Vertical Ownership and Trade: Firm-level evidence from France

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(comments are welcome)

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Abstract

In this paper, we study the impact of acquiring equity shares in intermediaries on export performance. We develop a trade model with vertically linked industries where the decisions to export and to own its intermediary are endogenous that we test on French data at the firm level. We show that: forward acquisition enables manufacturers to manage the double marginalization problem and to enjoy lower costs to foreign market access, so that the probability of exporting and export sales are higher for a firm with a participation in intermediaries. In addition, vertical ownership creates a market externality among manufacturers due to a reallocation of market shares from small firms to large firms forcing some low-productivity firms to exit from foreign markets.

Keywords: Exports, Forward integration, Heterogeneous firms, Intermediary
JEL Classification: F12; L22

1 Introduction

The international trade literature considers that manufacturers either export directly or contract with a retailer who takes over the selling activities. However, manufacturer can also reach end consumers through company-owned intermediary or acquiring equity in wholesalers or retailers. As shown in industrial organization literature, vertical ownership takes place to align the interest of the target and the acquirer in a same goal, to reduce transaction costs and double marginalization, to acquire information, or to enhance market power through foreclusion (Greenlee and Raskovich, 2006). Hence, manufacturers can be motivated to use forward integration as a business strategy to reach foreign markets. In this paper, we study theoretically and empirically the impact of acquiring equity shares in intermediaries on export performance at the firm level.

Recent studies in international trade reveal the important role of wholesalers and retailers in facilitating international trade (Bernard, Jensen, Redding, and Schott, 2010; Blum, Claro, and Horstmann, 2010). In this literature, intermediaries seem to face lower sunk costs of exporting and to be able to exploit economies of scope in exporting. For example, intermediaries export more products and ship to more destinations (Ahn, Khandelwal, and Wei, 2011), even though they are smaller than manufacturers in terms of export value (Akerman, 2010). A growing literature explores the issue of intermediation in international trade, which focused on matching frictions between buyers and sellers (Antràs and Costinot, 2011; Blum, Claro, and Horstmann, 2009), on the presence of networks in international trade (Rauch and Watson, 2004), or on the impact of the mode of export (either directly or indirectly through an intermediary) on exports (Ahn, Khandelwal, and Wei, 2011; Akerman, 2010; Felbermayr and Jung, 2011).

In this paper, we follow another strategy by studying the impact of vertical ownership on export performance of manufacturers (entry/exit decision and the level of export sales). Hence, our approach differs from trade literature. Indeed, whether recent studies consider that manufacturing firms may export indirectly through a wholesaler rather than managing their own distribution networks, they do not consider neither the impact of market structure and the strategic behavior of the intermediaries nor the decision to acquire an intermediary on export performance of manufacturers. Contrary to trade literature, the intermediaries operates under imperfect competition, acts strategically and may be independent, partially owned or fully controlled by manufacturers. Under these circumstances, a problem of double marginalization occurs because firms along each vertical chain have market power and set a price above marginal cost.

More precisely, we consider a general model with two vertically related industries where heterogeneous manufacturers produce a differentiated product and domestically-based intermediaries (downstream firms) distribute the differentiated products in the domestic and foreign markets. Manufacturers and intermediaries may be also linked by financial arrangements (*vertical ownership*), involving the acquisition of assets (Grossman and Hart, 1986) or an ownership share of profit (Riordan, 1991), or both. Even though equity establishes an ownership claim on residual profit, it does not necessarily change control rights over managerial decisions. From this setup, we determine endogenously the probability of acquiring an intermediary and its impact on the probability of serving a market and export sales. Note that our approach differs also from industrial organization literature by considering heterogeneous firms producing in monopolistic competition as well as fixed and variable trade costs in a general equilibrium model.

