Market Power in Input Markets:

Theory and Evidence from French Manufacturing*

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Abstract

This paper documents the market power of large buyers in foreign input markets, and evaluates its effect on the aggregate economy. I develop an empirical methodology to consistently estimate buyer power at the firm level, and apply it using longitudinal data on trade and production of French manufacturing firms from 1996-2007. My results show that the buyer power of large French importers is substantial, and concentrated in key sectors and firms. I then incorporate heterogeneous buyer power in a general equilibrium model of production, and show that it induces large distortionary effects on the aggregate economy, worth about 3% of gross manufacturing output in France. In spite of such output distortions, total real income in the economy increases, due to transfers of rents from foreign input markets. My analysis suggests that policies that spur import market integration can play a role in stimulating aggregate production.

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1 Introduction

A significant body of theoretical and empirical research has analyzed market power among sellers of goods. By contrast, market power on the *buyers'* side has been largely under-explored. Yet large buyers now figure prominently as a salient feature in many sectors of the economy, and their ability to force sellers to lower prices below competitive levels is raising concerns among competition authorities and policymakers.[1,2] Consider the example of Zara, one of the world's largest fashion manufacturers. Zara has sustained a remarkable growth in profits over the last decade, despite a thick market downstream that results in intense price competition. While there are many possible explanations for Zara's increasing margins, a cost advantage may plausibly be a significant factor. The company largely outsources its production to low-income countries, where it has a dominant buyer position. This position could potentially be used to extract low prices. Such behavior would generate distortions even beyond the input market, because downstream competitors might be unable to rival the dominant buyer's low input prices, and/or because of allocative inefficiencies in production.[3,4]

This paper documents the market power of buyers in *foreign input markets*, a setting where this type of distortion is likely to emerge. I lay out a methodology to consistently estimate buyer power from micro data. Using panel data on firm trade and production, I apply this methodology to study buyer power in a large economy: France. Based on the empirical findings, I incorporate oligopsony power in a workhorse static general equilibrium model of a production economy and study its effect on the equilibrium (mis)allocation of resources across heterogeneous firms. I then bring together model and empirics to quantify the magnitude of these effects for the French economy.

My starting point is a simple theoretical framework where cost minimizing producers choose the optimal quantity of at least two variable inputs free of adjustment costs. My conceptual framework builds on existing work in the literature on markup estimation (Hall,

[1]See, e.g. *American Antitrust Institute (AAl}'s Transition Report on Competition Policy* (2008) - Chapter 3).

[2]Hereafter, I am going to use the terms "buyer power" and "input market power" interchangeably. Noll (2004) defines buyer power as "the circumstance in which demand side of a market is sufficiently concentrated that buyers exercise market power [..] Thus, buyer power arises from monopsony (one buyer) or oligopsony (a few buyers), and is the mirror image of monopoly or oligopoly".

[3]The same line of reasoning is easily applicable to other sectors, such as retail, e.g. Amazon and Walmart, or services, e.g. Uber.

[4]As an economic issue, market power of firms (not necessarily as sellers of goods) has recently received renewed attention in the economic literature, due to its plausible connection to a number of trends common to many rich countries, such as the rising concentration and profit margins of large corporations. See, e.g. Barkai (2016); Blonigen and Pierce (2016); De Loecker and Eeckhout (2017); Zingales (2017).

1988; De Loecker and Warzynski, 2012; De Loecker et al., 2016), generalizing their underlying model of firm behavior to account for imperfect competition in input markets. I allow for imperfect buyer competition by allowing input prices to be a flexible function of the demand of the firm. In this framework, the market power of the buyer in a given input market is identified as an input efficiency wedge in her first order condition for that input. I show that this wedge can be expressed as a function of the revenue share of the input (namely the share of expenditure on the input over total firm revenues), its output elasticity, and the firm's markups over marginal costs. By exploiting the first order conditions of *two* variable inputs, I then obtain a system of two equations in three unknowns (one seller markup, and two buyer markups), which can be manipulated to obtain an expression that relates the *buyer* markups to revenue shares and output elasticities. The revenue shares are directly available in most production datasets, whereas the output elasticities can be obtained by estimating the firm-level production function.

I specify the production function of the firm as a function of capital, labor, domestic materials and foreign materials. The two material inputs, which I construct as firm-level aggregates, are the two variable inputs of interest. Throughout the empirical analysis, I maintain the assumption that firms are price takers in the market for the *domestic* material input, which enables me to pin down the *level* of buyer power in the *foreign* market, in comparison to this competitive benchmark.

I estimate the output elasticities of the productive inputs using state-of-the-art techniques from the production function estimation literature (e.g. Ackerberg et al., 2015). The lack of data on both physical units and prices of inputs and output at the firm level can present an important challenge here. A well-known problem associated with using *nominal* instead of *physical* measures of inputs and output is the existence of severe biases in the estimates of the production function, due to demand shocks, markups, and input market power (cf. Foster et al., 2008; Katayama et al., 2009; De Loecker and Goldberg, 2014). Existing approaches to these so-called *input* and *output price biases* involve restrictions on competition in both the input and output markets. In particular, due to data limitations, all input markets are usually assumed perfectly competitive (e.g. De Loecker et al., 2016).

I show that by using readily available trade data, this problem can be addressed. Specifically, I construct measures of firm-level prices of output and the imported input from the observed firm-product-country export and import unit values. The idea is that the data on unit values of firm exports and imports of intermediate goods contain information on how much more or less the firm charges (pays) for a given product-market, compared to the average firm in France. By aggregating firm-product-market price deviations at the level of the firm, I obtain a measure, for both the output and imported input, of the average deviation of the firm price from the average price in the industry, which I then use alongside existing bias correction approaches to address the estimation biases in an internally consistent way.

I use longitudinal data on firm trade and production for the French manufacturing sector over the period 1996-2007, and apply this methodology to study imperfect competition in the market for foreign intermediates. Imported intermediate inputs are an important feature of a country's economic performance. Intermediate inputs account for the majority of world trade (Johnson and Noguera, 2012) and play an increasingly important role in production in many sectors of the economy (Yi, 2003). Moreover, a large body of existing empirical literature documents that trade in intermediates has important implications for firm-level and aggregate-level economic outcomes, such as productivity and welfare (Goldberg et al., 2010; Halpern et al., 2015). The fragmented nature of the global marketplace, where input markets are often "isolated" due to formal or informal trade barriers, along with the concentration of imports in a small number of large firms (Bernard et al., 2007a), makes the market power of downstream firms a potentially important economic issue in this setting.

My empirical results provide evidence that firms exercise significant buyer power in the foreign input market, both within and across industries. Specifically, the evidence shows that the average firm spends *too little* on the foreign input relatively to the domestic one, given what one would expect in light of their output elasticities. I interpret this finding to suggest that firms curb the demand of the foreign input in order to keep its price low, and hence that buyer power is an important feature of the data. This particular structural interpretation of the input efficiency wedge is supported by several facts, and observations. Across industries, I find that average buyer power is high in sectors where inputs are exchanged in localized and spatially differentiated markets (e.g. livestock, unprocessed food), and are characterized by large transportation or storage factors (e.g. iron ore). These distinctive structural market characteristics have often been associated with the existence of monopsonistic buyers (e.g. Kerkvliet, 1991; Rogers and Sexton, 1994; Bergman and Brännlund, 1995 for the mining, food, and wood sector, respectively). Firm-level evidence further shows that buyer power is positively and significantly correlated with firm size and productivity.[5]

In order to investigate the implications of market power of buyers for the aggregate economy, in the second part of the paper I employ the empirical findings and incorporate oligopsony power in a simple static general equilibrium model of a production economy. In the model, I make two important assumptions: first, that there are increasing marginal costs

[5]To give an example of how these indirect evidence supports the buyer power interpretation, suppose that the geographic mobility of a given input is restricted, such that the sellers have access to only those buyers who are able to reach the production site in a cost-effective way. Because larger firms have superior sourcing technology, they can easily reach those production sites, and hence they are more likely to be in the position to take advantage of local sellers.

in the production of an horizontally differentiated intermediate input, which implies that the correspondent supply curve is upward sloping, and that there exist rents in the input market; second, I assume that buyers exercise market power, and seek to transfer rents from the sellers' to the buyers' side of the market. The source of market power of buyers is their positive market share in the market for the foreign intermediate input, which I allow to vary across firms due to the heterogeneity in the size of the demand of their competitors upstream, taken as given by the firm.

Market power of buyers generates equilibrium distortions along several channels. At the individual firm level, firms with high buyer power: *(i)* buy fewer inputs, *(ii)* have a higher capital-intermediate ratio, and *(iii)* produce less output. In the aggregate, total output decreases with the average degree of buyer power in the economy. This effect is due to an upward sloping supply of the distorted input and imperfect input substitutability, which together imply that all firms underproduce relative to the input-competitive equilibrium.

I then aim to evaluate the impact of buyer power on aggregate variables, focusing on total manufacturing output and imports, on the transfers between the foreign and the domestic country, and on total income. The estimation procedure in the first part of the paper returns direct estimates of almost all the unknown model parameters, making the model easy to fit to the data. The results show that total manufacturing output would increase by about 3% in a counterfactual world where firms are price takers in all input markets. In spite of that, total real income in the domestic economy would decrease in the competitive counterfactual, by 0.4%. The effect of buyer power on income depends on two underlying forces: on the one hand, income increases because total payments to the domestic input increase, due to the higher aggregate demand; on the other hand, total profits decrease, due to lower rent transfers from the foreign to the domestic economy, and this lowers the income of the representative agent owning both the productive input, and claims to firms' profits. I argue that these results suggest that buyer power could have important implications in terms of aggregate income inequality within a country. A straightforward policy recommendation that emerges from my model is that in order to spur the aggregate production of an economy, trade policy should foster import market integration, so as to make a larger number of buyers available to foreign producers, and thus reduce the scope of buyer power of large importers. In this sense, trade policy could implicitly act as an international antitrust policy.

This paper builds on prevailing related literature. The framework to measure buyer power from production data is based on a generalization of an approach developed by Robert Hall (1986; 1988; 1989) to estimate industry markups.[6] In particular, I build on recent work by

[6]The idea of conjugating producer theory and econometrics to provide structural estimates of market power has a long tradition in the industrial organization literature (e.g., Iwata, 1974; Appelbaum, 1982;

Crépon et al. (2005) and Dobbelaere and Mairesse (2013), who extended Hall's framework to estimate the degree of imperfect competition in French labor markets. Unlike these authors, I focus on imperfect competition in the market for foreign intermediate inputs; most important, I address several econometric issues in estimation, such as the endogeneity of input choice with respect to unobserved productivity, input prices and output prices. In this sense, my approach is similar to De Loecker and Warzynski (2012), who first combined Hall's framework with econometric tools to estimate markups of sellers.

My work also speaks to the literature on production function estimation. To date, empirical studies have ruled out input market power in production function estimation, mostly due to data limitations.[7] By contrast, I allow firms to have market power in the purchase of the imported goods, and still achieve consistency in estimation.

Another literature my paper speaks to is the one on imported intermediate inputs and productivity (Amiti and Konings, 2007; Goldberg et al., 2010; Gopinath and Neiman, 2014; Halpern et al., 2015). This literature finds that firms who use foreign intermediate inputs have higher measured productivity, with positive effects for the aggregate economy (Halpern et al., 2015).[8] Standard explanations for the foreign intermediates-productivity correlation include higher quality of foreign intermediates and a love-of-variety channel. These studies use expenditure-based measures of input productivity, and confound the effect of prices and quantity of inputs. My study suggests that buyer power may constitute a significant confounding effect of estimates of productivity of the foreign intermediate inputs.

My paper also contributes to the literature on imperfect competition and import trade (e.g. Krolikowski and McCallum, 2016; Eaton et al., 2016). In the prevailing literature, imperfect competition in import markets arises from search or information frictions. My findings suggest that models of monopsony or oligopsony power of large importers provide an alternative description of the data in a large number of manufacturing sectors.

Finally, my work relates to an extensive literature on misallocation and firm heterogeneity (e.g. Restuccia and Rogerson, 2008; Hsieh and Klenow, 2009) , and particularly to the literature on market-power induced misallocation (e.g. Epifani and Gancia, 2011; Peters, 2016), by studying the effect of buyer market power on the equilibrium (mis)allocation of

Bresnahan, 1989 together with Hall). Starting in the late eighties, several studies came out that popularized the use of conjectural-elasticity models to test price-taking behavior of firms in *both* input and output markets (Schroeter, 1988; Azzam and Pagoulatos, 1990; Murray, 1995). The majority of these papers specify a structural demand and supply model, and focus on specific industries.

[7]Existing empirical studies assume perfectly competitive input markets, and often ignore any firm-level variations in input prices (e.g. De Loecker and Warzynski, 2012; Ackerberg et al., 2015). These approaches are not appropriate in a study of market power.

[8]Other studies that document a positive welfare effect associated with higher imports of intermediate goods include Amiti and Konings (2007); Goldberg et al. (2010); Gopinath and Neiman (2014); Blaum et al. (forthcoming)

resources across heterogeneous firms. To the best of my knowledge, this paper is the first one doing this exercise, both at a theoretical and an empirical level.

The remainder of the paper is organized as follows. I introduce the conceptual framework and estimation routine in Section 2. In Section 3 I describe the empirical exercise, the data sources, and main results. In Section 4 I describe the theoretical model, the main theoretical results, and the counterfactual exercise. Section 5 concludes.

2 A Framework to Estimate Input Market Power

This section describes a simple framework for estimating input market power at the firm level. I build on existing work in the literature on markup estimation (Hall, 1988; De Loecker and Warzynski, 2012), and generalize their underlying model of firm behavior to account for imperfect competition in input markets. I consider the optimization problem of a firm i, producing output Q_{it} at time t. I assume that the firm uses two variable inputs in production: a *domestic* intermediate input, which I denote by V_{it}^m; and a *foreign* intermediate input V_{it}^x.[9] I consider domestic and foreign intermediates as firm-level aggregates. As such, I consider them as different *inputs* (e.g. apples vs. oranges), rather than different *varieties* of the same input (e.g. domestic apples vs. foreign apples).[10] This choice is motivated by the application and data used in this paper, which I describe in section 3. I present the conceptual framework and the main results in 2.1; I then describe production function estimation, and how I implement the methodology with the available data in 2.2.

