, μ and PMP^L used in the regression.

Table 9: Impact of Chinese competition by firm type

	markup declined between $(t-2)$ and $(t-1)$				global firms			
	$\log(\phi_{it})$ (1)	$\log(\mu_{it})$ (2)	$\log(PMP^L_{it})$ (3)	$\log(P^L_{it})$ (4)	$\log(\phi_{it})$ (5)	$\log(\mu_{it})$ (6)	$\log(PMP^L_{it})$ (7)	$\log(P^L_{it})$ (8)
$\text{Imp}^{Chn}_{i,t-1} \times \delta_i^{NO}$	-0.152**	-0.003	0.175***	-0.016	-0.205***	-0.052**	0.183***	-0.018
	(0.059)	(0.024)	(0.036)	(0.051)	(0.056)	(0.024)	(0.035)	(0.049)
$\text{Imp}^{Chn}_{i,t-1} \times \delta_i^{YES}$	-0.215***	-0.059**	0.191***	-0.013	0.000	-0.039	0.118***	0.073
	(0.059)	(0.025)	(0.036)	(0.051)	(0.067)	(0.030)	(0.043)	(0.054)
$\delta_i^{YES}(\Delta\mu_{i,t-2/t-1} < 0)$	-0.009***	-0.010***	0.002***	-0.001				
	(0.001)	(0.000)	(0.011)	(0.001)				
δ_i^{YES} (global firms)					-0.002	-0.002	-0.001	-0.002
					(0.005)	(0.002)	(0.003)	(0.003)
Observations	122,929	122,929	122,929	122,929	141,710	141,710	141,710	141,710
F stat. (2nd stage)	72.87	515.5	21.47	0.929	11.74	1.785	11.78	3.022
Kleibergen-Paap	2,138	2,138	2,138	2,138	2,457	2,457	2,457	2,457
F-test ($H_0 : \beta_{\delta^{NO}} = \beta_{\delta^{YES}}$)	13.55	67.90	3.040	0.043	18.19	0.342	4.281	7.036
$p-$value	< 0.001	0	0.081	0.836	< 0.001	0.559	0.039	0.008

All models are fixed effect instrumental variable (FE-IV) specifications, including firm and sector-year fixed effects. Standard errors clustered at the firm-level in parentheses. Significance: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$. The F stat. (2nd stage) tests the joint significance of regressors in the second stage. The endogenous variable $\text{Imp}^{Chn}_{i,t-1}$ is instrumented using total imports from China by seven countries outside the eurozone (Australia, Canada, Japan, New Zealand, Norway, Switzerland and the UK). The critical value for the Kleibergen-Paap statistic based on the Stock-Yogo weak instrument test with a size distortion of maximum 5% and two just-identified endogenous variables is 7.03. Variable δ_i^{YES} is an indicator variable taking value 1 when the firm has experienced a fall in its markup between $t-2$ and $t-1$ (Columns 1–4) or when its average export intensity across the sample period is in the top quartile and it imports intermediates from China (Columns 5-8), and 0 otherwise. Variable δ_i^{NO} is defined as the converse.

ϕ decreases significantly only for non-global firms. What is more, Chinese competition puts no downward pressure on the markups of global firms (in line with evidence presented by Caselli & Schiavo 2020), which also display a smaller increase in PMP^L. This further corroborates the presence of a strong link between product and labour market power as discussed above.

We interpret the results in Table 9 as discriminating between firms that benefit from globalisation and those that do not. On the one hand, we have firms forced to reduce their markups due to Chinese competition: they respond to this deterioration of market conditions by increasing labour productivity while keeping wages fixed, thus increasing efficiency, capturing more market power vis-à-vis their workers and demanding more from them (at the same wage). On the other hand, we have global firms that exploit the integration of world markets to their own advantage. Their internationalisation strategy shields them from a negative effect on price-cost margins, and this is reflected into no significant changes in labour market conditions as well. It is interesting to note that in column (8), concerning observed wages, the coefficients of the interaction terms have opposite signs and are statistically different one from another (although neither is significantly different from zero). This may conceal important heterogeneity between the two types of firms linked to changes in the composition of labour. Global firms focus their domestic production on high-value added activities, hence raising the skill composition of the workforce, whereas non-global companies are forced to compete on costs and efficiency grounds, and this reverberates on their workers. While this interpretation is highly stylized, it is consistent with the evidence presented by Mion & Zhu (2013) for Belgium.[17]

Next, we run our baseline specification (1) using three additional dependent variables, namely employment, total factor productivity and quality, that proxy for the strategies followed by French manufacturing firms when coping with Chinese competition (see Table 10). Results are presented for the baseline specification (1) (columns 1,4,7), including additional controls (columns 2,5,8), and also accounting for firm-level price heterogeneity in the production function (columns 3,6,9).

We start by looking at the effects on employment. Bearing in mind that: (i) the vast majority of firms in our sample are EB firms ($P^L > MRP^L$); (ii) there is no effect on wages, one could expect an effect on the level of employment within firms. This could happen if firms find it easier to reduce employment rather than renegotiate wage agreements, or if they exploit the threat of foreign competition to reorganise activities and shed workers. Thus, we estimate equation (1), using the number of employees (in logs) as the dependent variable, but find no significant effect. While apparently in contrast with the results in Malgouyres (2017), who finds a negative effect of foreign competition on employment in France, our results are based on within-firm changes. Instead, Malgouyres (2017) focuses on local employment areas and thus captures also the effect of firm exit and between-firm reallocation.

