Productivity, Relationship-Specific Inputs and the Sourcing Modes of Multinational Firms ⋆

Fabrice Defever [a] and Farid Toubal [b]

Abstract

This paper investigates the roles of productivity and the specificity of inputs for the international sourcing strategy of multinational firms. We modify the Antràs and Helpman (2004) model to allow both the productivity and the intensity of specific inputs provided by suppliers to vary across firms. We describe an equilibrium in which firms decide on their type of ownership according to these dimensions. The model is estimated using detailed firm-level data on French multinationals' imports. The dataset has information on multinationals' productivity, their intensity in relationship-specific inputs and their mode of sourcing. The empirical results support the predictions of the model and suggest that multinational firms' productivity and intensity of specific inputs alter the structure of international trade.

Keywords : Productivity, Incomplete Contracts, Intra-firm Trade, Outsourcing.

JEL classification : F23, F14, L22, L23

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[a] *University of Nottingham, School of Economics and Centre for Economic Performance at the London School of Economic. Sir Clive Granger Building, University Park, NG7 2RD, Nottingham. United Kingdom. Email : fabrice.defever@nottingham.ac.uk.*

[b] *University of Angers, Paris School of Economics and CEPII. Centre d'Économie de la Sorbonne, 106-112 Boulevard de l'Hôpital, 75647 Paris. E-mail : toubal@univ-paris1.fr.*

1 Introduction

Globalization has in recent decades been characterized by the increasing importance of multinational firms (MNEs) in investment, employment and foreign trade. One-third of world trade is intra-firm, and another third involves the participation of multinational firms in one of the two sides of the exchange (WTO, 1996). MNEs organize their production on a global scale, importing inputs from their affiliates (intra-firm trade) and/or from independent suppliers (outsourcing). The sourcing strategies of multinational firms have been the subject of considerable research efforts among trade theorists. In a new body of work, modern theories of the firm have been brought into models of international trade. [1]

In this paper, we follow Antràs and Helpman (2004, 2008) and develop a model that analyzes the input sourcing choice of multinational firms (MNE). We use a detailed French firm-level database that provides the geographical breakdown of French multinational firms' imports at product level under different sourcing modes – through independent suppliers and/or through affiliates. We find that the implications of the model are borne out in the data. We show that the intensity of inputs that require relationship-specific investments has a positive effect on the outsourcing decision. We build on the work of the French Statistical Office (INSEE) to propose a novel and direct firm-level measure of the intensity in relationship-specific inputs. We also investigate the productivity sorting predictions of the models of Antràs and Helpman (2004, 2008). We show that they are also supported by the data. As the authors stress, these predictions are sensitive to the ranking of fixed costs. Interestingly, the data

[1] Seminal contributions include McLaren (2000), Antràs (2003, 2005), Antràs and Helpman (2004, 2008) and Grossman and Helpman (2002, 2003, 2005). See Spencer (2005), and Helpman (2006) for detailed surveys of the literature.

reveal the same sensitivity. Whereas recent empirical works have considered both multinational and independent firms, we show that the empirical implications of the models of Antràs and Helpman (2004, 2008) are reversed when considering multinational firms only. This result is of importance as MNEs account for more than two third of the world trade.

The sourcing decision involves a first dimension which relates to the productivity of the firm. According to Antràs and Helpman (2004, 2008) only the most productive firms can have affiliates abroad and import their inputs internally. We propose a slightly modified version of the Antràs and Helpman (2004, 2008) models adapted to firms which are part of an international group. For these firms, the choice of organization may well be different as, by definition, they already have related affiliates located abroad. Since our study focuses on multinational firms only, we build on a framework in which these firms incur no affiliate set-up cost but only a fixed cost of organization specific to their choice of ownership structure. There are good reasons to believe that the cost of organization under outsourcing may be higher than the one associated with intra-firm trade. According to Williamson (1985), vertical integration involves lower fixed costs of organization because it amalgamates the coordination costs of two organizations. The survey conducted by the SESSI [2] shows that French multinational firms perceive outsourcing to be related to higher fixed costs than vertical integration (SESSI survey, 1999). At least 70% of the survey's respondents answer that intra-firm trade involves lower fixed organization costs than outsourcing.

Our empirical findings are consistent with this ranking of fixed organization costs. In particular, we find that the most productive multinational firms are more likely to outsource. This result seems at first to be at odds with other

[2] Service des études et des statistiques industrielles

recent studies using samples that contain information on both multinational and independent firms. Using aggregate data, Yeaple (2006) shows that the U.S. intra-firm ratio to total imports is positively correlated to sectoral productivity dispersion. Using French firm-level data, Corcos et al. (2009) find that intra-firm trade occurs among the group of highly productive firms. A similar result is also found in a sample of Spanish firms by Kohler and Smolka (2009) and in a sample of Italian firms by Stefano (2009). [3] The findings of these papers confirm that multinationals, which are more productive than firms without foreign affiliates, can import within the group. Without contradicting their conclusion, we argue that the impact of the productivity may well be different when considering only multinational firms.

For these firms, the choice between the different sourcing modes should imply a comparison between an already existing affiliate and an independent supplier. For any given country, there may or may not be a foreign related party from which the multinational can import the input. Once we control for the presence of a related party, we still find that the most productive multinational firms outsource.

Along with productivity, there is a second important determinant of the firm's sourcing strategy : the intensity of the production process in relationship-specific inputs. In Antràs (2003) and Antràs and Helpman (2008), a final good producer decides whether to source a specific intermediate input through an independent foreign supplier or to integrate it. Possible cost sharing for specific investments leads to a hold-up problem. As emphasized by Antràs (2003), a firm's organizational choice depends strongly on the share of relationship-

[3] These latter two papers also consider the case of national transactions. Both studies present evidence that most productive firms are more likely to trade with a local affiliate than with local independent supplier. See also Tomiura (2007) who shows that Japanese *multinationals* that outsource internationally are more productive than domestic firms.

specific inputs in the industry that require the engagement of suppliers. In particular, the final-good producer can alleviate the hold-up problem by offering the supplier a larger share of revenue, by using outsourcing, when the industry is intensive in intermediate inputs produced by the supplier. If the share of inputs that are produced by the final-good producer is large enough, then it should keep the residual rights of control and should integrate the supplier.

Measuring the amount of relationship-specific inputs (RSI) in production is very challenging. Using the Rauch (1999) classification, Nunn (2007) and Nunn and Trefler (2008) identify inputs that require relationship-specific investments as those inputs that are neither bought and sold on an exchange nor reference priced. Bernard et al. (2003) approximate the products' contractibility based on the degree of intermediation. These studies show that the intensity in relationship-specific inputs is a very important determinant of the sourcing choice. Following the INSEE, we classify the inputs with respect to their relationship specificity. According to French accounting rules, firms have to report the amount of their inputs that have been produced by suppliers following the firm's requirements and that form part of the firm's final output. This includes inputs bought from both independent suppliers and affiliates purchased nationally and internationally. Hence, we can compute a direct measure of the share of relationship-specific inputs on the total value of total inputs. Our novel variable is different from that used in previous studies because it does not rely on external information to classify the different type of inputs. In addition, it has the great advantage of being specific to the firm. In line with the theoretical prediction of our model, we find that the intensity in RSI increases the likelihood to outsource.