2.1 Deriving an Expression for Input Market Power

A firm i produces output in each period according to the following technology:

$$Q_{it} = Q(\mathbf{V}_{it}, \mathbf{K}_{it}; \Theta_{it}), \tag{1}$$

where $\mathbf{V}_{it} = \{V_{it}^m, V_{it}^x\}$ are the variable inputs in production, which the firm can flexibly adjust in each period; while $\mathbf{K}_{it}$ is the vector of "dynamic" inputs, subject to adjustment costs, or time-to-build.[11] I restrict to well-behaved production technologies, which means that I assume that $Q(\cdot)$ is twice continuously differentiable with respect to its arguments.

[9] The discussion can be easily generalized to the case where there are $N \geq 2$ variable inputs.

[10] This assumption is validated by a large body of work in the international trade literature showing that imported inputs are different than the domestic ones, both in terms of quality and product characteristics (e.g. Goldberg et al., 2010; Halpern et al., 2015).

[11] Although I assume $\mathbf{V}_{it} = \{V_{it}^m, V_{it}^x\}$, note that the only requirement that is necessary is that the vector $\mathbf{V_{it}}$ has *at least two* elements.

In each period, firms minimize short-run costs, taking as given output quantity and state variables, which include dynamic inputs ($\mathbf{K}_{it}$), exogenous factors such as firm location, and other payoff-relevant variables. In order to allow for non-competitive buyer behavior, I consider the following mapping between input price and input demand of firm i:

$$W_{it}^{j} = W\left(V_{it}^{j}; \mathbf{A}_{it}^{j}\right) \ \forall \ j = m, x, \tag{2}$$

where $\mathbf{A_{it}}^{j}$ denotes other exogenous variables affecting prices. Equation (2) encompasses both perfect and imperfect competition in input markets. In particular, when markets are competitive the firm takes prices as given, and $\frac{\partial W_{it}^{j}}{\partial V_{it}^{j}} = 0$. Conversely, under imperfect competition the buyer takes into account the effect that her demand has on prices, which means $\frac{\partial W_{it}^{j}}{\partial V_{it}^{j}} \neq 0$. Note that the key element in (2) is that W_{it}^{j} is allowed to depend on the quantity of input V_{it}^{j} chosen by the firm.

The first-order condition for any variable input V_{it}^{j} with $j = \{m, x\}$ is:

$$\frac{\partial \mathcal{L}}{\partial V_{it}^{j}} \equiv W_{it}^{j} + \frac{\partial W_{it}^{j}}{\partial V_{it}^{j}} V_{it}^{j} - \lambda_{it} \frac{\partial Q_{it}(\cdot)}{\partial V_{it}^{j}} = 0 \tag{3}$$

$$\implies \lambda_{it} \frac{\partial Q_{it}(\cdot)}{\partial V_{it}^{j}} = W_{it}^{j} + \frac{\partial W_{it}^{j}}{\partial V_{it}^{j}} V_{it}^{j} \tag{4}$$

$$= W_{it}^{j} \underbrace{\left(1 + \frac{\partial W_{it}^{j}}{\partial V_{it}^{j}} \frac{V_{it}^{j}}{W_{it}^{j}}\right)}_{\equiv \psi_{it}^{j}}, \tag{5}$$

where W_{it}^{j} denotes the price of input V_{it}^{j}, and where $\lambda_{it} = \frac{\partial \mathcal{L}}{\partial Q_{it}}$ is the shadow value of the constraint of the associated Lagrangian function, i.e. the marginal cost of output.

Equation (4) says that the *effective* marginal cost of the input, that is the shadow value of an additional unit of V_{it}^{j} (i.e. $\lambda_{it} \frac{\partial Q_{it}(\cdot)}{\partial V_{it}^{j}}$), is equal to the unit price W_{it}^{j} associated with the purchase of V_{it}^{j} units of inputs, plus an extra term $\frac{\partial W_{it}^{j}}{\partial V_{it}^{j}} V_{it}^{j}$, that accounts for the change in the marginal cost due to the change in the unit price of the *infra-marginal* units. This last term captures imperfect competition in the market of input j, and in particular the endogeneity of input prices with respect to individual demand.

In going from equation (4) to (5), I show that the existence of the extra term $\frac{\partial W_{it}^{j}}{\partial V_{it}^{j}} V_{it}^{j}$ generates an equilibrium *wedge* between the the marginal valuation of the input, namely the *effective* marginal cost of V_{it}^{j}, and its equilibrium price W_{it}^{j}. This wedge is defined as

$$\psi_{it}^{j} \equiv \left(1 + \frac{\partial W_{it}^{j}}{\partial V_{it}^{j}} \frac{V_{it}^{j}}{W_{it}^{j}}\right). \tag{6}$$

Note that the term ψ_{it}^{j} is equal to one if the market of input j is perfectly competitive, and is different than one under imperfect competition in the market, namely when $\frac{\partial W_{it}^{j}}{\partial V_{it}^{j}} \neq 0$. Therefore, ψ_{it}^{j} can be used as a measure of the market power of firm i in the market of input $j = \{m, x\}$.[12] Rearranging terms and multiplying both sides of (5) by $\frac{V_{it}^{j}}{Q_{it}}$ gives:

$$\frac{\partial Q_{it}(\cdot)}{\partial V_{it}^{j}} \frac{V_{it}^{j}}{Q_{it}} = \frac{1}{\lambda_{it}} \frac{W_{it}^{j} V_{it}^{j}}{Q_{it}} \cdot \psi_{it}^{j}. \tag{7}$$

Let us now denote the output elasticity of input V_{it}^{j} as $\beta_{it}^{j} \equiv \frac{\partial Q_{it} V_{it}^{j}}{\partial V_{it}^{j} Q_{it}}$, and let $\alpha_{it}^{j} \equiv \frac{W_{it}^{j} V_{it}^{j}}{P_{it} Q_{it}}$ denote the share of expenditure on input V_{it}^{j} for $j = m, x$ over total firm's revenues. Using these definitions, I can conveniently rewrite equation (7) for $j = x, m$ as:

$$\beta_{it}^{x} = \frac{P_{it}}{\lambda_{it}} \cdot \alpha_{it}^{x} \cdot \psi_{it}^{x}, \tag{8}$$

and

$$\beta_{it}^{m} = \frac{P_{it}}{\lambda_{it}} \cdot \alpha_{it}^{m} \cdot \psi_{it}^{m}. \tag{9}$$

The term $\frac{P_{it}}{\lambda_{it}}$ is the ratio of firm output price and marginal costs, which measures a firm's markups. The latter term is common to the two first order conditions, which means that we can divide (9) by (8) to write

$$\frac{\beta_{it}^{x} / \alpha_{it}^{x}}{\beta_{it}^{m} / \alpha_{it}^{m}} = \frac{\psi_{it}^{x}}{\psi_{it}^{m}}. \tag{10}$$

Equation (10) shows that the (relative) input market power of the firm in the two markets can be expressed as a function of two objects: the output elasticities of the inputs, and their revenue shares. This result is at the core of my methodology to estimate input market power from production data. The output elasticities can be estimated from standard production function estimation, while the revenue shares are directly observed in most production datasets.

This result has two main implications. First, it provides a simple test of the assumption of perfect competition in all input markets, which is maintained in the prevailing literature. In particular, if all markets were perfectly competely we should observe that $\frac{\beta_{it}^{x} / \alpha_{it}^{x}}{\beta_{it}^{m} / \alpha_{it}^{m}} = 1$.

[12] See discussion at the end of the section.

Second, equation (10) suggests that the *level* of input market power can be pinned down by normalizing one of the two buyer markups. In particular, if we fix the value of buyer power in the domestic market as $\psi_{it}^m = 1$, input market power in the market of foreign intermediates can be derived as:

$$\psi_{it}^x = \frac{\beta_{it}^x}{\beta_{it}^m} \cdot \left(\frac{\alpha_{it}^x}{\alpha_{it}^m} \right)^{-1}. \tag{11}$$

Suppose that the foreign intermediate input x was twice as productive as the domestic input m (had a higher output elasticity). Equation (11) says that if distortions in the foreign input market were absent (i.e. $\psi_{it}^x = 1$), the firm would spend twice as much on the foreign input as it does on the domestic one. Input market power is thus estimated positive (negative), insofar as we observe the firm spending too little (too much) on the foreign intermediate input relatively to the domestic one, in light of the differences in their output elasticities.

Is ψ a Good Measure of Buyer Power? - The conceptual framework set forth in this section encompasses a number of models of imperfect competition in the input markets. The structural interpretation of the input market power parameter ψ_{it}^x obviously depends on which specific model is assumed, namely on the specific functional form assumptions on equation (2). Interpreting ψ_{it} as the firm's buyer power is accurate in models of monopsonistic or oligopsonistic competition, where the function (2) corresponds to the inverse of the input supply function. In these settings, it is easy to show that $\psi^x \geq 1$, and it measures how much buyers (firms) are able to push input prices *b*elow the marginal revenue product of the input.

In general, values of $\psi^x < 1$ are also admissible. Dobbelaere and Mairesse (2013) show that in a worhorse model of efficient bargaining of the labor markets, the expression in (11) measures the relative bargaining power of firms (buyers) and workers (sellers).

The empirical strategy of this paper is to first estimate the ψ_{it}^x from micro data, without taking a stand on the particular interpretation of the input wedge. I then show that the buyer power interpretation of the wedge ψ^x turns out to be the empirically relevant case in my data, where I observe values of ψ_{it}^x consistently greater than one, particularly so in sectors and firms for which we would expect buyer power to be particularly important. While I will detail on my empirical strategy in Section 3, this brief discussion implies that the methodology is more general than the current application, and could be used to estimate any measure of imperfect competition in the input markets.

Output Market Power and Joint Efficiency Wedge - All the results I derived so far hold regardless of how the firm behaves in the output market. Yet the conceptual framework has many elements in common with existing studies of sellers' markups, where markups are identified as the ratio between the output elasticity and the revenue share of any input free of adjustment costs (e.g. Hall 1988; De Loecker and Warzynski 2012; De Loecker et al. 2016). To see how my approach relates to this literature, let us define markups μ_{it} as output prices over marginal costs, i.e. $\mu_{it} = \frac{P_{it}}{\lambda_{it}}$ (cf. De Loecker and Warzynski, 2012). The first order condition in (8) then becomes:

$$\frac{\beta_{it}^{j}}{\alpha_{it}^{j}} = \mu_{it} \cdot \psi_{it}^{j} \equiv \Xi_{it}^{j}, \text{ for } j = \{m, x\}. \tag{12}$$

Equation (12) shows that in a general setting, the ratio between the output elasticity and revenue share of an input reflects *both* input and output market power of a firm. I define the right hand side of equation (12) as the *joint efficiency wedge* of any variable input $j = \{x, m\}$. Only when input markets are perfectly competitive, such that $\psi_{it}^{j} = 1$, does the ratio correctly identify markups as

$$\Xi^{j} = \mu_{it} = \frac{\beta_{it}^{j}}{\alpha_{it}^{j}}. \tag{13}$$

However, if buyer power is (mistakenly) overlooked, existing approaches would *overestimate* the true level of markups and output market power. As a final remark, note that under the normalization $\psi^{m} = 1$, one can identify *both* input and output market power from equations (11), as noted above, and (13), by setting $j = m$.

2.2 Empirical Strategy and Output Elasticities

In this subsection I describe how I obtain estimates of the output elasticities, given the available data. In order to ease exposition, and because this is the functional form I use for estimation, I assume a Cobb-Douglas specification of the production technology, which means that (1) becomes

$$q_{it} = \beta_l l_{it} + \beta_k k_{it} + \beta_m m_{it} + \beta_x x_{it} + \omega_{it} + \varepsilon_{it}, \tag{14}$$

where lower-case letters denote logs: $m_{it} \equiv \log V_{it}^{m}$ and $x_{it} \equiv \log V_{it}^{x}$ are the material inputs, while l_{it} is labor, and k_{it} is physical capital. I denote with ω_{it} the unobserved shock component that is correlated with the inputs, which include the (log) productivity of the firm, and I denote with ε_{it} the component of the shock that is orthogonal to inputs, such as idiosyncratic measurement error.[13] I specify the state variable vector as follows:

$$\varsigma_{it} = \{\omega_{it,} k_{it}, l_{it}, G_i, \varPhi_{it}\}, \tag{15}$$

where G_i includes firms' observable characteristics that such as firm location, and $\varPhi_{it}$ is the firm's import sourcing strategy, i.e. a measure of the extensive margin of import.

Estimation of the production function in (14) requires dealing with three major sources of bias: unobserved productivity ω_{it} , unobserved input prices, and unobserved output prices. Correcting for the price biases is particularly important in this context, because the approach relies on measures of *physical* output elasticities, which can be estimated only when measures of quantity of output and inputs are available. The prevailing literature of production function estimation has developed methods to control for these biases. However, due to data limitations, existing approaches to the *input price bias* crucially rely on the assumption of perfectly competitive input markets (e.g. De Loecker et al., 2016). This approach is clerly not suitable in this case, as I am interested in estimating the degree market power in input markets.

In what follows, I discuss each one of these biases and my bias correction approach. Note that the main contribution to the prevailing literature in production function estimation is to use trade data to directly control for the imported input price bias, so that I can allow for market power of firms in the imported input market, while achieving consistency in estimation.

2.2.1 Output Price Bias

In most production datasets, distinct measures of physical units and prices of output are not available. Output is typically measured as total firm revenues, which can be then translated into physical units using industry-wide price deflators. Let q_{it} denote (log) physical output, and $r_{it} \equiv q_{it} + p_{it}$ be total firm revenues. Firm-level measures of output can be obtained as $\tilde{q}_{it} = r_{it} - \bar{p}_t = q_{it} - (\bar{p}_t - p_{it})$, where $\tilde{q_{it}}$ is *deflated* nominal output, $\bar{p}_t$ is the industry deflator, that is a measure of average output price within an industry, and p_{it} is the (unobserved) firm-level price. We can use this definition in equation (14) and write (in vector form):

$$\tilde{\mathbf{q}} = \beta_k \mathbf{k} + \beta_l \mathbf{l} + \beta_m \mathbf{m} + \beta_x \mathbf{x} + (\mathbf{p} - \bar{\mathbf{p}}) + \omega + \varepsilon. \tag{16}$$

If differences in firm-level prices exist, i.e. $(\mathbf{p} - \bar{\mathbf{p}}) \neq \mathbf{0}$, and are correlated with input demand, there is an *output price bias*. Output market power is a potential source of such

[13] All the results I derive in this section apply to more general production functions.

correlation: firms with high markups charge higher prices, sell less and thus buy less inputs.[14]

In order to address the output price bias, I exploit unit values information on exports at the firm-product-country level and construct measures of firm-level prices, which I then use to directly control for $(\mathbf{p} - \bar{\mathbf{p}})$ in (16). The key intuition is that disaggregated price data contains information about the *average* cost and markups of the firm, and on the average price $\bar{p_{it}}$ thereof. I provide a detailed description of how I construct such prices in Section A.1 of the Appendix.