Next, we study the relationship between Chinese competition and total factor productivity. We find that Chinese competition leads to higher TFP across all specifications (irrespective of whether we control for output price heterogeneity). This may simply reflect increases in the

[17]Unfortunately, we do not have the information on the skill composition of the workforce that would allow us to run a formal test.

Table 10: Impact of Chinese competition on employment, TFP and quality

	log(L)			log(TFP)			quality		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\text{Imp}^{Chn}_{i,t-1}$	-0.046	-0.097	-0.146	0.062***	0.064***	0.704**	0.254***	0.252***	0.189*
	(-0.109)	(-0.106)	(0.171)	(-0.014)	(-0.014)	(0.323)	-(0.079	(-0.079)	(0.104)
Additional controls	No	Yes	No	No	Yes	No	No	Yes	No
Observations	141,437	135,211	42,685	141,710	135,211	42,685	93,010	89,370	40,675
F stat. (2nd stage)	0.176	117.2	0.728	20.99	11.14	4.765	10.34	58.38	3.307
Kleibergen-Paap	4,714	4,564	2,340	4,739	4,563	2,340	3,759	3,574	2,186

All models are fixed effect instrumental variable (FE-IV) specifications, including firm and sector-year fixed effects. Standard errors clustered at the firm-level in parentheses. Significance: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$. The F stat. (2nd stage) tests the joint significance of regressors in the second stage. The endogenous variable $\text{Imp}^{Chn}_{i,t-1}$ is instrumented using total imports from China by seven countries outside the eurozone (Australia, Canada, Japan, New Zealand, Norway, Switzerland and the UK). The critical value for the Kleibergen-Paap statistic based on the Stock-Yogo weak instrument test with a size distortion of maximum 5% and one just-identified endogenous variable is 16.38. Additional controls include the log of the number of employees (not in columns 1 and 2), employment growth in the local labour market area, log capital intensity, the share of the firm in the local labour market (department-sector), export intensity, a dummy for firms importing intermediate goods from China, and offshoring, measured as imported materials over labour costs. All variables are lagged one year. Columns (3), (6) and (9) report results on the sample for which we derive a measure of firm-level output prices, that is firms that export at least 5% of their sales. Quality is computed following Khandelwal (2010) and is available for exporting firms only.

(value of the) marginal product of labour MP^L (or PMP^L), hence changes in labour market conditions, or stem from deliberate efforts by firms to increase productivity in order to fend off competition, increase their competitive edge, and restore their price-cost margins.

Linked to this last result, we also look at quality upgrading. To do so, we exploit information on products exported by firms and introduce a measure of product quality (as proposed by Khandelwal 2010) as the dependent variable.[18] The key finding is that companies react to Chinese competition by increasing their product quality. Hence, in order to cope with increased pressure from Chinese products, French manufacturers climb the quality ladder to escape competition. This may be seen as a discipline device of Chinese competition occurring not on the labour market, but on the product market, and it is consistent with the idea of a "virtuous adjustment" whereby successful domestic firms react to trade liberalisation by upgrading their processes and products rather than by reducing employment and wages.

5 Conclusion

We have examined the presence of labour market imperfections in France that lead to market power on the side of either firms or their workers. To do so, we have proposed a decomposition of the measure of imperfections that relates it to a firm's average labour cost, its markup, (the value of) labour productivity, and prices. We have also investigated how such imperfections respond to international competition, most notably from China. By doing so, we are able to distinguish the channels through which import competition affects frictions in the labour market.

Our main conclusion is that Chinese competition acts as a discipline device in the labour market, albeit its effect is asymmetric: while it reduces the wedge between actual and competitive wages when a firm's workforce is paid above its marginal product, we find no such effect for monopsonist firms. The decomposition has allowed us to document a link between imperfections in the output and input markets: import penetration lowers price-cost margins and this is associated with a smaller gap between actual and competitive wages.

Our findings show that within-firm adjustments triggered by Chinese competition do not take place through a reduction of wages or employment. Rather, such changes occur essentially via an increase in the (value of the) marginal product of labour. This is consistent with a strategy of quality and productivity upgrading adopted by manufacturing firms to escape competition, which has been documented elsewhere (Fernandes & Paunov 2013, Bloom et al. 2016), and to which we find corroborating evidence.

Our main conclusions are robust to a range of alternative empirical strategies. In particular, while the baseline analysis cannot distinguish between price and productivity effects, we have exploited export unit values to derive proxies for firm-specific prices and quantities, and to separately identify the impact of Chinese competition on the marginal product of labour and firm-level prices.

While our results do not rule out the possibility that Chinese competition induces job destruction via firm exit, the lack of a significant *within* effect on employment is interesting considering

[18] See Appendix D for details on the measure of quality.

that, during the period under consideration, the number of employees in the French manufacturing sector has declined substantially. More generally, the absence of any downward pressure of Chinese competition on wages and employment within firms may conceal unobserved adjustments in the composition of labour. This promising avenue remains open to further research.

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Appendix A. Theoretical Framework

We define our measure of labour market imperfections as the wedge between the observed wage P^L and the competitive wage, which corresponds to the marginal revenue product of labour MRP^L:

$$\phi = \frac{P^L}{MRP^L} = \frac{P^L}{\frac{\partial Q}{\partial L}P + \frac{\partial P}{\partial L}Q} = \frac{P^L}{\frac{\partial Q}{\partial L}P\left(1 + \frac{\partial P}{\partial Q}\frac{Q}{P}\right)} = \frac{P^L}{P}\frac{1}{\frac{\partial Q}{\partial L}}\frac{1}{\left(1 + \frac{\partial P}{\partial Q}\frac{Q}{P}\right)} = \frac{P^L \cdot \mu}{MP^L \cdot P}, \tag{A1}$$

where the last equality exploits the definitions of the markup μ as the inverse of the price elasticity of demand, $\mu = \frac{1}{1+\eta} = \left(1 + \frac{\partial P}{\partial Q}\frac{Q}{P}\right)^{-1}$, and of the marginal product of labour $MP^L = \frac{\partial Q}{\partial L}$ as the derivative of output with respect to labour. Equation (A1) then shows that ϕ can be decomposed as the product of wages, markups, and the inverse of the marginal product of labour and output prices.

