Markups, import competition and exporting*

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June 13, 2019

Abstract

This paper analyses the relationship between markups and international trade at the firm level using a large sample of French manufacturing firms for the period 1995-2007. In particular, the paper investigates the effect of increasing import competition from China on firms' price-cost margins and the way in which exporting interacts with this effect. The results show robust evidence that firms in more direct competition with Chinese imports decrease their markups. However, firms that become exporters experience a smaller reduction in their price-cost margins. Consistent with these findings, the results also show that firms facing tougher competition from China are more likely to start exporting to avoid such competitive pressures.

Keywords: markups, import competition, exporting, China, France.

JEL Classification Codes: D22, D24, F14, F61, L25.

*We thank Lionel Nesta, participants at the 2018 ISGEP workshop and two anonymous referees for their invaluable feedbacks. All remaining errors are ours.

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1 Introduction

The integration of low-wage countries, and China in particular, into world trade has raised serious concerns in many advanced economies and its effects have been intensively debated both within and outside academia for several years. It is not uncommon to read about firms closing their factory gates in Western Europe or Northern America and blaming rising competitive pressures from low-wage countries as the likely culprit. In response to this threat, there has been an increasing demand for protectionism. Indeed, the recent tariff war between the United States and China is just one of the political answers to such demands.

However, this is not the full story. Proponents of free trade have always advocated it on the basis that, while some firms and workers may lose, other firms and workers will benefit. In particular, the gains from trade come from new export opportunities, the availability of cheaper and more diversified imports that make consumers and firms better off, and the potential innovation and quality upgrading firms may engage in. Thus, protectionism is not the only way forward as it may lead to trade wars and may impede the gains from trade to be exploited.

This paper contributes to this debate by focusing on exporting as an escape strategy from the competitive pressures coming from a surge in imports, in particular from China. Thus, it looks at the relationship between markups, Chinese import competition and exporting at the firm level using a large sample of French manufacturing firms for the period 1995-2007. In the first place, we study the effect of increasing international competition from China, in particular following its access into the World Trade Organization (WTO) in 2001, on firms' price-cost margins. Unlike other contributions in the literature, we are able to calculate a firm-level measure of Chinese import competition by combining information on Chinese imports at the 4-digit industry level and firm-level weights in each industry. Then, we look at the role of exporting as a potential way to escape these competitive pressures. Indeed, we study how being an exporter is related to Chinese import competition. Moreover, we include in our analysis firms' choices over imports of Chinese intermediates and high-technology activities and how they affect the above relationships.

Our empirical methodology takes into account that Chinese import penetration, our preferred measure of Chinese competition, may be endogenous. Thus, we use the instrumental variable approach put forth in Autor et al. (2013), but we apply it at the firm level.

The results show that, indeed, firms in more direct competition with Chinese imports decrease their markups. However, when firms manage to become exporters, they face a smaller reduction in their markups. Consistent with these findings, the results also show that firms facing tougher competition from China are more likely to export to avoid such competitive pressures. On the other hand, the analysis shows no evidence regarding the effect of importing materials from China and technology on markups.

The paper is linked to several strands of the industrial organisation and international trade literature. Since the seminal works by De Loecker (2011) and De Loecker and Warzynski (2012), several papers have estimated markups at the firm level and have studied their relationship with productivity, quality, exporting status and other relevant variables (De Loecker and Goldberg, 2014; Collard-Wexler and De Loecker, 2015; Bellone

et al., 2016; De Loecker et al., 2016; Caselli et al., 2017). Our estimation of markups is taken from Caselli et al. (2018c), in which the same sample of French manufacturing firms is used to analyse the high incidence of firms displaying markups lower than unity for protracted periods of time. This paper shows that a potential reason why markups may fall, even below unity, is tougher competition from abroad.

Several papers build models with endogenous variable markups and firm heterogeneity that predict lower markups due to increasing product market competition (Melitz and Ottaviano, 2008; Atkeson and Burstein, 2008; Mayer et al., 2014; 2016). These papers can be included into the growing literature studying the pro-competitive effects of international trade (Edmond et al., 2015; Arkolakis et al., 2015). Our paper provides empirical evidence in favour of imports leading to greater competition and lower markups.

The rise of China in international markets and global value chains following its access into the WTO in 2001 is one of the most prominent examples of a trade shock that increases competition. Therefore, several papers have used this event to study the effects of trade on different aggregate outcomes, such as employment and wages (Autor et al., 2013; Dippel et al., 2017; Feenstra et al., 2017; Feenstra and Sasahara, 2017; Ciani and Mau, 2018) or voting patterns (Autor et al., 2016; Malgouyres, 2017; Dippel et al., 2017; Caselli et al., 2018b; Colantone and Stanig, 2018).

While all the previous papers look at the effects of rising Chinese competition on aggregate patterns, several contributions investigate the consequences of Chinese import competition on firms. These are, therefore, more related to the present work. Iacovone et al. (2013) analyse the intensive and extensive margin of adjustment by Mexican plants following the increase in imports from China. The authors find that sales of smaller plants and more marginal products lose, while larger plants and core products seem to be more impervious to the shock. Dhyne et al. (2016) look at the technical efficiency of Belgian firms and find that productivity increases with import penetration from China and that the productivity gains are higher for core products. Nesta and Schiavo (2018) exploit the same sample of French manufacturing firms used here to study the effect of Chinese import competition on workers' bargaining power.

