

Market Power in Input Markets: Theory and Evidence from French Manufacturing

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Abstract

This paper provides micro-level evidence of market power in input trade, and examines its implications for the aggregate economy. I develop a framework to estimate a measure of the firm's relative market power in foreign input markets from standard production and trade data. I propose an estimation strategy to correct for price biases in production function estimation that relies on information on prices observed in customs data. I apply the methodology using data on French manufacturing firms over the period 1996-2007, and provide robust evidence that the buyer power of individual importers is large, even with substantial heterogeneity across firms and sectors. I embed buyer power in a model of monopolistic competition with heterogeneous firms, and characterize its contribution to the aggregate performance of the French manufacturing sector, both qualitatively and quantitatively. When the buyer power is counterfactually removed, I calculate static gains in productive efficiency of 2-5%. My results imply that the productivity gains associated with input trade might be lower than what usually thought.

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1 Introduction

Recent years have seen a fruitful debate on the impact of the rise of trade in intermediate inputs on a country’s economic performance. A number of empirical studies have consistently shown that input trade benefits countries, by providing access to new products or varieties.¹

The literature has so far remained largely silent about the economic environment where importers operate, a key determinant of the effects of trade on productivity and welfare (e.g. [Harrison, 1994](#)). What we know is based on the premise that importers act as price takers in foreign input markets. While it is recognized that international trade largely takes place in less-than competitive environments, there is surprisingly little evidence on the importance of imperfect competition in input trade at the microeconomic level, and on its macroeconomic implications.

Recent research based on micro data on firms and trade yet suggests that the market power of individual importers is potentially sizable. Large fixed costs of sourcing limit the ability of firms to select into importing ([Antràs et al., 2017](#)), effectively acting as barriers to competition. As a result, import activities are concentrated in a small number of large, highly performing firms ([Bernard et al., 2007](#)), who are likely aware of their dominant buyer position, and who might act to profit from it. The market power of domestic importers affects not only foreign countries, but also the domestic market, where downstream competitors might be unable to rival the dominant buyer’s low input prices, and where distortions in the production process are potentially large.

This paper takes a first step towards filling the empirical and theoretical gap by investigating both the empirical size of market power in input trade, and its effects on the aggregate economy. The main contributions of this study are twofold: (1) I combine modern econometric techniques with rich micro data to provide novel empirical evidence on the buyer power of importers; (2) I incorporate buyer power in a tractable heterogeneous firm model of production, and characterize its effect on aggregate variables, both qualitatively and quantitatively.

The starting point is a general reduced-form theoretical framework that encompasses several models of imperfect competition and input trade. I focus on the optimal behavior of firms in foreign and domestic input markets. Importantly, I do not restrict competition in either market.

Ultimately, the existence of (anti-)competitive effects of trade depends on whether or not opening up to trade leads domestic firms to increase their market power ([Helpman and Krugman, 1989](#)). I show that a measure of the firm’s relative input market power in the foreign market, defined as the differential wedge between the price and the marginal revenue product of the two intermediate inputs, can be written as a function of two objects: their revenue shares, which are observed, and their output elasticities, which can be estimated jointly with the production function. My approach is based on [De Loecker and Warzynski \(2012\)](#) and [Dobbelaere and Mairesse \(2013\)](#), but I extend their methodology to account for imperfect competition in multiple input markets.

Estimating the physical output elasticities of the different inputs in a context where input markets are less than competitive is an important contribution of this paper. The key empirical

¹See, for example, [Amiti and Konings, 2007](#); [Goldberg et al., 2009, 2010](#); [Gopinath and Neiman, 2014](#); [Topalova and Khandelwal, 2011](#); [Halpern et al., 2015](#); [Blaum et al., 2018](#) and [Muendler, 2004](#), for an exception.

challenge is that data on physical units of output or inputs are not observed, such that industry-wide price deflators are needed to eliminate price variation from nominal variables. This practice, standard in empirical work, leads to well-known price biases if the unobserved prices differ across firms in a way that is correlated with the choice of inputs. Imperfect competition among buyers or sellers is a source of such correlation (De Loecker and Goldberg, 2014).

I propose a novel empirical strategy to address all price biases in estimation, which involves two main steps. First, I leverage data on export and import unit values to compute the mean normalized firm-level price of output and the imported input. I use these prices to construct measures of physical output and foreign intermediates that incorporate price differences across firms. This step alleviates concerns about the output price bias, and the foreign input price bias.

The second step is building a control function for the unobserved price of domestic intermediates. I show that, when an input market is less than competitive, the buyer share of a firm in the market is a sufficient statistic for the effect of buyer power on input prices. As a result, unobserved variation in input prices due to input market power can be controlled for by measures of buyer shares, which can be proxied for, up to a definition of the relevant market boundaries. My approach builds on De Loecker et al. (2016), who used similar techniques to correct for unobserved variation of competitive input prices.

The bias correction strategy dispenses with parametric assumptions on demand and/or market structure in all markets, consistent with the application of the paper. To the best of my knowledge, this paper is the first to contribute an approach to the treatment of market power in input markets in production function estimation, in a context where data on input prices are not directly available.²

I apply my methodology using French longitudinal firm-level data on trade and production over the period 1996-2007. My results show that the relative wedges are sizeable, indicating large differences in the structure of the foreign and domestic input markets. In particular, firms and industries behave as monopsonists or oligopsonists in foreign input markets, as they keep both the demand and the price of foreign inputs below competitive levels. In contrast, firm and industry behavior in domestic input markets appears to be close to efficient.³ The relative wedges are thus primarily driven by distortions in firm behavior in foreign input markets.

Sector and firm-level analyses corroborate the interpretation of the wedges as buyer power. The wedges are relatively large in sectors that are highly concentrated, where import competition is low and where entry costs into import markets are substantial. Across firms, large and productive firms are relatively more distorted than smaller, unproductive ones.

Unobserved fixed costs of sourcing could raise important skepticism about the size and structural interpretation of the input wedges. As these costs determine sourcing patterns of firms (Antràs

²The input price bias has received little attention in empirical work. Katayama et al. (2009) and De Loecker and Goldberg (2014) discuss the existence and the importance of the bias. De Loecker et al. (2016) is the first study that deals with the bias in empirical work, but does not allow for market power in input markets.

³This result has implications for the burgeoning empirical literature on the estimation of product and labor market imperfections, as it gives support to the (standard) assumption of perfect competition in intermediate input markets, insofar as the imported share of intermediates is not too high (De Loecker and Warzynski, 2012; De Loecker et al., 2016, 2019; Dobbelaere and Mairesse, 2013; Dobbelaere and Kiyota, 2018).

et al., 2017), if large firms disproportionately source from low-cost countries they will spend less on shipments of the same size, other things equal. The econometric framework might thus attribute differences in sourcing costs to differences in pricing power across firms. I address these concerns by means of regression analysis. I follow [Blaum et al. \(2019\)](#) and construct sourcing strategy fixed effects, which I use to purge the wedges from variation potentially unrelated to market power. The main results are qualitatively unaffected once I control for the global sourcing strategy of firms, indicating an important residual role for the buyer power of importers.

Reduced form evidence on the behavior of import prices provides additional support to the main empirical results. I show that, in line with the predictions of a model of imperfect competition in import markets, firm-level prices of imported inputs are negatively and significantly correlated with the buyer share in that market. This result is robust to controlling for a large set of fixed effects, capturing differences in quality and/or sourcing strategy across firms.

The evidence on import prices contributes to an empirical literature studying the determinants of input price dispersion. Studies have emphasized the role of quality ([Kugler and Verhoogen, 2012](#)), and demand non-homotheticity ([Blaum et al., 2019](#)). My study uncovers an important role of the market power of importers. This is of interest for empirical work aiming to understand the pass-through of shocks into import prices, an issue that has been drawing considerable attention following the recent surge in tariffs by the U.S. and other advanced economies.⁴

Motivated by the empirical findings, in the second part of the paper I investigate the contribution of buyer power of importers to the aggregate performance of the French manufacturing sector. To do so, I incorporate buyer power in an otherwise standard general equilibrium model of monopolistic competition with heterogeneous firms, in the spirit of [Hsieh and Klenow \(2009\)](#). The sources of input market power in the model are increasing marginal costs of producing the foreign input, and foreign market segmentation due to horizontal input differentiation.

The benefits of focusing on a simple model of production are twofold. First, I can investigate the specific channels through which buyer power affects the production decisions of firms. Second, the model yields an analytical characterization of the static aggregate equilibrium distortions, as well as a transparent mapping between the micro-level wedges and macro-level outcomes.

At the individual firm level, heterogeneous buyer power raises the marginal revenue product of the foreign input, leading to an inefficient substitution of the inputs in production, and to an inefficient firm size. The micro-level allocative inefficiencies lower both TFP and aggregate output, as compared to a counterfactual economy where all firms behave as price takers in all input markets.

These results relate to the macroeconomic literature on market power and misallocation.⁵ I show that the effect of misallocation induced by input market power on aggregate output is less severe than that induced by output market power. Output is inefficiently low in an economy with buyer power, and misallocation can in fact boost production by inducing less distorted firms to overproduce, albeit inefficiently. This paper is the first to explicitly model the effect of buyer power

⁴See [Amiti et al., 2019](#); [Fajgelbaum et al., 2019](#); [Cavallo et al., 2019](#); [Jaravel and Sager, 2019](#); [Flaen et al., 2019](#)

⁵See [Epifani and Gancia, 2011](#); [Holmes et al., 2014](#); [Edmond et al., 2015](#); [Peters, 2016](#); [Asker et al., 2018](#)

on the equilibrium allocation of resources, while pointing out a new type of productivity loss, not yet addressed by the literature.

A particularly interesting feature of the model is that, when the joint distribution of buyer power and productive efficiency is approximated by jointly independent log-normals, the first and second moments of the distribution of the foreign input wedges are *sufficient statistics* for quantifying the losses in aggregate output and TFP due to heterogeneous buyer power. Plugging the estimated wedges in the relevant model equations, I find that by hypothetically eliminating the buyer power of French importers, and its dispersion thereof, aggregate productive efficiency in the domestic economy would increase by 2-5%, while aggregate output would increase by about 1%.

The model suggests an interesting relationship between buyer power of importers, aggregate income, and trade policy. Buyer power induces a terms-of-trade improvement for the country, such that the increase in profits from rent transfers from foreign countries can effectively compensate for the reduction in payments to domestic factors.⁶ The effect of buyer power of importers is thus isomorphic to that of an import tariff, such that a planner maximizing national welfare could find it optimal to be lenient towards large, distorted, importers. A lenient national anti-trust policy can thus substitute for beggar-thy-neighbor trade policies.⁷

The findings of this paper contribute in important ways to several literatures in international trade and macroeconomics. Most directly, the results add to the debate on the effects of input trade for aggregate productivity (e.g. [Amiti and Konings, 2007](#); [Goldberg et al., 2010](#); [Topalova and Khandelwal, 2011](#); [Halpern et al., 2015](#)). By showing evidence that foreign input markets are relatively more distorted than domestic ones, this paper makes the case for anti-competitive effects of input trade, indicating an upward bias in standard estimates based on competitive models.

Similarly, this paper relates to the burgeoning literature on the competitive effect of international trade. While studies have mostly focused on exports, the effect of market power of importers on the gains from trade has received some attention in recent years, mostly in theoretical work. [Raff and Schmitt \(2009\)](#) study the implications of buyer power of retailers/wholesalers on the competitive effects of trade liberalization. [Bernard and Dhingra \(2019\)](#) analyze theoretically the effects of changes in the microstructure of import markets on the division of gains from trade, providing empirical support for the main model implications. The findings in this paper are consistent with, and provide empirical support to, the narrative that standard effects of a trade liberalization could be reversed in presence of the buyer power of importers.⁸

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 data and main empirical results, together with the reduced form evidence on buyer power. In section 4 I introduce the theoretical model, the main theoretical results, and the counterfactual exercise. Section 5 concludes.

⁶The model features fixed entry, and it recovers *static* profits. The model thus delivers only an upper bound of the effects of buyer power on domestic income, which are lower in presence of an initial investment in fixed costs.

⁷[Gaubert and Itskhoki \(2019\)](#) reach a similar conclusion in a model of international trade with granular exporters.

⁸Studies on exports and product market power include [Harrison, 1994](#); [Chen et al., 2009](#); [De Loecker and Warzynski, 2012](#); [De Loecker et al., 2016](#); [Arkolakis et al., 2018](#); [Dhingra and Morrow, 2019](#)

2 Empirical Model: A Framework to Estimate Input Market Power

The goal of the empirical analysis is to quantify the relative competitiveness of foreign and domestic input markets. To that end, this section sets up an econometric framework to estimate a relative measure of market power in foreign input markets.

The starting point is a general theoretical framework that encompasses several models of imperfect competition and input trade. I focus on the optimal firm choice of a foreign and a domestic intermediate input, and show that a measure of relative market distortions in the foreign market can be obtained given data on expenditure shares of the two intermediates, and estimates of their output elasticities. These elasticities can be recovered along with production function estimation.

My approach is based on [Hall \(1986\)](#), [De Loecker and Warzynski \(2012\)](#) and [Dobbelaere and Mairesse \(2013\)](#), but I extend their methodology by dispensing with restrictions on the market structure of variable input markets. Notably, this implies that the model does not impose market distortions to be necessarily larger in foreign markets relative than in domestic ones. This generalization introduces new estimation challenges that I must confront.

A relevant feature of my econometric framework is that, by dispensing with assumption on the structure of both domestic and foreign markets, it can capture in a reduced form way the importance of market power in firm-to-firm trade both within and across borders ([Bernard et al., 2018b](#); [Kikkawa et al., 2019](#)), as well as the potentially countervailing effect of granular exporters on the market power of importers ([Bernard and Dhingra, 2019](#)).

2.1 Conceptual Framework

The economy is populated by a mass of firms, indexed by i , which purchase multiple inputs to produce. Inputs can either be sourced domestically or can be imported. Any firm i produces output in each period according to the following technology:

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

where \mathbf{V}_{it} is the vector of variable inputs in production, which the firm can flexibly adjust in each period, and \mathbf{K}_{it} is the vector of “dynamic” inputs, such as capital or labor, which are subject to adjustment costs or time-to-build. I restrict to well-behaved production technologies, and assume that $Q(\cdot)$ is twice continuously differentiable with respect to its arguments.

The vector Θ_{it} includes all the state variables relevant to the firm at the time of production. Importantly, it is assumed that the vector Θ_{it} includes the firm’s import sourcing strategy, i.e. a measure of its extensive margin of imports in the spirit of [Antràs et al. \(2017\)](#) and [Blau et al. \(2019\)](#). This assumption implies separability between the intensive and extensive margin of firms’ import, such that firms’ import choices at the intensive margin are the solution to a static cost minimization problem. In other words, the firm imported input is a variable input in production.

Given the application of this paper, I assume that each firm chooses exactly two variable inputs in

production, namely a *domestic* intermediate input, which I denote by M_{it} ; and a *foreign* intermediate input, which I denote by X_{it} .⁹ In each period firms minimize short-run costs taking as given output quantity and state variables. In order to allow for non-competitive buyer behavior in the market of input $V = M, X$, I consider the following mapping between input price and input demand of firm i :

$$W_{it}^v = W(V_{it}; \mathbf{A}_{it}) \quad (2)$$

where W_{it}^v is the input v 's unit price, for $v = m, x$, and \mathbf{A}_{it} are other exogenous variables affecting prices, such as location (G_i), or input quality. As I discuss in section 2.1.1, equation (2) can be reconciled with a number of models of imperfect competition in the market of input V . When markets are competitive, the buyer behaves as a price taker, and $\frac{\partial W_{it}^v}{\partial V_{it}} = 0$. Conversely, when the buyer has input market power, $\frac{\partial W_{it}^v}{\partial V_{it}} \neq 0$.

Let $\mathcal{L}(M_{it}, X_{it}; \lambda_{it}, \mathbf{K}_{it}) = W_{it}^M M_{it} + W_{it}^X X_{it} + \lambda_{it} (Q_{it} - Q_{it}(\cdot))$ denote the Lagrangean function associated with the variable cost minimization problem of firm i . The first-order condition for any variable input V_{it} is given by:

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

$$\implies \lambda_{it} \frac{\partial Q_{it}(\cdot)}{\partial V_{it}} = W_{it}^v \left(1 + \frac{\partial W_{it}^v}{\partial V_{it}^v} \frac{V_{it}}{W_{it}^v} \right), \quad (4)$$

where the term $\lambda_{it} = \frac{\partial \mathcal{L}}{\partial Q_{it}}$ denotes the shadow value of the constraint of the Lagrangean function, i.e. the marginal cost of output. Equation (4) says that the marginal cost of the input in equilibrium is equal to the input unit price W_{it}^v , times a term which differs from one whenever $\frac{\partial W_{it}^v}{\partial V_{it}^v} \neq 0$. In other words, the existence of input market power generates a *wedge* between the marginal valuation of the input and its equilibrium price, which I denote by ψ_{it}^v and is equal to

$$\psi_{it}^v \equiv 1 + \frac{\partial W_{it}^v}{\partial V_{it}^v} \frac{V_{it}}{W_{it}^v}, \text{ for } v = m, x. \quad (5)$$

I consider ψ_{it}^v as a measure of firm i 's input market power in the market of $v = \{m, x\}$.

Let us denote firm-level markups as price over marginal costs, i.e. $\mu_{it} = P_{it}/\lambda_{it}$. It is easy to show using simple algebra that equation (4) can be rewritten as:

$$\Xi_{it}^v \equiv \psi_{it}^v \cdot \mu_{it} = \frac{\theta_{it}^v}{\alpha_{it}^v}, \text{ for } v = m, x. \quad (6)$$

In other words, a measure of the overall (output and input) market distortions affecting firm behavior, which I denote as Ξ_{it}^v , can be written as a function of the output elasticity of the input, i.e. $\theta_{it}^v \equiv \frac{\partial Q_{it} V_{it}}{\partial V_{it} Q_{it}}$, and the share of expenditure on the input over total firm's revenues $\alpha_{it}^v \equiv \frac{W_{it}^v V_{it}}{P_{it} Q_{it}}$, for

⁹This choice is without loss of generality. The discussion can be easily extended to the general case with $N \geq 2$ variable inputs.

$v = m, x$. If firms are price takers in both output and input markets, then $\Xi_{it}^v = 1$ such that the firm spends on input v a share of revenues equal to the input's output elasticity.

Equation (6) holds for any static input $V_{it} \in \mathbf{V}_{it}$. Given data on *two* static inputs, such as in this case domestic and foreign intermediates, we can get rid of the common (and unobservable) markup term by solving for the *relative* input market power as:

$$\frac{\psi_{it}^x}{\psi_{it}^m} = \frac{\theta_{it}^x}{\theta_{it}^m} \cdot \frac{\alpha_{it}^m}{\alpha_{it}^x}, \quad (7)$$

which is a function of observable shares, and output elasticities only. This expression will constitute the main estimating equation of this paper: the input expenditure shares are directly observed in the data, while the output elasticities can be estimated jointly with production function estimation.