We can further rearrange equation (A1) and show that:

$$\phi = \frac{P^L}{P}\frac{1}{\frac{\partial Q}{\partial L}}\frac{1}{\left(1 + \frac{\partial P}{\partial Q}\frac{Q}{P}\right)} = \frac{P^L}{P}\frac{\mu}{\frac{\partial Q}{\partial L}} = \frac{P^L}{P}\frac{\mu}{\frac{\partial Q}{\partial L}\cdot\frac{L}{Q}\cdot\frac{Q}{L}} = \frac{\mu}{\frac{\theta^L}{\alpha^L}}, \tag{A2}$$

where $\theta^L = \frac{\partial Q}{\partial L}\frac{L}{Q}$ is the output elasticity with respect to labour and $\alpha^L = \frac{P^L L}{PQ}$ is the revenue share of labour.

Thus, to provide an empirical content to ϕ we need a way to measure θ^L and the markup μ, while α^L is computed from standard firm-level data. The former, θ^L, can easily be derived from the estimation of a production function (see Appendix B), whereas we draw on the contribution by De Loecker & Warzynski (2012) to identify μ.[19]

Let Q be firm output as follows: $Q = Q(\mathbf{X}, \mathbf{K})$, where we abstract from subscripts i (firm) and t (time) for the sake of clarity. $\mathbf{K}$ is a vector of dynamic (quasi-fixed) factors such as capital, while the vector $\mathbf{X}$ represents static (flexible) inputs like intermediate materials M (but additional inputs such as energy or imported goods are equally possible). Note that this setup is agnostic with respect to the treatment of labour, which can be treated as either quasi-fixed or as a static input. In this framework, we assume the following: (i) $Q(\cdot)$ is twice differentiable and continuous; (ii) $\mathbf{X}$ has at least one element; and (iii) firms act as cost-minimizers. The associated Lagrangian function reads:

$$\mathcal{L} = \mathbf{P}^X\mathbf{X} + \mathbf{P}^K\mathbf{K} + \lambda(\bar{Q} - Q(\mathbf{X}, \mathbf{K})), \tag{A3}$$

where $\mathbf{P}^X$ and $\mathbf{P}^K$ are firm input prices. The first-order conditions satisfy:

$$\mathbf{P}^X + \frac{\partial \mathbf{P}^X}{\partial \mathbf{X}}\mathbf{X} = \lambda\frac{\partial Q(\mathbf{X}, \mathbf{K})}{\partial \mathbf{X}} \tag{A4}$$

[19] Recent work by Bond et al. (2020) has questioned the ability of the De Loecker & Warzynski's approach to correctly identify the level of the markup, especially when firm-level prices are not observed. As long as the price bias stemming from the distance between a firm's price and the sectoral mean is constant over time, it will not affect our results, as they are based on within-firm variation (Liu & Ma 2020).

and

$$\lambda = \frac{\partial \mathcal{L}}{\partial Q}. \tag{A5}$$

Observe that the Lagrangian multiplier λ represents the marginal cost of production. Defining markup μ as the price-to-marginal-cost ratio, $\mu \equiv \frac{P}{\lambda}$, it follows that:

$$\mathbf{P}^X + \frac{\partial \mathbf{P}^X}{\partial \mathbf{X}} \mathbf{X} = \frac{P}{\mu} \frac{\partial Q(\mathbf{X}, \mathbf{K})}{\partial \mathbf{X}}. \tag{A6}$$

Equation (A6) simply says that the optimisation programme of the entrepreneur is to equalise the left-hand-side term, the marginal cost of static inputs $\mathbf{X}$, with the right-hand-side term, the marginal revenue product of $\mathbf{X}$.

An important characteristic of equation (A6) is that it allows for all types of market imperfections, whether in the product or factor markets, and represents the most general form of the entrepreneur's decision. In the absence of imperfections in the factor markets, $\partial \mathbf{P}^X / \partial \mathbf{X} = 0$, and the entrepreneur acts as a price taker. Similarly with no market power in the product market, the price to marginal cost ratio is set to unity. If all markets are perfect, then $\mathbf{P}^X = P \cdot \partial Q(\mathbf{X}, \mathbf{K}) / \partial \mathbf{X}$. Any deviations from perfect markets alters factor and/or product prices and is reflected in (A6).

Multiplying both sides of equation (A6) by $\frac{X}{Q}$ and rearranging yields:

$$\left(\frac{\mathbf{P}^X \mathbf{X}}{PQ} \right) \left(1 + \frac{\partial \mathbf{P}^X / \mathbf{P}^X}{\partial \mathbf{X} / \mathbf{X}} \right) \mu = \frac{\partial Q / Q}{\partial \mathbf{X} / \mathbf{X}}. \tag{A7}$$

The first term on the left-hand side of (A7) is the share of inputs $\mathbf{X}$ in total revenues, whereas the right-hand-side term is the output elasticity of the static inputs $\mathbf{X}$.