A few studies have looked specifically at the effect of Chinese competition on prices and markups, finding that it exerts a negative effect on inflation and price-cost margins, both in the US and elsewhere. Chen et al. (2009) provide evidence for European countries using industry-level data, whereas Abraham et al. (2009) and Altomonte and Barattieri (2015) link import competition to lower markups respectively in Belgium and Italy. The effect of Chinese competition on Italian firms is also the focus of the work by Bugamelli et al. (2015), who find that a 0.1 percentage point increase in import penetration reduces price growth by 0.17 percentage points, and exerts a negative effect on employment, sales, and markups as well. The impact of Chinese competition on US prices has been recently investigated by Handley and Limão (2017) and Jaravel and Sager (2018): both papers document a significant negative effect. Finally, Caselli et al. (2018a) look at how markups and productivity dynamics of Mexican manufacturing plants are affected by Chinese competition by focusing on the heterogenous effects across plants and products. Their results show that less productive products and plants bear the negative effects of Chinese competition in terms of lower markups and lower productivity, possibly leading to a bad reallocation of resources across products within plants.

Our work is also related to the literature that investigates how firms respond to an

increase in import competition and, in particular, how they seek to escape from such competitive pressure. Fernandes and Paunov (2013) study the reaction of Chilean manufacturing plants to the trade liberalisation implemented at the end of the 1990s, and find that it led to significant quality upgrading. Utar (2014) finds that Danish firms directly affected by Chinese competition channel their innovative efforts away from products where China has a stronger competitive advantage, and become more skill oriented. Bloom et al. (2015) highlight a causal link between Chinese competition and the innovative efforts of European firms, measured in terms of patenting, ICT adoption and productivity growth. They show that import penetration triggers both increased innovation within firms, and a reallocation of employment towards the more technologically advanced companies. We contribute to all this growing literature by analysing the role of export as a strategy to escape the increase in competition, and the consequent decrease in markups.

The rest of the paper is organised as follows. The next section describes the data sources, the methodology used to estimate markups and provides some descriptive statistics. Section 3 describes the econometric model used to estimate the impact of Chinese competition on markups and shows the results of such analysis. On the other hand, Section 4 looks at how the exporting status of firms changes in response to Chinese competition. Section 5 provides some concluding remarks.

2 Data and estimation of markups

2.1 Data sources

We use data on a large sample of French manufacturing firms based on the *Enquête Annuelle d'Entreprises* (EAE), an annual survey that gathers information for manufacturing firms (excluding the food and beverages sector) with at least 20 employees. The survey was conducted by the French Ministry of Industry until 2007, which is the latest available year. The data include information from each company's income statement and balance sheet, from which we retrieve data regarding sales, value added, labour costs, number of employees, capital stock, intermediate inputs and exports. In particular, the output variable consists of revenues corrected by variation in inventories, labour is measured in terms of hours worked, obtained multiplying the number of effective workers by the average number of hours worked in a year in each sector (available at the 2-digit industry level from the *Groningen Growth Development Center*); the capital stock is obtained applying the permanent inventory method to information about investment and the book value of tangible assets (the necessary information on depreciation rates come from INSEE); intermediate inputs are defined as purchases of materials and merchandise, transport and travel, and miscellaneous expenses. After some basic cleaning, we have information for over 35,000 firms covering the period 1995-2007.[1]

The EAE also contains information about all the 4-digit industries in which the firm produces, with an indication of the amount of sales pertaining to each industry. Hence,

[1]We eliminate from the sample companies that only appear for a single year and those that have a ratio of intermediate inputs over sales smaller than 0.05 or greater than 2. After the estimation of markups, we also eliminate a small number of observations with extreme estimates of markups, that is below 0.1 and above 10.

we are able to compute a firm-specific measure of import penetration by combining information on the share of Chinese imports in domestic absorption (domestic production minus exports plus imports) at the 4-digit industry level, and weighting industries by their share in each firm's sales. We do not consider imports in intermediate products (as defined by the BEC classification) to compute import penetration: in this way, we limit the possibility that import penetration may pick up the beneficial effect of access to cheaper intermediate imports by French firms, and we also distinguish import competition from potential offshoring (Bernard et al., 2018), for which we do not have specific information. The weights are taken at the beginning of the period to avoid potential problems of endogeneity related to the fact that Chinese competition may also affect firms' choices in terms of product mix.[2] The use of fixed weights is appropriate in our context as the correlation between the weights at the beginning of the period and those in subsequent years is between 0.86 and 0.94 and, thus, the product portfolio remains relatively stable over time (Hummels et al., 2014; 2016). Given its definition, higher values of our import penetration variable imply higher potential competition from China for French firms.[3]

The list of the 4-digit industries in which each firm is active is also used to calculate the share of sales in high-technology industries. This information, however, is only available up until 2004. Last, we exploit data on exporting and importing activities by the universe of French firms, collected by the French Customs, to construct a dummy variable indicating whether a firm imports intermediate inputs from China.

2.2 Estimation of markups

In order to study how markups are affected by import competition from China, we first need to consistently estimate time-varying firm-level markups. The methodology is derived from De Loecker and Warzynski (2012) and it has been analysed further in several recent works (De Loecker and Goldberg, 2014; De Loecker et al., 2016). The approach assumes that firms minimise costs and at least one input is adjusted freely (materials), while the other factors may show frictions in their adjustment (capital and labour). Unlike previous contributions, however, this framework neither imposes constant returns to scale nor requires the computation of the user cost of capital.