Equation (6) suggests that unless markups μ_{it} are known, it is not possible to identify the level of input market power in the market of input $v = x, m$. Similarly, unless ψ_{it}^v are known, it is not possible to identify markups as a function of observable shares and output elasticities. This discussion makes clear an existing limitation in burgeoning empirical work on the estimation of markups (Hall, 1988; De Loecker and Warzynski, 2012; De Loecker et al., 2016), and labor market imperfection (Dobbelaere and Mairesse, 2013; Dobbelaere and Kiyota, 2018; Nesta et al., 2018). Existing studies typically assume that the markets of intermediates are perfectly competitive, that is, $\psi_{it}^m = 1 \forall i$. Equation (6) and (7) show that when input market power is mistakenly overlooked (i.e. when $\psi_{it}^m \neq 1$), standard approaches would over- or under- estimate the true level of markups, and in turn under- or over-estimate the level of labor market imperfections, depending on whether $\psi_{it}^m \geq 1$.

2.1.1 Interpreting the Input Efficiency Wedges

The supply function in (2) can be reconciled with a number of models of imperfect competition in the input markets, and the interpretation of the wedges ψ_{it}^x and ψ_{it}^m , and of their ratio thereof, can vary accordingly. Let ψ_{it} define the input wedge in a generic input market. In models of monopsonistic competition, the function in (2) corresponds to the inverse of the input supply function, which is characterized by a positive supply elasticity. This class of models implies that $\psi_{it} \geq 1$.¹⁰

Values of $\psi_{it} < 1$ are also admissible. Dobbelaere and Mairesse (2013) show that in models of efficient bargaining equation (6) identifies ψ_{it} as a function of the relative bargaining power of firms. This class of models yields values of $\psi_{it} < 1$. In Appendix B.1, I show that a model with second degree price discrimination (quantity discounts), and a model with two-part tariffs, also yield equilibrium values of ψ_{it} below unity. More generally, this is the case whenever the input supply technology shows increasing returns, i.e. whenever $\frac{\partial W_{it}^v}{\partial V_{it}} \frac{V_{it}}{W_{it}^v} < 0$. Table 1 summarizes the relationship between the values of the wedge ψ_{it} and models of input competition.

This discussion makes clear that the structural interpretation of the ratio ψ_{it}^x/ψ_{it}^m depends on

¹⁰In models of monopsony in the labor markets, the wedge ψ_{it} is often referred to as the ‘‘rate of exploitation’’ of workers (e.g. Pigou, 1932).

TABLE I. VALUE OF ψ_{it} AND INPUT MARKET STRUCTURE

VALUE OF ψ_{it}	$\psi_{it} > 1$	$\psi_{it} = 1$	$\psi_{it} < 1$
TYPE OF COMPETITION	Monopsony/ Oligopsony	Perfect Competition	Quantity Discount/ Efficient Bargaining

whether the nature of competition is similar in the two markets, namely, on whether $sign(\psi_{it}^x - 1) = sign(\psi_{it}^m - 1)$. Knowledge of the ratio ψ_{it}^x/ψ_{it}^m is not sufficient in itself to establish which model of competition can better describe the two markets. In Section 3, I argue that one can make progress by leveraging information on the markup distribution of firms. Intuitively, if firm-level markups were known, or correlates thereof, one could get a sense of the value of the wedges ψ_{it}^x and ψ_{it}^m , by purging the overall wedges Ξ_{it}^x and Ξ_{it}^m from the variation that is due to product market power.

2.1.2 Discussion

Equation (7) identifies the relative input market imperfections under two important conditions. The first condition is that domestic and the foreign intermediates are static inputs in production. This assumption can raise skepticism, in light of the evidence of substantial market entry costs (Roberts and Tybout, 1997; Das et al., 2007; Antràs et al., 2017), as well as inventory costs and delivery lags (Alessandria et al., 2010, 2013), associated with international trade. Arguably, neither inventory nor sourcing costs constitute important threats to identification. On the one hand, the analysis uses yearly data, such that delivery lags and inventory costs should be averaged out. On the other hand, in section 3 I show that I can leverage the firm-level dimension of the wedges and use regression analysis to purge them from variation potentially related to unobserved costs of sourcing.

A second important requisite of the empirical framework is that measures of *physical* output elasticities of the variable inputs can be feasibly obtained, given the available data. It is well-known that when firm-level prices of output and inputs are not directly observed, standard practices in the production function estimation literature can only recover *revenue* elasticities (Katayama et al., 2009; De Loecker and Goldberg, 2014). In Section 2.2, I introduce a novel empirical strategy to estimating physical output elasticities when firm-level prices are not directly observed. To that end, I preliminarily describe the implications of market power in input markets for the behavior of input prices.

2.1.3 Buyer Power and Input Prices

From equation (4), it is possible to write the equilibrium price of a generic input V as:

$$W_{it} = MFC_{it} \cdot (\psi_{it})^{-1}, \quad (8)$$

where $MFC_{it} \equiv \lambda_{it} \frac{\partial Q_{it}(\cdot)}{\partial V_{it}}$ denotes the marginal factor cost. When the market of input V is competitive ($\psi_{it} = 1$), the price of the input equals its marginal cost. Therefore, in competitive frameworks

variation in input prices across firms can only arise due to variation in the marginal factor cost. I follow De Loecker et al. (2016) and posit that firm-specific variation in the “competitive” component of input prices can arise through exogenous variation in input prices across local input markets, which I denote as G_i and/or variation in input quality, which I denote as ι_{it} . In other words, I posit $MFC_{it} = g(\iota_{it}, G_i)$.

Let $V_{It} = V_{it} + V_{-it}$ describe the total demand of input V in the relevant market, where V_{-it} is total demand of i 's competitors. If strategic interactions among buyers are not too large, it is possible to approximate the buyer power of firm i in market V as:¹¹

$$\psi_{it} \equiv 1 + \frac{\partial W_{it}}{\partial V_{it}} \frac{V_{it}}{W_{it}} \simeq 1 + \eta_{It} \cdot s_{it}, \quad (9)$$

where $\eta_{It} \equiv \frac{\partial W_{It}}{\partial V_{It}} \frac{V_{It}}{W_{It}}$ is the (inverse) elasticity of the input supply in the market where firm i operates, and $s_{it} \equiv \frac{V_{it}}{V_{It}}$ is the share of i 's demand over total input demand V_{It} .

Putting pieces together, the unit price paid by firm i for input V can be written as:

$$W_{it}^v = g(\iota_{it}, G_i) \cdot (1 + \eta_{It}^v \cdot s_{it})^{-1} = h \left(\begin{matrix} \iota_{it}, G_i, s_{it} \cdot \eta_{It} \\ (+) \qquad \qquad \qquad (-) \end{matrix} \right). \quad (10)$$

Equation (10) says that when input markets are less than competitive, variation in firm prices can arise not only through variation in prices or quality, but also through endogenous variation in buyer shares, weighted by the inverse supply elasticity of the input. Notably, if the supply elasticity is approximately constant across input varieties (buyers), the buyer share of firms is a *sufficient statistic* for the effect of buyer power on input prices. In the next paragraph, I show that this result can help to address input price bias in estimation when input prices are not directly observed.

2.2 Estimating the Output Elasticities

I consider the following class of production technologies for firm i at time t :

$$Q_{it} = \exp(\omega_{it} + \epsilon_{it}) F_t(K_{it}, L_{it}, M_{it}, X_{it}; \beta), \quad (11)$$

where Q_{it} is physical output, obtained using capital (K_{it}), labor (L_{it}), domestic intermediates (M_{it}), and foreign intermediates (X_{it}). The function $F(\cdot)$ satisfies standard regularity conditions. The term ω_{it} reflects a Hicks-neutral firm-specific productivity shock, while ϵ_{it} captures measurement error and idiosyncratic shocks to production. Neither ω_{it} nor ϵ_{it} are observed by the researcher.

I specify the state variable vector as $\varsigma_{it} = \{\omega_{it}, K_{it}, L_{it}, G_i, \Sigma_{it}\}$, where G_i denotes firms' ob-

¹¹Let W_{It} the price of input V in the market where firm i participates. We can think of W_{It} as the unique price paid by all firms participating in the market, such that we can write $W_{It} = W(V_{It})$. Using its definition:

$$\psi_{it} \equiv 1 + \frac{\partial W_{It}}{\partial V_{it}} \frac{V_{it}}{W_{It}} = 1 + \frac{\partial W_{It}}{\partial V_{It}} \frac{V_{It}}{W_{It}} \cdot \frac{\partial V_{It}}{\partial V_{it}} \cdot \frac{V_{it}}{V_{It}} \simeq 1 + \eta_{It} \cdot s_{it},$$

where the approximation holds as long as $\frac{\partial V_{-it}}{\partial V_{it}} \simeq 0$, i.e. when strategic interactions among buyers are not too large.

servable characteristics that might affect material prices (such as firm location), and Σ_{it} is the firm’s import sourcing strategy. This means that I consider both the capital and the labor input as dynamic inputs, which the firm chooses one period in advance.

Estimation of (11) requires dealing with several sources of biases. Along with a well-known simultaneity problem caused by the unobserved productivity term ω_{it} , the lack of direct data on the quantity produced - as well as input used - by the firm typically implies the existence of both output and input price biases.¹² While a significant body of empirical work has dealt with the output price bias (e.g. Syverson, 2004; De Loecker, 2011), the input price bias has received considerable less attention in the literature. The only study that has dealt with the input bias in empirical work is De Loecker et al. (2016), who did so while assuming perfect competition in input markets. In what follows, I propose a methodology to account for output and input price bias in estimation, while allowing for imperfect competition in both output and input markets.

I introduce my estimation procedure, together with my bias-correction approach, in section 2.2.1. I describe the details of my estimation strategy in section B.3 of the Appendix.

2.2.1 Estimation Procedure

I write the production function in (11) as:

$$q_{it} = f(l_{it}, k_{it}, m_{it}, x_{it}; \beta) + \omega_{it} + \epsilon_{it}, \quad (12)$$

where lower-case letters denote log variables, and where β is a vector of coefficients. I consider flexible approximations to technology $f(\cdot)$. This class of production functions allows to rely on proxy methods suggested by Olley and Pakes (1996); Levinsohn and Petrin (2003); Akerberg et al. (2015) in order to obtain consistent estimates of the parameters β .

For the baseline specification, I will consider a first-order polynomial approximation for $f(\cdot)$, which corresponds to a Cobb-Douglas production function (hereafter, CD). I will discuss advantages and disadvantages of this assumption in Section 3. To ease exposition, in what follows I will explicitly write equation (12) in its CD form. All the results can be easily extended to more flexible approximations of $f(\cdot)$.

Output Price Bias When information on the quantity produced by the firm is not available, the standard approach in the empirical literature has been to construct a measure of output as $\tilde{Q}_{it} = R_{it}/P_{It}$, where R_{it} is firm-level sales and P_{It} is an industry-wide producer price deflator. Using this definition, one can rewrite equation (12), in logs, as

$$\tilde{q}_{it} = \beta_l l_{it} + \beta_k k_{it} + \beta_m m_{it} + \beta_x x_{it} + (p_{it} - p_{It}) + \omega_{it} + \epsilon_{it} \quad (13)$$

The term $(p_{it} - p_{It})$ is unobserved, and generates an *output price bias* whenever it differs from zero in a way that is correlated with input choice. Market power is potentially a source of such bias:

¹²See De Loecker and Goldberg (2014) for a discussion, and references therein.

firms who charge high markups sell less, and thus buy less inputs.

To control for output price bias, I leverage information on export prices at the firm-product-destination country level, available from customs data. For each product market p , defined as a product \times destination cell, I measure how much the price of firm i deviates from the price of its French competitors, i.e. $p_{ipt} = (p_{ipt} - p_{Ipt}) \forall p, t$. I then construct a firm-level weighted average of these market-level deviations, which I denote by \hat{p}_{it} , and use it to induce firm-level variation in the industry-wide output deflator:

$$P_{it} = P_{It} \cdot \hat{p}_{it}. \quad (14)$$

I use the firm-level price P_{it} to compute output as $Q_{it} = R_{it}/P_{it}$. This measure of output takes into account differences in prices across firms, alleviating concerns about output price bias.

Input Price Bias: Domestic Intermediates When input quantities are not observed, measures of inputs are constructed by deflating expenditures with an industry-wide deflator, i.e. $\tilde{V}_{it} = E_{it}^V/W_{It}^V, \forall V$. An input price bias arises as firm-level prices for the input systematically deviate from this deflator, namely if $\exists W_{it}^V \neq W_{It}^V$ for some i . In my setting, the input price bias potentially affects domestic intermediates M_{it} , as well as foreign intermediates X_{it} .¹³

Let us formally introduce the bias associated with domestic materials M_{it} . By substituting deflated expenditures in equation (12), we get:

$$q_{it} = \beta_l l_{it} + \beta_k k_{it} + \beta_m \tilde{m}_{it} + \beta_x x_{it} + B(w_{It}^m - w_{it}^m; \beta) + \omega_{it} + \epsilon_{it}. \quad (15)$$

The term $B(w_{It}^m - w_{it}^m; \beta) = \beta_m(w_{It}^m - w_{it}^m)$ is unobserved, and captures the input price bias for the domestic material input. Building on [De Loecker et al. \(2016\)](#), I propose an approach to control for unobserved input prices using information on observables. I provide a formal argument that rationalizes my approach in Appendix B.2, while I summarize the intuition below.

In section 2.1.3 I argued that when markets are less than competitive, firm-specific input price variation can arise through exogenous factors, such as firm location (G_i), or input quality (ι_{it}), and/or differences in buyer shares. [De Loecker et al. \(2016\)](#) show that a flexible polynomial in output prices (p_{it}), and seller market shares (ms_{it}), can control for the exogenous sources, i.e. G_i and ι_{it} . It follows that if the buyer share of firm i in the domestic market for intermediates $s_{it}^m = M_{it}/M_{It}$ can be observed, or proxied for, addressing the input price bias of domestic intermediates is tantamount to controlling for a flexible polynomial in output prices (p_{it}), exogenous variables (G_i), and buyer (s_{it}^m) and seller (ms_{it}) market shares, i.e.:

$$B(w_{It}^m - w_{it}^m; \beta) = B(p_{it}, ms_{it}, G_i, s_{it}^m; \rho). \quad (16)$$

¹³Labor is measured in physical units, and thus does not generate similar problems. I am going to abstract from the problem of unobserved input price variation for capital, given that firm-level prices are never observed. The implicit assumption is that firms take the price of capital as given, and variation in the price of capital can only arise due to exogenous variation in quality.

The input control function in (16) can also control for quality bias in the capital input that arises when using deflated expenditures in place of physical units (De Loecker et al., 2016).

Input Price Bias: Foreign Intermediates Given that both the price and quantity of each imported input is observed, in principle a foreign input price bias should not exist. However, inputs are measured as firm-level aggregates in the empirical analysis, such that methodological issues can still arise in aggregation. To construct a firm-level physical measure of the imported input X_{it} , I use a procedure similar to the one used for output. I let w_{it}^X denote a measure of average firm deviation from the industry-level price of different imported inputs, which can be constructed from customs import price data. I then define a firm-level import price deflator as

$$W_{it}^X = W_{it}^X \cdot \hat{w}_{it}^X, \quad (17)$$

where W_{it}^x is the observed industry deflator for imported intermediates. I construct the foreign input X_{it} by deflating total imports of intermediates E_{it}^X by the firm-level import deflator W_{it}^x . In doing so, I take into account differences in imported input prices among firms, thus alleviating concerns about foreign input price bias.

Simultaneity bias The last source of bias in equation (12) 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 the demand equations of the static inputs, building on the work by Akerberg et al. (2015). As I show in the Appendix B.3.1, the unobserved term ω_{it} can be written as a nonparametric function of observables as:

$$\omega_{it} = h_t(k_{it}, l_{it}, \tilde{m}_{it}, x_{it}, w_{it}^x, p_{it}, ms_{it}, s_{it}^m, \Sigma_{it}, G_i). \quad (18)$$

This expression can be used in equation (12) to control for firm's productivity. Note that equation (18) includes a control for the extensive margin of import Σ_{it} . This is important, as it has been shown that productivity estimates can be biased due to offshoring (Houseman et al., 2011).

Estimation Putting all pieces together, the estimating equation reads

$$q_{it} = \beta_l l_{it} + \beta_k k_{it} + \beta_m \tilde{m}_{it} + \beta_x x_{it} + B(p_{it}, ms_{it}, G_i, s_{it}^m; \beta) + h_t(k_{it}, l_{it}, \tilde{m}_{it}, \tilde{x}_{it}, w_{it}^x, p_{it}, ms_{it}, s_{it}^m, \Sigma_{it}, G_i) + \epsilon_{it}. \quad (19)$$

I estimate (19) using the 2-steps GMM procedure in Akerberg et al. (2015).¹⁴ For my baseline estimation, I run the GMM procedure on a sample of firms that simultaneously import and export for two consecutive years. I focus on this subsample of firms because these are the firms for which information on both input and output prices are available.

¹⁴See Appendix B.3.2 for more details.

3 Data and Empirical Results

In this section, I apply the methodology laid out in Section 2 to gain insights about the nature of competition prevailing in foreign and domestic intermediate input markets.

The econometric framework infers the existence of market power in input market from distortions (wedges) in the cost-minimizing behavior of industries and firms in the two markets. Foreign and domestic intermediates are defined as firm aggregates. While useful to leverage production function estimation techniques to obtain consistent estimates of the wedges, this level of aggregation might lead to suspects about confounding factors affecting results. The trade and industrial organization literatures suggest a number of candidates, which include: entry costs into import markets, (differences in) the sourcing strategies of firms, and unobserved differences in technology.

For one, if entry costs into foreign markets are particularly large, they could affect not only the extensive margin but also the intensive margin choice of foreign inputs, violating the assumption of short run flexibility of intermediate inputs.¹⁵ Moreover, even when these costs do not directly distort the intensive margin behavior of firms, they can do so indirectly through their effect on the sourcing patterns of firms (Antràs et al., 2017). If larger firms source more from low-cost countries, they are going to spend systematically less on shipment of the same size, even absent market distortions. The econometric framework might thus attribute differences in sourcing costs to differences in pricing power across firms. Finally, there could be important differences in the way different firms combine inputs to produce their final output, especially when it comes to relative importance of foreign vs. domestic sourcing (Fort, 2017; Bernard et al., 2018a).

This section provides robust evidence that the size and variation in the wedges is large and economically important, even after entry costs, the sourcing set, and technology are controlled for. I proceed as follows: I introduce the data in section 3.1. In section 3.2 and 3.3 I present the results of production function estimation, and the analysis of the input wedges. In section 3.4 I leverage the micro-level dimension of import data to provide additional reduced form evidence supporting the main results. I conclude with a discussion on the potential sources of market power in foreign input markets.

3.1 Data

I employ two longitudinal datasets covering the activity of the universe of French manufacturing firms during the period 1996 - 2007. The first dataset contains the full company accounts, including nominal measures of output and different inputs in production, such as capital, labor, and intermediate inputs, at the firm level. 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.¹⁶ I describe the construction of the main variables in the Data Appendix.