Developing our model we show the probability of acquiring an intermediary increases with the productivity of firms. By increasing its control share on intermediary, sales shift upward because the price paid by the end consumers declines through a reduction in the effects of double marginalization and, in turn, operating profits increase. The gains associated with vertical ownership due to an upward shift in sales are higher than the acquisition costs when the productivity of manufacturers is high enough. As a result, vertical ownership enables the producer to neutralize double marginalization in a vertical chain, as expected, and, in turn, increases its probability of exporting and export sales. We also show that manufacturers that own an intermediary are more likely to serve countries with small potential market than firms without participation in intermediaries. In addition, because only high productivity (or , equivalently, large) firms are able to acquire equity shares in an intermediary, this creates a market externality among manufacturers due to a reallocation of market shares from small firms to large firms. By controlling an intermediary, large firms hurt small firms because the latter firms loose market shares or exit from foreign markets while the former firms enjoy higher foreign demands.

The purpose of vertical ownership can be also related to transfer intangible inputs within firms (Atalay, Hortacsu, and Syverson, 2012). Owning distribution network may help a new company to reduce fixed costs associated with exports or to acquire information on foreign market. Intermediaries such as wholesalers and retailers, by connecting producers with consumers, may have informational superiority about the foreign markets. As underlined by Rey and Tirole (1986), informational asymmetries exist between the producers and the intermediaries distributing their products. Distributors are better informed than producers about the state of uncertain demand because intermediaries are able to meet face to face consumers. The manufacturers can also benefit from potential mutualization of transports by wholesalers (boat uploading or downloading, container...). Hence, manufacturers can be motivated to use vertical integration as a business strategy to reduce fixed and variable export costs.

We test the implications of our model from a French dataset, combining two sources of information. First we work on an extraction of Amadeus (Bureau Van Dijk) during the year 2008. This extraction gathers information of all financial links concerning French agri-food firms. With this information we are able to identify agri-food firms that partially own or fully control intermediaries. We also know which agri-food firms are owned or controlled. Second, we complete the agri-food firm's dataset with the customs dataset that describes the volume and value sold by all French firms on each foreign market. Our results show the positive role of owning or controlling an intermediary on firm export performance. Intermediary ownership increases the probability of exporting for agri-food firms and their export sales. Controlling our empirical model for the fact that firms owning intermediaries are also among the most productive firms does not change our results and validates our theoretical model. Our study also reveals firms owning or controlling intermediaries have a non-negligible advantage to enter foreign market, especially those with small market size.

In the next section, we develop the model from which we build our predictions. In Section 3, we present the data and explain how we have succeeded in recovering firms' network. In section 4, we evaluate the causal effect of acquiring an intermediary on acquirer's export performance and perform a series of robustness tests. We also determine whether acquiring an intermediary allows acquiring firm to reduce the access costs to foreign markets. Finally, we present in Section 5 additional empirical results that validate other predictions of our model. Section 6 concludes.

2 Theory of vertical ownership in a global economy

In this section, we present our general equilibrium model with trade in the presence of vertical interactions and financial arrangements with hetereogeneous producers. Our purpose is to derive a set of predictions in a transparent manner and then confront them with data at the firm level.

2.1 General assumptions

Let us set the basic model. Some extensions will be introduced later. Consider in each country a continuum of manufacturers (upstream firms) with a mass M producing a differentiated good and a continuum of domestically-based intermediaries (downstream firms) distributing differentiated products in the foreign markets. Manufacturers and retailers are linked by the input supply and by financial arrangements (*vertical ownership*).

Vertical integration involves the acquisition of assets (Grossman and Hart, 1986) or an ownership share of profit (Riordan, 1991), or both. Indeed, whether equity establishes an ownership claim on residual profit, it does not necessarily change control rights over managerial decisions. We assume that partial ownership do not give control over the target firm so that each firm has as its owner-manager. Participation only right to a partial redistribution of operating profits of the target. The upstream suppliers may offer to buy a fraction $\theta \in [0, 1]$ of the downstream firm at price $b(\theta)$ with $b = 0$ when $\theta = 0$

and $b\prime \equiv \partial b/\partial \theta > 0$. However, above shares threshold, the acquirer has control rights over decisions managerial decisions. This limit value is normalized at 1 without loss of generality.