The term $\frac{\partial \mathbf{P}^X / \mathbf{P}^X}{\partial \mathbf{X} / \mathbf{X}}$ allows for the characterisation of market imperfections in the factor market. The first situation is that of monopsony power by firms in the factor market, whereby $\frac{\partial \mathbf{P}^X / \mathbf{P}^X}{\partial \mathbf{X} / \mathbf{X}} > 0$. This implies a positive elasticity of the factor price with respect to factor demand, that is, an increase in the factor price that firms will face when they increase their usage of that factor. The second case is one of perfect competition in factor markets, resulting in competitive prices and stemming from the fact that economic agents are price takers, $\frac{\partial \mathbf{P}^X / \mathbf{P}^X}{\partial \mathbf{X} / \mathbf{X}} = 0$. The last case features market power in the hands of the suppliers of factors. Here, an increase in the factor price is associated with a reduction in the quantities supplied to the market: $\frac{\partial \mathbf{P}^X / \mathbf{P}^X}{\partial \mathbf{X} / \mathbf{X}} < 0$. This is a typical result of a monopoly where prices are higher and quantities are lower than in a competitive equilibrium. Such situations may stem from market frictions, entry barriers, or inflexible contracts. Relevant examples in the present context are quantity discounts in the market for intermediate inputs or, if one includes labour among the static inputs, efficient bargaining in the labour market (McDonald & Solow 1981, Dobbelaere & Mairesse 2013), whereby firms and unions negotiate on wages and employment, and unions know that there is a trade-off between high wages and high employment.

Writing input $\mathbf{X}$'s share of revenues as $\alpha^{\mathbf{X}}$ and its associated output elasticity as $\theta^{\mathbf{X}}$ yields:

$$\mu\left(1+\frac{\partial \mathbf{P}^X/\mathbf{P}^X}{\partial \mathbf{X}/\mathbf{X}}\right)=\frac{\theta^{\mathbf{X}}}{\alpha^{\mathbf{X}}}=\mu^{\mathbf{X}}. \tag{A8}$$

An important implication of (A8) is that the ratio between the output elasticity and the revenue share of input $\mathbf{X}$, $\mu^{\mathbf{X}}$, is equal to the price-cost ratio μ only when the factor market is perfect, that is, when $\frac{\partial \mathbf{P}^X/\mathbf{P}^X}{\partial \mathbf{X}/\mathbf{X}}=0$. Any deviation from price-taking behaviour in the factor market will be reflected in $\frac{\partial \mathbf{P}^X/\mathbf{P}^X}{\partial \mathbf{X}/\mathbf{X}}\neq 0$. The implication is then straightforward: if one can properly measure product market power, then knowledge of $\theta^{\mathbf{X}}$ and $\alpha^{\mathbf{X}}$ allows us to quantify $\frac{\partial \mathbf{P}^X/\mathbf{P}^X}{\partial \mathbf{X}/\mathbf{X}}$, that is, market imperfections in factor markets.

The identification of product and factor market imperfections can follow different empirical strategies, the key decision being the definition of a benchmark μ. The strategy implicitly followed by De Loecker & Warzynski (2012) in their value-added production function, and explicitly stated in Dobbelaere & Mairesse (2013), Dobbelaere et al. (2015), Dobbelaere & Kiyota (2018) and Mertens (2020), is to assume that (iv) firms are price takers in the market for intermediate inputs M, implying $\frac{\partial P^M/P^M}{\partial M/M}=0$. Applying assumptions (i)-(iv) to the general framework derived above, one can write equations (A4) and (A8) as follows:

$$\frac{\partial Q(\cdot)}{\partial M}\frac{M}{Q}=\frac{P^M M}{\lambda Q} \tag{A9}$$

and

$$\mu^M=\frac{\theta^M}{\alpha^M}=\mu, \tag{A10}$$

where $\theta^M=\frac{\partial Q(\cdot)}{\partial M}\frac{M}{Q}$ is the output elasticity of materials and $\alpha^M=\frac{P^M M}{PQ}$ is the share of materials in total sales. Again, under assumptions (i)-(iv), μ^M represents the price cost margin μ, or a measure of the market power that firms enjoy in the product market.

Having established a benchmark, any deviation from μ^M for the ratio between the output elasticity and the revenue share of any other flexible inputs in $\mathbf{X}$ signals the presence of imperfections in that specific factor market. In particular, under the assumption that $L\in\mathbf{X}$, so that the quantity of labour can be adjusted in every period (even if L may still be "less flexible" than materials), one can define $\mu^L={}^{\theta^L}\!/_{\alpha^L}$ and compare it with μ^M to detect the presence of labour market imperfections. In fact, if the wage rate varies as a function of the quantity of labour demanded by the firm or offered by workers, (A6) yields the following expression:

$$\lambda\frac{\partial Q(\cdot)}{\partial L}\frac{L}{Q}=P^L\left(1+\frac{\partial P^L}{\partial L}\frac{L}{P^L}\right)\frac{L}{Q}\frac{P}{P}. \tag{A11}$$

Rearranging and using the definitions of θ^L and α^L that are analogous to those employed for materials, one can write:

$$\mu^L=\frac{\theta^L}{\alpha^L}=\mu\left(1+\frac{\partial P^L}{\partial L}\frac{L}{P^L}\right), \tag{A12}$$

meaning that the ratio between the output elasticity of labour (θ^L) and its share in total revenues (α^L) is equal to the price-cost margin μ, multiplied by a term that captures imperfections in the labour market.