2.2.2 Input Price Bias

Just like output, direct measures of physical units of the inputs on the right hand side of equation (14) are usually not available. Such units are often constructed by deflating measures of total *e*xpenditure on any given input by the associated industry-wide price deflator. An *input price bias* arises insofar as the firm specific input price deviates from these industry means.[15] Let us define (log) expenditure on input V as $v_{it}^{EXP} = v_{it} + w_{it}^{V}$, where $v_{it} = \log V_{it}$ is the log quantity of a generic input V, and w_{it}^{V} is the (log) unit price of input V. In addition, let $\bar{w}_{t}^{V}$ denote the industry deflator for input V. A physical measure of V is obtained as $\tilde{v}_{it} = v_{it}^{EXP} - \bar{w}_{i}^{V} = v_{it} + \left(w_{it}^{V} - \bar{w}_{t}^{V}\right)$. We can thus rewrite (16) as:

$$\tilde{\mathbf{q}} = \boldsymbol{\beta'}\tilde{\mathbf{z}} + \beta_x \mathbf{x} + (\mathbf{p} - \bar{\mathbf{p}}) + B(\mathrm{w}, \boldsymbol{\beta}) + \omega + \varepsilon, \tag{17}$$

where $\tilde{\mathbf{z}} = (\tilde{\boldsymbol{k}}, \tilde{\boldsymbol{m}})$ collects the inputs for which firm-level prices are not available. Inputs l_{it} and x_{it} are excluded from $\tilde{\mathbf{z}}$, since measures of prices of l_{it} are available at the firm level, and prices of input x_{it} can be obtained given trade data, as I discuss at the end of this section.

The term $B(\mathrm{w}, \boldsymbol{\beta}) \equiv \beta_k \left(w_{it}^{k} - \bar{w_t}^{k}\right) + \beta_m \left(w_{it}^{m} - \bar{w_t}^{m}\right)$ reflects (unobserved) price variation, and thus input price bias. To control for $B(\mathrm{w}, \boldsymbol{\beta})$, one can use the control function approach developed by De Loecker et al. (2016).[16] The authors observe that as long as firms are price takers in the input markets, differences in input prices across firms can only arise due to exogenous differences in prices across "local" markets, and/or differences in input quality. The former can be controlled for using firm fixed effects (G_i), and under some conditions, the latter can be controlled for by output prices.[17] I therefore impose the following (estimating) assumption:

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[14]The output price bias has been discussed extensively in the literature. For an extensive treatment of the issue, see for example Foster et al. (2008); De Loecker (2011); De Loecker and Goldberg (2014)

[15]For a more detailed description of the problem, see De Loecker and Goldberg (2014).

[16]I refer to the paper for a complete discussion of the approach.

[17]In particular, the authors show that this is the case in a model with vertical firm differentiation in the final good market, and input complementarities.

Assumption E1 *The markets of* k_{it} and m_{it} *are competitive, and firms take their prices as given.*

Under Assumption E1, one could write $B(\mathrm{w}, \boldsymbol{\beta})$ as a function of only output prices p_{it}, and exogenous factors $\mathbf{G}_i$, i.e.

$$B(\mathrm{w}, \boldsymbol{\beta}) = b(p_{it}, \mathbf{G}_i; \beta), \tag{18}$$

where p_{it} is the measure of price I construct from the trade data.

Measuring the Imported Intermediate Input - The data on trade include information on price and quantity of *imports* at the firm-product-country level. I use this information to construct measures of firm-level price and quantity of the foreign input x_{it}. Specifically, I first construct a measure of firm-level prices for x, similarly to what I did with output prices. I then consider the expenditure of each firm on this input, which I deflate using the firm-level input price. This will be my measure of x in equation (2.2.2). Note that, because I use firm-level deflators, the concern of input price bias for input x vanishes.

2.2.3 Simultaneity bias

The last source of bias in equation (14) is the unobserved productivity term ω_{it}. I deal with the well-known associated simultaneity problem by relying on a control function for productivity based on a static input demand equation, as in Ackerberg et al. (2015).[18] I consider the following (log) demand for the imported input:

$$x_{it} = x_t(\varsigma_{\mathbf{it}}, \mathbf{w_{it}}, m_{it}, \nu_{it}, \mathbf{G}_i). \tag{19}$$

The demand for x depends on the state vector $\boldsymbol{\varsigma}_{it}$, input price vector $\mathbf{w_{it}}$, domestic material demand m_{it}, and input quality ν_{it}. I choose to invert the demand for imported rather than (the more conventional) domestic material input because I observe firm-level prices of x_{it}, which means that the *scalar monotonicity* condition is more likely to be satisfied in this case.[19] In section A.2 in the Appendix, I show that in a simple model with buyer power, the import demand in (19) is strictly monotonic in productivity conditional on the included variables, which means that it can be inverted to write

$$\omega_{it} = h_t(w_{it}^X, x_{it}, \tilde{k}_{it}, \tilde{l}_{it}, \tilde{m}_{it}, p_{it}, \mathbf{G}_i). \tag{20}$$

[18] I refer to the paper for a complete discussion of the proxy control function approach. See also Olley and Pakes (1996); Levinsohn and Petrin (2003)

[19] The *scalar monotonicity* condition is a necessary condition for implementing the proxy approach. It requires that ω_{it} is the *only* unobserved *scalar* entering the input demand in (19) (see, e.g. Olley and Pakes (1996)). Because prices largely affect input demand, they shall be included whenever possible.

I substitute equation (20) in (14) to control for firm's productivity.

2.2.4 Estimation

I put all the pieces together and write the estimating equation as:

$$\begin{aligned}\tilde{q}_{it} =& \beta_l l_{it} + \beta_k \tilde{k_{it}} + \beta_m \tilde{m}_{it} + \beta_x x_{it} + (p_{it} - \bar{p}_t) + \\ & b(p_{it}, \mathbf{G}_i; \beta) + h_t(w_{it}^X, x_{it}, \tilde{k}_{it}, \tilde{l}_{it}, \tilde{m}_{it}, p_{it}, \mathbf{G}_i) + \epsilon_{it}.\end{aligned} \tag{21}$$

To estimate (21), I follow the 2-steps GMM procedure in Ackerberg et al. (2015). First, I run OLS on a non-parametric function of the dependent variable on all the included terms. Specifically, I run OLS of $\tilde{q_{it}}$ on a high order polynomial of $(l_{it}, \tilde{k_{it}}, \tilde{m_{it}}, x_{it}, p_{it}, w_{it}^X, G_i)$:

$$\tilde{q}_{it} = \phi_t(l_{it}, \tilde{k_{it}}, \tilde{m_{it}}, x_{it}, p_{it}, w_{it}^X, G_i) + \epsilon_{it}. \tag{22}$$

The goal of this first stage is to identify the term $\hat{\phi_{it}} \equiv \hat{q_{it}} - \hat{\epsilon}_{it}$, which is output net of unanticipated shocks and/or measurement error. The second stage identifies the production function coefficients from a GMM procedure. Let the law of motion for productivity be described by:

$$\omega_{it} = g(\omega_{it-1}) + \xi_{it}, \tag{23}$$

where $g(\cdot)$ is a flexible function of its arguments[20]. Using (21) and (22) we can express ω_{it} as

$$\omega_{it}(\beta) = \hat{\phi}_{it} - \Big(\beta_l l_{it} + \beta_k \tilde{k_{it}} + \beta_m \tilde{m_{it}} + \beta_x x_{it} + (p_{it} - \bar{p}_t) + b(p_{it}, \mathbf{G}_i; \beta)\Big), \tag{24}$$

which we can substitute in (23) to derive an expression for the innovation in the productivity shock $\xi_{it}(\beta)$ as a function of only observables and unknown parameters β.

Given $\xi_{it}(\beta)$, we can write the moments identifying conditions as:

$$\mathbb{E}\left(\xi_{it}(\beta) \begin{pmatrix} l_{it} \\ \tilde{k}_{it} \\ \tilde{m}_{it-1} \\ x_{it-1} \\ p_{it} \end{pmatrix} \right) = 0, \tag{25}$$

The identifying restrictions are that the TFP innovations are not correlated with current

[20] In the empirical application, I model $g(\cdot)$ as a second order polynomial in lagged productivity.

labor and capital, which are thus assumed to be dynamic inputs in production, and with last period domestic and imported materials, and prices. These moment conditions are fully standard in the production function estimation literature (e.g. Levinsohn and Petrin (2003); Ackerberg et al. (2015)). The next and final step is to run a GMM procedure given the moment conditions in (25) to finally estimate the βs.

Obtaining Markups and Input Market Power Parameter - Once the output elasticities have been estimated, computing input market power becomes a simple task. As a preliminary step, I follow De Loecker and Warzynski (2012) and compute the revenue share for each of the variable inputs $j = \{m, x\}$ as:

$$\alpha_{it}^{j} = \frac{W_{it}^{j} V_{it}^{j}}{P_{it} \frac{\tilde{Q_{it}}}{\hat{\epsilon}_{it}}}, \tag{26}$$

where $\hat{\epsilon}_{it}$ is the residual from the first stage of the production function estimation. This correction purges revenue shares from variation unrelated to technology or market power. I thus compute input market power and markups of the firm as

$$\begin{cases} \psi_{it}^{x} = & \frac{\hat{\beta^{x}}}{\hat{\beta^{m}}} \cdot \left(\frac{\tilde{\alpha_{it}}^{x}}{\tilde{\alpha_{it}}^{m}} \right)^{-1} \\ \mu_{it} = & \frac{\hat{\beta^{m}}}{\tilde{\alpha_{it}}^{m}} \end{cases}, \tag{27}$$

where the $\hat{\beta}$ are constant across firms and over time due to the Cobb-Douglas assumption.

3 Buyer Power in Foreign Input Markets

In this section, I apply the methodology set forth in Section 2 to study the market power of firms in imported input markets, analyzing how input market power varies across sectors and across firms within a sector. My primary purpose is to determine whether the behavior of firms in this market is consistent with the existence of significant firm buyer power (i.e. $\psi > 1$), or other forms of input competition ($\psi \leq 1$).

The market of foreign intermediates has often been associated to imperfect competition among firms. On the one hand, imports are dominated by large firms (e.g. Bernard et al., 2007a), and large firms can plausibly take advantage of sellers, especially in small, localized input markets. On the other hand, substantial search and information frictions in trade (e.g. Allen, 2014; Startz, 2017), can lead to the existence of market power both downstream and upstream. This means that both buyer's monopsonies and bargaining models are reasonable approximations of those markets.

Theoretical work in import trade and imperfect competition has recently focused on situations of the latter sort, emphasizing the empirical relevance of micro-level trade relationship and bargaining (e.g. Heise et al., 2016; Monarch and Schmidt-Eisenlohr, 2016; Krolikowski and McCallum, 2016; Eaton et al., 2016), while little attention has gone to analyzing the monopsony or oligopsony power of importing firms. This paper contributes to prevailing literature by providing new evidence of the type and magnitude of input market power of firms.

3.1 Foreign and Domestic Intermediate Inputs

The computation of buyer power relies on the existence of two variable inputs in production. Together with foreign intermediates, I focus on domestic intermediates as my second input of interest. Because I consider firms as price takers in the domestic input markets, my analysis is able to tell how distorted is the foreign input market, relatively to the domestic competitive benchmark.

The assumption that firms are price takers domestically is not without loss of generality, and it is hard to test in the available data. However, the assumption is supported by three observations. First, this choice is standard in the literature on production function and markup estimation (cf. Ackerberg et al., 2015; De Loecker and Warzynski, 2012; De Loecker et al., 2016). Second, domestic markets are more regulated and integrated than foreign markets, which means that it is likely that firms have less price setting power domestically than abroad. Third, given that we $n$eed to impose assumptions on the structure of the domestic market in the estimation stage, choosing perfect competition is a priori no worse than other alternatives, and at the same time it guarantees that existing bias control approaches can be applied (see Section 2.2.2).[21]

3.2 Data Description

I employ two main longitudinal datasets covering the activity of the universe of French manufacturing firms during the period 1996 - 2007. The first dataset comes from fiscal files and contains the full company accounts, including nominal measures of output and different

[21] Note also that using domestic materials as the second input is important to satisfy the requirement of short-run flexibility. One could think that using labor as the second input is a better option, given that wages are observed, and no assumptions are necessary on the market structure. However, labor markets in France are highly regulated and adjustment costs of labor are high, especially for large firms, which are the focus of my analysis (e.g. Abowd and Kramarz, 2003; Kramarz and Michaud, 2010; Garicano et al., 2016). To the extent that adjustment costs are an important factor in firms' labor decisions, the first-order condition of labor compounds the effects of market power and other unobserved factors, such as the expected stream of future profits, which implies that the methodology cannot be implemented.

inputs in production, such as capital, labor, and intermediate inputs, at the firm level.[22] The second dataset comes from official files of the French custom administration, and includes exhaustive records of export and import flows of French firms. Trade flows are reported at the firm-product-country level, with products defined at the 8-digit (NC8) level of aggregation. Trade and production data can be easily matched using unique firm identifiers (i.e. SIREN codes).

Sample Selection - I select all *manufacturing* firms that simultaneously import and export markets for at least two consecutive years[23]. These so-called "international firms" are the firms for which input and output prices are available. For my preferred sample, I further select those international firms that source from at least one country outside the EU, so-called "super-international" firms. Recall that a necessary condition to identify the market power parameters is that the inputs are flexible, such that their first order condition is given by equation (9). A concern is that unobserved factors other than adjustment costs, such as capacity constraints, might affect a firm's optimal choice of imports. This might be the case, for example, if shipping and transportation costs become prohibitively high above a certain threshold of imports. The idea behind my selection criterion is that firms that are large enough to afford to import from distant sources are less likely to be affected by these constraints.[24] Table 1 provides summary statistics for the selected firms. As expected, both the international and especially the super-international firms have superior performance (cf. Bernard et al., 2007a,b, 2009). These firms are bigger, sell more, and are more productive than the average manufacturing firm in France. Although the selected sample is *not* representative of the average manufacturing firm in France, large firms are arguably those for which market power is larger. Super-international firms constitute 40% of the sample of international firms, and about 6% of all the manufacturing firms. The final sample includes around 6700 firms per year, spread across 17 manufacturing sectors, for a total of 76,436 observations. In the Data Appendix, I discuss the variables and sample construction, along with additional sample statistics.