De Loecker and Warzynski (2012) derive a simple expression for markups from a firm's cost minimisation problem. This expression is given by

$$\mu_{it} = \theta_{it}^{m} \left(\alpha_{it}^{m} \epsilon_{it}\right)^{-1}, \tag{1}$$

where μ_{it} is the markup of firm i at time t, θ_{it}^{m} is the output elasticity of materials (superscript m), α_{it}^{m} is the revenue share of materials and ϵ_{it} is the error term of a regression of output on a third-order polynomial on all inputs and it is included to get

[2] We use the product mix in 1994 whenever this is available. For firms that enter the sample in later years, we compute weights in the first year of observation, but then drop the initial year from the subsequent analysis.

[3] As a robustness check, we use an alternative measure of import competition from China that is often used in the literature, that is the share of Chinese imports in total French imports. This variable is constructed in the same way as Chinese import penetration, but the denominator only includes total imports and not domestic absorption. The results presented in the rest of the paper are robust to the use of either proxy for Chinese import competition.

rid of pure error term in the measure of markups. While it is straightforward to compute the revenue share of materials from the data, the estimation of the output elasticity of materials is more demanding as it relies on estimates of a production function, assumed here to be translog.

In order to get unbiased estimates of the output elasticity of materials at the firm-year level, we consider the following general production function for firm i in industry s at time t:

$$\hat{y}_{it} = f_s\left(l_{it}, k_{it}, m_{it}; \beta\right) + \omega_{it} + \varepsilon_{it}, \tag{2}$$

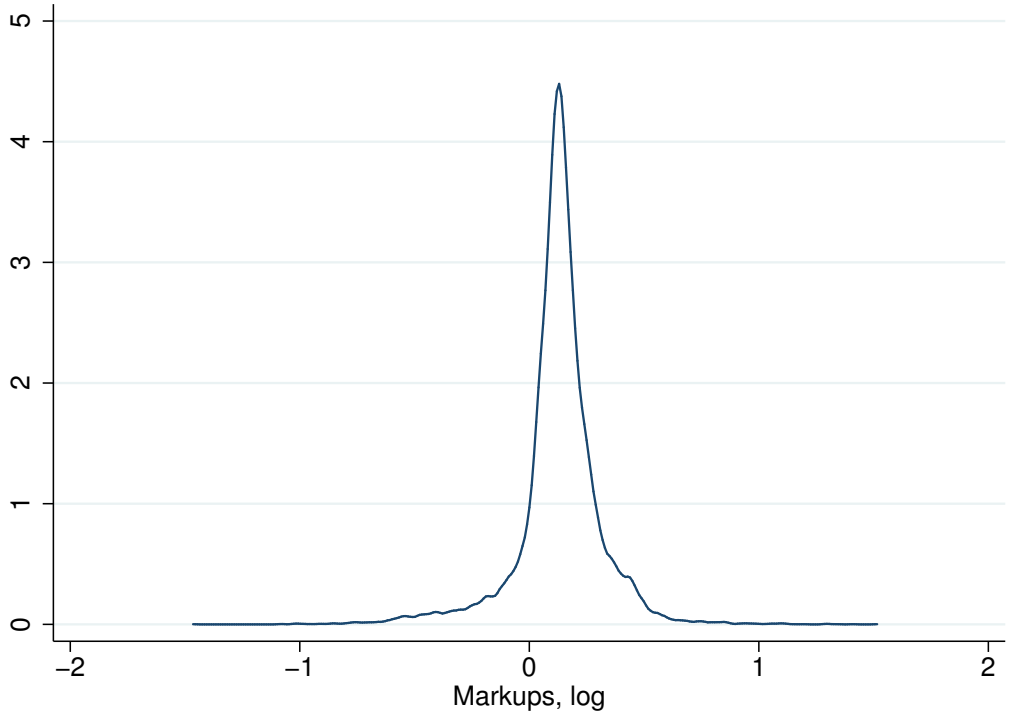
where $\hat{y}_{it}$ is the predicted natural logarithm of real sales of firm i at time t ($\hat{y}_{it} = y_{it} - \epsilon_{it}$), l_{it}, k_{it} and m_{it} are respectively the natural logarithms of the quantities of labour, capital and materials used by the firm and that get transformed into the output according to the production function f_s, β 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. Productivity is, thus, assumed to be Hicks-neutral and specific to the firm, as in the approach using inputs to control for unobservables in production function estimations (Olley and Pakes, 1996; Levinsohn and Petrin, 2003; Ackerberg et al., 2015). The function f_s is assumed to be translog and it is allowed to change across two-digit sectors, as implied by the subscript s. Thus, the parameter vector β is made up of nine parameters for each sector. The terms with a hat are estimated. It is important to notice that this is actually a revenue function as it is not possible to obtain data on output prices at the firm level.

Different estimators can be used to estimate the production function in equation (2). The preferred estimator in this paper is the Wooldridge-Levinsohn-Petrin (WLP) estimator, as derived from Wooldridge (2009) and implemented in Petrin and Levinsohn (2012). The WLP estimator is related to the approach of using inputs to control for unobserved productivity shocks in production function estimations. The introduction of lagged values of specific inputs as proxies for productivity addresses potential endogeneity issues related to the simultaneous determination of inputs and unobserved productivity, as suggested by Wooldridge (2009). Moreover, this estimator does not assume constant returns to scale, is robust to the Ackerberg et al. (2015) criticism of the Levinsohn and Petrin (2003) estimator and is programmed as a simple instrumental variable estimator.