Going back to equation (A2), it is now possible to show that $\phi = {}^{\mu^M}/_{\mu^L}$:

$$\phi = \frac{\mu}{\frac{\theta^L}{\alpha^L}} = \frac{\mu^M}{\mu^L} = \frac{1}{\left(1 + \frac{\partial P^L}{\partial L}\frac{L}{P^L}\right)}, \tag{A13}$$

implying that ϕ captures frictions in the labour market, which provide wage-setting power to either firms or workers.[20]

[20]Note that for the computation of ϕ_{it} it is irrelevant whether L is considered flexible or quasi-fixed.

Appendix B. Production Function Estimation

B.1 Wooldridge-Levinsohn-Petrin Estimator

The methodology used to compute unbiased estimates of the output elasticities with respect to our inputs follows Petrin & Levinsohn (2012) and is related to the use of inputs to control for unobservables in production function estimations, as set out by Olley & Pakes (1996), Levinsohn & Petrin (2003), Ackerberg et al. (2015) and Wooldridge (2009). The basic idea behind this approach is that the estimation of a production function may suffer from endogeneity bias because of a correlation between unobserved productivity shocks and inputs. This issue is solved by including lagged values of specific inputs as proxies for productivity.

In more detail, the methodology employed in this paper starts out with a first step in which we run

$$q_{it} = g\left(l_{it}, k_{it}, m_{it}\right) + \epsilon_{it}, \tag{B1}$$

where q_{it} is the natural logarithm of output of firm i at time t, and l_{it}, k_{it} and m_{it} are respectively the natural logarithms of labour, capital and materials used by the firm. In equation (B1), we use a third-order polynomial on all inputs to obtain estimates of expected output, $\hat{q}_{it}$, and an estimate for ϵ_{it}. This first step is included to get rid of pure error term in the measure of output and markups (Ackerberg et al. 2015, De Loecker & Warzynski 2012).

Then, we use a general production function of the following type:

$$\hat{q}_{it} = f_s\left(l_{it}, k_{it}, m_{it}, \mathbf{B}\right) + \omega_{it} + \varepsilon_{it}, \tag{B2}$$

where our inputs are transformed into the output according to the production function f_s, $\mathbf{B}$ is the parameter vector to be estimated in order to calculate the output elasticities, ω_{it} is the firm-level productivity term that is observable by the firm but not by the econometrician and ε_{it} is an error term that is unobservable to both the firm and the econometrician. Leaving subscripts i and t aside for simplicity, function f_s is assumed to be translog and reads:

$$\begin{aligned} f_s &= \alpha + \beta_L l + \beta_K k + \beta_M m + \beta_{L^2} l^2 + \beta_{M^2} m^2 + \beta_{K^2} k^2 + \\ &+ \beta_{KL} kl + \beta_{KM} km + \beta_{LM} lm \end{aligned} \tag{B3}$$

Observe that function f_s is allowed to change across two-digit sectors, as implied by the subscript s. Thus, the parameter vector δ is composed of nine parameters for each sector.

Different estimators may be used to estimate the production function in (B2). The preferred estimator in this paper is the Wooldridge-Levinsohn-Petrin (WLP) estimator, as derived from Wooldridge (2009) and implemented in Petrin & Levinsohn (2012). The main reason is that it corrects for the simultaneous determination of inputs and unobserved productivity by proxying the latter with firm-level material inputs. Moreover, it does not assume constant returns to scale, it is robust to the Ackerberg et al. (2015) criticism of the Levinsohn & Petrin (2003) estimator and it is programmed as a simple instrumental variable estimator.

In the baseline case, in which we assume that labour is a variable input, we instrument current labour and materials and their interactions with the first and second lags of labour as well as the second lags of capital and materials. On the other hand, in our robustness check I, in which we assume that labour is a quasi-fixed input, we instrument current materials, its square and its interactions with the other inputs with the second lags of materials, labour and capital. In addition, the WLP estimator requires the variables affecting the productivity process to be specified. We assume that productivity is a function of lagged capital and materials. Following De Loecker (2013), we include in the productivity process the potential effects of firms' international trade status on productivity via the import share for China and a dummy for exporting. Year fixed effects are also included to take into account time-variant shocks common to all firms. All these additional regressors are not included in the function f_s.

B.2 Accounting for Price Heterogenenity

The production function estimation described so far uses deflated output as the dependent variable, rather than the quantity of output. This means that we are effectively estimating a revenue function rather than a production function. The use of revenue rather than quantity of output may lead to a bias in the estimation of (B2) as differences in prices across firms and time may be wrongly attributed to differences in productivity. Moreover, (B2) does not take into account an additional source of bias caused by unobserved firm-level input prices. Indeed, if input prices vary by firm and they are correlated with firm inputs, such variation would end up in the error term and our production function coefficients would be biased. This is likely to occur, for instance, if larger firms also tend to acquire better quality, and thus relatively higher priced, inputs.

In order to avoid these issues, we check the robustness of our results controlling for unobserved firm-level product and input prices. To do so, we re-run our entire estimation procedure described above by applying the strategy implemented in De Loecker et al. (2016) and Caselli et al. (2017).

We start off by calculating a firm-level output price index using data on firm-product-destination export unit values from French customs, assuming that they accurately reflect domestic prices. We follow Caselli (2018) and calculate the firm-level price index from disaggregated data using the time-product dummy method, a stochastic approach based on running a weighted regression of log prices for product-destination-firm-year observations on product-destination dummies and dummies for each firm-year pair. The coefficients on these firm-year-pair dummies can be interpreted as the change compared to the firm-year pair used as base.

Then, we use the firm-level output price index in two different ways. First, we deflate firm sales by this estimated price index to calculate a firm-level quantity index of sales. This becomes the new dependent variable in equations (B1) and (B2), so that we can effectively estimate a physical production function rather than a revenue function.