We consider each intermediary distributes a single variety whereas each manufacturer supplies its product to a single intermediary. In other words, there are M configurations in each country where two firms, upstream and downstream, that each have market power. In addition, we assume the following sequence of events. In the first stage, manufacturers and intermediaries decide to enter/exit or not. In the second stage, the upstream suppliers decide to buy (or not) equity shares in downstream firms (θ). In the third and fourth stages, the manufacturer announces the wholesale price, z, knowing the price determined by the intermediary and the intermediaries take the wholesale price as given and maximizes its profits by choosing price p.

2.2 Demand, market structure and prices

In our framework, preferences, market structure, and trade costs are standard in trade literature: CES utility function, monopolistic competition, and fixed and variable trade costs. Because preferences across varieties of product have the standard CES form, each firm producing in country i faces demand from country j for its variety v given by $q_{ij}(v) = E_j P_j^{\varepsilon-1} p_{ij}(v)^{-\varepsilon}$ where $\varepsilon > 1$ is a constant elasticity of substitution, $p_{ij}(v)$ is the price of variety v paid by the end consumer in country j, E_j is the share of income of households living in country j for the differentitated good and $P_j = \left[\int_{\Omega_j} p(v)^{1-\varepsilon} \mathrm{d}v\right]^{1/(1-\varepsilon)}$ is the price index prevailing in country j and Ω_j is the set of varieties available in country j. Hence, the export sales for a firm located in country i and serving country j is given by $p_{ij}q_{ij}$ with

$$p_{ij}q_{ij} = E_j P_j^{\varepsilon-1} p_{ij}^{1-\varepsilon} \tag{1}$$

The manufacturer uses only labor which is used as numeraire and its marginal cost to serve country j is given by $w_i\tau_{ij}/\varphi$ where w_i is the wage rate prevailing in country i, τ_{ij} is the "iceberg" variable trade costs, and φ is the labor productivity. We assume that φ is randomly drawn from a common distribution $g(\varphi)$ where $g(\varphi)$ is positive over $(1, \infty)$ and has a continuous cumulative function $G(\varphi)$. However, contrary to trade literature, each product is not directly exported by the producer but traded by an intermediary. This intermediary may be independent, partially owned or fully controlled by manufacturers. The distribution of products in country j induces a constant marginal cost normalized at 0 and a fixed cost f_j. The manufacturers differ from supplied variety v, their labor productivity φ and their equity shares θ_i.

Hence, the profit of the intermediary distributing variety v located in country i is given

$$\pi_i = (1-\theta_i)\sum_j(\Lambda^r_{ij} - w_i f_{ij}) + b(\theta_i) \tag{2}$$

with $\Lambda^r_{ij} \equiv (p_{ij} - z_{ij})q_{ij}$ the operating profit of the intermediary (retailer or wholesaler) distributing product i with z_{ij} the unit price paid by the intermediary to distribute the product whereas the profit of manufacturer in country i is

$$\Pi_i = \sum_j \Lambda^m_{ij} + \theta_i \sum_j \left(\Lambda^r_{ij} - w_i f_{ij}\right) - b(\theta_i) \tag{3}$$

with $\Lambda^m_{ij} \equiv (z_{ij} - w_i\tau_{ij}/\varphi)q_{ij}$ the operating profits of manufacturer i.

Because we consider monopolistic competition, P_j as well as E_j are treated parametrically by firms when they determine their prices and the equity shares to be bought. Knowing $q_i = kp_i^{-\varepsilon}$ (where k is considered as a constant) and maximizing π_i with respect to p_{ij} leads to $p^*_{ij} = \varepsilon z_{ij}/(\varepsilon-1)$. The price of manufacturer maximizing its profit is given by

$$z^*_{ij} = \frac{\varepsilon}{\varepsilon - 1 + \theta_i}\frac{w_i\tau_{ij}}{\varphi} \tag{4}$$