I select only the firms that both import and export in a given year. These are the firms for which

¹⁵Roberts and Tybout, 1997; Das et al., 2007; Antràs et al., 2017 provide evidence of substantial fixed costs of

TABLE II. SUMMARY STATISTICS (2005)

Sample	International Firms
Number of Firms	14,206
(% of total)	46%
(% in total value added)	80%
(log) sales premium ^(a)	0.62
(log) wage premium	0.04
(log) TFP premium ^(b)	0.10
Belongs to a MNE ^(c)	50%
Imported Share of Intermediates	26%

Source: Author’s calculations. Notes: The number of manufacturing firms in a given year is, after basic cleaning, 30,840.^(a) The (log) premium of variable x is computed as the percentage difference in the average x between international firms and the average manufacturer. ^(b) TFP is computed as real value-added per worker. ^(c) Benchmark (All firms): 35% A firm is classified as MNE if it belongs to either a French private, or a Foreign private business group.

I can observe input and output prices. I will refer to them as “international firms”. Table 2 provides summary statistics for the selected firms. International firms are about 46% of the manufacturing firms in France, and they account for about 80% of total manufacturing value added. In line with the findings of a large empirical literature on firms and trade (e.g. [Bernard and Jensen, 1999](#); [Bernard et al., 2007, 2009](#)), the French data confirm a sizable size and productivity premium of manufacturing importers. These firms heavily rely on foreign intermediates in production: imported inputs account for about a quarter of total material expenditure. The final sample includes around 14 thousands firms per year, spread across 18 two-digit manufacturing sectors.

Table 3 summarizes the means, standard deviations and quartile values of the revenue share of all inputs, as well as of measures of extensive and intensive margin of imports. As expected for firm-level data, the dispersion of all these variables across firms is large. Firm heterogeneity is particularly dramatic when it comes to import behavior, as it can be seen from the 10/90 gap of almost all the import variables. This implies that there is large heterogeneity in the use of foreign inputs in production, which is a feature I will take into account later on when I discuss the robustness of my main results.

Firm-level Prices of Output and Imported Input My approach to correcting for input and output price bias in estimation crucially relies on the construction of firm-level deflators for output and the imported input. In equations (14) and (17), I define firm-level price deflators of output and imported input as $P_{it} = P_{It} \cdot \hat{p}_{it}$, and $W_{it}^X = W_{It}^X \cdot \hat{w}_{it}^X$, respectively, where P_{It} and W_{It}^X are the 2-digit industry output and import deflators, available from public sources.

entering both export and import markets.

¹⁶See [Blaum et al. \(2018\)](#) for a detailed description of these data sources.

TABLE III. DISTRIBUTION QUANTILES (1996-2007)

Variable	Mean	Std Dev	p10	p50	p90
<i>Revenue Shares of Inputs</i>					
Labor α_{it}^L	.19	.08	.09	.18	.30
Capital α_{it}^K	.07	.06	.02	.06	.15
Domestic Materials α_{it}^M	.28	.15	.10	.26	.48
Imported Materials α_{it}^X	.1	.09	.01	.06	.23
<i>Extensive Margin of Imports</i>					
No. of sourcing countries	5.8	4.5	1	5	11
No. of sourcing markets ^a	22	31	2	12	51
<i>Intensive Margin of Imports</i>					
Imported Share of Intermediates	.26	.2	.04	.21	.57

Notes: Numbers are averaged across time and sectors, and refer to the full baseline sample of international firms. Number of observations: 129,787. ^aA sourcing market is defined as a country-NC8 product combination.

The (unobserved) terms \hat{p}_{it} and \hat{w}_{it}^x denote firm-level deviations from the industry average prices. I construct the output (\hat{p}_{it}) and imported input (\hat{w}_{it}^x) terms by running the following regression:¹⁷

$$\log(uv_{iknt}^j) = \theta_{it}^j + c_{knt}^j + \epsilon_{iknt}, \quad (20)$$

where i indexes firms, k indexes NC8 digit products, n indexes destination or source country, and t indexes years. Finally, j is an index for either exports ($j = EX$) or imports ($j = IM$). The variable in the left hand side is the log of the unit value uv_{iknt}^j that firm i charges (pays) for product k sold in (sourced from) country n in year t . I calculate the unit value as value over quantity, for each i, k, n, t quadruple.

I regress the log of the unit values on firm-time fixed effects (θ_{it}^j), and product-country-time fixed effects (c_{knt}^j). The latter captures the average price of a particular product in a particular market across firms in a given year. Therefore, the firm-year effects θ_{it}^j measure the average firm-level deviation from these average prices. In other words, the term θ_{it}^j represents firm-level average (relative) prices purged of effects due to the composition of products.

I define firm-level average relative input prices of output and imported inputs as these OLS estimates, namely $\hat{p}_{it} = \hat{\theta}_{it}^{EX}$, and $\hat{w}_{it}^x = \hat{\theta}_{it}^{IM}$.

Table A1 in the Appendix summarizes the means, standard deviations and quartile values of \hat{p}_{it} and \hat{w}_{it}^x . There is substantial variation in these relative prices across firms. Panel B of Table

¹⁷Bastos et al. (2018) use a similar procedure to construct firm-level input prices using Portuguese data.

A1 shows that firm-level relative prices are significantly correlated with both material inputs, and output. This evidence suggests that both input and output price bias are potentially important issues for production function estimation.

Finally, note that the term \hat{p}_{it} also coincides with the measure of output price that I am going to use in the input control function for unobserved domestic input prices, as well as in the proxy control function for unobserved productivity.¹⁸

3.2 Output Elasticities

I first analyze the results of production function estimation. Table 4 reports the estimated output elasticities when production function is Cobb-Douglas (CD) together with standard errors, which I obtain by block bootstrapping over the entire procedure.

In Section B.5 of the Appendix, I discuss the results of the estimation when I choose a Translog (TL) specification of the production function instead. The reason why I do not choose a TL specification of the production function for my baseline results is the large skewness in import behavior of firms. This feature implies that both the mean and median output elasticity of the foreign input are unreasonably large, as it can be seen from Figure A1 in the Appendix. Nevertheless, all the results are qualitatively the same when I repeat the analysis under the TL assumption.

By choosing a CD production function, I constrain the elasticities to be constant across firms and over time. This leads to skepticisms when computing measures of market power from these elasticities, since if differences in technology exist, we could be attributing variation in technology across firms to variation in market power, potentially biasing the results (Raval, 2019).

In order to get a sense of the importance of these biases, I split the baseline sample into three groups - of small, medium and large importers - and run the estimation procedure separately on each group. The idea is that by comparing firms with similar import behavior we can capture unobserved differences in import and/or production technology. Table A2 in the Appendix shows the estimated elasticities for each of the three subsamples. On average, the foreign input elasticity is bigger, and the labor elasticity is smaller for the larger importers, indicating the relatively larger importance of offshoring activities for large global firms, as well as a relatively larger role for intermediates in production (cf. Yi, 2003; Bernard et al., 2018a). Nonetheless, the differences between these elasticities and those obtained in the entire sample of importers are rather small, suggesting a limited role for technological biases in my sample of manufacturing importers.¹⁹

¹⁸The average (relative) firm output market share $m\hat{s}_{it}$ is constructed in a similar way, starting from information on the firm's market share in each individual export market.

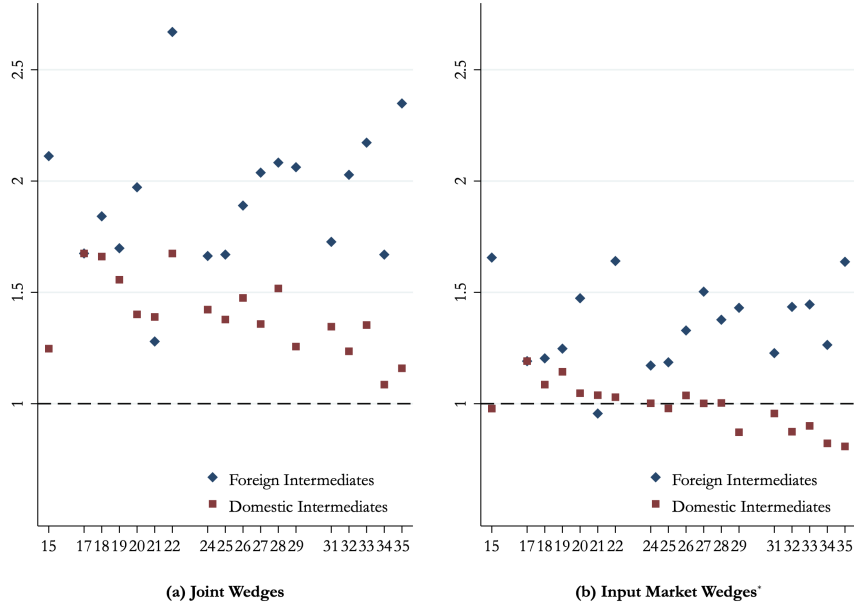
¹⁹The CD production function also restricts the elasticity of substitution among different inputs to be equal to one. Results could potentially be biased in case of important substitutability among foreign and domestic intermediates, which is the standard assumption in theories of input trade (e.g. Gopinath and Neiman, 2014; Halpern et al., 2015). The results in Figure A1 in the Appendix suggest that the CD elasticities can approximate well the behavior of domestic intermediates, which I take as evidence that the bias of restricting the substitution elasticity with foreign intermediates to be equal to one is not too large.

TABLE IV. OUTPUT ELASTICITIES, COBB-DOUGLAS, BY SECTOR

INDUSTRY	β_K	β_L	β_M	β_X	RETURN TO SCALE
15 Food Products and Beverages	0.07 (0.01)	0.20 (0.004)	0.54 (0.003)	0.14 (0.002)	0.96
17 Textiles	0.02 (0.02)	0.25 (0.01)	0.37 (0.005)	0.22 (0.004)	0.87
18 Wearing Apparel, Dressing	0.13 (0.02)	0.25 (0.01)	0.35 (0.006)	0.25 (0.005)	0.99
19 Leather, and Products	0.03 (0.03)	0.28 (0.01)	0.36 (0.009)	0.25 (0.006)	0.93
20 Wood, and Products	0.05 (0.01)	0.28 (0.01)	0.49 (0.005)	0.16 (0.003)	0.98
21 Pulp, Paper, & Products	0.06 (0.02)	0.30 (0.01)	0.40 (0.005)	0.16 (0.004)	0.92
22 Printing and Publishing	0.09 (0.02)	0.43 (0.01)	0.34 (0.006)	0.15 (0.005)	1.01
24 Chemicals, and Products	0.06 (0.01)	0.29 (0.01)	0.42 (0.004)	0.17 (0.003)	0.95
25 Rubber, Plastics, & Products	0.12 (0.01)	0.33 (0.005)	0.41 (0.004)	0.16 (0.003)	1.01
26 Non-metallic mineral Products	0.14 (0.02)	0.34 (0.01)	0.39 (0.005)	0.13 (0.004)	1.01
27 Basic Metals	0.07 (0.02)	0.24 (0.01)	0.38 (0.006)	0.21 (0.005)	0.90
28 Fabricated Metal Products	0.11 (0.01)	0.36 (0.004)	0.37 (0.003)	0.14 (0.002)	0.97
29 Machinery and Equipment	0.07 (0.01)	0.38 (0.01)	0.37 (0.004)	0.16 (0.002)	0.98
31 Electrical machinery & App.	0.07 (0.02)	0.34 (0.01)	0.38 (0.006)	0.17 (0.004)	0.97
32 Radio and Communication	0.15 (0.02)	0.35 (0.01)	0.35 (0.008)	0.16 (0.006)	1.00
33 Medical, Precision, Optical Instr.	0.07 (0.02)	0.40 (0.01)	0.32 (0.005)	0.17 (0.004)	0.96
34 Motor Vehicles, Trailers	0.09 (0.02)	0.29 (0.01)	0.39 (0.007)	0.18 (0.005)	0.95
35 Other Transport Equipment	0.05 (0.13)	0.37 (0.16)	0.32 (0.04)	0.19 (0.05)	0.93

Notes: The table reports the output elasticities when the production function is Cobb-Douglas. Cols 2–4 report the average estimated output elasticity with respect to each factor of production. Standard errors are obtained by block-bootstrapping, and are in parentheses. Col. 5 reports the returns to scale, which is the sum of the preceding 4 columns.

FIGURE I. INDUSTRY WEDGES (MEDIAN)



Notes: The figure on the left shows the overall wedges Ξ_I^v , in the foreign ($v = x$) and domestic ($v = m$) material input markets, for each 2-digit industry. The figure on the right shows the input wedge for the foreign and domestic input, obtained by dividing the overall wedge Ξ_I^v , for $v = x, m$, shown in the left panel, by the median industry markup. Markups (at the firm level) are obtained by dividing total sales by total costs as: $E_{it}^l + E_{it}^{int} + RK_{it}$, where E_{it}^l and E_{it}^{int} are total expenditures on labor and intermediates, respectively, and we assume a rental rate of 20% (e.g. [Blaum et al., 2018](#)). A similar picture would emerge if I computed markups as in [De Loecker and Warzynski \(2012\)](#). Values in the x-axis represent the 2-digit ISIC industry, which I classify according to the ISIC Rev. 3 classification. Confidence intervals are tiny, as the Cobb-Douglas point estimates are precisely estimated, and are thus omitted.

3.3 Market Power in Input Markets

I now use the output elasticities to compute the wedges of interest. I first leverage equation (6) to get an estimate of the overall impact of output and input market power on firm-level input choices:

$$\hat{\Xi}_{it}^v \equiv \mu_{it} \cdot \psi_{it}^v = \frac{\hat{\theta}_{it}^v}{\tilde{\alpha}_{it}^v}, \text{ for } v = m, x, \quad (21)$$

where I normalize the observed expenditure shares by the residual of the first stage regression $\hat{\epsilon}_{it}$, i.e. $\tilde{\alpha}_{it}^v = \frac{W_{it}^v V_{it}}{P_{it} Q_{it} / \hat{\epsilon}_{it}}$, in order to purge revenue shares from variation unrelated to technology or market power ([De Loecker and Warzynski, 2012](#)).

Panel (a) of Figure 1 plots, for each industry, the median estimated level of $\hat{\Xi}_I^v$. With a few exceptions, the overall effect of market power on the choice of the foreign intermediate input is substantially larger than the effect on the domestic intermediate input. It follows that input market power must be larger in the foreign market, that is, $\hat{\psi}_I^x \geq \hat{\psi}_I^m$ in (almost) all industries.²⁰

Looking at the joint wedges $\hat{\Xi}_I^v$ is not sufficient to infer what type of competition prevails in

²⁰The only two exceptions are the Textile (Isic code = 17) and Pulp and Paper (Isic code = 21) sectors. In the former, the joint wedges are not substantially different across markets. In the Pulp and Paper sector, the joint market distortion wedge is instead larger in the domestic than in the foreign market.

each market. In principle, the fact that $\hat{\psi}^x_I \geq \hat{\psi}^m_I$ is both consistent with $\hat{\psi}^x_I \geq \hat{\psi}^m_I \geq 1$, and with $1 > \hat{\psi}^x_I \geq \hat{\psi}^m_I$. The differences between these two scenarios are potentially very large. In the first case, the evidence supports theories of monopsony or oligopsony in input markets, with the foreign market being substantially more distorted than the domestic one. In the second case, the domestic market is relatively more distorted than the foreign one.

To get a sense of which of these scenarios is more plausible, I consider measures of industry markups, and use them in equation (21) to infer an estimate of both ψ^x_I and ψ^m_I . Consistent estimation of firm-level markups relies either on assumptions on the market structure of a static input, or on the existence of detailed market-level data, neither of which is a feasible option here.²¹ I thus consider two potentially flawed, yet widely used benchmark measures of markups. I first construct a measure of “accounting” markups, by taking the ratio of firm revenues to total costs. The second measure is obtained using the methodology in De Loecker and Warzynski (2012) (DLW). While inconsistent with the assumptions of this paper, markups obtained using the DLW methodology are widely employed in empirical work, and so can serve as a benchmark measure. Note that when input markets are less than competitive, both methodologies yield upward-biased measures of markups, and in turn, downward-biased estimates of the input wedges. This exercise is thus meaningful to the extent that it yields lower bound estimates of the input wedges. Table A3 in the Appendix summarizes the markups estimates.

Panel (b) of Figure 1 shows that while the domestic input wedges are rather small and close to the competitive level, the foreign input wedges are quite large across the different manufacturing sectors. The average industry wedge for the domestic input equals 0.99 when I use accounting markups, with a standard deviation of 0.10. On the contrary, the average industry wedge for the foreign input equals 1.35 (standard deviation 0.19).²²

Input Market Power Across Industries In the remainder of this paragraph, I am going to focus on the relative wedge ψ^x/ψ^m as the main variable of interest, while maintaining that $\hat{\psi}^x_I \geq \hat{\psi}^m_I \geq 1$. The relative wedges are computed from equation (7):

$$\left(\frac{\hat{\psi}^x_{it}}{\hat{\psi}^m_{it}}\right) = \frac{\hat{\Xi}^x_{it}}{\hat{\Xi}^m_{it}} = \frac{\hat{\theta}^x_{it}/\tilde{\alpha}^x_{it}}{\hat{\theta}^m_{it}/\tilde{\alpha}^m_{it}}, \quad (22)$$

where the expenditure shares are normalized as above.

Table 5 lists the median estimated relative wedges $\left(\frac{\hat{\psi}^x_I}{\hat{\psi}^m_I}\right)$ across manufacturing industries, along with the value of the foreign input wedge implied by the “external” measures of markups (column II), and the implied competition regime in the foreign input market (column III).²³

²¹See De Loecker and Warzynski (2012) for a thorough discussion of existing work on markup estimation.

²²Using the DLW methodology to compute markups, the average domestic wedge is 1.04 (standard deviation 0.05), while the average foreign wedge becomes 1.46 (standard deviation 0.25)

²³I classify an industry as belonging to the monopsony regime, (MO), if the lower bound of the 95% CI of the median wedge is above one. For the classification, I consider the lowest value among ψ^x_I/ψ^m_I and $\tilde{\psi}^x_I$. Similarly, I classify industries as belonging to the efficient bargaining/quantity discount regime (EB/QD), if the upper bound of the 95% CI of the median wedge is below one. I classify an industry as perfectly competitive (PC), if it cannot be

TABLE V. (RELATIVE) INPUT MARKET POWER, BY SECTOR

	(1)	(2)	(3)
SECTOR	ψ_I^x/ψ_I^m	$\tilde{\psi}_I^x \equiv \Xi_{it}^x/\mu_{it}$	FOREIGN MARKET REGIME
15 Food and Beverages	1.72	1.66	MO
17 Textiles	1.03	1.19	MO
18 Wearing Apparel	1.15	1.2	MO
19 Leather Products	1.13	1.25	MO
20 Products of Wood	1.46	1.47	MO
21 Pulp and Paper Products	0.95	.956	EB/QD
22 Printing and Publishing	1.49	1.64	MO
24 Chemical Products	1.18	1.17	MO
25 Rubber Products	1.25	1.19	MO
26 Non-metallic minerals	1.27	1.33	MO
27 Basic Metals	1.62	1.5	MO
28 Fabricated Metal Products	1.38	1.38	MO
29 Machinery and Equipment	1.68	1.43	MO
31 Electrical Machinery	1.40	1.23	MO
32 Radio and Communication	1.65	1.43	MO
33 Medical Instruments	1.66	1.45	MO
34 Motor Vehicles, Trailers	1.66	1.26	MO
35 Other Equipment	2.13	1.64	MO
Average	1.43	1.35	MO

Notes: Standard errors are obtained with the Delta Method, and are approximately equal to 0.001 for all industries. The average standard deviation in each industry is about 3. I trim observations with ψ that are above and below the 3rd and 97th percentiles within each sector. I classify an industry as MO, if the lower bound of the 95% CI of the median sectoral input market power is above one.