The remainder of this paper is structured as follows. Section 2 provides the

theoretical background and the empirical implications of the model. Section 3 provides a thorough discussion of the data and discusses the empirical strategy. Section 4 proposes some stylized facts that can be constructed from the data. Section 5 contains our core empirical results and provides some robustness checks. Section 6 concludes.

2 Theoretical Background

In this section, we slightly modify the Antràs and Helpman (2004, 2008) model and review its core empirical implications for our firm-level data analysis. We denote by v a vertically integrated firm that sources inputs abroad through its affiliate. We use the subscript o for a firm that sources inputs abroad through an independent supplier. [4] We assume that firms do not pay any fixed cost to set-up an affiliate abroad, as they already have affiliates located abroad. We follow Williamson (1985) and assume throughout this section that the fixed organization costs are higher under outsourcing than under intra-firm trade. We provide a brief discussion of the theoretical predictions when assuming a different ranking of fixed costs.

2.1 Set-up

Consumers are assumed to share Dixit-Stiglitz preferences for differentiated products which generate the inverse demand function $p_j(i) = D_j x_j(i)^{\alpha-1}$ for variety i in sector j. $p_j(i)$ is the price of this variety, $x_j(i)$ is the quantity demanded, D_j is an index of total demand for the output of sector j, and the elasticity of demand is equal to $1/(1-\alpha)$ and is larger than one. All final

[4] Since we consider only the case where the supplier's input is produced abroad, it should be read "vertical integration offshore" and "outsourcing offshore" instead. Offshoring means that the production of the inputs is made in a *foreign country*.

goods are freely traded with zero transport costs, so that D_j measures the world demand for the output of sector j.

Each sector j produces a differentiated good under monopolistic-competition. The production of the final good requires the use of two specialized intermediate inputs, x^h and x^m. x^h is produced locally by headquarters, HQ, with a wage that is normalized to one. x^m is sourced from supplier, M, located in foreign country, l, where the wage is $w^l < 1$. [5] In addition, only a fraction μ_h and μ_m of the activities produced respectively by HQ and M are contractible. As in Antràs and Helpman (2004, 2008), we assume the output of variety i to be Cobb-Douglas :

$$Q_i = \theta \left[\frac{\left(x_c^h\right)^{\mu_h} \left(x_n^h\right)^{1-\mu_h}}{\eta} \right]^{\eta} \left[\frac{(x_c^m)^{\mu_m} (x_n^m)^{1-\mu_m}}{1-\eta} \right]^{1-\eta} \qquad 0 < \eta < 1 \qquad (1)$$

where η is the intensity in headquarter services and x_c and x_n are respectively the contractible and non-contractible activities involved in the production of each input. θ is the firm-specific productivity parameter. $\omega \equiv (1-\eta)(1-\mu_m)$ measures the importance of the non-contractible Relationship-Specific Input (RSI) used in the production of the final good. We depart from Antràs and Helpman (2004, 2008) and assume firm-level heterogeneity in both θ and ω.

After observing θ and ω, the headquarter, HQ, faces a choice when sourcing its inputs. It can decide to import inputs from an independent supplier or import them from its affiliate. In this latter case, the multinational has to pay a fixed cost g_l to set-up an affiliate in the foreign country l. Since our study focuses on multinational firms which have previously set-up affiliates abroad, and since we are able to identify for each firm the countries where they have already an affiliate we can simplify the model by considering that $g = 0$.

[5] Throughout this paper, we rule out the possibility of sourcing x^m from a national supplier and focus on internationally fragmented production process.

In addition, the firm has to pay an additional fixed cost of organization F_o if it decides to import inputs from an independent supplier or F_v when it decides to import from its affiliate. We follow Williamson (1985) and assume that transactions with an independent agent generate higher organization costs than transactions within the firm, i.e. $F_o > F_v$. In fact, vertical integration creates economies of scope in the management of diverse activities, reducing the organization costs.

The headquarter, HQ, writes a contract with the supplier, M, stipulating the required investment in the contractible activities x_c^h and x_c^m. However, the transaction between HQ and M involves incomplete contracts because, ex-ante the headquarter and the supplier cannot sign enforceable contracts specifying the required investment in the non-contractible relationship-specific activities x_n^h and x_n^m. [6] Since x_h and x_m are entirely customized and have no value outside the relationship, both firms face a hold-up problem. After the specific investment has been made, there is a renegotiation over the ex-post quasi-rents. Let β be the share of ex-post gain from trade obtained by the HQ.

Following the property-rights approach, the ex-post bargaining takes place both under outsourcing and under vertical integration (Grossman and Hart, 1986 and Hart and Moore, 1990). Once the HQ selects the organization form $k \in \{o, v\}$, the quantity of intermediate inputs is chosen by M to maximize $(1-\beta_k)R(i)-w^l x_m$, while the quantity chosen by the HQ to maximize $\beta_k R(i)-w^N x_h$. However, the distribution of surplus is sensitive to the sourcing mode. Following Antràs and Helpman (2004), we assume $\beta_v > \beta_o$. Thus, on the one hand, integration yields the headquarter with a higher share of the surplus than under outsourcing. On the other hand, the supplier's share of surplus is lower, and this decreases its incentive to invest. When choosing their sourcing

[6] They also cannot specify the purchase of specialized intermediate inputs for a certain price or observe ex-ante the inputs' quality.

mode, the headquarter faces a trade-off between having more control and inducing more investment from its supplier.

Ex-ante, the supplier pays a transfer T to the headquarter. It ensures its participation in the relationship and is equal to its profit. [7] The choice of ownership is chosen ex-ante by the headquarters to maximize its profit, which includes the transfer. Then, the headquarters' profit equals :

$$\pi_k(\omega, \theta) = D^{\frac{1}{1-\alpha}} \theta^{\alpha/(1-\alpha)} Z_k(\omega) - F_k \tag{2}$$

where Z is defined as in Antràs and Helpman (2008). We obtain the empirical model by appending an unobserved zero-mean random variable, ϵ_k, to the profits under each mode of organization. Given its productivity level θ and its intensity in specific inputs ω, outsourcing will be chosen by the final-good producer if

$$\pi_o(\omega, \theta) + \epsilon_o > \pi_v(\omega, \theta) + \epsilon_v \tag{3}$$

$$\Leftrightarrow \Delta = \pi_o(\omega, \theta) - \pi_v(\omega, \theta) > \epsilon_o - \epsilon_v \tag{4}$$