with $\partial z^*_{ij}/\partial\theta_i < 0$. Hence, whether the pricing rule applied by the intermediaries is standard (price equals to a constant markup - $\varepsilon/(\varepsilon-1)$ - times marginal cost), price policy set by the manufacturers allows for a variable markup due to financial arrangement between the producers and intermediaries. As expected, the price paid by the intermediary decreases with θ_i. Note that when $\theta_i = 0$ the markup achieves its maximum value (standard configuration) while the price of the manufactured good is equal to the marginal cost when full ownership occurs ($\theta_i = 1$). Without participation in an intermediary, each firm then prices at a markup over marginal cost and we obtain the so-called double-marginalization problem. Vertical ownership enables the producer to neutralize double marginalization in a vertical chain and, in turn, increases its exports. Note that here we do not consider two-part tariffs or resale price maintenance. Hence, even if wholesale price is the only available instrument to determine the terms of trade with its intermediary, the producer may reduce excessively high prices set by its intermediary by acquiring equity shares. It is also worth stressing that markup is not constant with vertical ownership even though demands are iso-elastic.

Hence, we have

$$p^*_{ij} = \frac{\varepsilon}{\varepsilon-1}\frac{\varepsilon}{\varepsilon - 1 + \theta_i}\frac{w_i\tau_{ij}}{\varphi} \tag{5}$$

while firms are indirectly connected through price index P_j with

$$P_j^{1-\varepsilon} = \sum_k \int_0^\infty p_{kj}(\theta_i,\varphi)^{1-\varepsilon} M_{kj}\mu_{kj}(\varphi)\mathrm{d}\varphi \tag{6}$$

where M_{kj} is the mass of variety produced in country k and consumed in country j and $\mu_{kj}(\varphi)$ is the *ex post* distribution of productivity conditional on a variety produced in country k and consumed in country j over a subset of $[1,\infty)$. Even though the intermediary has not several suppliers, horizontal externalities among producers exist through index prices.

Note also that

$$\Lambda_{ij}^m = \frac{1-\theta_i}{\varepsilon - 1 + \theta_i} q_{ij} = \frac{(1-\theta_i)(\varepsilon-1)}{\varepsilon}\Lambda_{ij}^r$$

with $\Lambda_{ij}^m < \Lambda_{ij}^r$ as well as $\partial\Lambda_{ij}^m/\partial\theta_i < 0$ and $\partial\Lambda_{ij}^r/\partial\theta_i > 0$. Hence, an increase in θ shrinks (resp., boosts) the operating profits of the manufacturer (resp., intermediary). Indeed, the margin ($z_{ij} - w_i\tau_{ij}/\varphi$ for the producer or $p_{ij} - z_{ij}$ for the intermediary) decreases with θ_i while its demand increases (q_{ij}) due to a lower price paid by the end consumers. However, the former effect dominates the latter effect for the manufacturer while the reverse holds for the intermediary.

2.3 Equilibrium vertical ownership

Each manufacturer sets θ by maximizing its profits (see Eq.(3)). On the one side, by increasing its equity share in its intermediary, the manufacturer raises the consolidated operating profits (its operating profits $\Sigma_j\Lambda_{ij}^m$ plus the share of operating profits of the intermediary allocated to the manufacturer $\theta_i\Sigma_j\Lambda_{ij}^r$) given by

$$\sum_j \Lambda_{ij}^m(\theta_i,\varphi) + \theta_i \sum_j \Lambda_{ij}^r(\theta_i,\varphi) = \frac{\varepsilon - 1 + \theta_i}{\varepsilon}\sum_j \Lambda_{ij}^r$$

with

$$\sum_j \Lambda_{ij}^r(\theta_i,\varphi) = (\varepsilon - 1 + \theta_i)^{\varepsilon-1}\left(\frac{\varepsilon}{\varepsilon-1}\right)^{1-\varepsilon}\frac{\varphi^{\varepsilon-1}}{\varepsilon^{\varepsilon} w_i^{\varepsilon-1}}\sum_j E_j P_j^{\varepsilon-1}\tau_{ij}^{1-\varepsilon}$$

where we have used the expression of $z_{ij}^*(\theta_i)$ and q_{ij}. Unambiguously the operating profits of intermediary increases with θ_i due to a reduction of the negative effects of double marginalization. Even if $\partial\Lambda_{ij}^m/\partial\theta_i < 0$ due to a lower markup, the gains associated with higher operating profits for the intermediary offset the losses related to a lower margins in production. Note also the positive impact of θ_i on the operating profits of the intermediary increases with labor productivity of its supplier (φ) and with the foreign expenditures (E_j) and decreases with trade costs (τ_{ij}).