A large number of sectors can be classified under the monopsony/oligopsony regime. Intuitively, the fraction of revenues that importers spend on foreign inputs is too much lower than the revenue share of domestic inputs, in light of the differences in their output elasticities. Seen through the lens of the theoretical framework, the gap between an input price and its marginal revenue product is 43% larger when the firm buys this input from foreign markets than when the firm buys it from the domestic markets. Absent trade or adjustment costs, the theoretical framework attributes this equilibrium outcome to differences in the buyer power of firms in the two markets.

The results in Figure 1 and Table 5 suggest that firm behavior in domestic input markets is close to competitive, i.e. $\psi_I^m \simeq 1$. This result has important implications, as it validates the assumption of competitive firm behavior in intermediate input markets, standard in empirical work on markups estimation (e.g. De Loecker and Warzynski, 2012; De Loecker et al., 2016; Dobbelaere and Kiyota, 2018), as long as the imported share of intermediates is not too high.

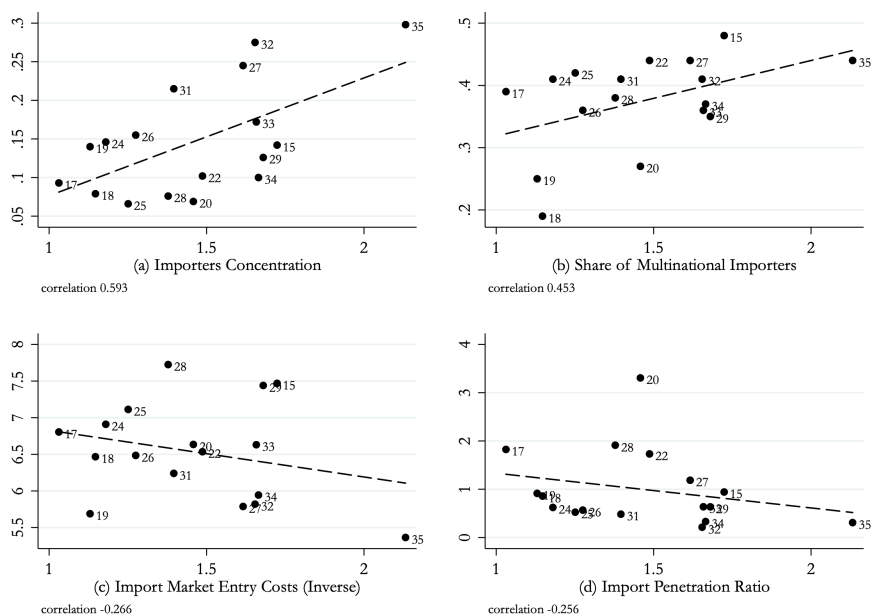
Foreign input wedges vary substantially across sectors: the median wedge in Table 5 range from .95-2.13, implying large differences in sectoral buyer power. This heterogeneity allows for an

classified neither as MO, nor as EB/QD.

external validation of the wedge interpretation by means of simple correlations.

In Figure 2, I tie the sectoral median relative wedge to industry observables that are plausibly correlated with input market power in foreign markets. Starting from the top-left panel and moving clockwise, the figure plots the sectoral wedges against: (1) the degree of concentration of importers (importers Herfindahl index), (2) the share of importers that are part of multinational enterprises (MNEs), (3) the total number of importers in the sector and (4) the import penetration ratio.

FIGURE II: RELATIVE WEDGE, ACROSS FIRMS



Notes: All statistics are computed on the sample of international firms. (a) Importers concentration is measured as the sectoral Herfindahl Index; (b) I define a firm as an MNE if it belongs to a multinational group, both French or foreign; (3) I use an inverse measure of import market entry costs the (log) number of importers in a given sector; (4) Import penetration ratio is computed as Total imports over Total Sales. I exclude sector 21 because firms in that sector seem to behave according a different competition regime. Results are robust to including that sector.

The first two measures are expected to correlate positively with the buyer power of importers. The latter two variables, on the contrary, are expected to correlate negatively with buyer power. The evidence in Figure 2 gives strong support to these priors, and thereby to the fact that foreign wedges are related to buyer power.

Input Market Power Across Firms When comparing wedges across firms, it is particularly important to take into account confounding factors that are potentially unrelated to market power in input markets. As discussed above, these factors include unobserved differences in technology, and differences in the extensive margin of imports. To the extent that heterogeneous sourcing costs affect firm intensive margin decisions only through their effect on the extensive margin of imports, the latter also accounts for differences in fixed costs of sourcing.

I first consider the following regression:

$$\log\left(\frac{\hat{\psi}_{it}^x}{\psi_{it}^m}\right) = X'_{it}\mu + \delta_{Ist} + \alpha_{\Sigma_{it}} + \varepsilon_{it}. \quad (23)$$

The vector X_{it} contains firm-characteristics such as MNE status and capital-labor ratio, while the term δ_{Ist} denotes industry×activity×time fixed effects, where activity refers to the main reported activity of the firm. Both X_{it} and δ_{Ist} aim to control for variation in the relative wedges due to unobserved differences in technology. The term $\alpha_{\Sigma_{it}}$ denotes a full set of product ×country sourcing-strategy fixed effects, as in [Blaum et al. \(2019\)](#). I estimate equation (23) via OLS, and define a measure of the relative wedges as the residuals from this regression. By doing so, I purge the original wedges from the variation potentially unrelated to buyer power.

TABLE VI. RESIDUAL WEDGES (WEIGHTED AVERAGE)

	ψ^x_I/ψ_I^m	$\tilde{\psi}^x_I$
<i>Fixed Effects^a</i>		
α_{Σ} (country)	1.53	1.34
α_{Σ} (country×HS4 products)	1.20	1.13
<i>Baseline Estimates</i>		
	2.06	1.98

Notes: The table shows the weighted average across industries of the residual input wedges, obtained as residuals from the OLS regression in equation (24). ^a Regressions include controls for MNE status, capital-labor ratio, and industry×activity×time fixed effects. The only difference between the values in the two rows is the definition of the term $\alpha_{\Sigma_{it}}$, i.e. the sourcing-strategy fixed effects. The industry estimates are given in Table A4 in the Appendix. I show both the value of the residual *relative* wedge ψ^x_I/ψ_I^m , and the value of the residual foreign input wedge $\tilde{\psi}^x_I \equiv \Xi_I^x/\mu_I$. For both measures, the median value of the residual is approximately equal to one in all industries, and is thus omitted.

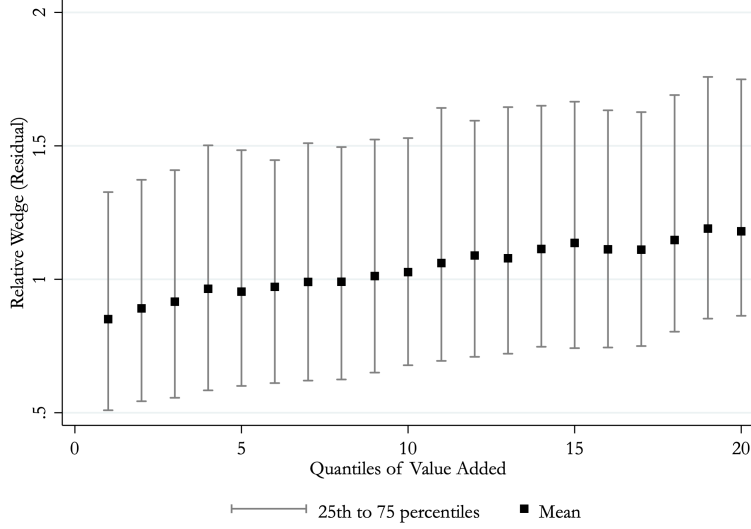
Table 6 shows how the average estimates of the input wedges change once technology and sourcing strategy are controlled for. The average value of the residual wedges is substantially above one, indicating an important residual role for market distortions. However, the median residual wedge is now equal to one in all industries, which suggest that technology and sourcing costs are also important. Figure 3 looks at the distribution of the residual wedges $\left(\frac{\hat{\psi}_{it}^x}{\psi_{it}^m}\right)$, across different quantiles of value added. Even with substantial heterogeneity, larger firms have higher wedges, and so have larger buyer power.

Finally, I consider the following extended version of equation (23):

$$\log\left(\frac{\hat{\psi}_{it}^x}{\psi_{it}^m}\right) = \gamma_0 + \gamma_1 \log size_{it} + \gamma_2 \log \hat{\omega}_{it} + X'_{it}\mu + \delta_{Ist} + \alpha_{\Sigma_{it}} + \varepsilon_{it}. \quad (24)$$

Firm size ($size_{it}$) is constructed as total sales of firm i in time t . The term $\hat{\omega}_{it}$ is firm-level TFP, obtained from production function estimation. Table 7 presents the results from estimating equation (24) via OLS fixed effects regressions. The coefficients of interest are $\hat{\gamma}_i$, with $i = 1, 2$. Each pair of columns show the coefficients on size ($\hat{\gamma}_1$) and productivity ($\hat{\gamma}_2$), for an increasingly stringent set of

FIGURE III: DISPERSION IN RELATIVE WEDGE, ACROSS FIRMS



Notes: The figure plots, for each quantile $q = 1, \dots, 20$, the average implied wedge of the quantile: $\left(\frac{\hat{\psi}^x}{\hat{\psi}^m}\right)_q = 1/N_f^q \sum_{i=1}^{N_f^q} \left(\frac{\hat{\psi}_{it}^x}{\hat{\psi}_{it}^m}\right)$ together with the 25th and 75th percentiles of the quantile distribution of implied wedges.

TABLE VII. MARKET POWER AND FIRM CHARACTERISTICS

Dependent variable	$\ln\left(\frac{\hat{\psi}_{it}^x}{\hat{\psi}_{it}^m}\right)$						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\log size_{it}$	0.191*** (0.003)		0.25*** (0.01)		0.25*** (0.02)		0.23*** (0.02)
$\log \hat{\omega}_{it}$		0.16*** (0.01)		0.26*** (0.01)		0.28*** (0.04)	0.19*** (0.04)
Fixed Effects		δ_{Ist}	$\delta_{Ist}; \alpha_{\Sigma}$ (Country)		$\delta_{Ist}; \alpha_{\Sigma}$ (Country \times HS6 Product)		
No. Observations	172,814	172,814	110,629	110,629	14,258	14,258	14,258
Adj. R^2	0.25	0.15	0.31	0.30	0.72	0.71	0.72
Impact of Δ_{sd} (size)	0.350		0.460		0.451		
Impact of Δ_{sd} (tfp)		0.091		0.149		0.158	0.110

Notes: The regressions exclude outliers in the top and bottom 3rd percentile of the distribution of input market power. Columns (1) and (2) include 3-digits industry \times time fixed effects; Columns (3) and (4) include 3-digits industry \times time fixed effects, plus sourcing-strategy fixed effects, where the latter is defined at the level of countries; Columns (5),(6) and (7) include 3-digits industry \times time fixed effects, plus sourcing-strategy fixed effects, defined at the HS $\hat{\wedge}$ digit product \times country level. All regressions include controls for the MNE status of the firm, and the capital-to-labor ratio. *** denotes significance at the 10% level, ** 5% and * 1%. Standard errors are obtained through a bootstrapping procedure.

fixed effects. Table A5 in the Appendix shows the same table, when the dependent variable is the foreign input wedge $\tilde{\psi}_{it}$ instead.

Columns (5)-(7) are the most preferred estimates, as they take into account the market-level sourcing strategy of the firm. Across specifications, input market power is positively and significantly correlated with size and measured productivity of firms. Quantitatively, a one standard deviation increase in sales is associated with an increase in the relative wedge of about 45%. A one standard deviation increase in firm TFP is associated with an increase of about 16%.

Discussion Overall, my analysis highlights three main facts about foreign input markets: first, competition in foreign intermediate markets is substantially more distorted than competition in domestic intermediate markets. Second, firm behavior in domestic markets is well approximated by competitive models, while firm behavior in foreign input markets is instead better approximated by models of monopsony or oligopsony. Third, large and productive firms are more distorted than small, unproductive firms. Notably, I showed that this evidence is robust to alternative interpretation of the wedges based on heterogeneous sourcing costs, and to stories based on technology.

Nonetheless, the evidence presented so far is closely tied to the theoretical framework in Section 2, which builds on some important assumptions. In the remainder of this section I aim to provide reduced form evidence in support of these assumptions. I do so by leveraging the micro-level dimension of customs data, while looking at the behavior of import prices across firms and markets.

3.4 Reduced Form Evidence on Buyer Power

Imperfect competition in input markets implies that input prices are endogenous to firm behavior. Notably, as I argued in section 2.1.3, when the input supply elasticity is approximately constant across firms the buyer share of a firm in the input market is a *sufficient statistic* for the effect of buyer power on input prices: the higher the buyer share, the lower the price.

This discussion implies that one could test for the existence of imperfect competition in foreign input markets by showing that, conditional on quality and exogenous factors affecting prices, firm-level prices depend on the firm buyer share in a given market. In customs data both prices and import shares are observed at the product-country level, which makes this kind of analysis feasible.

The main variable of interest is the (log) price that firm i pays for product k in country n at time t . Products are defined at the 8 digit level. As standard, prices are computed as unit values, namely value over quantity of each individual shipment. I define a market as a product-country-year triple, which is the most disaggregate level I could look at.

I document three empirical facts which I interpret as evidence of buyer power in foreign input markets, which I summarize here:

Fact 1 : *Within an import market, the average price of an input decreases, as market concentration increases.*

Fact 2 : *Across firms and within an import market, firms with higher buyer share pay a lower unit price for the same input.*

Fact 3 : *Within a market and within a firm, the price that a French importer pays for an imported input decreases as its buyer share increases, and as the tenure in that market increases.*

I start by showing evidence of Fact 1. I run the following regression:

$$\ln \bar{p}_{knt} = \gamma \times \ln HHI_{knt} + X'_{knt} \mu + c_{kn} + \delta_{nt} + \varepsilon_{knt}. \quad (25)$$

The dependent variable is the average price of an 8-digit product k sold by country n at time t : $\bar{p}_{knt} = \sum_{i=1}^{N_{knt}} p_{iknt}$. The term $\ln HHI_{knt}$ is the (log) Herfindahl index in market $k \times n \times t$, which is a measure of market concentration.²⁴ The vector X_{knt} include market level controls, such as the average size of shipments to France, the total number of French importers, and the total world imports from market $k \times n \times t$. Data on world shipments at the product level are obtained from the UN Comtrade database. Including these controls avoids the suspect that the correlation between price and market concentration is mechanically driven by market size. I also include fixed effects for product-country (c_{kn}), to control for the characteristics of the product, such as its average marginal cost, as well as country-time fixed effects, to control for country-specific time trends.

Table A6 in the Appendix shows the results of estimating (25) via OLS. The coefficient on market concentration is large, negative, and significant. Column (4) of Table A6 shows that the effect of market concentration is stronger in those markets where France accounts for a larger fraction of world total imports.

To show evidence of the second fact, I exploit across-firms variation in prices. I consider an augmented version of a standard price-size regression, that is:²⁵

$$\ln p_{iknt} = \gamma_1 \times \ln size_{it} + \gamma_2 \times s_{iknt} + X'_{knt} \mu + c_{Ikn} + \delta_t + \varepsilon_{iknt}. \quad (26)$$

The dependent variable is now the firm-level price in each market. Firm size ($size_{it}$) is defined as above. The term s_{iknt} denotes the buyer share of firm i in market $k \times n \times t$, that is, value of imports of firm i over total French imports from that market. The vector X_{knt} include market and firm-level controls, as in equation (25).

In order to control for the average price of a good in a given market, I now include industry-product-country (c_{Ikn}) fixed effects. The coefficients of interest thus indicate the effect of both size and import shares on the firm-level deviation from the average industry price.

²⁴Results are robust to using a different measure of market concentration, such as the Mean Log Deviation of import shares.

²⁵A growing empirical literature has studied input price behavior using a similar regression specification as the one in equation (26). Kugler and Verhoogen (2012) use Colombian data to document that larger plants pay more for their inputs, which they interpret as evidence that quality differences play an important role in generating within market price variation. More recently, Blaum et al. (2019) have looked at the plant size-price correlation using the same French manufacturing import data as those used in this paper, to show evidence of non-homothetic import demand for importers.

Table A7 in the Appendix shows the results of estimating (26) via OLS. While my results confirm the existence of the price-plant size correlation in input prices, as in [Kugler and Verhoogen \(2012\)](#) and [Blaum et al. \(2019\)](#), I uncover a novel role for the buyer share in determining the price of the imported inputs. I interpret these results as evidence that conditional on quality, which is captured by firm size, the buyer share of the firm has a large negative effect on prices.

One might argue that, as buyer share is correlated with the shipment size, the negative coefficient on the buyer share might be driven by bulk discounts, rather than to the pricing power of individual firms. Due to collinearity concerns, I cannot include controls for shipment size and buyer share in the same regression. However, by comparing the coefficients on quantity and buyer share from column (2) and (3) respectively, I can conclude that buyer share seems to have a role on prices that goes beyond its correlation with shipment size: if buyer share was important for prices only inasmuch as it correlates with shipment size, we would expect the coefficient on size to be similar in both columns, in contrast to what I find.

Finally, in Table A8 in the Appendix I show evidence for Fact 3, by looking at the within-firm variation in prices. The main equation of interest is:

$$\ln p_{iknt} = \gamma_1 \times \ln s_{iknt} + \gamma_2 \times \ln tenure_{iknt} + \gamma_e First_{iknt} + X'_{knt} \mu + c_{Ikn} + \delta_{it} + \varepsilon_{iknt}. \quad (27)$$

Unlike equation (26), firm-time fixed effects δ_{it} now capture all firm-level characteristics affecting prices, including quality. I include controls for the tenure of firm i in market $k \times n \times t$, as well as a dummy equal to 1 if t is the first year firm i imports product k from country n . The coefficient of interests are γ_1 - γ_3 , whose interpretation is now a “within” one: what happens to the price of the firm, as its buyer share (or tenure) increases in a given market.

Table A8 shows that buyer share is significantly and negatively correlated with the firm-level price of an input, even after controlling for quality and other firm-level characteristics. The coefficient on tenure is also negative and significant, albeit smaller. A one standard deviation increase in buyer share is associated with a decrease in the foreign input price of about 20%. Similarly, a one standard deviation increase in firm tenure in a given market is associated with a price decrease of about 3%.