Finally, if $\epsilon_o - \epsilon_v$ has a cdf, F(.), the probability of outsourcing is defined as follow

$$PROB\left[Outsourcing\right] = F(\Delta) \tag{5}$$

2.2 Illustration and empirical implications

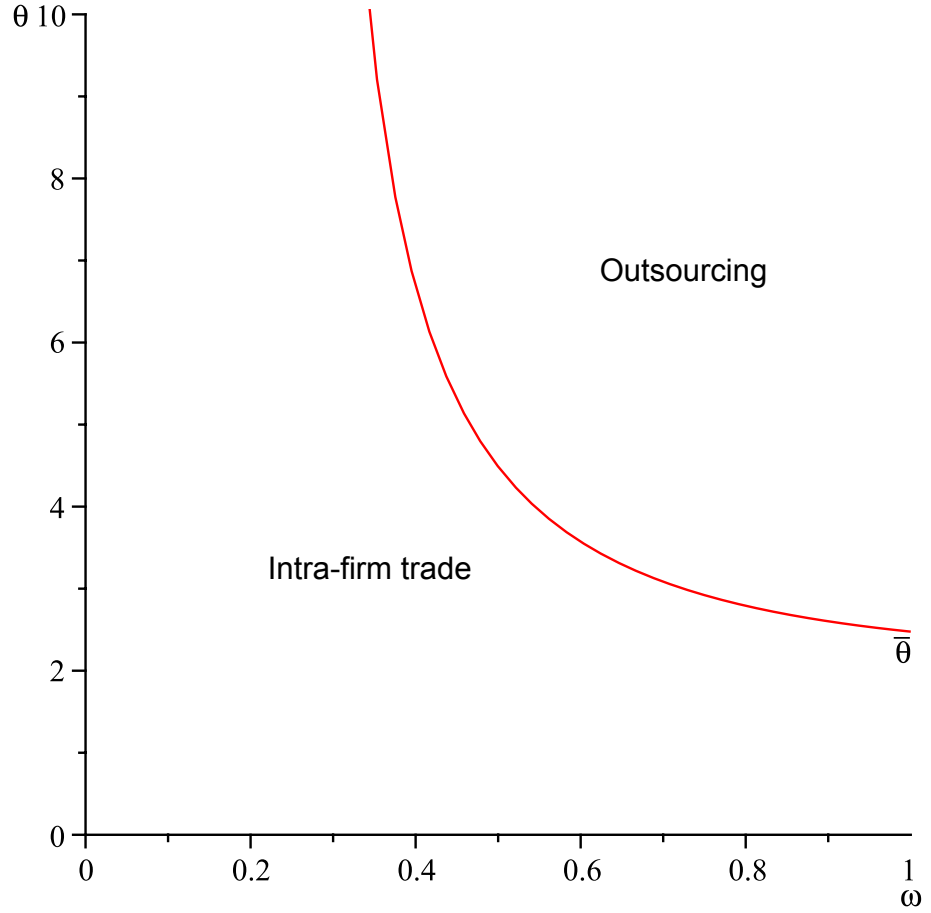
Using equation (4), one can determine $\overline{\theta}$, the threshold productivity level of the firm that is indifferent to both sourcing modes, i.e. $\Delta = 0$.

$$\overline{\theta} = D^{-1/\alpha} \left[\frac{(F_o - F_v)}{Z_o(\omega) - Z_v(\omega)} \right]^{(1-\alpha)/\alpha} \tag{6}$$

[7] See Antràs (2003) for details.

In Figure 1, we show simulated levels of the critical productivity value and how they relate to the relationship-specificity of the inputs. Given $F_o > F_v$, firms that are above the threshold value $\overline{\theta}$ outsource. The most productive firms that rely intensively on specific inputs from the supplier, choose outsourcing. More

FIGURE 1. Firm-level productivity, Relashionship-Specific Input intensity and sourcing modes



Authors' computation assuming $\alpha = 1/2,\ \eta = 1/2,\ \mu_h = 1/2,\ w_n = 1,\ w_s = 0.1,\ F_v = 0.2,\ F_o = 1,\ \beta_0 = 0.1,\ \beta_v = 0.9.$

formally, we can use equation (5) and the related equations above to derive a set of predictions concerning the effect of productivity and RSI intensity on the probability to outsource.

Proposition 1. $\frac{d\Delta}{d\omega} > 0$.

The likelihood of sourcing inputs through an independent supplier increases with the relationship-specific input intensity of the production.

As shown by Antràs and Helpman (2008), Z_o/Z_v increases with ω, and so, $dZ_o/d\omega - dZ_v/d\omega > 0$, which implies that $\frac{d\Delta}{d\omega} > 0$. Hence, the willingness to pay the fixed organization cost associated with outsourcing increases with ω. In fact, the supplier's RSI intensity affects the incentive the final good producer wants to give the supplier. The more intensive the production is in RSI that are produced by the supplier, the larger is the share of revenue that the producer wants to give the supplier. In particular, the share of revenue that H wants to give the supplier is increasing with the share of relationship-specific inputs. This is possible under outsourcing where $\beta_o < \beta_v$.

Proposition 2. $\frac{d\Delta}{d\theta} \geq 0$; $\frac{d\Delta}{d\omega d\theta} \geq 0$.
The likelihood of sourcing inputs through an independent supplier increases with the productivity of the firm. This effect is magnified by the intensity in relationship specific inputs.

As explained by Nunn and Trefler (2008), the mode of sourcing intermediate inputs depends on an interaction of θ with ω. Below a threshold value $\overline{\omega}$, the likelihood of outsourcing $F(\Delta)$ would be equal to zero, while $\frac{d\Delta}{d\theta} > 0$ for $\omega > \overline{\omega}$. As we consider firms that are heterogeneous according to ω, on the overall distribution $\frac{d\Delta}{d\theta} \geq 0$. Notice that this result depends on the ranking of fixed costs. Considering $F_v > F_o$, the most productive firms with a low RSI intensity prefer vertical integration.

In addition, for $\omega > \overline{\omega}$, we can show that $\frac{d\Delta}{d\theta} = f(Z_o(\omega) - Z_v(\omega))$. As mentioned in the first empirical prediction, $dZ_o/d\omega - dZ_v/d\omega > 0$. On the overall distribution, $\frac{d\Delta}{d\omega d\theta} \geq 0$. The second empirical implication implies that outsourcing is chosen solely by firms that are simultaneously intensive in relationship-specific inputs and very productive.

Notice also that for sake of simplicity, we do not consider free-entry. However, Nunn and Trefler (2008) show that two simultaneous effects arise with an in-

crease of ω when free-entry is taken into account. First, firms want to outsource more (this is our first empirical implication). Second, the less productive firms stop importing from the foreign market as the distortion associated with the incompleteness of contracts increases. Considering our ranking of fixed costs, the less productive firms are importing from affiliates. Hence, the likelihood of sourcing through an independent supplier increases with ω through both mechanisms.