(Data on) Revenue Shares - To construct the input's revenue shares ($\{\alpha_{it}^{j}\}_{j=l,k,m,k}$), I divide the firm nominal expenditure on each of the inputs by the firm nominal value of production. Table 2 reports the means, standard deviations and quartile values of these variables. These

[22]I refer to Blaum et al. (forthcoming) for a more detailed description of the data sources.

[23]I classify a firm as "manufacturing" if its main reported activity belongs to the NACE2 industry classes 15 to 35. Manufacturing firms account for 30% of the population of French importing firms and 53% of total import value (average across the years in the sample).

[24]The main results are not qualitatively affected by this selection criterion.

shares are fairly stable over the period 1996–2007. As expected for firm-level data, the dispersion of all these variables across firms is large, as it can be seen from the different interquantile ranges. Compared to the full sample of international firms,[25] the super-international firms are less labor intensive, and use a lower share of domestic material input in production and a larger share of foreign material inputs. In particular, the average revenue share of imported intermediate inputs is 5pp higher for the super-international firms than for the average French importer. This is consistent with the disintegration of the production process of global firms across borders (e.g. global value chain), and with a parallel increase in the use of intermediates in production, and in global sourcing (cf. Feenstra and Hanson, 1996; Feenstra, 1998; Hummels et al., 2001; Yi, 2003).

3.3 Results

I estimate the output elasticities for each manufacturing industry using the 2-steps GMM procedure described in section 2.2.[26]

Table 3 gives the estimated output elasticities together with standard errors, which I obtain by block bootstrapping. By and large, the output elasticities conform to the revenue shares. Consistent with the extensive global sourcing of large international firms, the labor and capital coefficients are typically smaller, and the two material coefficients larger, than what one would find by using a more representative subset of manufacturing firms.[27] The estimated returns-to-scale coefficient is slightly above one for the average manufacturing industry.

Before deriving the estimated measures of input market power and output market power from the system of equations in (27), it is instructive to just study the "raw" wedges in the first order conditions of the domestic and the foreign intermediate input. Concretely, let us consider equation (12), where we defined a measure of overall market distortions for each variable input $j = \{x, m\}$ as:

$$\Xi_{it}^{j} \equiv \frac{\hat{\beta}^{j}}{\tilde{\alpha}_{it}^{j}} = \mu_{it} \cdot \psi_{it}^{j} \; j = \{x, m\}. \tag{28}$$

As I discussed at the end of Section 2.1, the ratio between the output elasticity and revenue share of any variable input reflects *both* imperfect competition in the market of input j (i.e. ψ^{j}), and in the output market (i.e. μ_{it}). By looking at Ξ_{it}^{j}, one can get a sense of

[25]Results on the full sample of international firms are available upon request

[26]I use the NACE rev.1 industry classification, which is similar to the ISIC industry classification in the US. The level of aggregation is presented in Table A.1 in the Data Appendix

[27]cf. Dobbelaere and Mairesse (2013) for a comparable study using French manufacturing data.

the differences between the input market conditions in the domestic and foreign material markets. In particular, if all variable input markets were perfectly competitive, as it is often assumed in the empirical literature, we would expect these distributions to overlap, given $\psi_{it}^x = \psi_{it}^m = 1,\ \forall i,t\ \Xi_{it}^x = \Xi_{it}^m = \mu_{it}$.

Figure 1 plots the distribution of $\Xi_{it}^j,\ j = \{x, m\}$ in the French data. We can immediately observe that the hypothesis of joint perfect competition in all input markets is strongly rejected by the data, since there are substantial differences in the distribution of Ξ^j for the two material inputs. On the one hand, market distortions in the foreign input market are twice as large as distortions in the domestic input market (2.9 vs. 1.4 joint efficiency wedge, respectively). On the other hand, distortions in the foreign market are also more heterogeneous across firms, as shown by the 300% wider interquantile range.

Two clarifications are in order. First, all the variation in market power (i.e. in the Ξs) is driven by variation in the "adjusted" revenue shares $\tilde{\alpha}_{it}^j$ (see equation (26)). This is due to the assumption of constant output elasticities within an industry. Clearly, if output elasticities differ across firms, they would affect these shares, and bias the results. The second observation is that the distribution of Ξ_{it}^m seems to be consistent with the assumption of buyers being price takers in this market. In particular, the competitive assumption implies that the wedge Ξ_{it}^m coincides with the markup of the firm as a seller, i.e. μ_{it}. The average value Ξ_{it}^m of 1.42, would thus correspond to an average markup of 42% of international firms. The overall dispersion in Ξ_{it}^m the pooled sample is 1.38, which goes down to about 0.4 if we look across firms within an industry. These numbers are consistent with De Loecker and Warzynski (2012) who find, using similar methods for the Slovenian manufacturing sector, an average markup of around 22%, with a standard deviation of about 0.5. The larger average markups in my sample are consistent with French international manufacturers charging higher markups than the average Slovenian manufacturer.

I report firm-level markups, i.e. as $\mu_{it} = \Xi_{it}^m \equiv \frac{\hat{\beta^m}}{\tilde{\alpha}_{it}^m}$, in Table 4. The mean and median markups are 1.29 and 1.21, respectively, but there is considerable variation across sectors and across firms within sectors. Some firms report average markups below 1. This result may be due to the fact that part of the variation in revenue shares and markups can be related to technology differences across firms.

3.3.1 Input Market Power across Industries

We now have all the elements to compute input market power in the foreign input market given equation (11), i.e.

$$\psi_{it}^x = \frac{\beta_{it}^x}{\beta_{it}^m} \cdot \left(\frac{\alpha_{it}^x}{\alpha_{it}^m}\right)^{-1}. \tag{29}$$

Following the discussion at the end of section 2.1, I classify industries as "BP", i.e. *buyer power*, if the mean and median ψ in the industry are both greater than one; as "EB', i.e. *efficient bargaining*, if the mean and median ψ are both smaller than one; and as "PC" if both mean and median ψ are close to unity, and thus *perfect competition*. Where the distinction is less clear, I choose not to take a stand on that particular industry. Table 5 reports input market power at the industry level. The evidence indicates that in a large number of sectors, more than 50% of the firms behave as if they exercised significant buyer power in the imported input market. The mean and median input market power across sectors are 1.76 and 1.06, with an average standard deviation of 1.89. There is considerable variation across sectors and across firms within sectors. On average, in the imported input market, firms pay 76% less than the competitive price (i.e. value of marginal product of the input), which diminishes to 6% less than competitive for the median firm in the pooled sample. Note that, unlike markups (cf. Table 4), there is much more sectoral heterogeneity in input market power. For example, in the food industry, large international firms pay, on average, 250% less than the competitive price; the median value is also high, at 90% below the marginal revenue product. Conversely, firms active in sectors such as motor vehicles and medical instruments seem to engage in a different type of competition in the foreign input markets, where on average they pay more than the competitive price.

In Figure 2, I plot the distribution of markups and import market power in the pooled sample. Input market power is right-skewed, with a few firms apparently holding a large amount of buyer power.

Conversely, the distribution of markups in the economy looks more "normal". The result on buyer power is driven by a small number of firms spending too little on the foreign input. More precisely, we observe that some firms are spending a larger share of revenues on domestic intermediate inputs relative to foreign intermediates, although the difference in shares is not entirely justified by differences in input productivity (i.e. output elasticities). Given that, *ceteris paribus*, the behavior of firms in the market of the domestic input is optimal, the result is consistent with firms withholding the demand of their foreign intermediate inputs, so as to keep the price low. Below, I will investigate whether these differences across firms are meaningfully correlated with other measures of firm size and performance. A closer look at the inter-sectoral heterogeneity reveals that buyer power is greatest in the following sectors: food, wood, rubbers, metals (both basic and fabricated) and machinery and equipment. By contrast, the sectors where the buyer power story does not seem to have much hold are the chemical industry, medical and precision instruments, and the motor vehicle industry. Interestingly, buyer power seems to be concentrated in those sectors where the goods that are exchanged are frequently commodities, such as agricultural products (raw food, livestock) and natural resources (wood, pulp, unrefined metals). The markets for these products are often localized and spatially differentiated, and characterized by significant transportation or storage factors (Hotelling, 1929; Murray, 1995). This naturally gives rise to many atomistic sellers and few, concentrated buyers, a favorable condition for the insurgence of monopsony or oligopsony power (Rogers and Sexton, 1994).

Direct Evidence of Buyer Power in Selected Sectors - The evidence of buyer power in sectors such as food and food is consistent with the focus of an extended body of empirical literature that emerged during the eighties and nineties, which aimed to measure the extent of buyer power in those sectors concerned over market monopsonisation due to rising concentration, large economies of scale downstream, and a large number of atomistic sellers upstream.[28]

To further assess the plausibility of my results, I now examine whether differences in the average degree of buyer power seem to be driven by systematic differences in sector-level performance. In Table 6 I report the average level of output, employment, value added, total imports, measured TFP and number of firms across the two different groups of sectors identified by the average degree of buyer power being above or below one. The evidence shows that firms who operate in "monopsonised" sectors are, on average, larger (i.e. higher output, employment, and imports), more productive, and have a higher share of value added and a higher number of firms. This further shows that, as hypothesized in the prevailing literature of the eighties, firms that operate in sectors with larger average firm size and value added act as if they had monopsony or oligopsony power in the input markets.

3.3.2 Input Market Power across Firms

To verify whether market power is systematically correlated with firm-level characteristics, I run non-parametric regressions of the impact of firm size on the firm-level estimate of ψ_{it}, using local polynomial regressions.[29] Figure 3 reports the results for the main sample. The red solid line shows the estimates for the group of firms that operate under monopsony power (i.e. regime "BP"), while the blue dashed line reports the results for firms that operate in

[28] cf. Just and Chern (1980); Schroeter (1988); Azzam and Pagoulatos (1990) for studies in in the Food and meatpacking industry; and Murray (1995) and Bergman and Brännlund (1995) for studies of the Wood and Pulp industry. The bulk of (industry-level) findings of these studies do not reject the hypothesis of non-competitive buyer behavior in these sectors, although the magnitude of industry-level buyer power is at most modest. My firm-level evidence suggest that there is substantial heterogeneity within sectors, which means that buyer power can result modest in the aggregate, despite being large at the firm-level.

[29] Specifically, I estimate (separately for the two groups of firms as identified by the relevant regime):

$$\log \psi_{it} = m(\log employment_{it}) + \epsilon_{it}$$

the other regime, more consistent with efficient bargaining (i.e. regime "EB"). Beginning with the first group, the estimated degree of buyer power is increasing in firm size, along the whole size distribution, and the effect is stark. The results for the "EB" group show a rather flat relationship between input market power and size, which becomes positive only for the top quartile of firms.

I then run OLS regressions of a firm's market power (in both the input and output market) on different measures of firm size and performance. Specifically, I run

$$\log y_{it} = \beta X_{it} + regime\_BP_{it} + ind_{it} + \epsilon_{it}, \tag{30}$$

where $y_{it} = \{\psi^x_{it}; \mu_{it}\}$ and X_{it} are different measures of size or performance. The variable $regime\_BP_{it}$ is a dummy equal to one when the firm operates in a sector classified as "BP", whereas ind_{it} are sector dummies. The results are shown in Table 7, both when the dependent variable is $y_{it} = \psi_{it}$ (i.e Panel A) and when the dependent variable is $y_{it} = \mu_{it}$ (i.e. Panel B). The results in Table 4 show a positive and significant correlation between firm size and input market power. On average, a one standard deviation increase in firm size corresponds to a 2.5% increase in the gap between value of marginal product and marginal cost of the input. This number is about 7% in those sectors with evidence of monopsonistic and oligopsonistic competition. Examining the correlation between value added and input market power yields similar results. The evidence shows a strong negative correlation between TFP and buyer power, which becomes positive (and strong) for firms which operates in sectors that feature buyer power.

4 Buyer Power and the Aggregate Economy

The results in Section 3 highlight the existence of substantial efficiency distortions associated with the purchase of imported inputs by French manufacturing firms. In a number of industries, these distortions are consistent with market power of buyers. In this Section I aim to investigate the consequences of this type of firm behavior for the allocation of productive resources within and across firms, and for the aggregate output and income of the domestic economy. To do so, I develop a tractable general equilibrium model where firms are heterogeneous in both their efficiency, and market power as buyers. I show how the model parameters can be mapped to the empirical estimates in Section 3, and how this allows me to gauge the aggregate effect of market power of buyers for the French economy.

In 4.1, I describe the domestic economy, where the buyers operate (i.e. the French economy). In 4.2, I introduce the main theoretical contribution of this paper, that is the market of imported intermediate inputs. I assume that each firm sources its horizontally differentiated variety of the intermediate input from a different foreign market, and that the source of heterogenous buyer power across firms is the (heterogeneous) size of the total demand of the firms' competitors upstream, along with an elastic input supply. I show how this model fits well in the general framework set forth in Section 2. In 4.3., I characterize the firm-level and aggregate equilibrium in an economy where firms have buyer power. Finally, in 4.4, I discuss the model calibration, and the main quantitative results.

Note that in this Section, in order to ease the exposition, I use capital letters (X) for *aggregate* quantity of any variable x, and lower-case letters (x) for *firm-level* quantities.

4.1 The Domestic Economy

The (French) economy consists of $S+1$ sectors: a competitive final good sector, where the final good Q is produced; and S manufacturing sectors, where the sectoral goods $Q_s,\ s = 1,..,S$ are produced. The sectoral outputs are in turn the inputs in production of the final good, which is produced according to a Cobb-Douglas technology:

$$Q = \prod_{s=1}^{S} Q_s^{\theta_s}, \text{ where } \sum_{\mathrm{s}=1}^{\mathrm{S}} \theta_{\mathrm{s}} = 1. \tag{31}$$

Cost minimization implies that the fraction of revenues spent on sectoral output Q_s is:

$$\frac{P_s Q_s}{PQ} = \theta_s, \tag{32}$$

where P_s is the price of the industry output Q_s, and $P \equiv \prod_{s=1}^{S} \left(P_s/\theta_s\right)^{\theta_s}$ represents the price of the final good, which I also set as the numeraire.