Note that both in Table A7 and A8, the coefficient on the buyer share is larger in absolute value in those markets where France account for a large fraction of world total imports. In other words, the pricing power of firm i is stronger whenever the firm accounts for a larger fraction of total demand, just like in models of monopsonistic or oligopsonistic competition.

Sources of Buyer Power By and large, the reduced form evidence summarized by Facts 1-3 supports theories of oligopsonistic or monopsonistic competition, where firms with high buyer shares are able to push prices below competitive levels.

The importance of this evidence is twofold: on the one hand, it provides empirical support for the theoretical framework in Section 2, as well as for the structural interpretation of the input wedges. On the other hand, it yields insights into the potential sources of buyer power of importers.

Facts 1-3 unanimously suggest that the pricing power of an importer is large whenever it accounts for a big share of the total demand of a given input. In this sense, the “importance” of a buyer to a market seems to be a major determinant of buyer power.

Note that due to data limitations, I measure the buyer share of firms in terms of the total *world* demand of a given HS6 product from a given country. In reality, markets are much more segmented, both in terms of product characteristics or in terms of geographic barriers. This means that the effective buyer share of firms can be even higher than what I can measure in the data.

Buyer concentration is not necessarily related with large entry barriers into import markets, or with constrained foreign sellers. As a matter of fact, exporters are very large players, and they undoubtedly have the resources to reach a large number of customers (Freund and Pierola, 2015; Bernard et al., 2018b; Gaubert and Itkhoki, 2019).

Even then, buyer concentration can arise if exporters have limited scope of substitution among customers. If relationship-specific investments, such as product customizations, are an important feature of the buyer-seller relationship, then the market for a given product might be limited to a small number of buyers, who make up for a large fraction of total export supply. This argument is supported by recent empirical work in the literature on trade and development documenting the importance of global buyers to developing country suppliers, which seem to be willing to forfeit productivity to maintain their relationships with powerful buyers (Macchiavello and Morjaria, 2015; Cajal-Grossi et al., 2019; Adhvaryu et al., 2019).

In light of this discussion, investment irreversibility and horizontal market segmentation seem to be the most compelling sources of buyer power of importers. This observation motivates the modeling choices for the theoretical model in the next section.

4 Buyer Power and the Aggregate Economy

Motivated by the empirical findings, in this section I explore and quantify the contribution of the micro-level distortions in input trade to aggregate performance of the French manufacturing sector.

I build an heterogeneous firms model of production as in Hsieh and Klenow (2009), extended to incorporate buyer power in the market of an intermediate input, which the firms source from abroad. On account of the results in Section 3, I model perfect competition in the market of the domestic input, so that aggregate distortions can only be driven by firm behavior in import markets.

Buyer power emerges endogenously in the model as a result of two assumptions: first, the foreign input is supplied elastically by the foreign supplier, which means that there exist rents in foreign input markets. Second, markets are segmented due to horizontal input differentiation, such that there are only a relatively small number of buyers in each foreign market. These assumptions are motivated by the reduced form evidence on import prices in section 3.4.

For simplicity, I abstract from the extensive margin import decisions of firms, which I assume are made one period in advance. This assumption implies that I can focus on constant returns to scale production functions, while considering import decisions as the solution to a static profit

maximization problem of firms (Blaum et al., 2019). Notably, this assumption implies that, up to differences in technology, the framework below can be reconciled with standard models of input trade, which correspond to the limit case of price taking behavior of firms in foreign input markets.

4.1 Environment

I consider a one-sector economy consisting of a Home country (France), and a Foreign country (Rest of the World).²⁶ I focus on the equilibrium in France. A representative consumer inelastically supplies L units of labor, earning wage W^l for each unit of labor supplied, and consumes a final good. In addition to labor income, the consumer also owns claims to the profits of the domestic firms.

The final good Q , which is taken as the numeraire, is a CES composite of a continuum of differentiated products:

$$Q = \left(\int_{i \in M} q_i^\rho di \right)^{\frac{1}{\rho}}, \quad 0 < \rho < 1, \quad (28)$$

where $\frac{1}{1-\rho}$ is the elasticity of substitution among different goods.²⁷ The assumption on the numeraire implies that $P = \left(\int_{i \in M} p_i^{-\frac{\rho}{1-\rho}} di \right)^{-\frac{1-\rho}{\rho}} = 1$.

I focus on an equilibrium where entry is restricted, such that the measure M of firms active in the economy is fixed, and exogenous. Consumer optimization yields to the standard CES demand for variety i in sector s :

$$q_i = p_i^{-\frac{1}{1-\rho}} Q. \quad (29)$$

Total income Y of the representative consumer is given by the sum of the labor income ($W^L L$) plus profits (Π).²⁸ Because of the assumption on the numeraire, nominal (Y) and real (Y/P) income coincide in this economy, such that we can measure domestic welfare as:

$$W = \frac{Y}{P} = W^L L + \Pi. \quad (30)$$

4.1.1 Technology

Firms differ in their efficiency level $\phi \in (0, \infty)$. Production of the differentiated variety requires both local and foreign inputs according to the following constant returns Cobb-Douglas structure:

$$q_i = \phi_i x_i^\beta l_i^{1-\beta}, \quad (31)$$

²⁶It is straightforward to extend this model to a multi-sector economy with a competitive final good sector. The choice of a single sector allows for a clear-cut closed form representation of the aggregate equilibrium, while leaving the qualitative results unchanged.

²⁷The assumption of CES preferences is without loss of generality here. This choice is motivated by the fact that monopolistic competition + CES preferences are the main assumptions of workhorse models of international trade and macro, which makes the results easier to interpret. An extension of the model to preferences with variable demand elasticity and variable markups is available upon request.

²⁸It is understood that because the model features fixed entry, Π only recovers a measure of static (accounting) profits, which would be lower in presence of overhead costs.

where x denotes foreign inputs and l denotes domestic labor.²⁹

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. This assumption matches the large heterogeneity in product varieties imported by manufacturing firms.

4.1.2 The Market of the Foreign Intermediate Input

Each firm i buys its differentiated variety of x_i from a different market in Foreign. Markets are horizontally segmented by the product characteristics. In the foreign market, each buyer from Home competes with a fringe of competitive buyers from Foreign, but never with other buyers from Home, such that a Home firm's demand does not depend on the price paid by another Home firm. We can thus exclude general equilibrium effects of firm i 's behavior on the demand of other domestic firms.

Let us denote total demand by foreign competitors as $X_{-i} \in [0, \infty)$. I assume that X_{-i} varies across firms, and is exogenous. Total input demand in market i is thus given by $X_i = x_i + X_{-i}$, with $\partial X_i / \partial x_i = 1$. The assumption that X_{-i} is exogenous rules out strategic interactions across a Home firm i and its Foreign competitors. A firm is going to exercise buyer power when its demand relative to the competitors is large, namely when the buyer share, defined as $s_i^x = \frac{x_i}{X_i}$, is positive.

There exist economic rents on the Foreign markets, which arise owing to decreasing returns in production of the intermediate input varieties.³⁰ Each foreign seller supplies X_i units of the good according to the following (inverse) supply function

$$W_i^x = \left(\frac{x_i + X_{-i}}{a_i + X_{-i}} \right)^\eta. \quad (32)$$

where $\eta \equiv \frac{\partial W_i}{\partial X_i} \frac{X_i}{W_i} > 0$ represents the elasticity of intermediate input price to total demand, which is positive due to the assumption of decreasing returns, and is constant across firms. The denominator reflects market conditions in the Foreign market for input i , which are taken as given by the firm.

In agreement with the first part of the paper, I define buyer power of Home firm i in the Foreign market as the gap between the marginal factor cost and the unit price of the input. In this model, this is given by:

$$\psi_i = 1 + \eta s_i^x \geq 1. \quad (33)$$

Equation (5) shows that two conditions are necessary for buyer power to emerge: (i) the firm must be large compared to its competitors, namely $s_i^x > 0$, and (ii) the foreign export supply must be elastic, i.e. $\eta > 0$.

²⁹Note that l can be thought of as constant return to scale aggregator of l_i for $i = 1, \dots, N$ primary factors, including labor, capital, and domestic intermediates.

³⁰Let $C(X)$ denote total costs of producing X . Decreasing returns imply that $C'(X)$ are increasing in X , i.e. $C'' > 0$. This implies that in equilibrium, the unit price is higher than the average cost of production. These "excess returns" for the input represent the rents accruing to the seller, and often referred to as *Ricardian rents*.

The model nests the special cases of pure monopsony and perfect competition in a tractable way. When the Home firm is small compared to its competitors in Foreign (i.e. $X_{-i} \rightarrow \infty$ and $s_i^x \rightarrow 0$), as in the case of perfect competition, then $\psi_i = 1$ and $W_i^x = W^x = 1$. On the contrary, when the Home firm is the only buyer in the market for the differentiated input variety X_i , as in the case of monopsony, then $X_{-i} \rightarrow 0$ and $s_i^x \rightarrow 1$, such that $\psi_i = 1 + \eta > 1$ and $W_i^x = \left(\frac{x_i}{a_i}\right)^\eta$. The term a_i is chosen such that the input price of each firm W_i^x is constant and equal to 1 whenever the firm chooses the competitive quantity.

4.2 Firm-Level Equilibrium

Each firm is thus characterized by two objects: its productivity ϕ_i and the size of foreign demand X_{-i} . Both of these variables are state variables of the firm, and are drawn one period in advance by each firm from independent and known distributions $G_\phi(\cdot)$ and $G_{X_-}(\cdot)$, respectively.

Given (ϕ_i, X_{-i}) , the problem of firm i is to choose inputs so as to maximize variable profits, subject to demand (29), technology (31) and input supply (32), and taking aggregate variables (W^l, Q) as given. Formally, profits are given by

$$\pi_i = p_i q_i - W^x(x_i, X_{-i})x_i - W^l l_i,$$

where $W_i^x = W^x(x_i, X_{-i})$ is specified in (32). The main equations describing the firm-level equilibrium can be summarized as follows:

$$x_i \propto \phi_i^{\frac{\rho}{1-\rho}} \psi_i^{-\frac{1-\rho(1-\beta)}{1-\rho+\eta(1-\rho(1-\beta))}} \quad (34)$$

$$\frac{l_i}{x_i} \propto \psi_i^{\frac{1-\rho}{1-\rho+\eta(1-\rho(1-\beta))}} \quad (35)$$

$$q_i \propto \phi_i^{\frac{1}{1-\rho}} \psi_i^{-\frac{\beta}{1-\rho+\eta(1-\rho(1-\beta))}}. \quad (36)$$

For given aggregate variables, the equilibrium can be written in terms of firm productivity (i.e. ϕ_i), and firm buyer power (ψ_i). Notably, buyer power ψ_i is a *sufficient statistic* for the effect of foreign demand X_{-i} on firm-level variables.

Buyer power in foreign markets generate three sources of inefficiency. First, demand of the foreign input is too low (equation (34)). Second, firms with higher ψ substitute inefficiently the foreign input with the domestic one, such that l_i/x_i is too high (equation (35)). Third, final production is too low, such that output prices are above competitive levels (equation (36)). This is an interesting result, that contradicts the commonly held view among economists that buyer power can benefit final consumers, via lower output prices. Equation (36) shows that even if large ψ firms pay less for their inputs, these cost-savings are not passed on to final prices, which are in fact higher than in competitive models. This has to do with the fact that firms are able to extract low input prices by means of distortions in production.

The equilibrium effect of buyer power on the firm-level equilibrium can be understood by considering the marginal revenue product of the foreign input:

$$\text{MRPX}_i \equiv \frac{\partial p_i q_i}{\partial x_i} = W_i^x \psi_i = \psi_i^{\frac{1-\rho}{1-\rho+\eta(1-\rho(1-\beta))}}. \quad (37)$$

Buyer power drives a wedge between the marginal revenue product of the foreign input, and its price. In particular, the fact that $\psi_i \geq 1$ implies that $\text{MRPX}_i \geq W_i^x$, that is, buyer power always makes firm smaller than optimal. I summarize the firm-level equilibrium in the following proposition:

Proposition 1: *Buyer power in foreign markets raises the marginal revenue product of foreign inputs of the firm, making it smaller than optimal. As a result, the firm with buyer power charges a price that is higher than competitive in the final good market.*

4.3 Buyer Power and the Aggregate Economy

The model allows for a transparent characterization of the aggregate equilibrium. I show in the Appendix that market clearing in the labor market, together with the assumption on the numeraire, implies that we can write aggregate output as:

$$Q = \Gamma_Q \cdot \Phi \cdot \Omega \cdot L \quad (38)$$

where $\Gamma_Q \equiv \left(\frac{1}{\rho}\right)^{-\frac{\beta}{1-\beta}} \left(\frac{1}{\beta}\right)^{-\frac{\beta}{1-\beta}}$ is a constant, $\Omega \equiv \mathbb{E} \left(\phi_i^{\frac{\rho}{1-\rho}} \right)^{\frac{1-\rho}{\rho(1-\beta)}}$ is a productivity index, and $\Psi \equiv \mathbb{E} \left(\psi_i^{-\frac{\rho\beta}{1-\rho+\eta(1-\rho(1-\beta))}} \right)^{\frac{1-\rho}{\rho(1-\beta)}}$ is an index of aggregate distortions.

The term Ψ summarizes the effect of buyer power on aggregate output. We notice that in contrast to a standard result in literature of markups and misallocation, aggregate distortions in this economy depend on the *level* of buyer power: multiplying all the ψ_i by a constant factor does *not* leave output unchanged.³¹ This has to do with the fact that buyer power is related to an elastic supply of the foreign input. By changing the level of buyer power, the total supply of the foreign input changes, and so does aggregate output.

To build intuition, let us consider what happens in a counterfactual economy where I assign to all firms the average degree of buyer power, i.e. $\psi_i = \psi = E\psi$. Aggregate output in this economy is given by:

$$Q^{ND} = \Gamma_Q \cdot \Phi \cdot \Omega' \cdot L, \quad (39)$$

where $\Omega' \equiv \psi^{-\frac{\rho\beta}{1-\rho+\eta(1-\rho(1-\beta))}} \cdot \frac{1-\rho}{\rho(1-\beta)}$. Equation (39) shows that even in absence of dispersion across firms, buyer power negatively affect aggregate output. Furthermore, Jensen's inequality implies that $\Omega' < \Omega$, which means that a mean-preserving spread in the distribution of buyer power across firms has a positive effect on aggregate output.

³¹See, e.g. Epifani and Gancia (2011); Edmond et al. (2015); Peters (2016).

Dispersion in buyer power induces a reallocation of labor towards the less distorted firms. Because highly distorted firms produce too little in an economy where input supply is elastic, inducing misallocation across firms can alleviate the consequences of an inefficient firm size. Not surprisingly, the “cost” of misallocation is lower, the higher the elasticity of export supply. I summarize the theoretical results of this section in the following propositions:

Proposition 2: *Heterogeneity in buyer power introduces an intrasectoral misallocation, whereby firms with below-average buyer power overproduce, and industries with above-average buyer power underproduce. The efficiency cost of buyer power induced misallocation are inversely proportional to the inverse supply elasticity of the foreign input.*

Proposition 3: *Output is inefficiently low in an economy where firms have buyer power. A mean-preserving spread of the distribution of buyer power increases aggregate output, by inducing firms with low buyer power to overproduce, albeit inefficiently.*

Aggregate TFP The model also allows to derive an analytical expression for the aggregate TFP. I define TFP as: $\text{TFP} = \frac{Q}{L^{1-\beta} X^\beta}$. I show in the Appendix that it is possible to write:

$$\text{TFP} = \left(\mathbb{E} \phi^{\frac{\rho}{1-\rho}} \mathbb{E} \left(\frac{\overline{\text{TFPR}}}{\text{TFPR}_i} \right)^{\beta \frac{\rho}{1-\rho}} \right)^{\frac{1-\rho}{\rho}} \quad (40)$$

where $\overline{\text{TFPR}}$ is the harmonic mean of revenue productivity across firms, with weights equal to the firms’ market shares, and TFPR_i is defined as $\text{TFPR}_i = p_i \phi_i$.³² Note that equation (40) implies that the average buyer power *does not* matter for aggregate productivity: multiplying all ψ_i by any positive constant leaves aggregate TFP unaffected.

4.4 Aggregate Cost of Buyer Power in Foreign Markets

I now use equations (42) and (41) to quantify the cost of buyer power for the aggregate economy. For any given variable X , I denote as $\hat{X} \equiv \log X - \log X^{EFF}$ the log-difference between the value in the distorted economy and the counterfactually efficient value, which is obtained when all firms behave as price takers in foreign input markets. It is possible to show that when ϕ and ψ are jointly log-normally distributed, there is a simple closed-form expression for changes in aggregate output and TFP. The cost of buyer power in terms of aggregate output can be written as:

$$\hat{Q} = -\kappa_{Q,1} \cdot \mathbb{E} \log \psi + \kappa_{Q,2} \cdot \text{var} \log \psi, \quad (41)$$

³²In particular, $\overline{\text{TFPR}} = \rho^{-1} \left(\frac{1}{\beta} \right)^\beta \left(\frac{W^l}{1-\beta} \right)^{1-\beta} \left(\frac{1}{\int_i \frac{p_i q_i}{Q} \psi_i^{-\frac{1-\rho}{\Psi}} di} \right)^\beta \left(\frac{1}{\int_i \frac{p_i q_i}{Q} di} \right)^{1-\beta}$, while $\text{TFPR}_i = p_i \phi_i = \frac{1}{\rho} \left(\frac{W^l}{1-\beta} \right)^{(1-\beta)} \left(\frac{1}{\beta} \right)^\beta \psi_i^{\frac{\beta(1-\rho)}{\Psi}}$

where $\kappa_{Q,1} \equiv \frac{\beta(1-\rho)}{(1-\beta)(1-\rho+\eta(1-\rho(1-\beta)))}$, and $\kappa_{Q,2} \equiv \frac{\beta(1-\rho)}{(1-\beta)(1-\rho+\eta(1-\rho(1-\beta)))} \left(\frac{\rho\beta}{2(1-\rho+\eta(1-\rho(1-\beta)))} \right)$. Similarly, the cost of buyer power in terms of aggregate productive efficiency is given by:

$$\widehat{\text{TFP}} = -\kappa_{\Phi} \text{var} \log \psi, \quad (42)$$

where $\kappa_{\Phi} \equiv -\beta(1-\rho) \left[\frac{1-\rho+3\rho\beta}{2(1-\rho+\eta(1-\rho(1-\beta)))^2} \right]$.

Inspection of equations (42) and (41) reveals a striking result: for a given set of parameters, the only thing we need to know in order to quantify the efficiency and output cost of buyer power is $\mathbb{E} \log \psi_s$ and $\text{var} \log \psi_s$. In other words, first and second moment of the sectoral distribution of $\log \psi$ are sufficient statistics for the effect of imperfect competition in the aggregate economy. In the next paragraph I show how (almost) all the elements necessary to quantify equations (42) and (41) can be derived from the estimates in section 3.

4.4.1 Calibration and Results

In order to compute the right-hand side of equations (41) and (42), one needs estimates of the parameters ρ , β and η , as well as values of both $\mathbb{E} \log \psi$ and $\text{var} \log \psi$ for the manufacturing sectors.