3 Data and Estimation Strategy

3.1 Data

This paper uses information from the INSEE confidential firm-level survey which provides information on the trade organization of French firms in 1999. [8] The data are provided by SESSI. The survey was addressed to all French firms with trade worth more than 1 million Euro, owned by manufacturing groups that control at least 50% of the equity capital of a foreign affiliate. Hence, all the firms have at least one affiliate abroad and can be considered as multinationals. The survey covers 83% of the French industrial industry total imports of industrial products. [9] It provides a detailed geographical breakdown of French firms' import at product level (HS4) and their sourcing modes – through independent suppliers and/or affiliates. [10] A French intra-firm transaction is defined as trade with an affiliate controlled by the group with at least 50% of its equity capital.

[8] *Échanges internationaux intra-groupe.*

[9] `www.insee.fr/fr/ffc/docs_ffc/IP936.pdf`, INSEE WP 936, Table 1.

[10] A transaction is defined as a specific product that is imported from a country by a firm. Some transactions are broken into two lines if the firm has to announce an amount larger than the one previously filled by the customs services. We have aggregated these lines.

The SESSI survey provides little information at the firm level. We retrieve this information from the *EAE* database. It contains information on the balance sheet and income statement of all firms located in France that have more than 20 employees from 1996 to 2002. The *EAE* provides firm-level information on sales, capital, labor and intermediates use, as well as the 4-digit *NAF700* sector classification of the firm. [11]

3.2 Endogenous Variable : Sourcing Modes

Our dependent variable, y_{isjl}, is the share of input j that is imported by a multinational i active in sector s from an independent supplier located in country l : $\frac{M^o_{isjl}}{\left(M^o_{isjl}+M^v_{isjl}\right)}$. [12] We take into account the country dimension because HS4 goods produced in low-income countries are very different from similar goods produced in high income countries (Schott, 2004). We restrict our analysis to manufacturing sectors. However, we do not consider the manufacture of food products, beverages and tobacco because there is no detailed firm-level information for these sectors from the *EAE*. We exclude firms active in the manufacture of coke, refined petroleum products and nuclear fuel since the sourcing modes in this industry are likely to be determined by factors such as national sovereignty (Antràs, 2003). This leaves us with 2394 firms in our baseline specification realizing 68590 transactions.

3.3 Main Explanatory Variables

Our explanatory variables are built from the EAE database, that provides the non-consolidated income statement and balance sheet (see below). The model

[11] *Nomenclature d'Activité française* : nomenclature of French activities.

[12] Our dependent variable take the value *zero* or *one* in 87% of the cases. Considering the strong binary nature of our dependent variable, we use a fractional logit model as in Papke and Wooldridge (2006) and interpret our results in terms of likelihood.

requires an approximation of ω_i : the share of relationship-specific inputs (RSI) provided by supplier. We compute this share as follow :

$$\omega_i = \frac{Relashionship - Specific \;\; Inputs}{Total \;\; inputs \;\; used}$$

The EAE provides information on the total value of inputs used as well as the value of inputs that are relationship-specific (RSI). While the denominator is standard in the literature, the numerator is not. The value of the Relationship-Specific Inputs (RSI) is an accounting entry. The definition retained in the EAE survey is based on an accounting norm defined by the French national organization for standardization. [13] The RSI value corresponds to "all the operations for which an entrepreneur entrusts, by means of a sub-contract and under his responsibility, to another person, called the *supplier*, all or part of the fulfillment of the corporate contract or public contract signed with the *principal*" (AFNOR, norm X50-300). The supplier manufactures either spare-parts or semi-finished products that will integrate directly the contractor's final product. In addition, "the supplier is bound to comply exactly with the directives or technical specifications that the contractor defines" (INSEE - The French national Statistic Institute). [14]

There are three important comments that are worth mentioning. First, according to the AFNOR norm, the supplier is the only client of the contractor. In fact, the supplier works with the exclusive specifications ordered by the contractor. As the production realized by the subcontractor must comply exactly with the instructions or technical specifications fixed by the contractor, we consider these invoices as *specific* to the production process of the

[13] The French national organization for standardization ; AFNOR (Association française de Normalisation), is a member of the International Organization for Standardization

[14] www.insee.fr/en/methodes/default.asp ?page=definitions/sous-traitance-industrielle.htm

contractor. Second, as previously mentioned, the income statement and balance sheet are not consolidated at the group level and do not include the firm's affiliates, which have separate accounting. This implies that each firm in the EAE reports the values of all the invoices from any other firm independently of their location (in France or abroad), and independently of their financial relationship with the contractor (being affiliated or not). Third, the concept of "Relashionship-Specific Inputs" (or sub-contacted inputs) is directly related to the action of signing a contract with another firm. However, the concept is unrelated with the notion of "outsourcing". [15] Indeed, signing legal contract is not related to the ownership structure or the financial relationship between the contractors. Using data reporting only inputs produced within a "subcontracting" relationship (i.e. RSI transactions), recent papers by Kohler and Smolka (2009) and Stefano (2009) investigate the choice made by firms between outsourcing and intra-firm trade. [16]

We also use the EAE database to estimate the total factor productivity of each firm. Estimations have been realized for each of the 52 (3-digit) sectors. The TFP is estimated as the residual of the following three-factor Cobb-Douglas production function :

$$Q_{it} = \lambda_0 + \lambda_K K_{it} + \lambda_L L_{it} + \lambda_M M_{it} + \theta_{it} + \epsilon_{it}$$

with labor (L_{it}), deflated values of capital (K_{it}), and material inputs (M_{it}) as production factors. θ_{it} denotes the productivity variable and ϵ_{it} stands for measurement error in output. Labor is the firm specific number of employees.

[15] We avoid the use of the terminology "subcontracting", as it could be misleading. In fact, the reader could wrongly consider this concept as being related to our dependent variable. It is not. In reality, this concept is only related to the action of signing a contract with another firm.

[16] For France, the SESSI (2000) also reports strong variation in the sourcing mode, notably in the case of the RSI bought by the French firms. For instance, in the chemical industry, most of the relationship-specific inputs are bought from affiliates of the group. However, in the editing industry, firms usually purchase their specific-inputs from independent suppliers.

The deflators are obtained from the national accounts system of the French statistical office (INSEE). [17] We use the Olley and Pakes (1996) (OP) semi-parametric method to control for the simultaneity bias that arises from the endogeneity of a firm's inputs selection. The bias exists if a firm responds to unobservable productivity shocks by adjusting its input choices. This response yields correlation between the stochastic error term and an explanatory variable in the estimation of the production function. The OP estimator corrects for this possible bias by using the firm's investment decision as a proxy for unobserved productivity shocks. The main assumption of the OP technique is the existence of a monotonic relationship between investment and firm-level unobserved heterogeneity. [18]

3.4 Other Control Variables

In order to account for possible within-sector heterogeneity in terms of headquarter services intensity, we include firms' specific factor intensities. We use the firm-level capital-labor ratio, (k/l), to proxy the firm's capital intensity and its spending per-employee on information technology, (s/l), to roughly control for the firm's skill intensity. The data on firm factor intensity are taken from the EAE for the year 1999. Table A.1 in Appendix 1 reports the descriptive statistics.