Second, we incorporate our firm-level output prices in the production function to control for firm-level differences in input prices. To do so, we assume that product and input prices are correlated because firms selling products of higher quality (and thus more expensive) need to use inputs of higher quality. Thus, we incorporate an additional control function for input prices in our production function that includes the firm-level output price index and its interactions with our inputs for which we lack information on prices at the firm level (materials and capital).

In order to ensure that export unit values provide an accurate representation of firm-level prices, we restrict the sample to firms exporting at least 5% of their sales. As a result, the number of observations in this robustness check reduces greatly.

Appendix C. Regime Classification

To classify each firm-year observation into a specific labour market regime, we compute $\psi = \mu^M - \mu^L$ (Dobbelaere & Mairesse 2013). Given that positive (negative) values for ψ correspond to values above (below) unity for ϕ, we use ψ rather than ϕ because the former allows for a simpler characterisation of its confidence interval. Indeed, we define the 90% confidence interval for ψ as follows:

$$90\% \text{ C.I.}_{\psi_{it}} = \hat{\psi}_{it} \pm 1.64 \times \sigma^2_{\psi_{it}}. \tag{C1}$$

Based on (C1), we identify the labour market regime in which each firm operates in a given year as follows:

- EB: *Efficient Bargaining.* If $0 \notin 90\% \text{ C.I.}_{\psi_{it}}$, and $\hat{\psi} > 0$, then $\hat{\psi}$ is significantly higher than 0. Firm i operates under efficient bargaining in year t.
- PR: *Perfect competition.* If $0 \in 90\% \text{ C.I.}_{\psi_{it}}$, then $\hat{\psi}$ is not significantly different from 0: $\hat{\psi} = 0$, the firm behaves as price-taker in year t.
- MO: *Monopsony.* If $0 \notin 90\% \text{ C.I.}_{\psi_{it}}$, and $\hat{\psi} < 0$, then $\hat{\psi}$ is significantly lower than 0. The firm-year operates under monopsony.

To compute $\sigma^2_{\psi_{it}}$ we start from $\psi = \mu^M - \mu^L = \frac{\theta^M}{\alpha^M} - \frac{\theta^L}{\alpha^L}$, and note that while denominators α^M and α^L are observed, the numerators θ^M_{it} and θ^L are estimated, and must be considered as random variables. Hence:

$$\sigma^2_{\psi,it} = (\alpha^M_{it})^{-2} \cdot \sigma^2_{\hat{\theta}^M_{it}} + (\alpha^L_{it})^{-2} \cdot \sigma^2_{\hat{\theta}^L_{it}} - 2(\alpha^M_{it})^{-1}(\alpha^L_{it})^{-1}\text{cov}(\hat{\theta}^M, \hat{\theta}^L). \tag{C2}$$

Given the translog production function (B3), parameters $\hat{\theta}^M_{it}$ and $\hat{\theta}^L_{it}$ read, respectively:

$$\hat{\theta}^M_{it} = \hat{\beta}_M + 2\hat{\beta}_{M^2} m_{it} + \hat{\beta}_{KM} k_{it} + \hat{\beta}_{LM} l_{it}, \tag{C3}$$

and

$$\hat{\theta}^L_{it} = \hat{\beta}_L + 2\hat{\beta}_{L^2} l_{it} + \hat{\beta}_{KL} k_{it} + \hat{\beta}_{LM} m_{it}. \tag{C4}$$

Leaving subscripts i and t aside for simplicity, the terms $\sigma^2_{\hat{\theta}^M,it}$ and $\sigma^2_{\hat{\theta}^M,it}$ read, respectively:

$$\begin{aligned} \sigma^2_{\hat{\theta}^M} &= \sigma^2_{\hat{\beta}_M} + 4m^2\sigma^2_{\hat{\beta}_{M^2}} + k^2\sigma^2_{\hat{\beta}_{KM}} + l^2\sigma^2_{\hat{\beta}_{LM}} \\ &+ 4m \cdot \text{cov}(\hat{\beta}_M, \hat{\beta}_{M^2}) + k \cdot \text{cov}(\hat{\beta}_M, \hat{\beta}_{KM}) + l \cdot \text{cov}(\hat{\beta}_M, \hat{\beta}_{LM}) \\ &+ 4km \cdot \text{cov}(\hat{\beta}_{M^2}, \beta_{KM}) + 4lm \cdot \text{cov}(\hat{\beta}_{M^2}, \hat{\beta}_{LM}) + 2lk \cdot \text{cov}(\hat{\beta}_{KM}, \beta_{LM}) \end{aligned} \tag{C5}$$

and

$$
\begin{aligned}
\sigma^2_{\hat{\theta}^L} &= \sigma^2_{\hat{\beta}_L} + 4l^2\sigma^2_{\hat{\beta}_{L^2}} + k^2\sigma^2_{\hat{\beta}_{KL}} + l^2\sigma^2_{\hat{\beta}_{LM}} \\
&+ 4l \cdot \text{cov}(\hat{\beta}_L, \hat{\beta}_{L^2}) + k \cdot \text{cov}(\hat{\beta}_L, \hat{\beta}_{KL}) + m \cdot \text{cov}(\beta_L, \hat{\beta}_{LM}) \\
&+ 4kl \cdot \text{cov}(\hat{\beta}_{L^2}, \beta_{KL}) + 4lm \cdot \text{cov}(\hat{\beta}_{L^2}, \hat{\beta}_{LM}) + 2mk \cdot \text{cov}(\hat{\beta}_{KL}, \hat{\beta}_{LM}).
\end{aligned} \tag{C6}
$$