A continuum of measure M_s of monopolistically competitive firms operates in each sector $s \in S$. Each firm i produces a differentiated variety. Individual varieties are combined to produce the industry output, according to the following CES technology:

$$Q_s = \left(\int_{i \in M_s} q_s(i)^{\frac{\sigma_s - 1}{\sigma_s}} di \right)^{\frac{\sigma_s}{\sigma_s - 1}}, \quad \sigma_s > 1. \tag{33}$$

Equation (33) implies that the demand for variety i in sector s is given by:

$$q_s(i) = A_s p_s(i)^{-\sigma_s}, \quad A_s = P_s^{\sigma_s} Q_s, \tag{34}$$

where A_s is a sector market index, determined by the sectoral demand Q_s and the price index. As it is standard, the price index can be derived as

$$P_s = \left(\int_{i \in M_s} p_s(i)^{1-\sigma_s} di \right)^{\frac{1}{1-\sigma_s}}. \tag{35}$$

With a continuum of firms, each firm is measure zero in the market, and takes A_s as given.

Technology - Firms in each sector differ in their efficiency level $\omega_i \in \mathbb{R}_+$. In order to ease the exposition, hereafter I drop the sector subscript, implicit in all variables unless stated otherwise. Production requires two variable factors: a domestic input, which can be interpreted as physical capital k, and an intermediate input x. I assume that each firm uses a horizontally differentiated variety of the input x for the production of its differentiated final variety. For example, different varieties of x in the Food manufacturing sector can be cattle for a beef processor, or raw organic milk for packaged organic milk producers.[30] Capital is purchased from a competitive market at unit price R, which all firms take as given. The markets for the intermediate input x are allowed to depart from the competitive benchmark, as I describe in the next paragraph. I assume a Cobb-Douglas production technology, so each output variety is produced as

$$q_i = \omega_i {x_i}^{\phi} {k_i}^{1-\phi}, \tag{36}$$

where ϕ and $(1-\phi)$ represent the output elasticities of inputs x and k, respectively.

4.2 The Market of the Intermediate Input

Monopolistically competitive *producers* in the domestic economy are in turn *buyers* of the intermediate input in the global marketplace. Each firm i buys its differentiated variety of input x_i from a different foreign market. Before getting into the details of the the specific modelling assumptions, I briefly give an overview of the basics of each input market upstream.

Input Markets and Ricardian Rents - I assume that in each input market there is a representative producer (seller) who can supply all buyers. There exist economic rents on the supply side of the markets, such that the foreign supplier receives overall more revenues than she actually needs to provide the quantity of the good that is demanded. These are the rents that a dominant foreign buyers would like to extract. I assume that the source of these rents are decreasing returns in production. Let $C(X)$ denote total costs, which satisfies standard

[30] The assumption of horizontally differentiated input varieties is made for simplicity. The same results are obtained by assuming that the input is homogeneous, and firms source from spatially differentiated markets.

regularity conditions.[31] Decreasing returns imply that marginal costs $C'(X)$ are increasing in X, i.e. $C'' > 0$. In equilibrium, the price of the intermediate input x_i, which I denoted by W_i, is always pinned down by the marginal cost curve, namely $W_i = W(X_i) = C'(X_i)$, where the capital X_i denote aggregate input demand in the market for x_i. Because $C" > 0$, and because the seller charges a unique price per unit of good, the equilibrium price of x is higher than its average cost of production. This gap represents the rents accruing to the seller, often referred to as *Ricardian rents.* Figure 4 provides a convenient graphical representation of this type of rents.[32]

Input Price, and Marginal Expenditure - The representative seller in each market has zero market power, and supplies X_i units of the good according to the following (inverse) supply function

$$W_i = \gamma_i \cdot X_i^{\eta}, \tag{37}$$

where γ_i is a term that reflects market conditions in the $i's$ input market, and the constant $\eta > 0$ represents the elasticity of input price to total demand, and is defined as:[33]

$$\eta \equiv \frac{\partial W_i}{\partial X_i} \frac{X_i}{W_i}. \tag{38}$$

In each input market, the buyer from France competes with a fringe of foreign buyers, but never with other French buyers, such that a French firm's input demand does not depend on the price paid by another French firm. This assumption implies that we can exclude general equilibrium effects of the price paid by i on the demand of other domestic firms. Let us denote total input demand by foreign competitors in each market as X_{-i}. I assume that X_{-i} can vary by market, and is exogenous to the firm. I further exclude strategic interactions across a French firm i and its foreign competitors, namely $\partial X_{-i}/\partial x_i = 0$. Total input demand in market i is thus given by $X_i = x_i + X_{-i}$, with $\partial X_i/\partial x_i = 1$. I consider the

[31] In particular, $C(\cdot):\ C(X) \in \mathcal{C}^3$, with $C(0) = 0$, and $C(X), C'(X) > 0$ for $X > 0$. Here, I assume that in each market there is one representative seller, that produces the good (intermediate input) using primary factors of different productivity. For example, the primary factor can be land, and the increasing marginal cost might be due to the use of increasingly less productive parts of the land as demand increases. One could alternatively assume that increasing costs are due to heterogenous efficiency of different suppliers.

[32] Alternative sources of economic rents can arise from quasi-rents, if there are sunk cost in production in the input market, or monopoly rents, that exist if the seller enjoy market power. See Noll (2004) for a discussion.

[33] Note that while the discussion here is based on the input price elasticity η, in general, we are used to think in terms of the *supply* elasticity, which we should think as $\eta^{-1\cdot}$. Note that a positive input price elasticity, and therefore a *finite* supply elasticity, follows from the assumption of increasing marginal costs, i.e. $C" = \eta > 0$.

following functional form for γ_i:

$$\gamma_i = (a + X_{-i})^{-\eta}, \; a \in \mathbb{R}_+, \tag{39}$$

such that we can rewrite equation (37) as:

$$W_i = \left(\frac{x_i + X_{-i}}{a + X_{-i}}\right)^{\eta}. \tag{40}$$

As noted in Section 2, an important object for the derivation of the firm-level equilibrium is the marginal *expenditure* on input x_i. This is given by

$$\frac{\partial(W_i x_i)}{\partial x_i} \equiv W_i + \frac{\partial W_i}{\partial x_i} x_i = W_i + W_i \eta \frac{x_i}{x_i + X_{-i}} = W_i \underbrace{(1 + \eta s_i^x)}_{\equiv \psi_i}, \tag{41}$$

where

$$\psi_i \equiv (1 + \eta s_i^x) \tag{42}$$

is the gap between the marginal input expenditure and the input price, and hence describes the market power as a buyer of firm i; and where I defined

$$s_i^x \equiv \frac{x_i}{x_i + X_{-i}} \in (0, 1), \tag{43}$$

the input market share of firm i. Note that expression for market power of firm i as a buyer of input x in (42) is equivalent to equation (6) in Section 2. Under the model's functional form assumptions, the term ψ_i is a function of two things: the input price elasticity η, and the market share of the firm in the input market, s_i^x. A high level of buyer power occurs in two cases: *(i)* when the demand of the firm is large relative to the total demand of its competitors (s_i^x high); or *(ii)* when the input price is sufficiently elastic (i.e. η high).[34]

Note that the price formula in (40) encompasses the two extremes of monopsony and perfect competition in the market of x in a tractable way. When foreign input demand is high (i.e. $X_{-i} \to \infty$ and $s_i^x \to 0$), as in the case of perfect competition, then $\psi_i = 1$ and $W_i = W = 1$. On the contrary, when $X_{-i} \to 0$, such that $s_i^x \to 1$ as in the case of monopsony, $\psi_i = (1 + \eta) > 1$, and $W_i = \left(\frac{x_i}{a}\right)^{\eta}$, such that the price of the input is only a function of individual input demand.

In Figure 5, I show the (partial) equilibrium in the market of x_i for different values of s_i^x,

[34]Note that in models with perfectly competitive input markets, it is usually assumed that $\eta \to 0$, which means that $\psi_i = 1$ and that buyer power is always ruled out.

in a simple economy where the supply curve is increasing, and characterized by a positive price elasticity $\eta > 0$, and where the marginal revenue product (curve D), is constant and equal to p.

Because the input supply S is upward sloping, an increase in the total supply X raises the price, which is always pinned down by S. In a competitive setting, the firm sets its marginal revenues, given by the curve D, equal to the marginal cost of the input, which in this case is equal to S. Conversely, firms with buyer power (i.e. $s^x > 0$) set their marginal revenues D equal to an *effective* marginal cost curve (e.g. S' or S'') which is steeper than S, due to the fact that the firms internalize the increase in the cost of all the infra-marginal units. In equilibrium, firms with high input market share pay lower prices, and buy lower quantities relative to the competitive benchmark. Given the assumption of perfect competition in output markets, in Figure 5 we can easily visualize buyer power ψ_i as the vertical gap between the equilibrium input price (red stars), and its competitive level (curve D).

4.3 Equilibrium

In this section I describe the static equilibrium allocation of firms in a given sector $s \in S$, for given measure M of firms, total supply of capital K, and distributions of efficiency $\omega_i \sim G_\omega(\cdot)$ and input demand $X_{-i} \sim G_{X_-}(\cdot)$ of foreign competitors. Each firm chooses the optimal quantities of inputs k and x by solving the following profit maximization problem:

$$\pi_i\left(\omega_i, X_{-i}\right) = \max_{k,x} p_i q_i - W_i x - Rk, \tag{44}$$

subject to final demand (34), input supply (40), and technology (36), and such that the market for capital clears, i.e.

$$K = \int_{i \in M} k_i di. \tag{45}$$

Since I assume fixed entry, each firm i will make positive profits in equilibrium. In order to gauge the effect of profits on total welfare in the economy, I assume that there is a representative consumer in this economy, who owns both the productive capital K, and owns claims to the firms' profits. Total real income in the economy is thus given by

$$I = \Pi + RK, \tag{46}$$

where

$$\Pi = \sum_{s=1}^{S} \left(\int_{i \in M_s} \pi_s(i) di \right). \tag{47}$$

In this simple economy, and given the final price normalization, welfare $\tilde{W}$ can be measured as real income, i.e.

$$\tilde{W} = I. \tag{48}$$

Equilibrium Characterization - Together with demand, input supply function, and technology, the (unique) equilibrium allocation solves the following first order conditions:

$$\frac{\phi}{\alpha_i^x} = \frac{\sigma}{\sigma - 1} \cdot \psi_i \tag{49}$$

$$\frac{1-\phi}{\alpha_i^k} = \frac{\sigma}{\sigma - 1}, \tag{50}$$

where $\alpha_i^x = \left(\frac{W_i x_i}{p_i q_i}\right)$, and $\alpha_i^k = \left(\frac{R k_i}{p_i q_i}\right)$ are the revenue shares of intermediate input and capital, respectively. Note that (49) and (50), are isomorphic to the cost-minimization conditions in Section 2 (cf. equation (8)). Note also that in this particular case, the markup component is constant across firms and equal to $\mu = \frac{\sigma}{\sigma-1}$, due to the CES assumption.

The equilibrium solution is hard to characterize analytically. In particular, the equilibrium input demand is found as an implicit solution of:

$$x_i = A\left(\frac{\sigma}{\sigma-1}\right)^{-\sigma} \omega_i^{\sigma-1} \left(\frac{R}{1-\phi}\right)^{-(\sigma-1)(1-\phi)} \left(\frac{W_i \psi_i}{\phi}\right)^{-(1+\phi(\sigma-1))}, \tag{51}$$

where both $W_i = W(x_i, \underbrace{X_{-i}}_{(+)})$ and $\psi_i = \psi(x_i, \underbrace{X_{-i}}_{(-)})$ endogenously change with x_i. Note that when foreign competition X_{-i} increases, such that the market of input x is more competitive, the equilibrium demand is affected via two channels: on the one hand, the price W_i increases due to higher demand overall, such that the input demand decreases; on the other hand, buyer power decreases due to higher competition, such that total input demand increases.

In order to illustrate qualitatively the overall distortions induced by the existence of buyer power, and to see which of these two effects prevails, Figure 6 plots the equilibrium demand of x_i and k_i, the equilibrium output q_i, and the equilibrium capital intermediate ratio as a function of foreign competition X_{-i}, for a typical calibration of the equilibrium.

Buyer power (lack of foreign competition) induces distortions at the firm level along several channels. First, firms buy less intermediate input, as shown in the top left panel. Second, because capital is an imperfect substitute for the intermediate input, high buyer power firms also decrease the amount of capital used in production (cf. top right panel). This effect has two main implications. On the one hand, even though the *level* of capital decreases, its share in total revenues increases (cf. bottom right panel). On the other hand, since the firm uses a lower amount of both productive inputs, the equilibrium output also shrinks (cf. bottom left panel). Together, these effects imply that the final output price is higher. I summarize these results in the following proposition:

Proposition 1: *Compared to the competitive benchmark, firms with high buyer power buy less inputs, have a higher capital-intermediate ratio, and produce less output.*

Since I assumed that firms are heterogeneous in X_{-i}, I briefly discuss the equilibrium effect of the heterogeneity in buyer power across firms. We can do so by looking at Figure 6. The top right panel tells us that compared to an equilibrium where all firms have the same ψ, in the model with heterogeneity capital is reallocated from more to less distorted firms, namely to firms with higher X_{-i}. Because more distorted firms are using too much capital relative to the intermediate input (cf. bottom right panel), the dispersion in buyer power may have an offsetting effect on these allocative distortions at the firm level, and thus a positive effect on aggregate output.

4.4 Quantifying the Costs of Input Market Power

This section aims to evaluate the effect of buyer power on aggregate output Q, and welfare W. Calibrating the model to the data is a rather straightforward task, given that the estimation procedure in Section 2 returns estimates of almost all the unknown model parameters. I set the Cobb–Douglas production function parameter ϕ_s equal to the estimated output elasticity of the imported input in each sector, i.e. $\phi_s = \hat{\beta}_{sx,s}$. I choose the elasticity of substitution between varieties σ_s such that the implied markup $\mu_s = \frac{\sigma_s}{\sigma_s - 1}$ is equal to the average markup in each sector (cf. Table 4). The sector share θ_s are set equal to the shares of each sector in total manufacturing value added, directly observed in the production data. I set the aggregate capital equal to 1, which means that capital income $RK = R$ is equal to the rental price of capital. The parameter I do not directly estimate is η, the elasticity of the inverse input supply. Given equation (42), and given the estimates for buyer power of firms in Section 3 ((cf. Table III)), I set $\eta = 5$, which is such that the highest observable degree of buyer power, namely the degree of buyer power of a monopsonist with $s_i^x = 1$, is $\bar{\psi} = 1 + \eta = 6$.