3.5 Estimation Strategy

Since our dependent variable is bounded between zero and one, the OLS linear regression is unsuitable because it cannot guarantee that the predicted values

[17] Nominal values of output are deflated using two-digit sectoral price indexes. Material inputs are deflated using two-digit sectoral price indexes for intermediate inputs published by the INSEE.

[18] See Section A of Appendix A for details on the methodology.

lie in the unit interval, like for binary data models. We use the fractional logit estimation method developed by Papke and Wooldridge (2006) to deal with fractional response variables bounded between zero and one. Since the unit of observation is a transaction, but none of our variables are measured at the transaction level–the finest being the firm level– we correct the standard errors by clustering by firm (Wooldridge, 1996).

We also correct for non-response in our sample survey by using specific weight that have been constructed by the SESSI. The weight coefficients corresponds to the inverse probability that a multinational firm answers the survey. It is based on several characteristics. The SESSI methodology gives more weight to the answer of small firms in the survey. This correction for non-response is commonly used in all official releases. [19]

From our theoretical framework, the organizational choice is a function of firm's productivity θ_i and the RSI intensity ω_i. To estimate the predictions of the model, we also need to estimate how the relationship between the intensity in suppliers' inputs changes with the productivity. We add additional controls such as the capital-labor intensity $(k/l)_i$ and the skill intensity $(s/l)_i$.

All estimations include a set of specific effects at the French sector level, NAF_s, the imported product level, HS_j, and the country level, C_l. The baseline equation is reported below.

$$\begin{aligned} y_{isjl} = {} & \lambda_0 + \lambda_1\theta_i + \lambda_2\omega_i + \lambda_3\left(\omega_i \times \theta_i\right) \\ & + \lambda_4(k/l)_i + \lambda_5(s/l)_i \\ & + NAF_s + HS_j + C_l + \nu_{isjl} \end{aligned} \tag{7}$$

The interpretation of interaction effects in non-linear models is complex. Ai and Norton (2003) argue that odds ratios have no meaningful interpretation

[19] The methodology used by SESSI to construct the weighted coefficient is presented in the section B of the Appendix A.

the interaction terms. We apply the Ai and Norton (2003) correction to our fractional logit estimations.

4 Preliminary results

Table 1 reports the number of firms, transactions and countries for firms reporting intra-firm trade and firms reporting outsourcing. The sample is composed of 2422 firms that imports 1009 different types of SH4 products from 134 countries. The total number of observations is 69203. The number of firms that report outsourcing is about 1.5 times larger than the number of firms that report intra-firm trade. The number of transactions reported by firms that outsource is larger than that reported by firms that imports through their affiliates.

TABLE 1
Descriptive statistics on the full sample

	Full Sample	Firms reporting	
Number of :		Intra-firm trade	Outsourcing
– firms	2394	1489	2134
– countries	134	93	129
– products	1009	869	977
– transactions	68590	24353	54286
Mean of TFP	19.81	17.57	21.03
Mean of RSI	0.19	0.15	0.22

A crude look at the means of the TFP and RSI variables show that firms that report outsourcing are more productive and use more relationship specific inputs. We implement a two-sided Kolmogorov-Smirnov test on firms' TFP and RSI distribution in order to investigate further these results. [20] Table 2

[20] The KS-test has the advantage of making no assumption about the sample distribution. It determines whether two distributions differ significantly. Therefore, it calculates the largest difference between the observed and expected cumulative frequencies, which is called *D-statistics*. This statistic is compared against the critical D-statistic for that sample size. We run the tests at the firm level by aggregating the imports under both modes. A firm is classified under "outsourcing" if more than half of its imports are under this sourcing mode.

TABLE 2
Kolmogorov-Smirnov test for equality of productivity and RSI distributions

	Difference	P-value	Corrected
Total Factor Productivity (Olley and Pakes, 1996)			
$TFP_o > TFP_v$	0.0406	0.229	
$TFP_o < TFP_v$	-0.0841	0.002	
Combined K-S	0.0841	0.004	0.003
Labor Productivity			
$LP_o > LP_v$	0.0038	0.987	
$LP_o < LP_v$	-0.1704	0.000	
Combined K-S	0.1704	0.000	0.000
Relationship Specific Inputs			
$RSI_o > RSI_v$	0.0054	0.974	
$RSI_o < RSI_v$	-0.0985	0.000	
Combined K-S	0.0985	0.000	0.000

show that the total factor productivity and the labor productivity distribution are both statistically different at 1% level of significance. [21] Importantly, the two-sided test rejects the null hypothesis of higher productivities under integration. However, it accepts the hypothesis that firms that outsource have higher productivities than vertically integrated firms. The KS-test on the RSI distribution shows a similar pattern. Firms that outsource are more intensive in relationship specific inputs than firms that import from their affiliates. The KS-test also rejects the null hypothesis of higher RSI intensity under integration.

5 Estimation Results

The Tables of Section 5 present the marginal effects of the fractional logit estimations. We evaluate the marginal effect at sample means. We have centered all variables around their respective mean and include in all specifications of Tables 3 and 4 a full set of French sector, product and country fixed effects.

[21] Labor productivity is calculated as the production minus all the intermediate inputs used in the production, and then divided by the number of workers.

5.1 Baseline Specification

The first three columns (S1-S3) of Table 3, presents the results using the full sample of available transactions. In specifications (S4) to (S6), we estimate the model using a sample composed of intermediate inputs. We follow the methodology developed by Feenstra and Hanson (1996), which identifies imported intermediate inputs as purchased inputs registered in another HS3-digit sector than that in which the French multinational reports its main activity.

TABLE 3
Baseline Results. Dependent variable : Y= share of outsourcing (marginal effects presented.)

		Full Sample			Intermediate Inputs		
	Label	(S1)	(S2)	(S3)	(S4)	(S5)	(S6)
Productivity	θ_i	0.006^a	0.005^a	0.007^a	0.006^a	0.006^a	0.006^a
		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
RSI intensity	ω_i	0.136^a	0.157^a	0.166^a	0.170^a	0.192^a	0.200^a
		(0.052)	(0.043)	(0.044)	(0.058)	(0.049)	(0.049)
Interaction term	$\theta \times \omega_i$		0.009^b	0.010^b		0.010^b	0.010^b
			(0.003)	(0.003)		(0.004)	(0.004)
Skill intensity	$(s/l)_i$			-0.026^a			-0.026^a
				(0.009)			(0.009)
Capital-labor ratio	$(k/l)_i$			-0.001			0.006
				(0.009)			(0.011)
Observations		68590	68590	68590	49007	49007	49007
Log likelihood		-52767	-52659	-52465	-34911	-34850	-34702
Number of cluster		2394	2394	2394	2183	2183	2183

All regressions contain sector, product and country fixed effects. Robust standard error clustered at the firm level into brackets. ^{a}, ^{b} , ^{c} significantly different from 0 at 1%, 5% and 10% level, respectively.