In turn, the covariance term $\text{cov}(\hat{\theta}^M, \hat{\theta}^L)$ is computed as:

$$
\begin{aligned}
\text{cov}(\hat{\theta}^M, \hat{\theta}^L) &= \text{cov}(\hat{\beta}_M, \hat{\beta}_L) + 2l \cdot \text{cov}(\hat{\beta}_M, \hat{\beta}_{L^2}) + k \cdot \text{cov}(\hat{\beta}_M, \hat{\beta}_{KL}) \\
&+ m \cdot \text{cov}(\hat{\beta}_M, \hat{\beta}_{LM}) + 2m \cdot \text{cov}(\hat{\beta}_{M^2}, \hat{\beta}_L) + 4lm \cdot \text{cov}(\hat{\beta}_{M^2}, \hat{\beta}_{L^2}) \\
&+ 2km \cdot \text{cov}(\hat{\beta}_{M^2}, \hat{\beta}_{KL}) + 2m^2 \cdot \text{cov}(\hat{\beta}_{M^2}, \hat{\beta}_{LM}) + k \cdot \text{cov}(\hat{\beta}_{KM}, \hat{\beta}_L) \\
&+ 2kl \cdot \text{cov}(\hat{\beta}_{KM}, \hat{\beta}_{L^2}) + k^2 \cdot \text{cov}(\hat{\beta}_{KM}, \hat{\beta}_{KL}) + km \cdot \text{cov}(\hat{\beta}_{KM}, \hat{\beta}_{LM}) \\
&+ l \cdot \text{cov}(\hat{\beta}_{LM}, \hat{\beta}_L) + 2l^2 \cdot \text{cov}(\hat{\beta}_{LM}, \hat{\beta}_{L^2}) \\
&+ kl \cdot \text{cov}(\hat{\beta}_{LM}, \hat{\beta}_{KL}) + lm \cdot \text{cov}(\hat{\beta}_{LM}, \hat{\beta}_{LM})
\end{aligned} \tag{C7}
$$

Using (C5), (C6) and (C7), we compute the 90% confidence interval for ψ_{it} and classify observations in the three labour market regimes.

Table C1: Regime classification, by industry

Industry	#obs.	#firms	MO	PR	EB
All manufacturing	141,710	17,275	4.55%	11.66%	83.80%
Automobile	4,359	516	2.62%	25.14%	72.24%
Chemicals	16,296	1938	2.49%	12.00%	85.51%
Clothing & footwear	7,889	1147	0.89%	8.56%	90.56%
Electric & electronic comp.	6,391	769	0.94%	5.45%	93.62%
Electric & electronic eq.	7,784	965	1.40%	4.82%	93.78%
House eq. & furnishings	9,650	1210	0.61%	3.23%	96.16%
Machinery & mechanical eq.	26,414	3150	6.07%	6.51%	87.42%
Metallurgy, iron & steel	20,998	2467	7.06%	8.84%	84.10%
Mineral industries	6,500	787	2.89%	16.62%	80.49%
Pharmaceuticals	3,493	445	0.52%	18.81%	80.68%
Printing & publishing	12,298	1433	2.61%	7.50%	89.89%
Textile	8,191	1039	12.72%	20.16%	67.12%
Transportation machinery	2,262	272	6.37%	43.55%	50.09%
Wood & paper	9,185	1137	9.00%	31.43%	59.56%

For each industry, the table reports the number of firms and observations and the percentage of observations in each of the three labour market regimes.

Appendix D. Quality Estimation

To obtain a measure of export quality at the firm level, we employ the methodology developed by Khandelwal (2010) based on the nested logit framework developed by Berry (1994). In particular, we follow the strategy implemented by Bernini & Tomasi (2015), for firm-level data.

The basic intuition behind Khandelwal's (2010) approach is to infer the quality of a firm's variety as the part of its market share within a given market that is not explained by its price. Thus, according to this approach, the quality of firm i, product j (measured at the six-digit level of the HS classification), destination d at time t can be measured as the residual from the estimation of the following demand model

$$\ln(s_{ijdt}) - \ln(s_{odt}) = \gamma p_{ijdt} + \sigma \ln(ns_{ijdt}) + \lambda_{1,ij} + \lambda_{2,dt} + \lambda_{3,it}, \tag{D8}$$

where s_{ijdt} is the market share of firm i, product j, in destination d at time t in terms of quantity of export within a given two-digit sector; s_{odt} is the market share of an outside variety, used to normalise the utility from the consumption of each variety; p_{ijdt} is the unit value of variety ij; ns_{ijdt} is the nest share – i.e., the market share of each variety over more disaggregated six-digit products; $\lambda_{1,ij}$ and $\lambda_{2,dt}$ are firm-product and destination-year fixed effects; and $\lambda_{3,ijdt}$ is an idiosyncratic error term. According to theory, the coefficient γ is supposed to be negative and the coefficient σ should lie between 0 and 1. All the variables described can be obtained from French customs data based on information for all exporting firms in combination with CEPII-BACI data for information on outside varieties.

The market share of each firm is calculated as $s_{ijdt} = q_{ijdt}/MKT2_{dt}$, where q_{ijdt} is the quantity index of variety ij and $MKT2_{dt} = \sum_i \sum_j q_{ijdt}/(1 - s_{odt})$ is a proxy for the total market size of each two-digit sector. To calculate total market size, we divide the total quantity sold by French producers by the share of French producers within that market, i.e., one minus the share of the outside option. The outside option is a substitute for French varieties and, thus, is composed of world imports from all countries except France from the CEPII-BACI data. We choose to measure the market shares within two-digit sectors because too few observations would be available for more disaggregated industry levels. The nest share is calculated as $ns_{ijdt} = q_{ijdt}/MKT_{pdt}$, with $MKT_{pdt} = \sum_i q_{ijdt}/(1 - s_{odt})$ as a proxy for total market size at the six-digit industry level.