Average values of the elasticity of substitution ρ and the output elasticity of the foreign input β can be directly obtained from Table A3 and Table 4, respectively. The choice of the foreign supply elasticity η is less straightforward. For my baseline results, I compute the median inverse export supply elasticity from [Soderbery \(2018\)](#). The author uses UN Comtrade data over the period 1991-2007 and provides estimates of the export supply elasticities of each HS4 manufacturing product imported from France, and other countries in the world. For robustness, I then consider alternative values based on other moments of the distribution, as well as estimates implied by my reduced form evidence on import prices.

Finally, values of both $\mathbb{E} \log \psi$ and $\text{var} \log \psi$ can be derived from the estimated moments of the input wedges $\mathbb{E} \psi$ and $\text{var} \psi$, by using the properties of the lognormal distribution.³³ For this exercise, I consider the moments relative to the *residual* wedges in Table A4 in the Appendix, which I summarize in Table 6 of the main text. In so doing, I make sure that the wedge distribution only reflects variation in buyer power.

Table 8 summarizes the calibration results (panel a), and the aggregate cost of buyer power (panel b). Changes in aggregate output vary between 1-2%. The effect on aggregate productive efficiency is instead larger, and varies by -1% to -5%. Different values correspond to different choices for the elasticity η . In columns (1)-(3), I compute this elasticity respectively as the median, the simple mean, and the weighted average across the export supply elasticities in [Soderbery \(2018\)](#).

³³If ψ is distributed lognormal, i.e. $\psi \sim \log \mathcal{N}(\mu_{x_s}, \sigma_{x_s}^2)$, the following relationships hold: $\mathbb{E} \log \psi_s = \mu_{x_s}$ and $\text{var} \log \psi_s = \sigma_{x_s}^2$. The values μ_{x_s} and $\sigma_{x_s}^2$ solve the following system of equations:

$$\begin{cases} \mathbb{E}(\psi_s) = & \exp\left(\mu_{x_s} + \frac{\sigma_{x_s}^2}{2}\right) \\ \text{var}(\psi_s) = & [\exp(\sigma_{x_s}^2) - 1] \exp(2\mu_{x_s} + \sigma_{x_s}^2) \end{cases}$$

TABLE VIII. AGGREGATE COST OF BUYER POWER

Panel a. Calibration of main moments/parameters								
PARAMETER	β	ρ	μ_x	σ_x^2	$\eta(1)$	$\eta(2)$	$\eta(3)$	$\eta(4)$
VALUE	0.16	0.7	0.2	0.48	0.9	1.4	1.5	0.2
SOURCE	TABLE 4	TABLE A3	TABLE A4		SODERBERY (2018)		TABLE A8	

Panel b. Changes in Aggregate Variables				
	(1)	(2)	(3)	(4)
$\Delta\%TFP$	-1.7	-1	-84	-4.7
$\Delta\%Q$	-1.3	-1.1	-1	-1.8

In column (4), I calibrate this elasticity as the absolute value of the OLS coefficient on the buyer share from Table A8 in the Appendix. The result makes clear that the value of the export supply elasticity plays an important role in determining the aggregate cost of buyer power.³⁴

Productivity Gains from Input Trade The results so far suggest that opening up to trade could increase a firm’s scope of buyer power, while increasing a country’s exposure to distortions and misallocation. What do these results imply for the effects of input trade on productivity?

Let the production function of a representative firm under autarky be $q = \phi^A f(k, l, m)$, where ϕ^A is production efficiency under autarky. After a trade liberalization, the firm starts using foreign intermediates in production, and the technology becomes $q = \phi^{FT} g(k, l, m, x)$, where ϕ^{FT} is production efficiency under free trade. The term ϕ^{FT} can be decomposed as $\phi^{FT} = \phi^{FT,C} + \hat{\phi}$, where $\phi^{FT,C}$ is aggregate TFP in a *counterfactual* competitive economy under free trade, while $\hat{\phi}$ describes the effect of a noncompetitive international environment on aggregate domestic efficiency. Existing studies in the literature of input trade and productivity impose $\hat{\phi} = 0$.

Neglecting the role of market power in input trade can affect our understanding of the productivity gains from input trade in two ways. First, I showed in Table 8 that the value of $\hat{\phi}$ is arguably sizeable, and negative. Second, market power in input trade generates an upward bias on estimates of $\phi^{FT,C}$ based on competitive models. Therefore, market power in input trade implies that the productivity gains of input trade are potentially much lower than traditional studies assert.

4.5 Welfare and Policy Implications of Buyer Power

Having established the contribution of buyer power for aggregate output and TFP, I finally turn to discussing its consequences for welfare, and trade policy.

Given equation (30), changes in welfare in this model are computed as the sum of changes in domestic labor income, and changes in aggregate profits. It is easy to show that the income of the

³⁴In a different context, Broda et al. (2008) show that the export supply elasticity is a key parameter to determine the market power motive in trade policy.

inelastically supplied labor must decrease in the distorted economy, due to the adverse effect on wage of a lower labor demand. In contrast, aggregate profits must increase, due to rents transferred from foreign suppliers to domestic firms. We saw earlier that the behavior of firms in foreign market is such that domestic prices increase relative to import prices. Therefore, buyer power induces a terms-of-trade effect for the country, and its effect on welfare is, in principle, ambiguous. In contrast, buyer power is unambiguously detrimental from the point of view of global welfare, due to the simultaneous deterioration of the foreign terms of trade.

A planner maximizing national welfare will optimally choose to be lenient towards large, distorted, importers. A lenient antitrust policy could thus substitute for a beggar-thy-neighbor trade policy (Gaubert and Itskhoki, 2019). My study thus suggests that international cooperation of anti-trust authorities could foster global efficiency and welfare, while reducing the scope of market power of granular international firms.

5 Conclusions

This paper provides micro-level estimates of market power in input trade, and examines its implications for the aggregate economy. I show that the market power in input markets can be consistently estimated from standard firm-level production and trade data. I propose an estimation strategy to correct for input price bias in production function estimation that combines insights from a theoretical model of imperfect competition and price information contained in customs data. This approach dispenses with assumptions on the market structure in both output and input markets, consistent with the application of the paper.

In order to link the estimates of buyer power to macroeconomic outcomes, I develop a tractable theoretical model of heterogeneous firms and market power in input markets, that allows for a transparent characterization of the main equilibrium forces. I show how the empirical estimates can inform us about distortions and the magnitude of misallocation within an economy. This paper contributes to our understanding of the role of buyer power in modern economies. While the phenomenon of buyer power has been drawing increased attention from economists in recent years, there have been only few attempts of modeling its aggregate consequences in general equilibrium.

My results have broader implications for thinking about the relationship between globalization and market structure in advanced economies. As participation in international trade increases the scope of market power of large firms, the overall level of competition in the economy can decline. This observation relates to a recent debate about the causes of the increase in market concentration, and the contemporaneous decline in business dynamism in the U.S. and other advanced economies, by bringing international trade and offshoring in the picture (See, e.g., De Loecker et al., 2019; Van Reenen, 2018; Syverson, 2019; Eggertsson et al., 2018; Akcigit and Ates, 2019).

A promising area for future research would then be to carry out an explicit analysis of the role of globalization in explaining the observed increase in concentration and market power in large economies.

A Additional Tables and Figures

TABLE AI. FIRM RELATIVE EXPORT AND IMPORT PRICES

Variable	1996-2007				
	Mean	Std Dev	p10	p50	p90
(Relative) output price \hat{p}_{it}	-0.06	.48	-.55	-0.5	.41
(Relative) imported input price \hat{w}_{it}^x	-0.03	.38	-.42	-0.03	.34

Panel B. Correlation with Main PF Variables

	\hat{p}_{it}	\hat{w}_{it}^x
$Corr(\cdot, Y_{it})$	-.41	-.02
$Corr(\cdot, L_{it})$	0	.08
$Corr(\cdot, M_{it})$	-.06	.03
$Corr(\cdot, X_{it})$	-.11	-.2

Notes: Numbers are averaged across time and sectors, and refer to the full baseline sample of international firms. Number of observations: 129,787. ^aA sourcing market is defined as a country-NC8 product combination.

TABLE AII. OUTPUT ELASTICITIES, COBB-DOUGLAS, BY IMPORTER CLASS

Sample of Importers	β_k	β_l	β_m	β_x
Small	0.06	0.40	0.37	0.13
	(0.05)	(0.03)	(0.02)	(0.01)
Medium	0.07	0.32	0.40	0.15
	(0.03)	(0.02)	(0.01)	(0.01)
Large	0.08	0.28	0.39	0.20
	(0.03)	(0.01)	(0.01)	(0.01)
All internationals	0.08	0.32	0.39	0.18
	(0.02)	(0.01)	(0.01)	(0.004)

Notes: The reported elasticities are averaged across sectors. In parenthesis I report the average industry standard error. Class of importers are drawn based on terciles of extensive margin distribution of imports.

TABLE AIII. MARKUPS, BY SECTOR

SECTOR	μ_I	
	ACCOUNTING	DLW (2012)
15 Food and Beverages	1.28	1.23
17 Textiles	1.41	1.51
18 Wearing Apparel	1.53	1.56
19 Leather Products	1.36	1.45
20 Products of Wood	1.34	1.33
21 Pulp and Paper Products	1.34	1.30
22 Printing and Publishing	1.63	1.63
24 Chemical Products	1.42	1.36
25 Rubber Products	1.41	1.36
26 Non-metallic minerals	1.42	1.38
27 Basic Metals	1.36	1.30
28 Fabricated Metal Products	1.51	1.39
29 Machinery and Equipment	1.44	1.23
31 Electrical Machinery	1.41	1.35
32 Radio and Communication	1.41	1.30
33 Medical Instruments	1.50	1.40
34 Motor Vehicles, Trailers	1.32	1.16
35 Other Equipment	1.43	1.21
Average	1.42	1.36

Notes: The table reports the median markup, for each 2-digit manufacturing sector. The average standard deviation in each industry is about 0.34 and 0.46 for the two measures. Accounting markups are defined as total sales over total firm costs. We include capital in our measure of total costs, which I define as $Cost_i = E_i^L + E_i^m + RK_i$, where I assume a value for $R = 20\%$, following Blaum et al. (2019).

TABLE AIV. INPUT MARKET POWER, BY SECTOR - RESIDUAL WEDGES

SECTOR	MEAN ^a			
	$\alpha_{\Sigma}(\text{country})$		$\alpha_{\Sigma}(\text{country} \times \text{HS4 products})$	
	ψ^x_I / ψ^m_I	$\tilde{\psi}^x_I$	ψ^x_I / ψ^m_I	$\tilde{\psi}^x_I$
15 Food and Beverages	1.53	1.39	1.24	1.17
17 Textiles	1.61	1.34	1.14	1.07
18 Wearing Apparel	1.74	1.36	1.26	1.15
19 Leather Products	1.52	1.28	1.29	1.17
20 Products of Wood	1.69	1.45	1.50	1.33
21 Pulp and Paper Products	1.53	1.32	1.24	1.15
22 Printing and Publishing	1.62	1.35	1.32	1.18
24 Chemical Products	1.41	1.26	1.05	1.03
25 Rubber Products	1.57	1.37	1.22	1.14
26 Non-metallic minerals	1.51	1.33	1.22	1.15
27 Basic Metals	1.40	1.23	1.10	1.07
28 Fabricated Metal Products	1.62	1.40	1.31	1.20
29 Machinery and Equipment	1.59	1.38	1.21	1.13
31 Electrical Machinery	1.47	1.32	1.11	1.07
32 Radio and Communication	1.53	1.33	1.04	1.02
33 Medical Instruments	1.64	1.36	1.24	1.14
34 Motor Vehicles, Trailers	1.46	1.30	1.20	1.14
35 Other Equipment	1.45	1.32	1.17	1.11
Average	1.53	1.34	1.20	1.13

Notes: The table shows the industry average value of the residual input wedges, obtained as residuals from the OLS regression in equation (24). I show both the value of the residual relative wedge, and the value of the residual foreign input wedge. For both measures, the median value of the residual is approximately equal to one in all industries, and is thus omitted.

TABLE AV. MARKET POWER AND FIRM CHARACTERISTICS

Dependent variable	$\ln \tilde{\psi}_{it}^x$						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\log size_{it}$	0.11*** (0.01)		0.13*** (0.01)		0.10*** (0.02)		0.07*** (0.02)
$\log \hat{\omega}_{it}$		0.19*** (0.01)		0.28*** (0.01)		0.32*** (0.03)	0.3*** (0.03)
No. Observations	172,814	172,814	110,629	110,629	14,258	14,258	14,258
Adj. R^2	0.27	0.14	0.31	0.31	0.73	0.73	0.73
Impact of Δ_{sd} (size)	0.194		0.240		0.191		
Impact of Δ_{sd} (tfp)		0.111		0.159		0.185	0.169

Notes: The regressions exclude outliers in the top and bottom 3rd percentile of the distribution of input market power. Columns (1) and (2) include 3-digits industry \times time fixed effects; Columns (3) and (4) include 3-digits industry \times time fixed effects, plus sourcing-strategy fixed effects, where the latter is defined at the level of countries; Columns (5),(6) and (7) include 3-digits industry \times time fixed effects, plus sourcing-strategy fixed effects, defined at the HS $\hat{}$ digit product \times country level. All regressions include controls for the MNE status of the firm, and the capital-to-labor ratio. *** denotes significance at the 10% level, ** 5% and *** 1%.

TABLE AVI. AVERAGE IMPORT PRICE AND COMPETITION

DEPENDENT VARIABLE:	$\ln p_{pct}$			
	(1)	(2)	(3)	(4)
$\ln \text{HHI}_{pct}$	-0.031*** (0.002)	-0.147*** (0.001)	-0.148*** (0.002)	-0.186*** (0.010)
\ln Average Shipment Quantity		-0.206*** (0.001)	-0.206*** (0.001)	-0.206*** (0.001)
\ln Foreign competitors			0.039*** (0.002)	0.034*** (0.002)
$\ln \text{HHI}_{pct} \times \ln$ Foreign competitors				0.009*** (0.002)
FIXED EFFECTS:	Country \times Product; Country \times Time			
IMPACT OF A 1SD INCREASE IN HHI (FROM MEAN)	-0.15	-0.07	-0.07	-0.09
OBSERVATIONS	4,275,601	4,275,601	3,637,687	3,637,687
FE		Country \times Product; Country \times Year		
IDENTIFIED FE	141900	141900	114183	114183
OF WHICH SINGLETONS	2	2	2	2

Notes: Regressions at the product \times country level, products (i.e. product-country) imported by at least 2 firms. Robust standard errors in parentheses with ***,** and * respectively denoting significance at the 1%, 5% and 10% levels. All regressions include a control for the number of French importers of the given product-country variety. The sets of fixed effects that are inserted in each specification are indicated in each column. The R^2 is about 0.96 for all specifications

TABLE AVII. IMPORT PRICES AND COMPETITION: BETWEEN VARIATION

DEPENDENT VARIABLE:	$\ln p_{ipct}$			
	(1)	(2)	(3)	(4)
$\ln \text{Sales}_{it}$	0.023*** (0.001)	0.064*** (0.001)	0.025*** (0.001)	0.025*** (0.001)
$\ln \text{Shipment Size}$		-0.174*** (0.000)		
$\ln \text{Import Share}_{it}$			-0.139*** (0.005)	-0.113*** (0.007)
$\ln \text{France World Share}$				(0.027)
$\ln \text{Import Share} \times \ln \text{France World Share}$				-0.295*** (0.056)
FIXED EFFECTS: Industry \times Product \times Country; Time				
IMPACT OF A 1SD INCREASE IN SALES (FROM MEAN)				
	.05	.14	.06	.06
IMPACT OF A 1SD INCREASE IN IMPORT SHARE (FROM MEAN)				
		-.14	-.12	
OBSERVATIONS	3,292,839	3,292,839	3,292,839	3,292,839
IDENTIFIED FE	1251552	1251552	1251552	614815
OF WHICH SINGLETONS	975437	975437	975437	338700

Notes: Regressions at the product \times country level, products (i.e. product-country) imported by at least 2 firms. Robust standard errors in parentheses with ***, ** and * respectively denoting significance at the 1%, 5% and 10% levels. All regressions include a control for the number of French importers of the given product-country variety. The sets of fixed effects that are inserted in each specification are indicated in each column. The R^2 ranges from 0.76 to 0.89 in all specifications

TABLE AVIII: IMPORT PRICES AND COMPETITION: WITHIN VARIATION

DEPENDENT VARIABLE:	$\ln p_{ipct}$			
	(1)	(2)	(3)	(4)
$\ln \text{Tenure}_{ipct}$	-0.036*** (0.001)		-0.025*** (0.001)	
First year (dummy) $_{ipct}$	0.029*** (0.002)	0.051*** (0.002)	0.026*** (0.002)	0.051*** (0.002)
$\ln \text{Import Share}_{ipct}$		-0.189*** (0.003)	-0.182*** (0.003)	-0.149*** (0.005)
$\ln \text{Import Share}_{ipct} \times \ln \text{France World Share}$				-0.446*** (0.038)
FIXED EFFECTS:	Product \times Country \times Time; Firm \times Time			
IMPACT OF A 1SD INCREASE IN TENURE (FROM MEAN)	-0.03		-0.02	
IMPACT OF A 1SD INCREASE IN IMPORT SHARE (FROM MEAN)	-.19			-0.15
OBSERVATIONS	3,394,913	3,394,913	3,394,913	3,394,913
IDENTIFIED FE	1574556	1574556	1574556	936642
OF WHICH SINGLETONS	880690	880690	880690	242776

Notes: Regressions at the product \times country level, products (i.e. product-country) imported by at least 2 firms. Robust standard errors in parentheses with ***, ** and * respectively denoting significance at the 1%, 5% and 10% levels. All regressions include a control for the number of French importers of the given product-country variety. The sets of fixed effects that are inserted in each specification are indicated in each column. The R^2 ranges from 0.76 to 0.89 in all specifications

TABLE AVIII. AGGREGATE COST OF BUYER POWER, DETAILS

SECTOR	PARAMETERS		MOMENTS		η_s SODERBERY (2018)		η_s IMPLIED		
	θ_s	β_s	ρ_s	$\mathbb{E} \log \psi_s^x$	$\text{var} \log \psi_s^x$	(1)		(2)	(3)
15 Food and Beverages	0.15	0.14	0.75	0.16	0.54	0.46	0.81	0.79	2.19
17 Textiles	0.03	0.22	0.68	0.25	0.46	0.74	1.05	1.14	3.78
18 Wearing Apparel	0.01	0.25	0.62	0.33	0.44	1.14	1.19	1.17	3.16
19 Leather Products	0.01	0.25	0.71	0.20	0.44	1.06	1.32	1.69	2.97
20 Products of Wood	0.02	0.16	0.73	0.22	0.60	0.72	1.37	1.29	4.32
21 Pulp and Paper Products	0.05	0.16	0.72	0.19	0.47	0.70	1.17	0.86	2.77
22 Printing and Publishing	0.05	0.15	0.54	0.26	0.43	0.83	1.17	1.48	3.96
24 Chemical Products	0.14	0.17	0.66	0.13	0.42	1.03	1.86	2.62	1.66
25 Rubber Products	0.08	0.16	0.68	0.20	0.51	0.84	0.93	1.13	4.03
26 Non-metallic minerals	0.04	0.13	0.69	0.18	0.47	0.73	1.25	1.15	2.85
27 Basic Metals	0.05	0.21	0.71	0.12	0.43	0.59	0.88	1.02	1.49
28 Fabricated Metal Products	0.10	0.14	0.62	0.22	0.53	0.85	1.20	1.20	3.52
29 Machinery and Equipment	0.10	0.16	0.65	0.21	0.51	1.30	2.52	3.16	3.96
31 Electrical Machinery	0.05	0.17	0.69	0.14	0.48	1.15	1.22	1.30	4.19
32 Radio and Communication	0.02	0.16	0.67	0.22	0.41	1.83	2.81	3.14	4.03
33 Medical Instruments	0.03	0.17	0.63	0.27	0.45	0.84	0.92	1.06	5.54
34 Motor Vehicles, Trailers	0.05	0.18	0.73	0.16	0.43	0.95	1.00	1.01	3.80
35 Other Equipment	0.02	0.19	0.65	0.12	0.49	1.05	1.91	1.15	1.86
Weighted average		0.16	0.68	0.18	0.48	0.88	1.36	1.55	3.1
CHANGES IN AGGREGATE VARIABLES									
					$\Delta\%TFP$	-1.7	-1	-.84	-4.7
					$\Delta\%Q$	-1.3	-1.1	-1	-1.8

Notes: The table reports estimates of main moments and parameters necessary to compute TFP and \hat{Q} from equations (52)-(53), together with the main results. The sector shares ζ_s are directly observed in the balance sheet data. The β_s are the Cobb-Douglas β s and ρ are estimated as in Section 3. The ρ_s are calculated as $\rho_s = (\mu_s)^{-1}$, where μ_s is the average markup in sector $s = 1, \dots, S$, computed as sales over total costs. The η_s are taken from Soderbery (2018), and computed as a median over manufacturing products (1), as the simple mean (2), or as the weighted average, with weights given by the share of the product in total French imports (3). The values of η in (4) are instead inferred from the observed buyer power and the observed shares of France in total world import of a given HS4 product, using the formula $\bar{\psi} = 1 + \eta \bar{s}$. Finally, the $\mathbb{E} \log \psi$ and $\text{var} \log \psi$ are computed from the estimated $\mathbb{E} \tilde{\psi}$ and $\text{var} \tilde{\psi}$ using the properties of the log normal distribution.