The results of Table 3 provide strong support for our theoretical prediction. In particular, the most productive firms that rely intensively in specific inputs import from independent suppliers. In both samples, a positive and significant marginal effect on TFP variable can be found. The size of the marginal effect is similar across columns. The magnitude of the effect is economically meaningful. The marginal effect associated with the productivity is 0.006. This

result is consistent with the prediction of Antràs and Helpman (2004), but for a different ranking of fixed costs.

There is also evidence that the share of relationship specific inputs affects the multinational sourcing mode. The marginal effect of the RSI intensity variable is positive and statistically significant. It is estimated with a high level of precision. For a given productivity, we find that going from the lowest to the highest intensity in suppliers' input increases the share of outsourced inputs by 17 percentage points. [22]

The marginal effect of the interaction term on the other hand bears a positive sign and appears to be significant. This finding is robust across specifications and confirms the theoretical prediction of the model. Greater intensity in the RSI intensity increases the marginal effect of the TFP variable on the likelihood to source through an independent supplier.

As for the other control variables, the marginal effect of the skill intensity variable is negative and significant, indicating a higher likelihood to trade intra-firm for those multinationals that have more per-capita spending on information technology. Further, we do not find any significant effect of the firm specific capital intensity on the sourcing mode.

5.2 Fixed set-up costs of an affiliate

Next, consider our hypothesis that the fixed set-up cost is equal to zero, i.e $g_l = 0$. For any given country in the sample, there may or may not be an affiliate located there that imports a specific input. The choice between the different sourcing modes should imply a comparison between an already existing affiliate and an independent supplier. We need to correct for this potential

[22] The calculation is based on the subsample of intermediate inputs (Specification S4)

selection bias (Bernard et al. 2003).

To examine this question, we identify the location of the firm's foreign related parties that supply the inputs. We use information from the LIFI data set which provides a survey on the financial links between firms. We construct a dummy variable, g_l, that takes the value of one if the Ultimate Beneficial Owner (UBO) u of the firm report a foreign related party located in a particular country. It takes the value of zero otherwise.

We address the selection issue by using the two following methodologies. First, we drop all transactions between a firm and any countries where the UBO of the firm has no related party. In other words, we drop all transactions for which our dummy variable takes the value of zero. The mode of sourcing for a specific input at the firm level is thus guided by the comparison between an existing related party and an independent supplier. This first procedure eliminates about one fifth of the total number of transactions in the full and the intermediate inputs' samples. The results shown in Table 4 still support our theoretical predictions (columns S1-S3 and S6-S8). A significant and positive correlation is found between the level of productivity and the outsourcing likelihood. Moreover, the positive effect of outsourcing is reinforced by the firm's intensity in RSI. The results are still economically significant. These findings are broadly consistent with our baseline results with larger estimated marginal effects.

Second, we apply a two-step estimation procedure (columns S4-S5 and S9-S10 of Table 4). The equation to be estimated in the first stage is a probit equation using the related parties dummy variable as the dependent variable. The selection equation is identified by two variables : the number of related parties located in France owned by its Ultimate Beneficial Owner (UBO) u (from which we exclude the firm itself) and a dummy variable that identifies

TABLE 4. Sample selection specifications

		Full sample					Intermediate inputs sample				
					Two stages equation					Two stages equation	
					1^{st}stage	2^{nd}stage				1^{st}stage	2^{nd}stage
		(S1)	(S2)	(S3)	(S4)	(S5)	(S6)	(S7)	(S8)	(S9)	(S10)
Productivity	θ_i	0.009^a	0.008^a	0.009^a	0.000	0.008^a	0.009^a	0.008^a	0.009^a	0.001	0.007^a
		(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
RSI intensity	ω_i	0.163^b	0.201^a	0.209^a	-0.021^c	0.201^a	0.200^a	0.229^a	0.238^a	-0.027^a	0.231^a
		(0.068)	(0.052)	(0.053)	(0.011)	(0.045)	(0.073)	(0.058)	(0.059)	(0.010)	(0.049)
Interaction term	$\theta \times \omega_i$		0.013^c	0.014^b	-0.000	0.013^a		0.013^b	0.013^b	0.000	0.013^a
			(0.003)	(0.004)	(0.001)	(0.004)		(0.004)	(0.004)	(0.001)	(0.004)
Skill intensity	$(s/l)_i$			-0.024^b	0.014^a	-0.031^a			-0.024^b	0.012^a	-0.029^a
				(0.010)	(0.004)	(0.009)			(0.010)	(0.004)	(0.010)
Capital-labor ratio	$(k/l)_i$			-0.008	-0.002	-0.008			0.004	-0.001	0.002
				(0.015)	(0.006)	(0.014)			(0.017)	(0.005)	(0.015)
UBO-Number of	a_u				0.095^a					0.086^a	
related French parties					(0.006)					(0.006)	
UBO-Foreign group	$Foreign_u$				0.069^a					0.062^a	
					(0.013)					(0.013)	
Mills ratio	$Mills$					-0.862^a					-0.854^a
						(0.213)					(0.234)
Observations		58202	58202	58202	68117	57729	42366	42366	42366	48153	41512
Log likelihood		-46799	-46669	-46556	-20500	-45980	-45977	-31347	-31261	-13903	-30886
Number of firms		2247	2247	2247	2366	2219	2036	2036	2036	2148	2001

All regressions contain sector, product and country fixed effects Robust standard error clustered at the firm level into brackets. ^{a}, ^{b} , ^{c} significantly different from 0 at 1%, 5% and 10% level, respectively.

firms that are owned by a foreign group. We expect these variables to have a positive impact on the likelihood of having a related party abroad. However, they should be exogenous to the firm's sourcing choice. The equation to be estimated in the second stage is the one related to the sourcing choice. We estimate the fractional probit equation augmented by the inverse Mills' ratio. [23] The results are qualitatively similar. The inverse mills ratio is significant and negative indicating that the correction for selection bias reduces the outsourcing share. In Appendix C, we show in Table C.1 that our main findings are qualitatively similar when we take into account the product dimension in the construction of the related party dummy variable. [24]

5.3 Results from aggregate level data

We follow Yeaple (2006) and Bernard et al. (2003) and aggregate our data at 4-digit sector, 3-digit product and country level. We compute the outsourcing share as the ratio of the value of imports from independent suppliers to the value of total imports. Total imports have been computed as the sum of imports from affiliates plus imports from independent suppliers from the SESSI survey. Using the EAE database on all firms located in France with more than 20 employees, we measure the extent of dispersion within an industry using the standard deviation of firms' TFP in that industry. We also compute the RSI intensity at the sectoral level, as the ratio of the value of relationship-specific inputs to the total inputs used in the sector. We also calculate the skill intensity and capital intensity for each sector.

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[23] See Wooldridge (2007) for an example of a two step selection model with a fractional probit in the second stage.