As mentioned above, differences in quality between varieties are generated from variations in their market shares (segmented in subclasses of closer substitutes) not explained by differences in prices. Quality is thus defined as $\lambda_{ijdt} = \lambda_{1,ij} + \lambda_{2,dt} + \lambda_{3,ijdt}$, where the first term on the right-hand side captures the time-invariant valuation of variety ij and the second term captures the secular trend common to all firms within a market. The variety and destination-year fixed effects substitute for missing information on detailed variety characteristics. The third term represents deviations in valuation from the fixed effects that are observed by the econometrician. This definition of quality is indubitably broad and embodies both horizontal and vertical components.

The error term or quality component $\lambda_{3,ijdt}$ might be correlated with the price and the nest share, thus potentially giving rise to a problem of endogeneity. To address this issue, we estimate equation (D8) by two-stage least squares (2SLS) using four instruments. The first instrument is the median price computed across all French varieties of the same 6-digit product j exported to country d at time t. The second instrument for the price is the variety average price computed across the varieties exported by all other countries (except France) in the same product-destination-year market. Third, we instrument for the nest shares of individual firms by using the number of different product categories exported by the same firm to d at time t. The last instrument is the number of French firms operating in each *pdt* triplet.

Once we have obtained a reliable measure of quality at the firm-product-destination-year level, it is possible to aggregate at the firm-year level by using as weights the export shares of each product-destination variety within each firm-year pair.

Appendix E. The Decomposition of Aggregate Labour Market Imperfections Φ

Define Φ_t as the average value of firm-specific measures of labour market imperfections measured in logs $\log \phi_{it}$ for year t, weighted by firms' market share in labour: $s_{it} = \frac{N_{it}}{\sum_i N_{it}}$, where N represents the number of employees.

$$\Phi_t = \sum_i s_{it} \log \phi_{it} \tag{E1}$$

Subtracting Φ_{t-1} from Φ_t yields $\Delta\Phi_t = \Phi_t - \Phi_{t-1}$. This approximates the relative change in labour market imperfections. A positive change in Φ ($\Delta\Phi > 0$) implies an increase in the cost of labour relative to its marginal revenue product, whereas a fall ($\Delta\Phi < 0$) identifies the opposite situation. In what follows, we decompose $\Delta\Phi_t$ in two ways that allows identifying the sources of the observed dynamics of aggregate labour market imperfections.

E.1 The FHK Decomposition Applied to Aggregate Labour Market Imperfections Φ

We use the decomposition method proposed by Foster et al. (2001) and apply it to $\Delta\Phi$. Using firm-level information on the log transformed value of ϕ_{it} and s_{it}, changes in aggregate Φ may be decomposed as follows:

$$\begin{aligned} \Delta\Phi_t &= \underbrace{\sum_{i \in S} s_{it-1} \Delta \log \phi_{it}}_{\text{Within}} + \underbrace{\sum_{i \in S} (\log \phi_{it-1} - \Phi_{t-1}) \Delta s_{it} + \sum_{i \in S} \Delta s_{it} \Delta \log \phi_{it}}_{\text{Between}} \\ &+ \underbrace{\sum_{i \in E} (\log \phi_{it} - \Phi_{t-1}) s_{it}}_{\text{Entry}} - \underbrace{\sum_{i \in X} (\log \phi_{it-1} - \Phi_{t-1}) s_{it-1}}_{\text{Exit}} \end{aligned} \tag{E2}$$

Equation (E2) states that overall changes in labour market frictions may stem from four different sources. The first two components exclusively concern surviving firms ($i \in S$). First, aggregate movements may be the result of within-firm changes, given the firm's initial market share of labour s. The second source, labeled as the between-firm effect, involves changes in the firms' market share of labour s. Such changes are multiplied by the initial level of market frictions ($\log \phi_{it-1}$) and by their changes within firms ($\Delta \log \phi_{it}$). Note that even in the case of no within firms variations ($\Delta \log \phi_{it} = 0$), there may be an overall increase in market frictions simply by virtue of a composition effect, that is, due to firms with an initially high $\log \phi_{it}$ increasing their share of labour s.

The last two components reflect industry churn, that is, the entry of new firms ($i \in E$) and firm exit ($i \in X$). Entry has a positive effect on market frictions if the gap between the wage and the MRP^L in new firms is higher than the industry average in the previous period

($\log \phi_{it} > \Phi_{t-1}$). In a similar fashion, the contribution of exit will be positive if those firms had a lower $\log \phi_{it}$ relative to the industry average Φ_{t-1}.

E.2 The Decomposition of Aggregate Labour Market Imperfections Φ into its components P^L, μ, PMP_L, and P^D

We use (E1) and substitute $\log \phi$ with its components as in equation (8), yielding:

$$\Phi_t = \sum_i s_{it}\big(\log P^L_{it} + \log \mu_{it} - \log PMP^L_{it} - \log P^D_t\big). \tag{E3}$$

It follows immediately that:

$$\Delta\Phi_t = \Delta \log P^L_t + \Delta \log \mu_t - \Delta \log PMP^L_t - \Delta \log P^D_t \tag{E4}$$

where $\Delta \mathbf{C}_t = \sum_i s_{it}\mathbf{C}_t - \sum_i s_{it-1}\mathbf{C}_{t-1}$, and $\mathbf{C} = \{\log P^L_i, \log \mu_i, \log PMP^L_i, \log P^D\}$.