Finally, I need to determine the parameters of the underlying distributions of productivity ($\omega_i \sim G_\omega(\cdot)$) and foreign competition ($X_{-i} \sim G_{x_-}$). In Section 2, I estimated the entire distribution of both productivity ω and buyer power ψ across firms within each manufacturing sector. The main challenge for the calibration exercise is thus to choose the parameters of the distribution $G_{X_-}(\cdot)$, which is not directly observed in the data. I estimate the moments of $G_{X_-}(\cdot)$ using a Simulated Method of Moments, such that I minimize the distance between the moments of the distribution of buyer power $\hat{\psi}$ which I simulate from the economic model, and the corresponding moments which I computed from the data. In Table 8, I summarize the model parameters, for the different manufacturing sectors. Note that I focus on those sectors for which the evidence on input market power is consistent with the model assumptions. I assume that the remaining sectors are not distorted.

In Figure 7, I plot the distribution of buyer power ψ across firms, both in the calibrated model and in the data.

To see how well the model perform compared to the data, in Figure 8, I plot the distribution of domestic share across quantiles of buyer power, both in the calibrated model and in the data. The Figure shows that the model does a good job in replicating the distribution of domestic shares across quantiles of buyer power.[35]

Counterfactual Exercise - I now I aim to quantify the effect of buyer power on aggregate variables for the calibrated French economy. In particular, I focus on: *(i)* the *production distortion,* that is the effect on gross manufacturing output; *(ii)* the *import distortion*, namely how much imports decrease due to buyer power; *(iii)* the *transfers* between the foreign countries and France, as measured by the change in total profits in the French economy; and *(iv)* the overall effect on the *welfare* of the representative agent, as measured by total real income, which I defined in equation (46) as the sum of aggregate profits and aggregate capital income.

I summarize the results in Table 9. The results show that buyer power has a large negative effect on both total imports and gross manufacturing output in France. Specifically, I find that in the counterfactual scenario where all firms are price takers in both the domestic and foreign input markets (i.e. $\psi_i = 1, \; \forall \; i$) , total imports would increase by 32%, and gross manufacturing output by 3.2%. Because firms demand more of all inputs when input markets are competitive, in the counterfactual economy total payments to domestic capital also increase, by 3%. By contrast, firms make lower profits, about 9% less, due to lower transfers of rents from foreign input markets. The drop in profits more than offsets the 3% increase in capital income, and together they imply a loss in total real income (total GNP in France) by 0.4%. The latter result further highlights an important shift in the aggregate income composition. The profits-to-income ratio in the counterfactual competitive economy is about 31%, and this number goes up to 36% in the distorted economy. This suggests that in a more realistic setting where the capital and the firms are owned by different individuals, the existence of buyer power can benefit firm owners, but can hurt the individual who own

[35]The model cannot replicate as well the dispersion in total firm imports across quantiles of buyer power which is observed in the data.

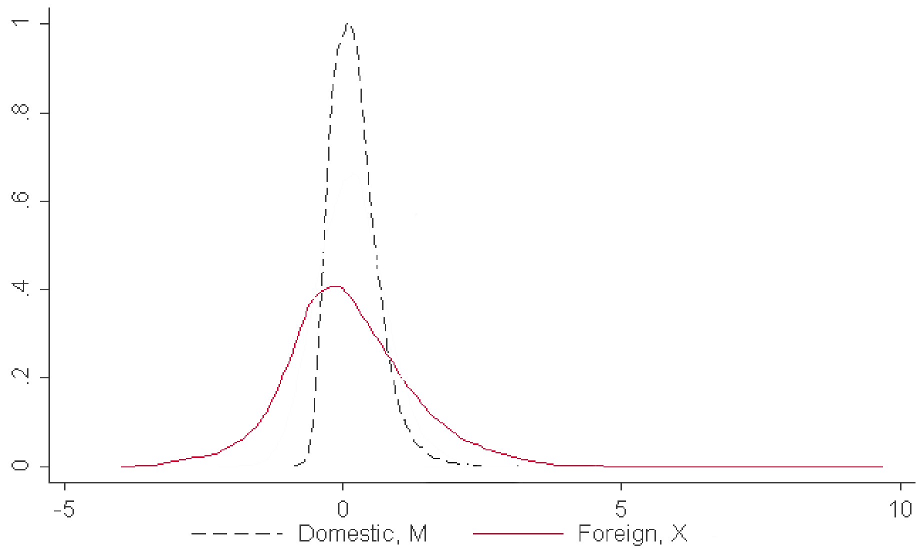
the productive inputs, with potentially important implications in terms of aggregate income inequality within a country.

Policy Implications - The analysis of the simple model with buyer power suggests that higher market integration can increase output in both the foreign and the domestic country, by reducing the scope of buyer power of importers in foreign input markets. Policies should therefore encourage import participation, in order to make more buyers accessible to foreign sellers, which could contrast the buyer dominance in foreign input markets.

5 Conclusions

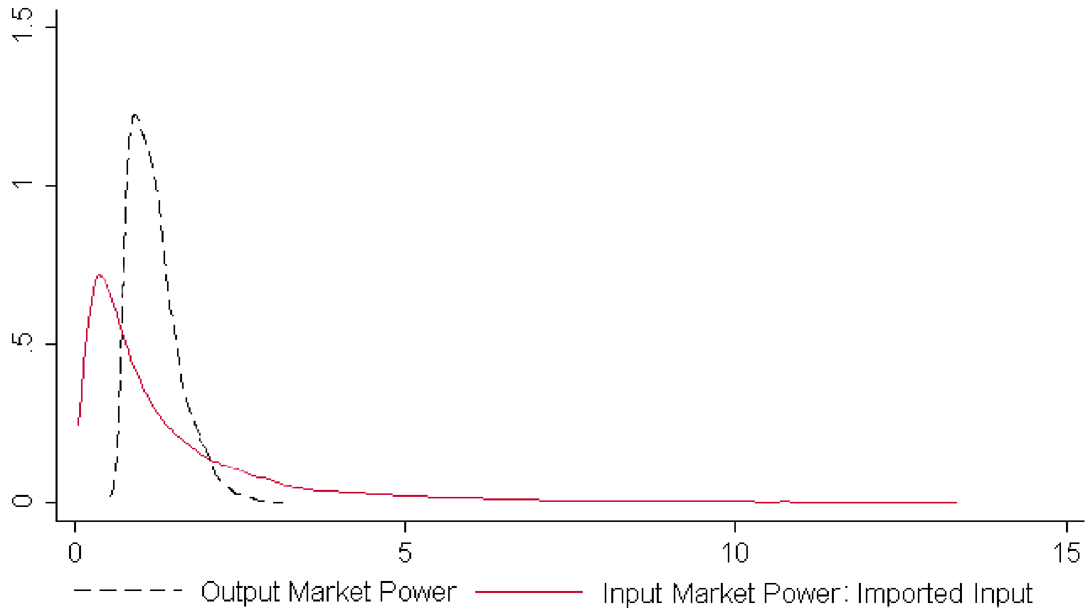
This paper makes two contributions. On the methodological side, I show that the input market power of firms can be consistently estimated from standard production data. On the theoretical side, I show that input market power induces large distortions in the domestic economy, over and above the well-known effects on the equilibrium price and quantity of the inputs. This paper studies buyer power in the context of imports of intermediates, using longitudinal trade and production data on French manufacturing. I document evidence of significant distortions in this market, which are consistent with French firms withholding imported intermediate demand so as to keep the price of imported inputs low. In so doing, I show how disaggregate trade data on firm-product-country level imports and exports can be used along with production data to address well-known price biases in production function estimations, thus contributing an approach to a long-standing problem in the empirical literature. The paper then presents a quantitative general equilibrium framework of a production economy that incorporates (heterogeneous) buyer power of firms in the purchase of one of two inputs in production. The model yields tractable equilibrium equations and provides simple explanations for the documented evidence based on the existence of buyer power. I use the model to study, and then quantify, how much output is lost due to the existence of buyer power of firms in (international) markets. This paper contributes to the literature examining the role of imperfect competition in international markets. While the focus of this literature has been hitherto on exports and output markets, I suggest that taking the perspective of international markets as input markets offers new and important insights on firm behavior and trade policy. Buyer power will likely be important in other settings as well, and my methodological framework easily translates to a variety of other situations. A fruitful direction for future research would be to examine whether firms exercise significantly higher buyer power for imports from poorer economies.

Figure 1: Distribution of joint input and output market distortions ($\log \Xi_{it}^{j}$, for $j = m, x$)



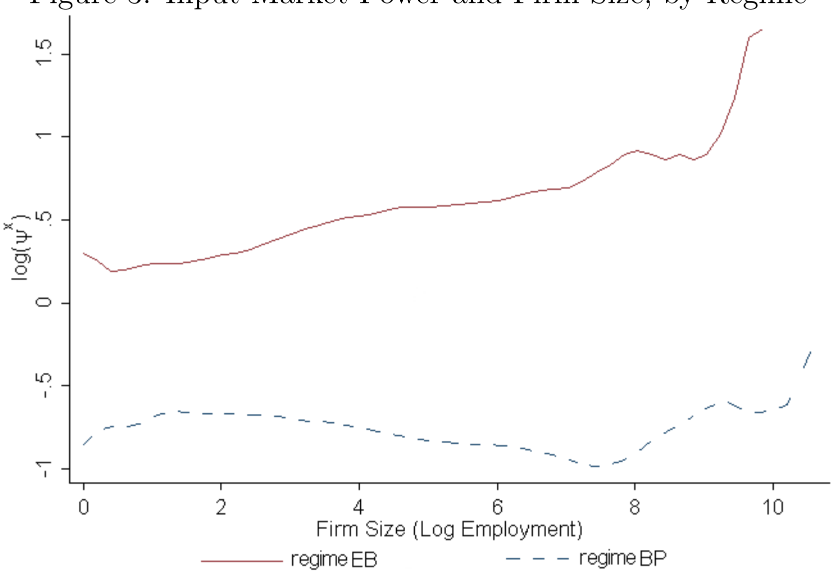
Notes: Super-international firms, pooled across industries. The mean and interquantile range (i.e. $p90 - p10$) of Ξ_{it}^{j} are: [1.42;1.38],[2.9;4.41] for $j = m, x$ respectively. Note that the Figure plots $\log \Xi^{j}$.

Figure 2: Market Power in Input and Output Market, Pooled



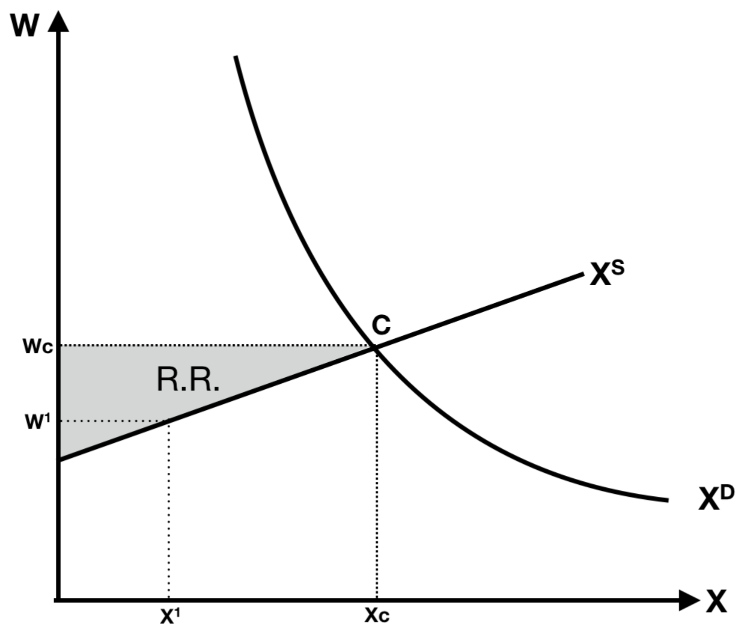
Note: Sample: super-international firms, pooled across industries and years. The figure plots the distribution of buyer power ψ, and markups μ, in the French manufacturing sector. The moments of the two distribution are $[\mathbb{E}\psi, \text{p50}(\psi), \text{SdDev}(\psi)] = [1.76, 1.06; 1.89]$ and $[\mathbb{E}\mu, \text{p50}(\mu), \text{SdDev}(\mu)] = [1.29; 1.21; 0.35]$

Figure 3: Input Market Power and Firm Size, by Regime



Note: Sample: Super-international firms. The Figure reports estimates from kernel-weighted local polynomial regressions of the (log of) input market power parameter ψ on firm size, as measured by log employment l. Estimates are pooled across firms and years. Regime "BP" includes sectors {15, 20, 25, 27, 28, 29}. Regime "EB" includes sectors {19,24,31,33,34}

Figure 4: Ricardian Rents



The Figure plots a representation of the Ricardian Rents, which are indicated by the grey shaded area. Due to increasing marginal costs, (curve X_s) and because there is a *unique* input price in equilibrium (i.e. price discrimination across input units is ruled out), the inframarginal units, such as point x_1, will be paid in equilibrium a price that is higher than the marginal cost to produce them, that is $w_c > w_1$. The gap $(w_c - w_1)$ represents the Ricardian Rent accrueing to the productive unit x_1.