[24] In this case, we use a more restrictive definition. We construct a dummy variable, g_{jl} which takes the value of 1 if the firm has a related party in a foreign country that provides a 3-digit input. The results are qualitatively similar. They are shown in Table C.1 of Appendix C.

TABLE 5
Results from the aggregated sample

	Full Sample			Intermediate Inputs		
	(S1)	(S2)	(S3)	(S4)	(S5)	(S6)
Sector productivity	0.010^a	0.010^a	0.009^b	0.010^a	0.010^a	0.009^b
dispersion	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Sector RSI intensity	0.281^a	0.222^c	0.290^b	0.277^a	0.209	0.294^b
	(0.109)	(0.128)	(0.138)	(0.107)	(0.127)	(0.139)
Interaction term		0.058^b	0.064^b		0.068^b	0.075^b
		(0.029)	(0.030)		(0.030)	(0.031)
Sector skill intensity			-0.005^b			-0.005^b
			(0.002)			(0.002)
Sector capital intensity			0.049			0.062^c
			(0.031)			(0.034)
Observations	22002	22002	22002	18312	18312	18312
Log likelihood	-11539	-11522	-11486	-9379	-9360	-9313
Number of sector	240	240	240	236	236	236

All regressions contain product and country fixed effects. Robust standard error clustered at the sector level into brackets. ^{a}, ^{b} , ^{c} significantly different from 0 at 1%, 5% and 10% level, respectively.

Table 5 presents the results of the fractional logit model. We control for product and country specific heterogeneity by using a set of product and country fixed effects. Robust standard-errors are clustered at the 4-digit sector level.

The results are in line with the predictions of our theoretical framework. The findings are qualitatively similar to those of the firm-level regressions of Table 3. We find a larger outsourcing share in industries that are intensive in relationship specific inputs. The share of intra-firm imports is lower in industry with higher dispersion in productivity. This suggests a higher fixed organization cost under outsourcing than under intra-firm trade. Moreover, the productivity dispersion variable magnifies the effect of the RSI variable.

6 Conclusion

We conduct a thorough analysis of the sourcing strategies of multinational firms. Antràs and Helpman (2004, 2008) have identified a number of key firm- and sector-level characteristics that influence the firm's import mode. In particular, firm-level productivity and the intensity in relationship-specific inputs at industry level are central to their theory.

We propose a refinement of Antràs and Helpman (2004, 2008) model by assuming a production function for the final-good producers that is firm specific. Moreover, we assume that the firms are multinationals and rule out the possibility of domestic sourcing. Our model predicts that (i) the likelihood of outsourcing increases with firm-level productivity and (ii) that it increases with the interaction between the relationship specific inputs intensity of the production and with firm's productivity.

The analysis is based on very detailed firm-level data from France. Our sample contains information on the sourcing choice of multinational firms. Contrary to the previous empirical literature, we use data on the firm's intensity in relationship specific inputs. This is the share of all intermediate inputs that are specific to the relationship between the supplier and the buyer. We approximate firm-level productivity using the methodology of Olley and Pakes (1996). We find that a higher firm's productivity increase the share of outsourcing and that this effect is magnified by a higher intensity in RSI. These findings are consistent with our model.

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Appendices

A Descriptive Statistics

TABLE A.1
Summary statistics of variables

	Label	Mean	Std. Dev.	Obs.
Full Sample				
TFP	θ_i	0.000	14.400	68590
RSI	ω_i	0.000	0.384	68590
Firm Skill Intensity (Log)	$(s/l)_i$	0.910	7.140	68590
Firm Capital-Labor Ratio (Log)	$(k/l)_i$	1.944	1.200	68590
Interaction term 1	$\omega_i \times \theta_i$	0.662	0.936	68590
Intermediate inputs sample				
TFP	θ_i	0.000	14.171	49007
RSI	ω_i	0.000	0.367	49007
Firm Skill Intensity (Log)	$(s/l)_i$	0.817	6.708	49007
Firm Capital-Labor Ratio (Log)	$(k/l)_i$	1.963	1.211	49007
Interaction term 1	$\omega_i \times \theta_i$	0.676	0.942	49007

Web Appendices (Not to be published)

A TFP Measurement

We use the Olley and Pakes (1996) (OP) semiparametric method to estimate firm-level TFP. Estimations have been made for each one of the 52 sectors (3 digit). This method allows robust estimation of the production function. It takes into account the endogeneity of some inputs, as well as the unobserved permanent differences among firms. The main assumption that the OP technique relies on, is the existence of a monotonic relationship between investment and firm-level unobserved heterogeneity.

We consider the following Cobb-Douglas production function

$$Q_{it} = \lambda_0 + \lambda_K K_{it} + \lambda_L L_{it} + \lambda_M M_{it} + \theta_{it} + \epsilon_{it}$$

and denote the logarithm of output, capital, labor and intermediate inputs with Q_{it}, K_{it}, L_{it} M_{it}, respectively. Subscripts i and t stand for firm and time, θ_{it} denotes productivity, and ϵ_{it} stands for measurement error in output. It is assumed that θ_{it} follows an exogenous first order Markov process :

$$\theta_{it+1} = E[\theta_{it+1}|\theta_t] + \upsilon_{it+1}$$

where υ_{it} is uncorrelated with the productivity shock. The endogeneity problem stems from the fact that K_{it} and L_{it} are correlated with the θ_{it}. This makes λ_{OLS} biased and inconsistent. Given that investment is strictly monotonic, it can be inverted as :

$$\theta_{it} = h(I_{it}, K_{it})$$

and substituting this function in the production function leads to

$$Q_{it} = \lambda_L L_{it} + \lambda_M M_{it} + \Phi(I_{it}, K_{it}) + \epsilon_{it}$$

where $\Phi(I_{it}, K_{it}) = \lambda_0 + \lambda_K K_{it} + h(I_{it}, K_{it})$. Since the functional form of $\Phi(\cdot)$ is not known, we cannot estimate the coefficients of the capital and labor variable directly. Instead, we use a linear model that includes a series estimator using a full interaction term polynomial in capital and investment to approximate $\Phi(\cdot)$. From this first stage, the consistent estimates of the coefficients on labor and material inputs as well as the estimate of the polynomial in I_{it} and K_{it} are obtained. The estimated coefficients are shown in Table A.