On the other side, a rise in θ_i induces a higher cost of acquisition (b) and a higher fraction of distribution costs to be incurred by the manufacturer. Knowing $b(\theta)$ and $z_{ij}^*(\theta_i)$, the first order condition $\partial\Pi_{ij}/\partial\theta_i = 0$ implies that the equilibrium equity share is given by θ_i^* such that

$$\sum_j \Lambda_{ij}^r - b'(\theta_i^*) - \sum_j w_j f_{ij} = 0 \qquad (7)$$

An interior solution occurs if and only if $b''(\theta_i) > \sum_j \partial\Lambda^r_{ij}/\partial\theta_i$. Consider first that $b''(\theta_i) < \sum_j \partial\Lambda^r_{ij}/\partial\theta_i$. Because profits increase with productivity, there exists a unique value of productivity $\overline{\varphi}_i$ such that $\theta^*_i = 1$ when $\varphi \geq \overline{\varphi}_i$ such that $\Pi_i(1,\overline{\varphi}_i) = \Pi_i(0,\overline{\varphi}_i)$ or, equivalently, $\sum_j \left[\Lambda^r_{ij}(1,\overline{\varphi}_i) - w_j f_{ij}\right] - b(1) = \frac{\varepsilon-1}{\varepsilon}\sum_j \Lambda^r_{ij}(0,\overline{\varphi}_i)$, or, equivalently,

$$\left[1-\left(\frac{\varepsilon}{\varepsilon-1}\right)^{-\varepsilon}\right]\left(\frac{\varepsilon}{\varepsilon-1}\right)^{1-\varepsilon}\frac{\overline{\varphi}_i^{\varepsilon-1}}{\varepsilon w_i^{\varepsilon-1}}\sum_j E_j P_j^{\varepsilon-1}\tau_{ij}^{1-\varepsilon} = \sum_j w_i f_{ij} + b(1) \qquad (8)$$

with $\partial\overline{\varphi}_i/\partial\tau_{ij} > 0$ and $\partial\overline{\varphi}_i/\partial E_j < 0$. For all $\varphi \geq \overline{\varphi}_i$, the manufacturer controls fully the intermediary and its profit is given by $\Pi_{ij}(\varphi,1) = \sum_j[\Lambda^r_{ij}(1) - w_j f_j] \geq b'(1)$. In addition, we have $\partial^2\Pi_i/\partial\theta_i\partial\tau < 0$ and $\partial^2\Pi_i/\partial\theta_i\partial E_j > 0$ implying that $\partial\theta^*_i/\partial\tau_{ij} < 0$ and $\partial\theta^*_i/\partial E_j > 0$. In other words, the gains associated with forward acquisition increase with trade liberalization and the size of trade partners.

Consider now that $b''(\theta) > \sum_j \partial\Lambda^r_{ij}/\partial\theta_i$. Under this configuration there exists an interior solution θ^*_i given by

$$(\varepsilon-1+\theta^*_i)^{\varepsilon-1}\left(\frac{\varepsilon}{\varepsilon-1}\right)^{1-\varepsilon}\frac{\varphi^{\varepsilon-1}}{\varepsilon^\varepsilon w_i^{\varepsilon-1}}\sum_j \frac{E_j P_j^{\varepsilon-1}}{\tau_{ij}^{\varepsilon-1}} = b'(\theta^*_i) + \sum_j w_i f_{ij}$$

with $\partial^2\Pi_{ij}/\partial\theta_i\partial\varphi > 0$ so that $\partial\theta^*_i/\partial\varphi > 0$ when $1 > \theta^*_i > 0$. Hence, there exists a threshold value of productivity $\overline{\varphi}_i^-$ such that $\theta^*_i \geq 0$ when $\varphi \geq \overline{\varphi}_i^-$ given by $-b'(0) + \sum_j[\Lambda^r_{ij}(0,\overline{\varphi}_i^-) - w_i f_{ij}] = 0$ and a limit value of productivity $\overline{\varphi}_i^+$ such that $\theta^*_i = 1$ when $\varphi \geq \overline{\varphi}_i^+$ given by $-b'(1) + \sum_j[\Lambda^r_{ij}(1,\overline{\varphi}_i^+) - w_i f_{ij}] = 0$.