The WLP estimator requires the variables affecting the productivity process to be specified. Following Petrin and Levinsohn (2012), it is assumed that productivity is a function of a first-order polynomial in the natural logarithms of lagged capital and materials. In addition, following De Loecker (2013), we take into account the potential effects of firms' international trade status on productivity by means of a dummy for exporting. Year fixed effects are also included to account for time-variant shocks common to all plants. All these additional regressors are not included in the function f_s.

After having estimated the production function parameters β based on the translog specification, it is possible to compute the output elasticity of materials. Using these estimates of the output elasticity of materials and the calculated revenue shares of materials, we calculate markups at the firm-year level based on equation (1). Moreover, using the same estimates of the production function parameters, it is possible to compute total factor productivity (or simply productivity) as the difference between observed and

Figure 1: Distribution of markups, 2000



Source: Own estimations using French manufacturing data from *Enquête Annuelle d'Entreprises* and the WLP estimator of the production function.

expected output:

$$\hat{\omega}_{it} = \hat{y}_{it} - f_s\left(l_{it}, k_{it}, m_{it}; \hat{\beta}\right). \tag{3}$$

As noted by Petrin and Levinsohn (2012), this estimate of productivity includes the error term ε_{it}. However, as long as this error term is pure noise and uncorrelated with the variables in the production function, it does not bias the results, but it may lead to larger standard errors.

2.3 Descriptive statistics

Next, we provide some descriptive statistics for our estimated markups and rising import penetration from Chinese imports. Figure 1 shows the distribution of the point estimates for markups (in logs) for the year 2000. The figure shows that most markups fall within a narrow range, indeed about two thirds of observations have price-cost margins between zero and 25%. The mean and median values of price-cost margins are pretty close, about 13%, thus implying a rather symmetric distribution. Similar figures can be found for other years and can also be observed for the case of India (De Loecker and Goldberg, 2014; De Loecker et al., 2016) and Mexico (Caselli et al., 2017). It is interesting to notice that during the time period analysed, both mean and median markups tend to decrease.

The explanation put forth in this paper for this decrease in markups is the increase in competition in world markets coming from Chinese (and other low-wage-country) firms.

Table 1: Rise of China in France, 1995-2007

	Import penetration share			*Share of imports*		
	1995	2007	%Δ	1995	2007	%Δ
Automotive	0.0005	0.0006	20%	0.0010	0.0022	120%
Chemicals	0.005	0.013	160%	0.014	0.036	157%
Clothing and footwear	0.052	0.166	219%	0.097	0.235	142%
Electric and electronic comp.	0.002	0.005	150%	0.059	0.069	17%
Electric and electronic eq.	0.0004	0.0031	675%	0.0011	0.0063	473%
House equipment and furnishings	0.032	0.078	144%	0.059	0.139	136%
Machinery and mechanical eq.	0.0002	0.0019	850%	0.0008	0.0068	750%
Metallurgy, iron and steel	0.002	0.006	200%	0.011	0.034	209%
Mineral industries	0.007	0.020	186%	0.015	0.046	207%
Pharmaceuticals	0.0007	0.0036	414%	0.0024	0.0140	483%
Printing and publishing	0.0003	0.0018	500%	0.0014	0.0071	407%
Textile	0.009	0.045	400%	0.026	0.081	212%
Transportation machinery	0.002	0.006	200%	0.003	0.023	667%
Wood and paper	0.006	0.010	67%	0.021	0.021	0%
Total	0.009	0.019	111%	0.023	0.043	87%

Notes: The table reports the (unweighted) mean values for the Chinese import penetration share and the share of Chinese imports, measured at the firm level, in 1995 and 2007 and the percentage change during this period by two-digit manufacturing sectors.

From 1995 to 2007, the value of Chinese imports in France increased seven-fold. This is in line with what happened in other advanced economies (Autor et al., 2013; Dippel et al., 2017; Caselli et al., 2018b). Over this period, Chinese imports grew faster than total imports in France and, therefore, the share of Chinese imports in total imports went up from just below 2% to over 6% on average. In a related manner, the market share of Chinese imports (or import penetration) in France more than doubled on average as it went from just less than 1% to almost 2%. Thus, during this period French manufacturing firms faced a large increase in competition from Chinese imports.

Table 1 shows how the Chinese import penetration share and the share of Chinese imports in France, both measured at the firm level, changed from 1995 to 2007 by two-digit manufacturing sectors based on data in our sample. The table shows for each variable the unweighted average levels in 1995 and 2007 and the percentage change over this period. The sectors that got hit the hardest by the rise of China are machinery and mechanical equipment, electric and electronic equipment, printing and publishing, pharmaceuticals and textile, with increases in the import penetration share above 400%. On the other hand, the sectors that were hit the least are automotive, and wood and paper. Both proxies for Chinese import competition show similar patterns and, thus, in the rest of the analysis we focus on the Chinese import penetration share.