	OLS			OP		
	β_M	β_L	β_K	β_M	β_L	β_K
C11	0.54	0.31	0.05	0.54	0.25	0.06
C12	0.48	0.42	0.06	0.50	0.34	0.06
C20	0.62	0.33	0.03	0.69	0.25	0.01
C31	0.77	0.15	0.06	0.78	0.12	0.01
C32	0.76	0.23	0.01	0.77	0.20	0.02
C41	0.63	0.33	0.05	0.67	0.27	0.05
C42	0.68	0.24	0.04	0.66	0.20	0.08
C43	0.61	0.29	0.08	0.61	0.23	0.10
C44	0.74	0.22	0.02	0.77	0.19	0.03
C45	0.61	0.32	0.05	0.62	0.28	0.10
C46	0.54	0.40	0.06	0.59	0.34	0.03
D01	0.70	0.31	0.01	0.71	0.27	-0.04
D02	0.71	0.25	0.03	0.72	0.16	0.08
E11	0.56	0.45	0.00	0.63	0.37	0.02
E12	0.70	0.26	0.03	0.70	0.26	0.03
E13	0.48	0.60	0.00	0.56	0.32	0.03
E14	0.59	0.41	0.00	0.63	0.43	-0.04
E21	0.58	0.37	0.07	0.65	0.27	0.06
E22	0.41	0.56	0.05	0.50	0.46	0.02
E23	0.59	0.36	0.06	0.63	0.32	0.05
E24	0.60	0.38	0.03	0.66	0.32	0.03
E25	0.52	0.46	0.06	0.62	0.31	0.05
E26	0.54	0.42	0.03	0.59	0.34	0.08
E27	0.52	0.44	0.06	0.58	0.31	0.07
E28	0.61	0.34	0.07	0.63	0.32	0.00
E31	0.62	0.41	0.00	0.63	0.38	0.04
E32	0.56	0.37	0.09	0.58	0.34	0.08
E33	0.54	0.44	0.06	0.59	0.35	0.06
E34	0.51	0.38	0.10	0.54	0.27	0.13
E35	0.55	0.42	0.06	0.59	0.39	0.05
F13	0.50	0.42	0.11	0.53	0.34	0.09
F14	0.62	0.32	0.07	0.66	0.24	0.05
F21	0.66	0.23	0.02	0.68	0.17	0.05
F22	0.54	0.41	0.03	0.56	0.31	0.05
F23	0.62	0.26	0.04	0.61	0.20	0.06
F31	0.64	0.28	0.07	0.63	0.26	0.07
F32	0.70	0.27	0.05	0.71	0.19	0.10
F33	0.56	0.42	0.05	0.62	0.31	0.07
F41	0.68	0.30	0.02	0.66	0.20	0.13
F42	0.77	0.16	0.06	0.68	0.06	0.14
F43	0.75	0.23	0.03	0.75	0.16	0.10
F44	0.74	0.18	0.03	0.73	0.07	0.07
F45	0.55	0.45	0.03	0.61	0.37	0.04
F46	0.59	0.40	0.04	0.63	0.29	0.01
F51	0.70	0.19	0.09	0.68	0.15	0.02
F52	0.81	0.08	0.08	0.78	0.10	0.08
F53	0.52	0.41	0.07	0.62	0.30	0.06
F54	0.44	0.49	0.07	0.53	0.35	0.06
F55	0.52	0.39	0.08	0.55	0.30	0.03
F56	0.61	0.27	0.07	0.67	0.17	0.03
F61	0.59	0.36	0.04	0.61	0.30	0.06
F62	0.55	0.37	0.08	0.57	0.30	0.09

B Firm weight and the probability to answer the survey

The SESSI firm survey includes French firms trading with more than 1 million Euro worth of goods and that are owned by manufacturing groups that control at least 50% of the equity capital of their foreign affiliates. These limitations sharply reduce the number of participants. However, the coverage remains significant.

An important limitation of the survey is that only 55% of the firms actually answered the questionnaire. To take into account the resulting sample bias, the SESSI includes in its survey a weighting coefficient that is firm-specific and corresponds to the inverse probability that a firm answers the survey. The model used to build this coefficient is a simple logistic model that relates the probability to answer the survey and several firm characteristics : firm's trade volumes, its 2-digit sector classification, and the nationality of its group. The results of this exercise are as follow : large firms, trading important volume and firms part of a French group were significantly more likely to answer the questionnaire. [25]

[25] For 330 Firms for which the SESSI did not affect any weighting coefficient, we affect the average weighting coefficient of 1.6. As a robustness check, we also run regression with applying a coefficient of 1 (the minimum possible value) and of 3.6 (the maximum value observed) to these firms. We do not present these results.

C The two-stage equation

In this section, we use a more restrictive definition that takes into account the product dimension. We construct a dummy variable, g_{jl} which takes the value of 1 if the firm has a related party in a foreign country that provides a 3-digit input. The analysis is conducted as in the main text. The selection equation is estimated using a probit model on the g_{jl} dummy variable and specified using the number of the firm's related parties located in France own by the firm's UBO and a dummy variable that identifies firms that are owned by a foreign group. In the second stage equation is augmented by the inverse Mill's ratio.

TABLE C.1. Sample selection specifications

		Full sample					Intermediate inputs sample				
					Two stages equation					Two stages equation	
					1^{st} stage	2^{nd} stage				1^{st} stage	2^{nd} stage
		(S1)	(S2)	(S3)	(S4)	(S5)	(S6)	(S7)	(S8)	(S9)	(S10)
Productivity	θ_i	0.012^a	0.012^a	0.013^a	-0.003	0.012^a	0.015^a	0.014^a	0.014^a	-0.002	0.014^a
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)
RSI intensity	ω_i	0.127^c	0.183^a	0.191^a	-0.075^a	0.206^a	0.170^b	0.213^a	0.221^a	-0.091^a	0.247^a
		(0.067)	(0.053)	(0.054)	(0.023)	(0.051)	(0.084)	(0.064)	(0.065)	(0.030)	(0.061)
Interaction term	$\theta \times \omega_i$		0.013	0.013^c	-0.002	0.014^a		0.012	0.013^c	-0.003	0.014^a
			(0.004)	(0.004)	(0.002)	(0.004)		(0.004)	(0.005)	(0.002)	(0.005)
Skill intensity	$(s/l)_i$			-0.023^b	0.019^b	-0.028^b			-0.021	0.019^c	-0.026^c
				(0.011)	(0.009)	(0.011)			(0.014)	(0.011)	(0.014)
Capital-labor ratio	$(k/l)_i$			-0.014	-0.016	-0.011			0.005	-0.022	0.007
				(0.019)	(0.013)	(0.019)			(0.024)	(0.017)	(0.022)
UBO - Number of	a_u				0.118^a					0.110^a	
related French affiliates					(0.013)					(0.015)	
UBO - Foreign group	$Foreign_u$				0.285^a					0.281^a	
					(0.025)					(0.027)	
Mills ratio	$Mills$					-0.430^b					-0.498^c
						(0.208)					(0.257)
Observations		35171	35171	35171	68574	35155	22793	22793	22793	49000	22786
Log likelihood		-29349	-29283	-29226	-40007	-29176	-18902	-18875	-18850	-28219	-18812
Number of firms		1943	1943	1943	2391	1940	1633	1633	1633	2182	1632

All regressions contain sector, product and country fixed effects Robust standard error clustered at the firm level into brackets. ^{a}, ^{b} , ^{c} significantly different from 0 at 1%, 5% and 10% level, respectively.