To summarize,

Proposition 1 *The probability of acquiring equity in an intermediary by a manufacturer increases with its productivity, foreign market size and trade liberalization.*

Note also export sales of a manufacturer with no equity shares are given by $(\varepsilon - 1)\Lambda^m_{ij}(0,\varphi)$ whereas the exports of the manufacturers owning an intermediary is given $\Lambda^r_{ij}(1,\varphi) = (\varepsilon-1)\varepsilon^\varepsilon\Lambda^m_{ij}(0,\varphi)/(\varepsilon-1)^\varepsilon > \Lambda^m_{ij}$. Further, the positive impact on exports of lower trade costs and higher foreign market size is higher for firms with participation in its intermediary than the other firms. In addition, average markup of manufacturers decreases with falling trade costs and with market size. As a result, *manufacturers owning equity shares have not only lower marginal costs but also lower markup.* Hence,

Proposition 2 *The probability of exporting and exports are higher for a firm with a participation in its intermediary.*

2.4 Entry

The entry/exit process follows the procedure in Melitz (2003) except that we consider also downstream firms and the producers may own intermediaries. We consider without loss of generality that $b''(\theta) < \sum_j \partial \Lambda^r_{ij}/\partial\theta_i$ so that a manufacturer control its intermediary ($\theta_i = 1$) if and only if $\varphi > \overline{\varphi}_i$ where

$$\overline{\varphi}_i^{\varepsilon-1} = \frac{\left(\frac{\varepsilon}{\varepsilon-1}\right)^{\varepsilon-1}\left(\frac{\varepsilon}{\varepsilon-1}w_i\right)^{\varepsilon-1}}{\left[\left(\frac{\varepsilon}{\varepsilon-1}\right)^{\varepsilon-1} - \left(\frac{\varepsilon}{\varepsilon-1}\right)^{-1}\right]} \frac{\varepsilon\left(\sum_j w_i f_{ij} + b\right)}{\sum_j E_j P_j^{\varepsilon-1}\tau_{ij}^{1-\varepsilon}}$$

Remember that $\Lambda^r_{ij}(1,\varphi) > \Lambda^r_{ij}(0,\varphi)$ and profits rise with labor productivity, implying thus $\pi(1,\varphi) > \pi(0,\varphi)$. Hence, an intermediary serves country j if and only if $\Lambda^r_i(0,\varphi) > w_i f_{ij}$ or, equivalently, the productivity of the upstream firm is higher than the cutoff productivity for an independent intermediary located in country i to serve country j, noted φ_{ij}, and given by

$$\varphi_{ij}^{\varepsilon-1} = \left(\frac{\varepsilon}{\varepsilon-1}\right)^{\varepsilon-1}\left(\frac{\varepsilon}{\varepsilon-1}w_i\right)^{\varepsilon-1} \frac{\varepsilon w_i f_{ij}}{E_j P_j^{\varepsilon-1}\tau_{ij}^{1-\varepsilon}} \tag{9}$$

where $\overline{\varphi}_i > \varphi_{ij}$ if and only if

$$\frac{\sum_j w_i f_{ij} + b}{\sum_j E_j P_j^{\varepsilon-1}\tau_{ij}^{1-\varepsilon}} > \left[\left(\frac{\varepsilon}{\varepsilon-1}\right)^{\varepsilon-1} - \left(\frac{\varepsilon}{\varepsilon-1}\right)^{-1}\right] \frac{w_i f_{ij}}{E_j P_j^{\varepsilon-1}\tau_{ij}^{1-\varepsilon}}$$

In other words, *foreign countries with small potential market can be served if the manufacturers own an intermediary and exhibit high productivity.* Note that Akerman (2010) and Ahn, Khandelwal, and Wei (2011) reveals that intermediary export shares increase in distance and fall with destination GDP.