Figure 5: Equilibrium in the Intermediate Input Market

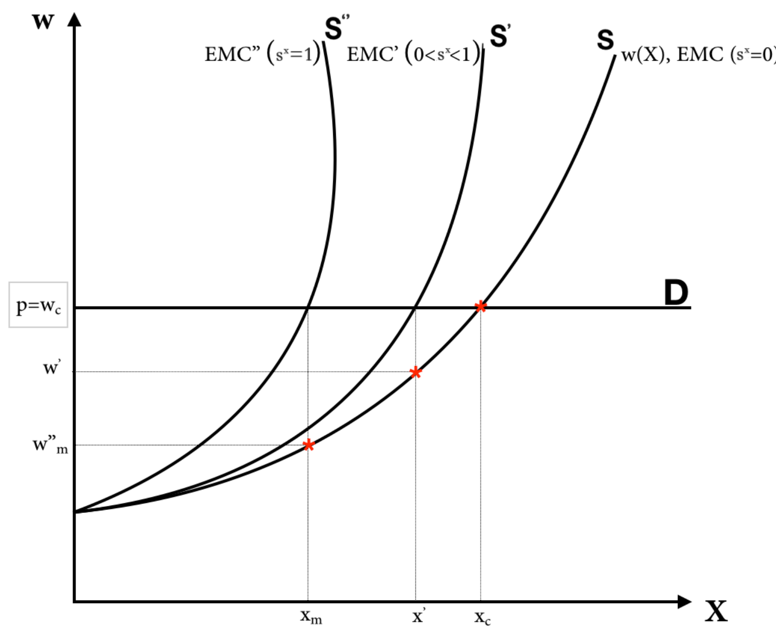


Figure 6: Firm-level Equilibrium as a Function of Foreign Competition X_{-i}

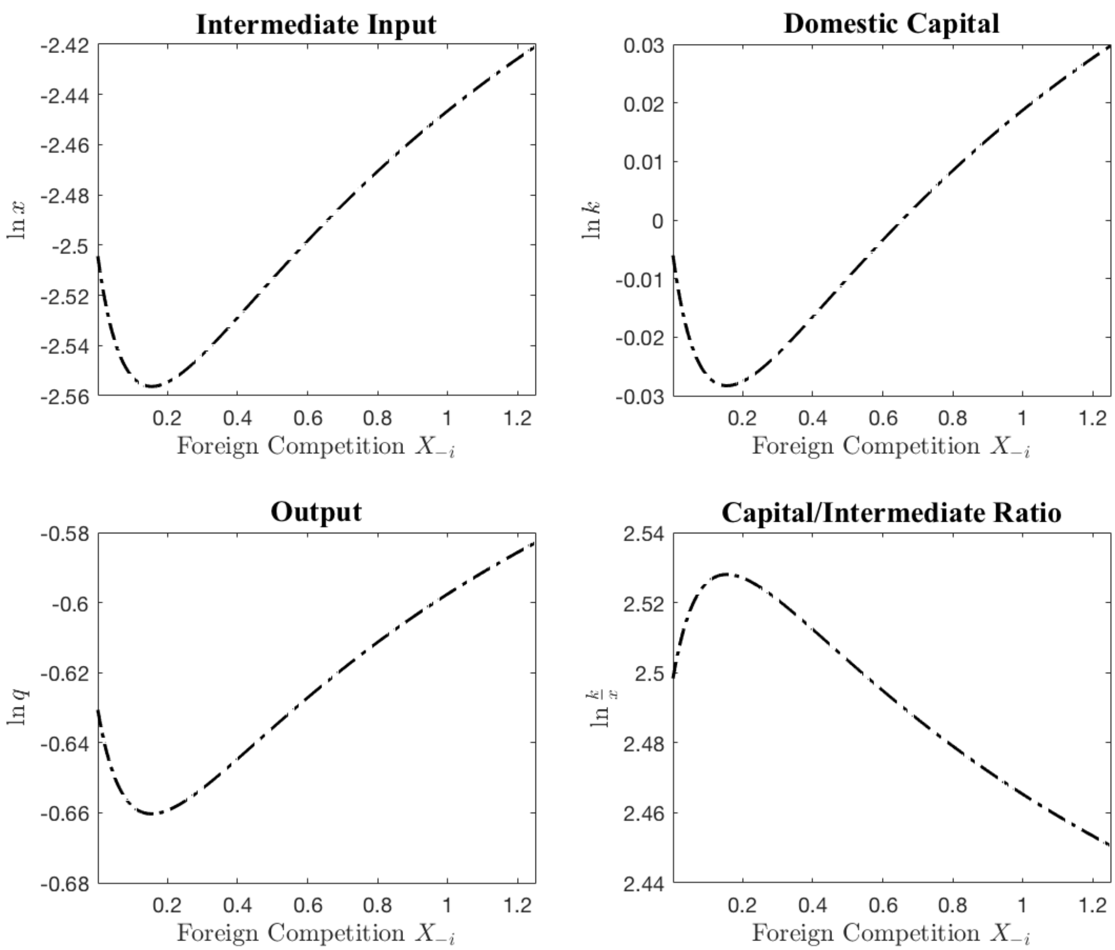


Figure 7: Buyer Power and Domestic Share of Input Expenditure, Model vs. Data

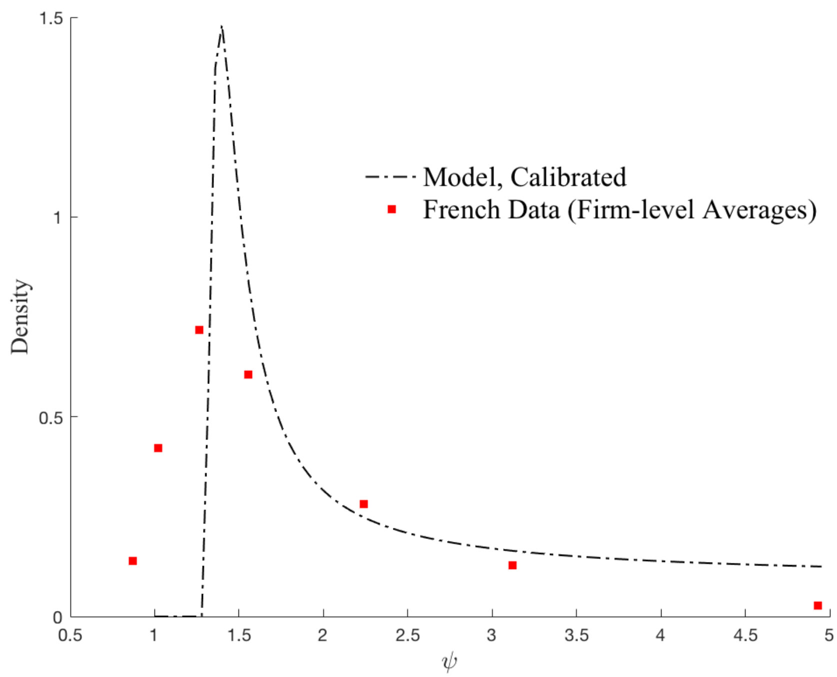


Figure 8: Model Fit

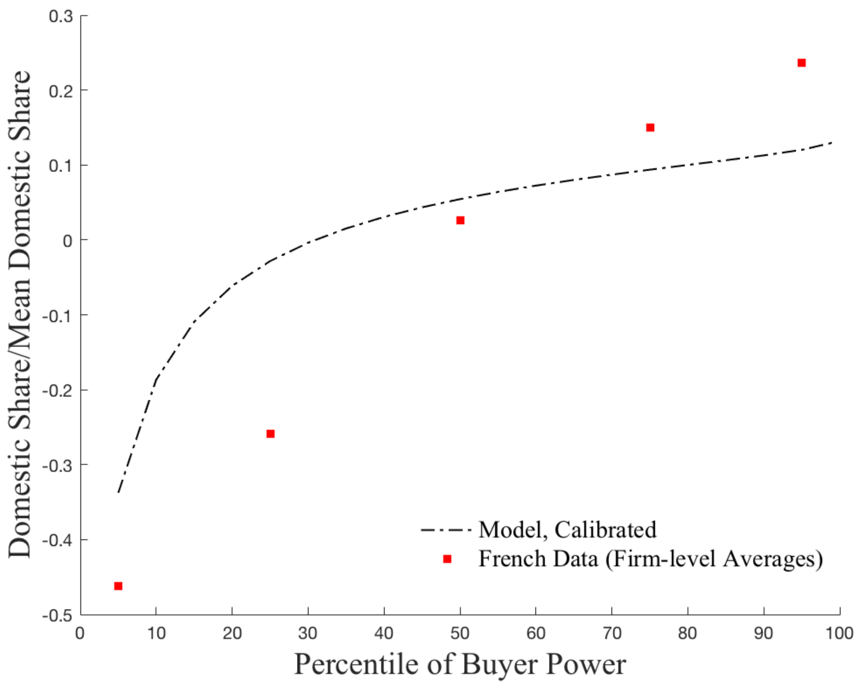


Table 1: Summary Statistics (Average 1996-2007)

Variable	**All International**	**Super International***
# Firms	14,592	6,389
(% of total)	13.9%	6.1%
(log) employment premium[(a)]	1.9	2.47
(log) sales premium	2.42	3.12
(log) wage premium	0.31	0.36
(log) TFP premium[(b)]	0.2	0.29
Belongs to a group[(c)]	52.5%	66%
# Years in the sample	8.3	7.66
Total (log) imports	13.5	14.5
Import revenue share	15.3%	19.6%
No. Observations	173,953	76,436

Source: Author's calculations. Notes: The average number of *all* the manufacturing firms in a given year is 105,051.[(a)] The (log) x premium is computed as the percentage difference in the average x in the selected sample (i.e. all international or super-international) relative to the average x in the full sample of manufacturers. [(b)] TFP is computed as real value-added per worker. [(c)] Benchmark (All firms): 13.4% A firm "belongs to a group" if it is classified as either French private, French public, foreign private (group).

Table 2: REVENUE SHARES: DISTRIBUTION QUANTILES

Variable	1996-2007				
	Mean	Std Dev	p10	p50	p90
Labor α_{it}^{L}	.17	.08	.07	.16	.27
Capital α_{it}^{K}	.03	.05	.004	.02	.07
Domestic Materials α_{it}^{M}	.49	.16	.28	.5	.7
Imported Materials α_{it}^{X}	.20	.17	.03	.15	.43

Notes: Super-international firms (cf. Table 1), pooled sample. Number of observations: 76,436.

Table 3: Average Output Elasticities, By Sector

	Industry	No. Obs.	β_L	β_K	β_M	β_X	Return to Scale
C15	Food Products and Beverages	6,177	0.09	0.11	0.55	0.24	0.99
C17	Textiles	5,915	0.14	0.08	0.57	0.20	1.00
C18	Wearing Apparel, Dressing	5,775	0.13	0.02	0.64	0.29	1.09
C19	Leather, and Products	1,842	0.19	0.09	0.54	0.22	1.04
C20	Wood, and Products	2,140	0.08	0.09	0.62	0.21	1.00
C21	Pulp, Paper, & Products	2,635	0.09	0.09	0.68	0.17	1.02
C22	Printing and Publishing	2,438	0.23	0.08	0.57	0.09	0.97
C24	Chemicals, and Products	8,266	0.10	0.04	0.81	0.11	1.06
C25	Rubber, Plastics, & Products	5,249	0.21	0.08	0.52	0.18	1.00
C26	Other non-metallic Minerals	2,465	0.31	0.15	0.36	0.27	1.08
C27	Basic Metals	2,032	0.18	0.07	0.52	0.26	1.03
C28	Fabricated Metal Products	8,000	0.20	0.12	0.50	0.14	0.96
C29	Machinery and Equipments	9,248	0.25	0.12	0.46	0.18	1.01
C31	Electrical machinery & App.	4,071	0.24	0.03	0.68	0.11	1.06
C33	Medical, Precision, Optical Instr.	6,344	0.50	0.03	0.47	0.03	1.02
C34	Motor Vehicles, Trailers	2,163	0.09	0.01	0.81	0.08	0.98
C35	Other Transport Equipment	1,676	0.14	0.03	0.73	0.13	1.03
	Average, Manufacturing	4,496	0.19	0.07	0.59	0.17	1.02

Notes: The table reports the output elasticities from production function estimation. Column 1 reports the number of observations for each production function estimation. Cols 2–4 report the estimated output elasticity with respect to each factor of production. Standard errors are obtained by block-bootstrapping. Col. 5 reports the average returns to scale, which is the sum of the preceding 4 columns.

Table 4: Markups, by Sector

Sector	μ_{it}	
	Mean	Median
15 Food Products and Beverages	1.03	0.97
17 Textiles	1.33	1.27
18 Wearing Apparel, Dressing	1.75	1.58
19 Leather, and Leather Products	1.53	1.43
20 Wood and Products of Wood	1.23	1.14
21 Pulp, Paper and Paper Products	1.43	1.36
22 Printing and Publishing	1.15	1.10
24 Chemicals and Chemical Products	1.64	1.56
25 Rubber and Plastic Products	1.07	1.02
27 Basic Metals	1.12	1.03
28 Fabricated Metal Products	1.09	1.04
29 Machinery and Equipments	0.93	0.88
31 Electrical machinery and Apparatus	1.51	1.43
33 Medical, Precision Instruments	1.05	0.99
34 Motor Vehicles, Trailers	1.72	1.58
35 Other Transport Equipment	1.55	1.45
Average	1.29	1.21

Notes: The table reports the mean and median markups by sector for the preferred sample over the period 1996-2007. The average standand deviation across industries is 0.35, with little heterogeneity across sectors. Markups are computed as the "joint distortion wedge" Ξ^m for the domestic material input. The table trims observations with markups that are above and below the 3^{rd} and 97^{th} percentiles within each sector.

Table 5: Input Market Power, by Sector

	Sector	$\psi^x{}_{it}$ Mean	$\psi^x{}_{it}$ Median	Regime
C15	Food Products and Beverages	3.45	1.91	BP
C20	Wood and Products of Wood and Cork	2.26	1.30	BP
C25	Rubber and Plastic Products	2.01	1.31	BP
C27	Basic Metals	2.56	1.71	BP
C28	Fabricated Metal Products	2.01	1.12	BP
C29	Machinery and Equipments	3.23	1.86	BP
C24	Chemicals and Chemical Products	0.81	0.47	EB
C33	Medical, Precision and Optical Instruments	0.43	0.24	EB
C34	Motor Vehicles, Trailers & Semi-Trailers	0.42	0.27	EB
C17	Textiles	1.15	0.78	
C18	Wearing Apparel, Dressing and Dyeing Fur	1.16	0.66	
C19	Leather, and Leather Products	0.97	0.60	
C21	Pulp, Paper and Paper Products	1.07	0.71	
C22	Printing and Publishing	1.44	0.88	
C31	Electrical machinery and Apparatus	1.04	0.57	
C35	Other Transport Equipment	1.28	0.68	
Average		1.76	1.06	

Notes: The table reports the mean and median input market power by sector for the preferred sample over the period 1996-2007. The average standard deviation across industries is 1.89, with some heterogeneity across sectors. Input market power is computed as the ratio between the "joint distortion wedge" Ξ^x for the foreign intermediate input and the markups, as obtained in Table 4. The table trims observations with ψ that are above and below the 3^{rd} and 97^{th} percentiles within each sector.