B Appendix

B.1 Models of Imperfect Competition in the Input Markets

In this section, I consider two particular models of price discrimination in the input markets, and discuss their implications for the input efficiency wage ψ_{it}^x . I first consider a model of second degree price discrimination with quantity discounts, and then a model with two-part pricing. The choice of these particular models is based on their saliency in the literature of international trade and industrial organization.

B.1.1 A Model with Quantity Discounts

Let us consider the following price (cost) schedule for the firm demand of input j . For orders less than 500 units, the supplier charges a price W_{it}^j equal to a_1 per unit, for orders of 500 or more but fewer than 1000 units, it charges a_2 per unit, and for orders of 1000 or more, it charges a_3 per unit, with $a_1 > a_2 > a_3$. The discount schedule is applied to all units purchased, so that there is a unique price per order. The unit cost function can thus be described as:

$$W(V_{it}^j) = \begin{cases} a_1 & \text{for } 0 < V_{it}^j < 500 \\ a_2 & \text{for } 500 < V_{it}^j < 1000 \\ a_3 & \text{for } V_{it}^j \geq 1000 \end{cases}.$$

Note that the function $W(\cdot)$ can be rewritten as:

$$W(V_{it}^j) = a(V_{it}^j)V_{it}^j,$$

where $a(V_{it}^j) = a_1 1(V_{it}^j \in [0, 500)) + a_2 1(V_{it}^j \in [500, 1000)) + a_3 1(V_{it}^j \in [1000, \infty))$. In

the limit case where the function $a(\cdot)$ is continuous, we have $a' < 0$, and $\epsilon_{it}^j \equiv \underbrace{\frac{\partial W_{it}^j}{\partial V_{it}^j}}_{-} \underbrace{\frac{V_{it}^j}{W_{it}^j}}_{+} < 0$, which

would imply $\psi_{it}^j \equiv 1 + \epsilon_{it}^j < 1$.

B.1.2 Non-linear pricing - Two-part Tariff

Let us now consider the case where the firm has to pay a “fee” to buy imports (such as an import license for entry), after which it can buy intermediates at a fixed unit cost a . The total price of V_{it}^j units of the inputs is

$$C(V_{it}^j) \equiv W(V_{it}^j)V_{it}^j = F + aV_{it}^j$$

If the firm takes the fee into account (the fee is not sunk from the firm’s point of view), then

$$W(V_{it}^j) = \frac{F + aV_{it}^j}{V_{it}^j},$$

which implies that $\frac{\partial W_{it}^j}{\partial V_{it}^j} = -\frac{F}{V_{it}^{j2}} < 0$, and therefore $\psi_{it}^j \leq 1$. Otherwise, if fee is considered a sunk cost, $W(V_{it}^j) = a$ and the firm behaves as a price taker in the input market, such that $\psi_{it}^j = 1$.

B.2 A Formal Model of Input Price Variation

This appendix provides a description of an economic model that rationalizes the use of a flexible polynomial in output prices, market shares in final good markets, and market shares in domestic material markets to control for input prices. The model combines insights from the literature on input prices and quality variation (e.g. Verhoogen, 2008; De Loecker et al., 2016), and from models of imperfect competition in input markets, as the one in section 2.

B.2.1 Production Function for Output Quality

I start from a benchmark case of perfect competition in input markets. This is the case considered in De Loecker et al. (2016), which I summarize in this paragraph. Let ν denote the quality of the firm output, and ι_v denote the individual quality levels of each input V . It is assumed that the production function for output quality belongs to the class of “O-Ring” production functions discussed in Kremer (1993) and Verhoogen (2008), and can be summarized as:

$$\nu = g(\iota_1, \dots, \iota_V; \omega),$$

with $\frac{\partial \nu}{\partial \iota_i \partial \iota_j} > 0$ for any $i \neq j$, $i, j = 1, \dots, V$ namely, such that it features complementarity in the quality of inputs. This feature of the production function implies that higher output quality requires high quality of all inputs. The production function for quality can vary across industries, but it is assumed that all firms producing in the same industry face the same quality production function. In addition to the production function for quality, it is assumed that higher quality inputs are associated with higher input prices. Let W_I^v denote the sectoral average of the price of input V (e.g., sectoral wage) and $W^v(\iota_v)$ the price of a specific quality ι of input V . Then,

$$W^v(\iota_v) - W_I^v = z_v \iota_v, \text{ with } z_v > 0.$$

Therefore, in a framework that postulates perfectly competitive input markets and input complementarity in the production of quality, input markets are characterized by vertical differentiation only, such that all firms pay the same input prices conditional on input quality.

De Loecker et al. (2016) show that one can express output quality as a function of output prices and market shares in final output markets, as well as exogenous variables:

$$\nu = g_v(p, ms, G).$$

Using a standard firm maximization problem, they also show that in this class of models, input quality is an increasing function of output quality for every input, such that *input* quality can be expressed as:

$$\iota_v = W_v(p, ms, G). \quad (43)$$

Equation (43) implies that when input markets are competitive, one can use a polynomial in output prices, market shares in final good markets, and exogenous observable variables to control for differences in prices among firms, and thus to control for input price bias. The function in (43) will be, in general, input-specific, as the indexation by v indicates.

B.2.2 Quality, and Imperfect Competition

I now consider an extension of the previous model that account for imperfect competition in input markets. For expositional purposes, in what follows I am going to focus on the material input market.

Let us suppose that when buying inputs of a given quality, firms compete under imperfect competition. I showed in section 2 that in a large class of models, a measure of input market power can be written as a function of the firm input market share and the input supply elasticity, which I denote as η_m and assume common across firms. It follows that the unit price of the input M with quality level ι_m is given by i.e.

$$W_i^m(\iota_m, s_i^m) = f(W^m(\iota_m), s_i^m),$$

where $W^m(\iota_m)$ is the price that the firm would pay under perfect competition, which depends on the input quality, and s_i^m is the market share of firm i in market M . When the supply elasticity is constant across firms within an industry, the input market share s_i^m summarizes the (differences in) firms input market power.

It is important to notice that the function f is such that $\frac{\partial f}{\partial s_i^m} < 0$, i.e. firms with higher market share have more buyer power and pay a lower unit price. This means that if $W^m(\iota_m)$ denotes the average price of an input of quality ι_m , we should have

$$W_i^m(\iota_m, s_i^m) - W^m(\iota_m) = \tilde{a}_m s_i^m, \text{ with } \tilde{a}_m < 0. \quad (44)$$

Note that by simple manipulations of equation (44), one can write:

$$\begin{aligned} W_i^m(\iota_m, s_i^m) - W_I &= (W_i^m(\iota_m, s_i^m) - W_i^m(\iota_m)) + (W_i^m(\iota_m) - W_I) \\ &= z_m W_m(p_{it}, ms_{it}, G_i) + \tilde{a}_m s_i^m \end{aligned} \quad (45)$$

$$= B(p_{it}, ms_{it}, G_i, s_i^m). \quad (46)$$

This means that in a model with imperfect competition and quality differences, the unobserved price deviation from the industry average can be written as a function of *both* the buyer share of the firm, and the input quality, which we showed in the previous paragraph being a function of observable output prices and the firm market share as a seller.

One important challenge at this point is that the buyer share of firms in the domestic market is not directly observed, as we do not know who are the firm's direct competitors. To make progress, I define a market as an industry (narrowly defined)-region-year triple, and then measure the share s_{it}^m as the firm's share of total material expenditure in such narrowly defined market (denoted as `mat_shit`). It follows that we can now write the domestic input prices as:

$$W^m(\iota_{it}, s_{it}^m) - W_{It} = B(p_{it}, ms_{it}, G_i, \text{mat_sh}_{it}).$$

B.3 Production Function Estimation

B.3.1 Simultaneity bias

Let us consider a setting where heterogeneous firms produce output using two variable inputs: domestic intermediates m_i , and foreign intermediates x_i . The market for domestic material is competitive, such that firms take price w_i^m as given. The price w_i^m is allowed to vary by firms due to quality differences across firms. The market for x_i is not perfectly competitive, and I let ψ_i denote the degree of firms buyer power in the market for foreign intermediates. This environment is similar to the one I consider for the theoretical model in section 4, and the reader should refer to that section for the derivation of the main equations. In particular, it can be shown that the demand for the two productive inputs (conditional on state variables) is given by

$$x_i = f(\omega_i, \psi_i, w_i^x, w_i^m | \varsigma_i) \quad (47)$$

$$m_i = g(\omega_i, \psi_i, w_i^x, w_i^m | \varsigma_i), \quad (48)$$

where ω_i is unobserved firm productivity, w_i^v with $v = x, m$ are the variable input prices, and ς is the vector of state variables. Since the competitive input m_i is monotonically decreasing in ψ_i , the second expression can be inverted to write:

$$\psi_i = \tilde{g}(\omega_i, w_i^x, w_i^m, m_i). \quad (49)$$

We can now write $m_i = \tilde{m}_i - (w_i^m - \bar{w}^m)$, where \bar{w}^m is the material deflator in the relevant industry, and we can further write, as argued in the main text, $(w_i^m - \bar{w}^m) = w(p_i, G_i)$, given the assumption that the domestic market is perfectly competitive. Putting all pieces together, the demand for intermediate can be written as:

$$x_i = x(\omega_i, \tilde{m}_i, w_i^x, p_i, G_i | \zeta_i), \quad (50)$$

such that productivity ω_i is the only unobserved *scalar* entering the input demand. Since imported input demand is monotonically increasing in firm TFP, we can invert (50) to get

$$\omega_i = h(x_i, \tilde{m}_i, w_i^x, p_i, G_i | \zeta_i). \quad (51)$$

In order to account for model mis-specification, and other unobservables, I generalize the previous expression (in terms of observables) as:

$$\omega_{it} = h_t(\tilde{k}_{it}, l_{it}, \tilde{m}_{it}, x_{it}, \hat{w}_{it}^x, \hat{p}_{it}, \hat{m}\hat{s}_{it}, G_i, \Phi_{it}). \quad (52)$$

I substitute equation (52) in (12) to control for firm's productivity.

B.3.2 Estimation

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

$$\begin{aligned} q_{it} = & \beta_l l_{it} + \beta_k \tilde{k}_{it} + \beta_m \tilde{m}_{it} + \beta_x x_{it} + \hat{p}_{it} + \tilde{B}(\hat{p}_{it}, \hat{m}\hat{s}_{it}, \mathbf{G}_i; \beta) \\ & + h_t(\tilde{k}_{it}, l_{it}, \tilde{m}_{it}, x_{it}, \hat{w}_{it}^x, \hat{p}_{it}, \hat{m}\hat{s}_{it}, G_i, \Phi_{it}) + \epsilon_{it}, \end{aligned} \quad (53)$$

which corresponds to equation (19) in the text. To estimate (53), I follow the 2-steps GMM procedure in [Akerberg 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 third order polynomial of $(l_{it}, \tilde{k}_{it}, \tilde{m}_{it}, x_{it}, p_{it}, w_{it}^X, G_i)$:

$$q_{it} = \phi_t(l_{it}, \tilde{k}_{it}, \tilde{m}_{it}, \tilde{x}_{it}, \hat{w}_{it}^x, \hat{p}_{it}, \hat{m}\hat{s}_{it}, G_i, \Phi_{it}) + \epsilon_{it}. \quad (54)$$

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:

$$\omega_{it} = g(\omega_{it-1}) + \xi_{it}, \quad (55)$$

where I approximate $g(\cdot)$ as a second order polynomial in all its arguments. Using (53) and (54) we can express ω_{it} as

$$\omega_{it}(\beta) = \hat{\phi}_{it} - \left(\beta_l l_{it} + \beta_k \tilde{k}_{it} + \beta_m \tilde{m}_{it} + \beta_x x_{it} - \tilde{B}(\hat{p}_{it}, \hat{m}_{it}, \mathbf{G}_i; \rho) \right). \quad (56)$$

We can now substitute (56) in (55) 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:

$$\mathbb{E} \left(\begin{matrix} \xi_{it}(\beta) \\ \mathbf{Y}_{it} \end{matrix} \right) = 0, \quad (57)$$

where \mathbf{Y}_{it} contain lagged domestic and foreign materials, current capital and labor, lagged output prices, market shares, and their higher order and interaction terms. The identifying restrictions are that the TFP innovations are not correlated with current 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); Akerberg et al. (2015)). I run the GMM procedure on a sample of firms that simultaneously import and export for two consecutive years. In particular, I follow the procedure suggested in Wooldridge (2009) that forms moments on the joint error term $(\xi_{it} + \epsilon_{it})$.

B.4 Data Appendix

B.4.1 Variable Construction

To estimate the production function, we need firm-level output, labor, capital, and materials. Output is measured as total firm sales in a given year, deflated by the firm-level price deflator I define in section 2.2.1. The industry-level output price deflator is taken from the STAN industry dataset. 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 define total intermediate inputs as the total expenditure in raw materials by an enterprise in the process of manufacturing or transformation into product reported on the fiscal files. I construct the *foreign* intermediate input using information on all firm imports of intermediate inputs. First, I drop observations on the import of HS8 digit products which are both imported and exported by the firm in a given year (about 20% of the observations). Then, I drop those import products classified as “final goods” by the Broad Economic Classification (BEC). I finally construct total expenditures on intermediates as the sum of the imports at the firm year level of all residual products. Results are robust to using different definitions of the foreign intermediate input, including restricting the attention to those goods that the BEC classification classifies as intermediates.³⁵ To measure the expenditure on domestic inputs,

³⁵I choose not to use this definition in the baseline estimation due to the the large number of hs8 products which are not classified neither as intermediates, nor as final good.

I subtract the total value of imports of intermediates from the total expenditure on intermediate inputs. Capital is measured by gross fixed assets, which includes movable and immovable assets. As this value is reported at the historical value, I infer a date of purchase from the installment quota given a proxy lifetime duration of Equipment (20 years) to obtain the current value of capital stock.³⁶ Results are robust to using an alternative measure of capital, which I construct 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 it might vary by sector, from [Olley and Pakes \(1996\)](#).

All these variables are deflated by two-digit STAN input price indexes. For the foreign intermediate input, I construct a firm-level price deflator as described in section 2.2.1, where I take the 2-digit import price deflator from INSEE data.

B.4.2 Classification of Industries

I consider 18 manufacturing industries, based on the NACE Rev.1 industry classification, which is similar to the ISIC Rev. 3 industry classification in the US. I classify a firm as “manufacturing” if its main reported activity belongs to the NACE industry classes 15 to 35. Manufacturing firms account for 19% of the population of French importing firms and 36% of total import value (average across the years in the sample). 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. Table A1 presents the industry classification and the number of firms and observations for each industry $s \in \{1, \dots, 17\}$.

³⁶I thank Claire Lelarge for this suggestion

TABLE A.VIII 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 Equipment	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.

B.5 Market Power in Input Markets when Production Function is Translog

Table A9 shows the results of production function estimation using a Translog specification for the production function.³⁷ Figure A1 plots, for each of the four inputs, the estimated Cobb-Douglas (CD) coefficients against the median estimated Translog (TL) coefficients at the 2-digit industry level. While the coefficients of capital, labor and domestic materials are overall similar across specifications, the one on the foreign intermediate input is, to a great extent, bigger in the Translog case as compared to the Cobb-Douglas case. This is due to the large positive skewness of the import distribution, which is likely to affect the estimates of the TL elasticities.³⁸ On the contrary, the CD elasticities are less affected by the existence of important outliers, which means that they are more reliable in the current context. This explains the focus on the CD specification for my baseline procedure.

³⁷Note that in order to obtain the translog elasticities, I duly adjust the procedure to account for interactions of inputs and prices in the relevant control functions.