The increase in Chinese competition has been heterogeneous not only across different sectors, but also across firms within the same sector. Such heterogeneity across firms in the increase in Chinese import competition may be associated with fundamental differences across firms. To understand such differences, Table 2 reports the results of a series of bivariate ordinary least squares (OLS) regressions of firm characteristics in each row on a dummy variable indicating whether firms face a level of import penetration from China above the median value in each industry (high import penetration) and year. The firm

Table 2: Chinese import penetration premia

	(1)	(2)
Log sales	0.12***	-0.01***
Log hours worked	0.12***	
Log capital/labour	-0.16***	-0.18***
Log productivity	0.002***	0.002***
Log markups	-0.01***	-0.01***
Export status	0.04***	0.03***
Import China	0.03***	0.02***
Hi-tech share	0.04***	0.03***
Additional covariates	sector & year fe	sector & year fe + log labour

Notes: The table reports the results of bivariate ordinary least squares regressions of the firm characteristic described in each row on a dummy variable indicating whether firms face a level of import penetration from China above the median value (high) in each sector and year. Regressions in column (1) include two-digit sector and year fixed effects and regressions in column (2) include two-digit sector and year fixed effects and log of number of hours worked by employees (log labour) as controls. The variable 'Export status' is a dummy equal to one if the firm exports. The variable 'Import China' stands is a dummy indicating whether a firm imports intermediate inputs from China. The variable 'Hi-tech share' stands for the share of sales in high-technology industries. *** indicate coefficients significantly different from zero at the 1% level respectively.

characteristics we analyse are sales, labour, capital-labour ratio, productivity, markups, export status, a dummy indicating whether firms import intermediate inputs from China and share of sales in high-technology industries. The results reported use all years in the sample. For the variables in logarithms, the coefficients shown can be interpreted as average percentage differences.

Results do not change considerably depending whether we control only for sector and year differences (column 1), or also for firm size (column 2), with the exception of sales. Focusing on the results in column (2), firms that face more import competition from China seem to be somewhat smaller, less capital intensive and with slightly smaller markups, but higher productivity. Therefore, it seems that firms whose products are in more direct competition with foreign ones tend to struggle more along the above dimensions, with the exception of productivity. However, it is also possible to observe that firms facing more Chinese import competition tend to export more, import more intermediate inputs from China and to sell more high-tech products. These three characteristics are interesting because it is plausible that firms may try to escape foreign competition by exploring new markets, either geographically by exporting or through new and better products that may require different intermediate inputs. In the rest of the analysis we will explore more formally this hypothesis.

3 Markups and import competition

We analyse the impact of import competition from China on firm-level markups by means of a two-way fixed effects (FE) model. The baseline specification of our econometric model is given by the following equation:

$$\mu_{it} = \gamma_1 ChinaSh_{i,t-1} + \gamma_2 ExpD_{i,t-1} + \gamma_3 ChinaSh_{i,t-1} \times ExpD_{i,t-1} + \tau_{st} + \eta_i + e_{it}, \quad (4)$$

where $ChinaSh_{i,t-1}$ is the lag $(t-1)$ of Chinese import penetration based on the initial product mix of firm i, $ExpD_{i,t-1}$ is a dummy variable equal to one if firm i exports at time $t-1$, τ_{st} represents sector-year fixed effects, η_i represents firm fixed effects and e_{it} is an error term. It should be noticed that equation (4) also includes the interaction between Chinese import penetration and the export dummy, which is meant to capture the differential effect of foreign competition on exporting and non-exporting firms.[4]

While the use of lags for our right-hand-side variables should avoid some potential endogeneity problems related to reverse causality, we still cannot fully exclude that Chinese import penetration and firms' export status are exogenous. With regards to the potential endogeneity of export status, this stems from the fact that firms decide whether to export or not depending on their characteristics (e.g., productivity), which may be unobservable for us. To solve this issue, we follow the literature on dynamic panel data models (Blundell and Bond, 1998) and instrument the lag of firms' export status with its second lag.[5]

With regards to the potential endogeneity of Chinese import penetration, omitted variables, such as unobserved demand shocks, may impact both the relative quantity of Chinese imports and markups. While this endogeneity is clear at an aggregate level, it is also possible to find mechanisms causing endogeneity at the firm level. For instance, firms may decide which products to manufacture based on different competitive pressures. As mentioned in the previous section, this problem is partly solved by using fixed weights based on firms' initial product mix to construct the level of Chinese import competition faced by firms. Another reason why endogeneity may arise is related to the fact that larger firms and specific industries may be able to lobby politicians to push up tariffs and non-tariff barriers to trade to insure more protection from imports.

In order to address the potential endogeneity of Chinese imports, we follow the methodology developed by Autor et al. (2013). We develop an instrumental variable (IV) approach and use information on the imports from China recorded in seven high-income countries that do not belong to the Eurozone to construct an instrument for Chinese exports to France.[6] This allows us to exploit non-Eurozone trade patterns to identify 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

[4]It should be noted that equation (4) does not include any additional plant-level regressors, such as productivity, capital-labour ratio or the multi-product status of firms. The reason is that the inclusion of these potentially endogenous variables can bias our estimates on the main variables of interest, for which we do implement a strategy to account for potential endogeneity and omitted variables. Yet, all our results are robust to the inclusion of these additional covariates.

[5]Following the dynamic panel data models literature, there is the possibility that our econometric specification may produce biased estimates as it does not control for the potential persistence in markups. This bias can be potentially solved by using our IV approach described below, as long as the instruments are strictly exogenous. Alternatively, the inclusion of the lagged dependent variable among the controls in combination with the use of the system GMM estimator may also control for this issue. However, this approach provides unbiased estimates only if the error terms are serially uncorrelated and, moreover, it is only advisable if the persistence in markups is relatively high (Bobba and Coviello, 2007; Blundell and Bond, 1998). In our case, this last point does not seem to apply as the estimation of an AR(1) model yields an autoregressive coefficient for markups close to 0.4.