Each firms have to pay a sunk entry cost equal to f_e units of labor, but manufacturers do not know a priori their productivity and intermediaries do not know a priori their supplier (and thus the productivity of the firm producing the product to be traded). Firms decide then to serve country j. If the firm does produce, it faces with a constant probability δ a shock which forces it to exit. As the productivity of a firm remains constant over time, its optimal profit level is constant too, until a shock forces it to exit. A manufacturer enters the market as long as the expected value of entry is higher than the enter sunk cost. The expected profit of a manufacturer prior to enter the market is given by $[1 - G(\varphi_{ii})]\overline{\Pi}_i$ where $[1 - G(\varphi_{ii})]$ is the probability to enter market and $\overline{\Pi}_i$ is the expected profit conditional on succesful entry. However, manufacturers have to take into account that intermediary can serve the foreign market if and only if $\pi(0,\varphi) > 0$ or, equivalently, its productivity is higher than φ_{ij}. Because the ex post productivity distribution of firms producing in country i and serving country j is $g(\varphi)/[G(\overline{\varphi}_i) - G(\varphi_{ij})]$

and firms owning its intermediary is $g(\varphi)/[1-G(\overline{\varphi}_i)]$, we have

$$\overline{\Pi}_i = \sum_j \lambda_{ij} \int_{\varphi_{ij}}^{\overline{\varphi}_i} \Lambda_{ij}^m(0,\varphi) \frac{g(\varphi)}{G(\overline{\varphi}_i) - G(\varphi_{ij})} \mathrm{d}\varphi + \lambda_i^M \int_{\overline{\varphi}_i}^{\infty} \left[\Lambda_{ij}^r(1,\varphi) - w_j f_j\right] \frac{g(\varphi)}{1 - G(\overline{\varphi}_i)} \mathrm{d}\varphi \tag{10}$$

where $\lambda_{ij} = [G(\overline{\varphi}_i) - G(\varphi_{ij})]/[1 - G(\varphi_{ii})]$ is the probability to serve country j and to have no equity shares in intermediaries and $\lambda_i^M = [1 - G(\overline{\varphi}_i)]/[1 - G(\varphi_{ii})]$ is the probability to acquire an intermediary and to export. To simplify the analysis, we specify the distribution of productivity. As in Arkolakis, Demidova, Klenow, and Rodriguez-Clare (2008), we consider that φ is Pareto distributed on $[1, +\infty)$ with shape parameter γ (with $\gamma > \varepsilon - 1$), and where high γ means that production is highly skewed across firms. More precisely, the probability that firm k exhibits a productivity higher than a value x can be written as $P(\varphi_k > x) = (x)^{-\gamma}$ with $x \geqslant 1$. By using the same strategy adopted in Arkolakis, Demidova, Klenow, and Rodriguez-Clare (2008), we show in Appendix A.2.2 that

$$\overline{\Pi}_i = \frac{\varphi_{ii}^{\gamma}(\varepsilon - 1)}{\gamma - (\varepsilon - 1)} \sum_j \left[w_i f_{ij} \frac{\gamma}{\varepsilon} \varphi_{ij}^{-\gamma} + \overline{\varphi}_i^{-\gamma} (w_i f_{ij} + b)\right]$$

Hence, $[1 - G(\varphi_{ii})]\overline{\Pi}_i = w_i f_e$ is equivalent to

$$\frac{\varepsilon - 1}{\gamma - (\varepsilon - 1)} \sum_j \left[w_i f_{ij} \frac{\gamma}{\varepsilon} \varphi_{ij}^{-\gamma} + \overline{\varphi}_i^{-\gamma} (w_i f_{ij} + b)\right] = w_i f_e \tag{11}$$