Table 6: Buyer Power And Correlates, by Regime

Variable	Regime "BP"	Regime "EB"	Difference
(log) Input market power (ψ)	0.54	-.77	1.31
(log) Markups (μ)	.02	.36	-0.34
(log) TFP (ω)	1.13	.73	0.4
(log) Size (output)	16.56	16.34	0.18
(log) Size (employment)	4.52	4.28	0.24
(log) Size (value added)	15.37	15.14	0.23
(log) Size (total imports)	14.69	14.17	0.5
Number of Firms	443.5	382.34	16%

Notes: The table reports the average value of (log) input market power, markups, tfp, output, employment, value added, total imports, measured TFP and the average number of firms for the two groups "BP", and "EB". Groups are classified according to Table 5. Group "BP" includes sectors {15, 20, 25, 27, 28, 29}. Group "EB" includes sectors {19,24,31,33,34}

Table 7: Buyer Power And Firm Characteristics

Panel A. Dependent Variable: Input Market Power $\ln \psi_{it}$	(1)	(2)	(3)	(4)	(5)	(6)
(log) Employment$_{it}$	.025***	.014***				
	(8.55)	(4.09)				
(log) Value Added$_{it}$			.0013	-.009**		
			(0.48)	(-2.79)		
(log) TFP$_{it}$					-.47***	-.44***
					(-15.42)	(-47.98)
Regime "BP" (dummy)		1.31***		1.32***		1.49***
		(132.92)		(133.54)		(141.56)
Adj R^2	0.32	0.28	0.32	0.28	0.32	0.31

Panel B. Dependent Variable: Markups $\ln \mu_{it}$	(7)	(8)	(9)	(10)	(11)	(12)
(log) Employment$_{it}$	.004***	.01***				
	(5.10)	(8.99)				
(log) Value Added$_{it}$			-0.001	0.004***		
			(-1.35)	(3.86)		
(log) TFP$_{it}$					.28***	.31***
					(23.67)	(4.23)
Regime "BP" (dummy)		-0.39***		-0.39***		-0.39***
		(-137.23)		(-136.6)		(-137.23)
Adj R^2	0.43	0.29	0.43	0.29	.44	.38
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
# Observations			59,591			

Notes: The table reports the estimates of OLS regressions on equation (28). In Panel A, the dependent variable is $y_{it} = \psi_{it}$. In Panel B, the dependent variable is $y_{it} = \mu_{it}$. The results are shown for the sample of super international firms (cf. Table 1). All regressions include Industry Fixed Effects. Column (2)-(4)-(6) in Panel A and (8)-(10)-(12) in Panel B includes a dummy that is equal to 1 if the firm belongs to those sectors where the average and median estimated buyer power is consistent with monopsony distortions. This group includes sectors $BP = \{15, 20, 25, 27, 28, 29\}$. *** denotes significance at the 10% level, ** at the 5% and *** at the 1%. Panel A is reported and discussed in the main text. The results in Panel B show a positive and significant correlation between measures of firm size and performance on markups. This is consistent with the findings in De Loecker and Warzynski (2012), for example, who find higher markups for large, successful exporters. We find that that the effect is much weaker in sectors where input distortions are higher.

Table 8: Model Parameters

Variable:	ψ		φ [(a)]		ϕ_s	σ_s	θ_s
	Mean	**Std Dev**	Mean	Std Dev			
Source:	Estimation				Estimation		Data
Food and Beverages	3.45	4.18	10.06	2.07	0.24	34.33	0.13
Textiles	1.15	1.04	13.20	2.49	0.20	4.03	0.02
Wearing, Apparel	1.16	1.35	3.70	1.13	0.29	2.33	0.01
Wood and Products	2.26	2.57	7.16	1.60	0.21	5.35	0.02
Rubber and Plastics	2.01	1.96	32.20	6.84	0.27	15.29	0.03
Basic Metals	2.56	2.50	12.54	3.46	0.26	9.33	0.03
Fabricated Metal Prod	2.01	2.34	46.39	9.50	0.14	12.11	0.09
Machinery and Equip	3.23	3.68	43.59	13.45	0.18	34.33[(b)]	0.08
Electrical machinery	1.04	1.27	14.36	3.14	0.11	2.96	0.04
Other Transport Equip	1.28	1.57	11.04	9.54	0.13	2.82	0.04
Other Manufacturing[(c)]	1	0	16.15	4.29	0.17	4.45	0.51
Average	1.60	1.79	48.50	11.58	0.17	8.51	0.05

Notes: The table reports the main estimates of the model parameter. I consider only sectors when the mean estimated input market power is above 1, which are the sectors that are consistent with the model assumptions. [(a)] The estimation procedure yields estimates of mean and standard deviation of $\log \varphi$. In order to infer mean and variance of φ I assume that $\varphi \sim \log \mathcal{N}(\mu, \sigma^2)$, such that I can use the properties of the log normal to derive $\mathbb{E}\varphi = e^{\mu + \frac{1}{2}\sigma^2}$ and $SD(\varphi) = e^{\mu + \frac{1}{2}\sigma^2}\sqrt{e^{\sigma^2} - 1}$. [(b)] I set this number arbitrarily high, since the true underlying markup is below one. [(c)] The category "Other manufacturing" collects all those manufacturing sectors for which the model assumptions seem not to hold. The data are obtained as the average manufacturing value for the variable.

Table 9: Changes in Aggregate Variables

Variable: $X = \sum_s \theta_s X_s$	Imports X^{Exp}	Output Q	Capital Inc. RK	Profits Π	Income I	Profits-to-Income $\frac{\Pi}{I}$
Equilibrium:						
Distorted	0.07	0.54	0.3	0.17	0.47	36%
(Input) Competitive	0.11	0.57	0.32	0.14	0.47	31%
% Change:						
"BP" Sectors Only	58.4%	6.7%	6.7%	-14.3%	-0.8%	-13.6%
Total Manufacturing*	32.2%	3.2%	3.2%	-8.9%	-0.4%	-6.4%

Notes: The table reports the equilibrium value of the main aggregate variables in the distorted and the counterfactual economy, and the percentage change from moving to the former to the latter. I define the change in total manufacturing output as the weighted average of the change in the sectoral output between the calibrated and the counterfactual economy, i.e. $\%\Delta Q = \sum_{s=1}^{S} \theta_s \%\Delta Q_s$. To compute the "change in total manufacturing" I consider only sectors when the mean estimated input market power is above 1, which are the sectors that are consistent with the model assumptions. In the last row I compute the aggregate change in the whole economy, by taking into account the share of manufacturing in total value added in France.

A Appendix

A.1 Firm-Level Output Prices

The average "international" firm exports multiple products in different destinations. For this firm, the concept of "firm-level" price is inherently an average across firm-product prices.

Let p_{ipct} the price that firm i charges for product p in destination market c. I assume that firm-product markup can vary across different destinations, and I write (log) markup in destination c as:

$$\mu_{ipct} = \bar{\mu}_{ipt} + \hat{\mu}_{ipct}, \tag{52}$$

where $\hat{\mu}_{ipct}$ is the deviation in country c from average firm-product markup $\bar{\mu}_{ipt}$. I write (log) price p_{ipct} as

$$p_{ipct} = mc_{ipt} + \mu_{ipct} = p_{ipt} + \hat{\mu}_{ipct}, \tag{53}$$

where $p_{ipt} \equiv mc_{ipt} + \bar{\mu}_{ipt}$ is the sum of the log marginal cost of the product and the average (log) product markup, and therefore represents a measure of the average product price across destinations. The important assumption here is that marginal cost of the product is common across destinations, a standard assumption in the literature of pricing to market (e.g. Burstein and Gopinath (2014)).

Equation (53) suggests that I can run fixed effects OLS on

$$p_{ipct} = \gamma_{pit} + \varepsilon_{fint}, \tag{54}$$

and get an estimate of the average firm-product price as $\hat{p}_{ipt} = \hat{\gamma}_{ipt}$, where the γ_{ipt} are firm-product-time fixed effects.

The following step involves the aggregation of a number of firm-product prices $\hat{p}_{ipt}$ into a single firm-level price. Because different firms export different product bundles, consistent aggregation requires us to take this product heterogeneity into account. For example, consider two firms in the dairy production sector, one selling regular and organic milk at a unit price of 1 and 5 Euros, respectively, and the second one selling organic milk and cheese at 5 and 20 Euros, respectively. A simple average of these product prices would imply that the two firms charge on average 3 and 12.5 Euros, which imply a price differential of 400%, although the two firms charge the same price for organic milk. This difference has nothing to do with firm level prices and markups, but only reflects a combination of different product bundles. In order to deal with this product heterogeneity, a preliminary step which seems sensible to do is to normalize each price by the average price in France for that product. We normalize each price as:

$$\tilde{p}_{ipt} = p_{ipt} - N^{-1} \sum_{i=1}^{N_p} p_{ipt}, \tag{55}$$

where $N_p \geq 3$ is the number of French firms exporting product p[36]; and I compute firm-level prices as a weighted average of the normalized firm-product prices, i.e.

$$p_{it} = \sum_{i \in N_{it}} \omega_{ipt} \cdot \tilde{p}_{ipt}, \tag{56}$$

over the N_{it} products sold by firm i in a given year, with the weights given by the shares of each product in total firm exports $\omega_{ipt} \equiv \left[\frac{Tot.Revenues\ from\ p}{Tot.Revenues}\right]_{ipt}$. In our example above, suppose that we find that the average price for regular milk, organic milk, and organic cheese in France are 2, 5, and 10 Euros respectively. This means that the first firm charges 100% less than average for the first product, and the average price for the second product. The mean normalized price is thus -0.5. The mean normalized price for the second firm is instead 0.5, which is consistent with the firm charging the average price for organic milk, but twice as much as average for the organic cheese. The normalized average prices thus reflect markup differences more appropriately.

A.2 Proxy Control Function for Unobserved Productivity

Let us consider a setting where heterogeneous firms produce output using two inputs: capital k_i and intermediate input x_i. The market for capital is competitive, such that firms take its price r_i as given. The price r_i is allowed to vary by firms because firms might use inputs of different quality. The market for x_i is not perfectly competitive. I let ψ_i denote the degree of firms buyer power. This environment is similar to the one I consider for the theoretical model in section 4, and the reader should refer to that for the derivation of the main equations. It can be shown that the demand for the two productive inputs is given by

$$\begin{aligned} x_i =& f(\omega_i, \psi_i, w_i^x, r_i) \\ k_i =& g(\omega_i, \psi_i, w_i^x, r_i), \end{aligned}$$

where ω_i is unobserved firm productiviity, and w_i^x is the price of the intermediate input. Since capital is monotonically decreasing in ψ_i, the second expression can be inverted to

[36] In computing prices, I drop all the products which are exported by less than 3 firms in France, so as to have a meaningful "average" price for each product.

write:

$$\psi_i = \tilde{g}(\omega_i, w_i^x, r_i, k_i).$$

Moreover, since the market for capital is perfectly competitive, we argued that it is possible to write the firm-level input price as a function of output prices ap_i, market share in the output market ms_i; and exogenous factors G_i, all of which are observable. Therefore,we can write

$$r = r(p_i, ms_i, G_i).$$

Putting all pieces together, the demand for intermediate can be written as:

$$x_i = h(\omega_i, w_i^x, p_i, ms_i, G_i),$$

such that productivity ω_i is the only unobserved *scalar* entering the input demand.

A.3 Data Appendix

A.3.1 Variable Construction

Output is measured as total firm sales in a given year, deflated by the STAN industry output deflator. Labor is measured as the total number of "full-time equivalent" employees in a given year. The FICUS Dataset also includes a measure of firm-level cost of salaries, which I use to derive firm-level wages by dividing total cost of labor by total firm employment. I derive (and try) two different measures of the capital input. For the first "rough" measure, I take the book value of capital reported at the historical value, infer a date of purchase from the installment quota given a proxy lifetime duration of equipments, and then use deflators[37]. The second and preferred measure of capital is constructed using a perpetual inventory method, i.e. $K_t = (1 - \delta_s)K_{t-1} + I_t$. I consider the book value of capital on the first year of activity of the firm as the initial level, and take the values for the depreciation rate δ_s, where s indicates that i might vary by sector, from Olley and Pakes (1996).

The procedure to construct domestic and imported intermediate input is more elaborated. In the fiscal files, I observe total expenditures on intermediates. In the custom files, I observe total expenditure on imports. The domestic material input is then constructed by subtracting total import expenditures from total expenditures in intermediates, as in Blaum et al. (forthcoming). Note that the imported intermediate input in my preferred specification is defined as total import expenditure of the firm. Clearly, it is possible that the firm imports final products along with intermediate inputs in production, which means

[37] I thank Claire Lelarge for this suggestion

that total imports overstate the actual intermediate expenditure. As a robustness check, in other specifications I consider only the imports of those products classified as "intermediates" in the Broad Economic Categories (BEC) classification. In yet other specifications, I instead build sectoral shares of intermediate imports from the IO linkages tables for France, and use those shares to scale down total imports. I prefer to use total imports for consistency with the total value. Total expenditure on intermediates is the sum of expenditures on final goods, material goods and other categories. I believe that using both total expenditures and total imports gives a more accurate measure of the two inputs.

A.3.2 Sample Construction, and Sample Statistics

I start by considering the full FICUS (production) dataset for the universe of the French manufacturing firms. I merge this sample with the trade variables, and keep only those firms for which I have a non-empty entry for both output and input price. These are the so-called "international firms". Then, to go from international to "super-international" firms, I keep only those firms that import from more than one country outside the EU.

Classification of Industries - I consider 17 manufacturing industries, based on the ISIC (International Standard Industrial Classification) Rev. 3. Sectors 15-35 of the ISIC 3 are classified as manufacturing sectors. Among those, I drop sectors 16 ("Tobacco Products"), 23 ("Coke, Refined Petroleum Products") and 30 ("Office, Accounting and Computing Machinery") for insufficient number of observations in the selected sample. I also drop sector 32 ("Radio, Television and Communication Equipment and Apparatus") for lack of precision in the production function estimation. Table A1 presents the industry classification and the number of firms and observations for each industry $s \in \{1, .., 17\}$.

Table A.I Manufacturing Sectors, and Sample Size

	Industry	No of Obs. [(a)]	No Firms	% Super Intl Firms
C15	Food Products and Beverages	17,917	1506	0.66
C17	Textiles	11,620	989	0.49
C18	Wearing Apparel, Dressing and Dyeing Fur	10,046	860	0.43
C19	Leather, and Leather Products	3,741	321	0.51
C20	Wood and Products of Wood and Cork	6,727	573	0.68
C21	Pulp, Paper and Paper Products	6,053	508	0.56
C22	Printing and Publishing	8,236	693	0.70
C24	Chemicals and Chemical Products	13,656	1141	0.39
C25	Rubber and Plastic Products	14,632	1230	0.64
C26	Other non-metallic Mineral Products	6,200	520	0.60
C27	Basic Metals	4,359	364	0.53
C28	Fabricated Metal Products	25,479	2140	0.69
C29	Machinery and Equipments	21,092	1769	0.56
C31	Electrical machinery and Apparatus	6,634	555	0.39
C33	Medical, Precision and Optical Instruments	10,267	858	0.38
C34	Motor Vehicles, Trailers & Semi-Trailers	4,558	382	0.53
C35	Other Transport Equipment	2,736	229	0.39

Notes: The table reports the list of manufacturing sectors, the total number of observations and the total number of firms in each sector (average over 1996-2007). [(a)] The number of observation refers to the sample of ALL international firms.

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