[6]These countries are Australia, Canada, Japan, New Zealand, Norway, United Kingdom, Switzerland. We choose non-Eurozone countries because shocks within the Eurozone are strongly correlated across countries.

WTO at the end of 2001) or by the increase in Chinese firms' productivity (Caselli et al., 2018b). It should be noted that also the instrument is calculated with the same firms' fixed weights used to construct the Chinese import share in France.[7]

Table 3 shows the effects of lagged Chinese import penetration and export status on markups based on the estimation of equation (4). The values of the Kleibergen-Paap F statistic are higher than the Stock-Yogo critical values, with the exception of the last specification. Thus, the instruments used in the main specifications are informative and our estimates do not suffer weak-instrument problems. Indeed, the first-stage regressions (available upon request) indicate that Chinese import competition has increased in analogous ways in France and in the seven non-Eurozone countries used to construct the instrument and that firms' export status is correlated with their past export status.

Column (1) shows a basic specification that only includes Chinese import penetration. The negative and significant coefficient indicates that higher competition from China leads to lower markups. With regards to the economic significance of the size of the coefficient, we can consider the average increase in Chinese import penetration between 1995 and 2007, that is one percentage point. Thus, average markups decreased by slightly more than 0.6 percentage points due to rising Chinese competition in this period. Alternatively, we can consider that the standard deviation of Chinese import penetration in the sample is 0.03 and, thus, markups decrease on average by 1.8 percentage points due to an increase in Chinese import competition by one standard deviation (above the mean). These are not insignificant numbers considering the small margins many firms survive with. Indeed, these effects imply that between one and two percent of firms in any given year would start charging a price below marginal cost due to rising Chinese import competition to stay on the market.

The negative effect of rising Chinese competition on markups is also found to be heterogenous across sectors. This is shown in Table 5 in Appendix A, where it can be seen that the effect is negative and significant in chemicals, electric and electronic equipment, house equipment and furnishings, and pharmaceuticals. These sectors have on average experienced larger percentage increases in Chinese import competition, as shown in Table 1.

In column (2), we add lagged export status to our specification in column (1). We find a negative, but statistically insignificant, coefficient on the export dummy. Even though this coefficient is not significant, it is in contrast with previous findings from the literature (e.g., De Loecker and Warzynski, 2012). On the other hand, the coefficient on Chinese import competition does not change significantly and, thus, remains negative and statistically significant.

The specification in column (3) adds an interaction between Chinese import penetration and a firm's export status. The coefficient is positive and statistically significant at the 5% level, while the coefficient on Chinese import competition remains negative and significant. Thus, Chinese import competition has a negative effect on markups, but this

[7]While below we provide evidence that the instrument is informative and the main results are not affected by weak instruments, it is important to notice that this so-called shift-share instrument has encountered some criticisms (Adão et al., 2018; Borusyak et al., 2018). However, such criticisms are more relevant at higher levels of aggregation than for applications at the firm level. Yet, we check the robustness of our results by clustering the standard errors at the industry level. The results do not change qualitatively and are available upon request.

Table 3: Markups response to Chinese import competition

	FE-IV (1)	FE-IV (2)	FE-IV (3)	FE-IV (4)	FE-IV (5)	FE-IV (6)
China share, lag	-0.612***	-0.527**	-0.930***	-0.845**	-0.945***	-1.629***
	(0.235)	(0.237)	(0.329)	(0.333)	(0.338)	(0.470)
Export, lag		-0.004	-0.008*	-0.009*	-0.009*	-0.012**
		(0.005)	(0.005)	(0.005)	(0.005)	(0.006)
China share, lag ×			0.451**		0.461**	0.417
Export, lag			(0.213)		(0.215)	(0.311)
China share, lag ×				0.345		
Export, lag × New exp = 0				(0.232)		
China share, lag ×				0.763***		
Export, lag × New exp = 1				(0.243)		
Import China, lag					-0.018	
					(0.015)	
China share, lag ×					0.155	
Import China, lag					(0.304)	
Export, lag ×					0.012	
Import China, lag					(0.015)	
China share, lag ×					-0.140	
Export, lag × Import China, lag					(0.319)	
Hi-tech share, lag						0.052***
						(0.015)
China share, lag ×						-0.383
Hi-tech share, lag						(1.348)
Export, lag ×						0.014
Hi-tech share, lag						(0.016)
China share, lag ×						1.528
Export, lag × Hi-tech share, lag						(1.383)
Firm fixed effects	yes	yes	yes	yes	yes	yes
Sector-year fixed effects	yes	yes	yes	yes	yes	yes
No of obs.	167392	144041	144041	144041	144041	118769
Kleibergen-Paap F statistic	216.00	1010.06	112.13	42.37	36.47	2.46

Notes: The dependent variable is the markup at the firm-year level. The variable 'Export, lag' is the lag of a dummy variable equal to one if a firm exports. The variable 'New exp' is a dummy equal to one for firms that have never exported before a given year and, once they start exporting, they do so in all the following years in which they are present in the sample. The variable 'Import China, lag' stands for the lag of a dummy variable indicating whether a firm imports intermediate inputs from China. The variable 'Hi-tech share, lag' stands for the lag of the share of sales in high-technology industries. The instrument used for 'China share, lag' is the share of Chinese imports in consumption goods in seven non-EU countries (Australia, Canada, Japan, New Zealand, Norway, Switzerland, United Kingdom). The instrument used for 'Export, lag' is the second lag of the dummy indicating the export status of a firm. Standard errors clustered at the plant level are shown in parentheses. *, ** and *** indicate coefficients significantly different from zero at the 10%, 5% and 1% level respectively.