³⁸I write the Translog production function as a second order polynomial in the four inputs, i.e. $q_{it} = \beta_k k_{it} + \beta_l l_{it} + \beta_m m_{it} + \beta_x x_{it} + \beta_{kk} k_{it}^2 + \beta_{ll} l_{it}^2 + \beta_{mm} m_{it}^2 + \beta_{xx} x_{it}^2 + \beta_{kl} k_{it} l_{it} + \beta_{km} k_{it} m_{it} + \beta_{kx} k_{it} x_{it} + \beta_{lm} m_{it} l_{it} + \beta_{lx} l_{it} x_{it} + \beta_{mx} m_{it} x_{it} + \beta_{klm} k_{it} l_{it} m_{it} + \beta_{klx} k_{it} l_{it} x_{it} + \beta_{kmx} k_{it} l_{it} x_{it} + \beta_{lmx} l_{it} m_{it} x_{it} + \beta_{klmx} k_{it} l_{it} m_{it} x_{it}$. In the case of the foreign input, the output elasticity is thus defined as:

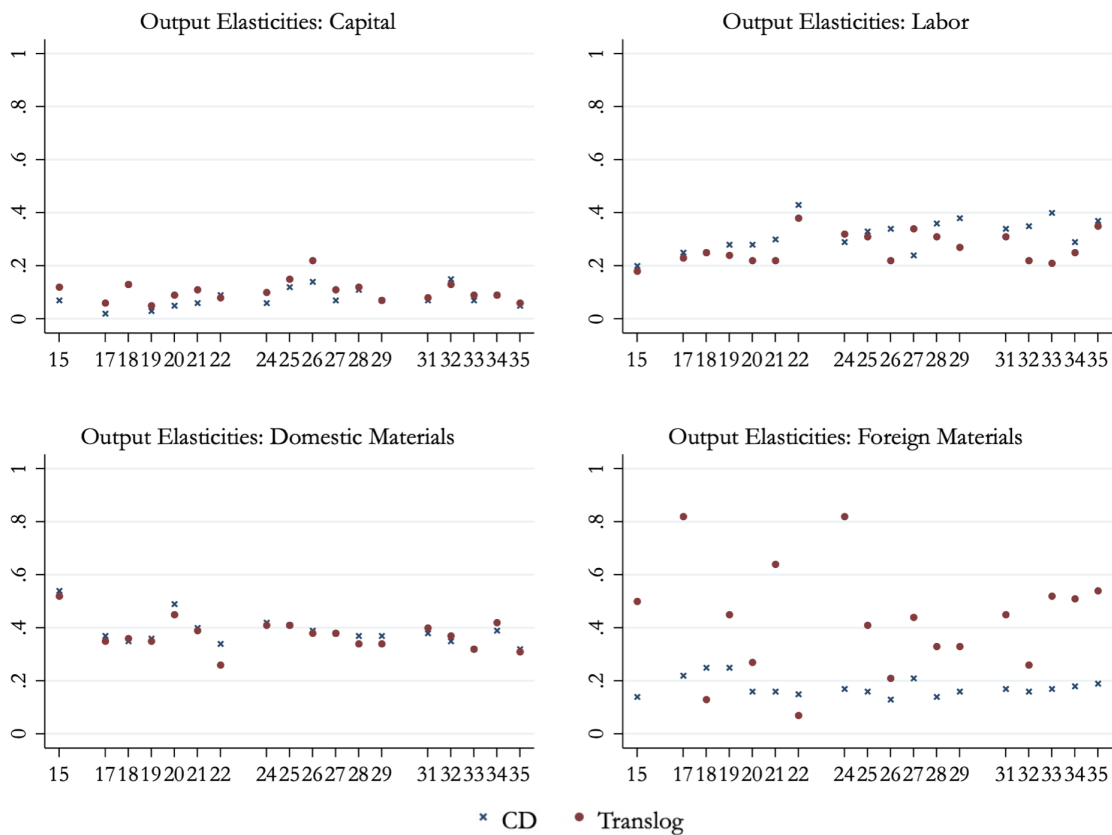
$$\begin{aligned} \theta_{it}^x &= \beta_x + 2\beta_{xx} x_{it} + \beta_{kx} k_{it} + \beta_{lx} l_{it} + \beta_{mx} m_{it} + \\ &= \beta_{klx} k_{it} l_{it} + \beta_{kmx} k_{it} m_{it} + \beta_{lmx} l_{it} m_{it} + \beta_{klmx} k_{it} l_{it} m_{it} \end{aligned}$$

TABLE AIX. MEDIAN OUTPUT ELASTICITIES, TRANSLOG, BY SECTOR

	INDUSTRY	β_K	β_L	β_M	β_X	RETURN TO SCALE
15	Food Products and Beverages	0.12 (0.07)	0.18 (0.08)	0.52 (0.16)	0.50 (0.13)	0.98
17	Textiles	0.06 (0.08)	0.23 (0.15)	0.35 (0.16)	0.82 (0.24)	0.86
18	Wearing Apparel, Dressing	0.13 (0.07)	0.25 (0.13)	0.36 (0.19)	0.13 (0.18)	1.00
19	Leather, and Products	0.05 (0.04)	0.24 (0.13)	0.35 (0.12)	0.45 (0.18)	0.85
20	Wood, and Products	0.09 (0.04)	0.22 (0.12)	0.45 (0.15)	0.27 (0.10)	0.98
21	Pulp, Paper, & Products	0.11 (0.08)	0.22 (0.09)	0.39 (0.13)	0.64 (0.18)	0.92
22	Printing and Publishing	0.08 (0.05)	0.38 (0.24)	0.26 (0.19)	0.07 (0.16)	1.11
24	Chemicals, and Products	0.10 (0.10)	0.32 (0.15)	0.41 (0.18)	0.82 (0.17)	1.14
25	Rubber, Plastics, & Products	0.15 (0.07)	0.31 (0.09)	0.41 (0.15)	0.41 (0.12)	1.16
26	Non-metallic mineral Products	0.22 (0.11)	0.22 (0.15)	0.38 (0.17)	0.21 (0.10)	1.03
27	Basic Metals	0.11 (0.07)	0.34 (0.15)	0.38 (0.17)	0.44 (0.13)	1.13
28	Fabricated Metal Products	0.12 (0.06)	0.31 (0.16)	0.34 (0.14)	0.33 (0.10)	1.07
29	Machinery and Equipment	0.07 (0.04)	0.27 (0.19)	0.34 (0.17)	0.33 (0.11)	0.93
31	Electrical machinery & App.	0.08 (0.03)	0.31 (0.12)	0.40 (0.14)	0.45 (0.21)	1.07
32	Radio and Communication	0.13 (0.05)	0.22 (0.12)	0.37 (0.21)	0.26 (0.16)	0.93
33	Medical, Precision, Optical Instr.	0.09 (0.04)	0.21 (0.15)	0.32 (0.15)	0.52 (0.19)	0.83
34	Motor Vehicles, Trailers	0.09 (0.06)	0.25 (0.18)	0.42 (0.17)	0.51 (0.17)	1.00
35	Other Transport Equipment	0.06 (0.05)	0.35 (0.25)	0.31 (0.17)	0.54 (0.21)	1.06

Notes: The table reports the output elasticities when the production function is translog. Standard deviations (not standard errors) are in parentheses. Cols 2–4 report the median estimated output elasticity with respect to each factor of production. Col. 5 reports the median returns to scale.

FIGURE A1. OUTPUT ELASTICITIES, COBB-DOUGLAS VS TRANSLOG



Notes: The figure plots the estimated Cobb-Douglas industry elasticities against the median industry Translog elasticity for each of the four inputs in production. Confidence intervals are quite narrow around the point and median estimates, and they are thus omitted. Values in the x-axis represent the 2-digit ISIC industry, according to the Rev. 3 classification. See Data Appendix for further details on the classification.

References

- ACKERBERG, D. A., K. CAVES, AND G. FRAZER (2015): “Identification properties of recent production function estimators,” *Econometrica*, 83, 2411–2451.
- ADHVARYU, A., V. BASSI, A. NYSHADHAM, AND J. TAMAYO (2019): “No Line Left Behind: Assortative Matching Inside the Firm,” *Available at SSRN 3462873*.
- AKCIGIT, U. AND S. T. ATEŞ (2019): “What Happened to US Business Dynamism?” Tech. rep., National Bureau of Economic Research.
- ALESSANDRIA, G., J. P. KABOSKI, AND V. MIDRIGAN (2010): “Inventories, lumpy trade, and large devaluations,” *American Economic Review*, 100, 2304–39.
- (2013): “Trade wedges, inventories, and international business cycles,” *Journal of Monetary Economics*, 60, 1–20.
- AMITI, M. AND J. KONINGS (2007): “Trade liberalization, intermediate inputs, and productivity: evidence from Indonesia,” *The American Economic Review*, 97, 1611–1638.
- AMITI, M., S. J. REDDING, D. E. WEINSTEIN, ET AL. (2019): “The Impact of the 2018 Tariffs on Prices and Welfare,” *Journal of Economic Perspectives*, 33, 187–210.
- ANTRÀS, P., T. C. FORT, AND F. TINTELOT (2017): “The Margins of Global Sourcing: Theory and Evidence from U.S. Firms,” *The American Economic Review*, 107.
- ARKOLAKIS, C., A. COSTINOT, D. DONALDSON, AND A. RODRÍGUEZ-CLARE (2018): “The elusive pro-competitive effects of trade,” *The Review of Economic Studies*, 86, 46–80.
- ASKER, J., A. COLLARD-WEXLER, AND J. DE LOECKER (2018): “Market Power, Production (Mis) Allocation, and OPEC,” *The American Economic Review*.
- BASTOS, P., J. SILVA, AND E. VERHOOGEN (2018): “Export destinations and input prices,” *The American Economic Review*, 108, 353–92.
- BERNARD, A. B. AND S. DHINGRA (2019): “Importers, Exporters and the Division of the Gains from Trade,” .
- BERNARD, A. B., T. C. FORT, V. SMEETS, AND F. WARZYNSKI (2018a): “Heterogeneous globalization: Offshoring and reorganization,” Tech. rep.
- BERNARD, A. B. AND J. B. JENSEN (1999): “Exceptional exporter performance: cause, effect, or both?” *Journal of international economics*, 47, 1–25.
- BERNARD, A. B., J. B. JENSEN, S. J. REDDING, AND P. K. SCHOTT (2007): “Firms in international trade,” *The Journal of Economic Perspectives*, 21, 105–130.

- BERNARD, A. B., J. B. JENSEN, AND P. K. SCHOTT (2009): “Importers, exporters and multi-nationals: a portrait of firms in the US that trade goods,” in *Producer dynamics: New evidence from micro data*, University of Chicago Press, 513–552.
- BERNARD, A. B., A. MOXNES, AND K. H. ULLTVEIT-MOE (2018b): “Two-sided heterogeneity and trade,” *Review of Economics and Statistics*, 100, 424–439.
- BLAUM, J., C. LELARGE, AND M. PETERS (2018): “The Gains from Input Trade in Firm-Based Models of Importing,” *American Economic Journal: Macroeconomics*.
- (2019): “Firm size, quality bias and import demand,” *Journal of International Economics*, 120, 59–83.
- BRODA, C., N. LIMA, AND D. E. WEINSTEIN (2008): “Optimal tariffs and market power: the evidence,” *American Economic Review*, 98, 2032–65.
- CAJAL-GROSSI, J., R. MACCHIAVELLO, AND G. NOGUERA (2019): “International Buyers’ Sourcing and Suppliers’ Markups in Bangladeshi Garments,” .
- CAVALLO, A., G. GOPINATH, B. NEIMAN, AND J. TANG (2019): “Tariff Passthrough at the Border and at the Store: Evidence from US Trade Policy,” .
- CHEN, N., J. IMBS, AND A. SCOTT (2009): “The Dynamics of Trade and Competition,” *Journal of International Economics*, 77, 50–62.
- DAS, S., M. J. ROBERTS, AND J. R. TYBOUT (2007): “Market Entry Costs, Producer Heterogeneity, and Export Dynamics,” *Econometrica*, 75, 837–873.
- DE LOECKER, J. (2011): “Product Differentiation, Multiproduct Firms, and Estimating the Impact of Trade Liberalization on Productivity,” *Econometrica*, 79, 1407–1451.
- DE LOECKER, J., J. ECKHOUT, AND G. UNGER (2019): “The Rise of Market Power and the Macroeconomic Implications,” .
- DE LOECKER, J. AND P. K. GOLDBERG (2014): “Firm performance in a global market,” *Annu. Rev. Econ.*, 6, 201–227.
- DE LOECKER, J., P. K. GOLDBERG, A. K. KHANDELWAL, AND N. PAVCNİK (2016): “Prices, markups, and trade reform,” *Econometrica*, 84, 445–510.
- DE LOECKER, J. AND F. WARZYŃSKI (2012): “Markups and firm-level export status,” *The American Economic Review*, 102, 2437–2471.
- DHINGRA, S. AND J. MORROW (2019): “Monopolistic competition and optimum product diversity under firm heterogeneity,” *Journal of Political Economy*, 127, 196–232.

- DOBBELAERE, S. AND K. KIYOTA (2018): “Labor market imperfections, markups and productivity in multinationals and exporters,” *Labour Economics*, 53, 198–212.
- DOBBELAERE, S. AND J. MAIRESSE (2013): “Panel data estimates of the production function and product and labor market imperfections,” *Journal of Applied Econometrics*, 28, 1–46.
- EDMOND, C., V. MIDRIGAN, AND D. Y. XU (2015): “Competition, markups, and the gains from international trade,” *The American Economic Review*, 105, 3183–3221.
- EGGERTSSON, G. B., J. A. ROBBINS, AND E. G. WOLD (2018): “Kaldor and Piketty’s facts: the rise of monopoly power in the United States,” Tech. rep., National Bureau of Economic Research.
- EPIFANI, P. AND G. GANCIA (2011): “Trade, markup heterogeneity and misallocations,” *Journal of International Economics*, 83, 1–13.
- FAJGELBAUM, P. D., P. K. GOLDBERG, P. J. KENNEDY, AND A. K. KHANDELWAL (2019): “The return to protectionism,” *Quarterly Journal of Economics*.
- FLAAEN, A. B., A. HORTAÇSU, AND F. TINTELNOT (2019): “The Production Relocation and Price Effects of US Trade Policy: The Case of Washing Machines,” Tech. rep., National Bureau of Economic Research.
- FORT, T. C. (2017): “Technology and production fragmentation: Domestic versus foreign sourcing,” *The Review of Economic Studies*, 84, 650–687.
- FREUND, C. AND M. D. PIEROLA (2015): “Export Superstars,” *Review of Economics and Statistics*, 97, 1023–1032.
- GAUBERT, C. AND O. ITSKHOKI (2019): “Granular comparative advantage,” Tech. rep., National Bureau of Economic Research.
- GOLDBERG, P., A. KHANDELWAL, N. PAVCNİK, AND P. TOPALOVA (2009): “Trade Liberalization and New Imported Inputs,” *The American Economic Review, Papers and Proceedings*, 99, 494–500.
- GOLDBERG, P. K., A. K. KHANDELWAL, N. PAVCNİK, AND P. TOPALOVA (2010): “Imported intermediate inputs and domestic product growth: Evidence from India,” *The Quarterly Journal of Economics*, 125, 1727–1767.
- GOPINATH, G. AND B. NEIMAN (2014): “Trade Adjustment and Productivity in Large Crises,” *The American Economic Review*, 104, 793–831.
- HALL, R. E. (1986): “Market Structure and Macroeconomic Fluctuations,” *Brookings papers on Economic activity*, 1986, 285–338.
- (1988): “The relation between price and marginal cost in US industry,” *Journal of Political Economy*, 96, 921–947.

- HALPERN, L., M. KOREN, AND A. SZEIDL (2015): “Imported inputs and productivity,” *The American Economic Review*, 105, 3660–3703.
- HARRISON, A. E. (1994): “Productivity, Imperfect Competition and Trade Reform. Theory and Evidence,” *Journal of International Economics*, 36, 53–73.
- HELPMAN, E. AND P. R. KRUGMAN (1989): *Trade Policy and Market Structure*, Cambridge, Massachusetts: MIT Press.
- HOLMES, T. J., W.-T. HSU, AND S. LEE (2014): “Allocative efficiency, mark-ups, and the welfare gains from trade,” *Journal of International Economics*, 94, 195–206.
- HOUSEMAN, S., C. KURZ, P. LENGERMANN, AND B. MANDEL (2011): “Offshoring bias in US manufacturing,” *Journal of Economic Perspectives*, 25, 111–32.
- HSIEH, C.-T. AND P. J. KLENOW (2009): “Misallocation and manufacturing TFP in China and India,” *The Quarterly Journal of Economics*, 124, 1403–1448.
- JARAVEL, X. AND E. SAGER (2019): “What are the price effects of trade? Evidence from the US and implications for quantitative trade models,” .
- KATAYAMA, H., S. LU, AND J. R. TYBOUT (2009): “Firm-level productivity studies: illusions and a solution,” *International Journal of Industrial Organization*, 27, 403–413.
- KIKKAWA, K., G. MAGERMAN, AND E. DHYNE (2019): “Imperfect Competition in Firm-to-Firm Trade,” *mimeo*.
- KUGLER, M. AND E. VERHOOGEN (2012): “Prices, Plant Size, and Product Quality,” *The Review of Economic Studies*, 79, 307–339.
- LEVINSOHN, J. AND A. PETRIN (2003): “Estimating production functions using inputs to control for unobservables,” *The Review of Economic Studies*, 70, 317–341.
- MACCHIAVELLO, R. AND A. MORJARIA (2015): “The value of relationships: evidence from a supply shock to Kenyan rose exports,” *American Economic Review*, 105, 2911–45.
- MUENDLER, M.-A. (2004): “Trade, technology and productivity: a study of brazilian manufacturers 1986-1998,” .
- NESTA, L., S. SCHIAVO, ET AL. (2018): “International competition and rent sharing in French manufacturing,” Tech. rep., Observatoire Francais des Conjonctures Economiques (OFCE).
- OLLEY, G. S. AND A. PAKES (1996): “The Dynamics of Productivity in the Telecommunications Equipment Industry,” *Econometrica*, 64, 1263–1297.
- PETERS, M. (2016): “Heterogeneous mark-ups, growth and endogenous misallocation,” *unpublished manuscript, Yale University*.

- PIGOU, A. C. (1932): “The Economics of Welfare, 1920,” *McMillan&Co., London*.
- RAFF, H. AND N. SCHMITT (2009): “Buyer power in international markets,” *Journal of International Economics*, 79, 222–229.
- RAVAL, D. (2019): “Testing the Production Approach to Markup Estimation,” *Available at SSRN 3324849*.
- ROBERTS, M. J. AND J. R. TYBOUT (1997): “The Decision to Export in Colombia: An Empirical Model of Entry with Sunk Costs,” *The American Economic Review*, 87, 545–564.
- SODERBERY, A. (2018): “Trade elasticities, heterogeneity, and optimal tariffs,” *Journal of International Economics*, 114, 44–62.
- SYVERSON, C. (2004): “Market structure and productivity: A concrete example,” *Journal of Political Economy*, 112, 1181–1222.
- (2019): “Macroeconomics and Market Power: Facts, Potential Explanations and Open Questions,” .
- TOPALOVA, P. AND A. KHANDELWAL (2011): “Trade liberalization and firm productivity: The case of India,” *Review of economics and statistics*, 93, 995–1009.
- VAN REENEN, J. (2018): “Increasing differences between firms: market power and the macro-economy,” .
- VERHOOGEN, E. (2008): “Trade, Quality Upgrading, and Wage Inequality in the Mexican Manufacturing Sector,” *Quarterly Journal of Economics*, 489–530.
- WOOLDRIDGE, J. M. (2009): “On estimating firm-level production functions using proxy variables to control for unobservables,” *Economics Letters*, 104, 112–114.
- YI, K.-M. (2003): “Can Vertical Specialization Explain the Growth of World Trade?” *Journal of Political Economy*, 111, 52–102.