effect is reduced when a firm exports. In quantitative terms, markups of non-exporting firms decreased by slightly less than one percentage point due to the average increase in Chinese competition between 1995 and 2007. However, the decrease in markups is halved for exporting firms. Alternatively, it is possible to calculate that markups of non-exporting firms decrease by almost three percentage points and those of exporting firms by about 1.5 percentage points due to an increase in Chinese import competition by one

standard deviation.

This result may suggest that exporting can be a successful strategy to escape rising competition from abroad. To investigate this further, we run an additional regression, shown in column (4), in which we also include a triple interaction between Chinese import competition, export status and a dummy equal to one for new exporters. Firms are defined as new exporters if they have never exported before a given year and, once they start exporting, they do so in all the following years in which they are present in the sample. The inclusion of this triple interaction is meant to detect if the reduction in the negative effect of Chinese import competition coming from exporting is heterogeneous and due to firms that start exporting (shown by the coefficient on the triple interaction when the dummy variable for new exporters is equal to one) or all firms that generally export (shown by the coefficient on the triple interaction when the dummy variable for new exporters is equal to zero). While the coefficient on Chinese import penetration remains negative and significant, the coefficient on the interaction between Chinese import penetration and export status becomes not significant for firms that are not defined as new exporters. On the other hand, the coefficient on the triple interaction associated with new exporters is positive and significant. The results show that the negative effect of Chinese import competition on markups is reduced only for firms that become exporters. In the next section, we will explore further how exporting and Chinese import competition are related.

Column (5) and column (6) test potential channels through which Chinese imports can influence markups. The specification in column (5) checks if importing materials from China affects markups as well as the relationship between Chinese import competition and markups by including a set of interaction variables. None of these additional variables displays a significant coefficient.[8] Finally, the specification in column (6) checks if engaging in high-technology activities matters in our findings by including the share of sales in high-technology industries and its interaction with both Chinese import penetration and exporting. The coefficient on Chinese import penetration is still negative and statistically significant, but it is now much larger in absolute terms. The share of high-technology activities has a positive and statistically significant relationship with markups, which implies that more technology-intensive firms have greater market power and enjoy higher price-cost margins, as one would imagine. All other coefficients are not statistically different from zero.

4 Exporting and import competition

Overall, the results suggest that rising competition from China has put pressure on French manufacturing firms, which have had to lower their markups. However, those firms that managed to start exporting were better able to withstand this challenge of rising international competition. Therefore, in this section we want to examine whether firms

[8] As a robustness, we check that the results we find are not affected by the inclusion of each firm's imports from China in the total Chinese import penetration measure we calculate. Indeed, the inclusion of eventual imports from China by the firm in question may not only cause some endogeneity, but it may also dampen the effect of Chinese imports on competition if firms import intermediate inputs within the same 4-digit industries they produce in and that are used to construct our firm-level proxies for Chinese import competition. The results do not change qualitatively and are available upon request.

are more likely to start exporting due to rising Chinese import competition.

Table 4: Export response to import competition (extensive margin)

	CRE-IV (1)	CRE-IV (2)	CRE-IV (3)
China share, lag	5.828***	4.591***	10.207***
	(0.863)	(0.989)	(1.092)
Import China, lag		0.211***	
		(0.058)	
China share, lag ×		-3.674**	
Import China, lag		(1.568)	
Hi-tech share, lag			0.191*
			(0.109)
China share, lag ×			-2.308
Hi-tech share, lag			(2.678)
Error term, 1st stage (1)	-7.660***	-6.572***	-12.029***
	(1.263)	(1.369)	(1.843)
Error term, 1st stage (2)		3.827*	4.743
		(2.258)	(5.809)
Marginal effects (at means)			
China share, lag	0.633***	0.459***	1.058***
	(0.096)	(0.105)	(0.118)
RHS vars, mean	yes	yes	yes
Random effects	yes	yes	yes
Sector fixed effects	yes	yes	yes
Year fixed effects	yes	yes	yes
No of obs.	167392	167392	141608
Wald statistic	1212.89	1528.97	1614.44
Wald statistic, 1st stage (1)	7452.71	883.03	8975.35
Wald statistic, 1st stage (2)		1800.40	669.11

Notes: The dependent variable is a dummy variable indicating the export status of firm-year pairs. The variable 'Import China, lag' stands for the lag of a dummy variable indicating whether a firm imports intermediate inputs from China. The variable 'Hi-tech share, lag' stands for the lag of the share of sales in high-technology industries. The instrument used for 'China share, lag' is the share of Chinese imports in consumption goods in seven non-EU countries (Australia, Canada, Japan, New Zealand, Norway, Switzerland, United Kingdom). The variable 'Error term, 1st stage (1)' and the statistic 'Wald statistic, 1st stage (1)' refer to the first stage for 'China share, lag'. The variable 'Error term, 1st stage (2)' and the statistic 'Wald statistic, 1st stage (2)' refer to the first stage for 'China share, lag × Import China, lag' in column (2) and 'China share, lag × Hi-tech share, lag' in column (3). 'RHS vars, mean' refers to the inclusion of regressors based on the within-firm mean of right-hand side variables. Standard errors clustered at the plant level are shown in parentheses. *, ** and *** indicate coefficients significantly different from zero at the 10%, 5% and 1% level respectively.

In order to study firms' decision to export, we estimate the following equation:

$$ExpD_{it} = \delta_1 ChinaSh_{i,t-1} + \varsigma_s + \iota_t + \xi_i + \varepsilon_{it}, \tag{5}$$

where ς_s represents sector fixed effects, ι_t represents time fixed effects, ξ_i represent firm-level effects and ε_{it} is an error term. As our dependent variable is a binary variable equal to one if the firm exports, we can estimate equation (5) with the probit estimator.[9]

[9]In order to interpret the estimated effects in the probit model, we calculate and report marginal

Accounting for heterogeneity across firms in a probit estimation is not straightforward. Therefore, we follow the approach by Papke and Wooldridge (2008) and actually estimate equation (5) with the correlated random effects (CRE) estimator. This estimator is based on probit, but includes both random effects as well as the within-firm means of each right-hand-side variable. Moreover, as shown by Papke and Wooldridge (2008), this estimator can also include an IV strategy to take into account endogenous variables. In this case, however, because the probit model is nonlinear, it is preferable to include in the second stage the error term from the first stage alongside the original endogenous variable rather than the predicted values of the endogenous variable.

Table 4 shows the estimates of different specifications based on equation 5. As for the markups regressions, Chinese import penetration may be endogenous and, therefore, we use the same IV approach as before and construct an instrument for Chinese imports in France based on imports from China recorded in seven high-income countries that do not belong to the Eurozone.

Column (1) includes Chinese import penetration by itself. Firstly, it is important to notice that the coefficient on the error term from the first stage is highly significant, which implies that Chinese imports are likely to be endogenous. Moreover, our IV strategy should be informative based on the Wald statistic from the first stage. The coefficient on Chinese import penetration is positive and highly significant, which implies that firms facing greater import competition from China are more likely to export. The marginal effect shows that an increase by one percentage point in Chinese import penetration increases the probability of exporting by 0.6 percentage points.

Then, we test whether importing or engaging in high-technology activities affects the probability of exporting. The results, shown in column (2) and (3), provide some evidence in favour of the fact that firms that import intermediate inputs from China and high-technology firms are more likely to export. Moreover, importing firms that face higher Chinese import competition tend to have a lower probability of exporting relative to firms that do not import from China, although the total marginal effect of an increase in Chinese import penetration is positive for both groups of firms. While this result may seem apparently odd, it could be due to the fact that firms directly importing from China can take advantage of cheaper and more diverse inputs and, as such, may be less in need to escaping Chinese competition by moving into exporting. On the other hand, high-technology firms that also face higher Chinese import competition do not engage differently in the export market.

5 Conclusion

Several contributions have shown that trade openness, in particular with low-wage countries and China, is associated with rising product market competition and, therefore, lower market power of domestic firms. This paper contributes to this strand of the economic literature by showing robust evidence in favour of these predictions using a large sample of French manufacturing firms for the period 1995-2007. In particular, we study

effects at the means of all additional regressors. Alternatively, one could estimate the model in equation (5) by means of a straightforward fixed effects model, but this would yield results that are less reliable. Indeed, the linear probability model leads to more than half of observations with predicted values for firms' export status either lower than zero or greater than one.

how the increase in Chinese import penetration on the French market affects markups. Moreover, we analyse whether exporting can provide a way to escape such competitive pressures.

The results show that firms whose product mix is in more direct competition with Chinese imports decrease their markups. However, firms manage to reduce their markups by a smaller magnitude if they are exporters. In line with these findings, the results also show that firms facing tougher competition from China are more likely to export to avoid the competitive pressures caused by the increase in import penetration. On the other hand, the analysis finds no strong evidence regarding the role of importing materials from China and engaging in high-technology activities.

Yet, the paper is not able to detect if firms start exporting to other countries that face less competition from China or they decide to export because they can command higher markups in foreign markets. This is an interesting avenue for future research regarding exporters' success.

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Appendix

A Effect of China share on markups by sector

Table 5: Markups response to Chinese import competition by sector

	FE-IV (1)
China share, lag ×	
Automotive	0.875
	(3.149)
Chemicals	-1.561***
	(0.550)
Clothing and footwear	-1.524
	(1.023)
Electric and electronic components	0.863
	(2.095)
Electric and electronic equipment	-2.042**
	(0.915)
House equipment and furnishings	-1.066***
	(0.346)
Machinery and mechanical equipment	-0.304
	(0.421)
Metallurgy, iron and steel	-0.165
	(0.239)
Mineral industries	-0.379
	(0.240)
Pharmaceuticals	-2.279*
	(1.346)
Printing and publishing	4.338
	(3.021)
Textile	-0.778
	(0.640)
Transportation machinery	2.373
	(4.633)
Wood and paper	-1.057
	(0.788)

Notes: The dependent variable is the markup at the firm-year level. The instrument used for 'China share, lag' is the share of Chinese imports in consumption goods in seven non-EU countries (Australia, Canada, Japan, New Zealand, Norway, Switzerland, United Kingdom). Standard errors clustered at the plant level are shown in parentheses. *, ** and *** indicate coefficients significantly different from zero at the 10%, 5% and 1% level respectively.