It appears also that $\partial\varphi_{ij}/\partial\overline{\varphi}_i < 0$. Indeed, at given mass of firms, $\partial P_j/\partial\overline{\varphi}_i > 0$ because the fraction of manufacturers with a lower markup increases when $\overline{\varphi}_i$ decreases. Because, price index diminishes, the demand for the suppliers with no participation ($q_{ij}(0,\varphi) = E_j P_j^{\varepsilon-1} p_{ij}(0,\varphi)^{1-\varepsilon}$) declines. Hence, the less productive firms exit from the export market (φ_{ij} increases). Hence,

Proposition 3 *A higher share of firms with equity shares ($\overline{\varphi}_i$ decreases) reduces the probability of exporting of firms with no participation.*

Given the high fixed costs of distribution, the participation of a producer in an intermediary can act as a barrier to entry for small manufacturers.

2.5 Discussion

We discuss on the robustness our results by extending our framework.

2.5.1 Multi-product retailers with local monopoly power

We consider a single intermediary importing products for each country. In other words, each intermediary has an exclusive territory like in Rey and Stiglitz (1995). As in Mathewson and Winter (1987), we assume that intermediaries have a small share of the product

i sales justifying they do not behave as a monopsony. Hence, the sequence of events holds and the profit for an intermediary serving country j becomes

$$\pi_j = \sum_i (1-\theta_i)(\Lambda^r_{ij} - w_i f_{ij}) + \sum_i g(\theta_i)$$

and for manufacturer i is

$$\Pi_i = \sum_j \Lambda^m_{ij} + \theta_i \sum_j (\Lambda^r_{ij} - w_i f_{ij}) - \sum_j g(\theta_j)$$

This configuration corresponds to the case of monopolistic competition with multi-product firms (Feenstra and Ma, 2007). Hence, the profit maximizing price set by the intermediary is given by

$$p_{ij} = \left[\frac{1}{(\varepsilon-1)(1-s_j)} + 1\right] z_{ij} \quad \text{with} \quad s_j \equiv \int_{\underline{\varphi}_j} p_{ij}^{1-\varepsilon} \mathrm{d}\varphi \Big/ \int_{\Omega_j} p^{1-\varepsilon}$$

where s_j is the market share of its products in country j. For the manufacturer, P_j and s_j are given so that the wholesale price maximizing the profit of the manufacturer is now

$$z_{ij} = \frac{\varepsilon(1-s_j)}{(\varepsilon-1)(1-s_j)+\theta_i} \frac{\tau_{ij}}{\varphi}$$

with $\partial z_{ij}/\partial s_j < 0$ and $\partial p_{ij}/\partial s_j < 0$. As a result, the operating profits arising from the distribution of product i are

$$\Lambda^r_{ij}(\theta_i, \varphi, s_j) = \frac{[(\varepsilon-1)(1-s_j)+\theta_i]^{\varepsilon-1}}{[\varepsilon(1-s_j)+s_j]^{\varepsilon}} \left(\frac{\varepsilon}{\varepsilon-1}\right)^{1-\varepsilon} \frac{\varphi^{\varepsilon-1} E_j P_j^{\varepsilon-1}}{\tau_j^{\varepsilon-1}}$$

with $\partial \Lambda^r_{ij}/\partial s_j > 0$ if and only if $\varepsilon(\theta_i - s_j) + s_j > 0$ and the operating profits of each producer are

$$\Lambda^m_{ij}(\theta_i, \varphi, s_j) = \frac{(1-s_j-\theta_i)(\varepsilon-1)}{\varepsilon} \Lambda^r_{ij}(\theta_i, \varphi, s_j)$$

with $\partial \Lambda^m_{ij}/\partial s_j < 0$. Hence, when $s_j \to 0$, we fall back on the benchmark case. Starting from low values of s_j, a marginal increase in s_j reduces export sales of firms without no equity shares and exit the less productive firms. Stated differently, *the probability of serving a country decreases with the market power of its retailers.* In contrast, export sales of producers controlling their intermediaries increase when s_j rises marginally. Hence, ceteris paribus, *market shares of more productive exporters are higher in the country where the distribution sector is highly concentrated.*

2.5.2 Forward and backward integration

Consider now that the intermediary has equity shares in its supplier. For simplicity, we consider that each intermediary is specialized in one product. The profit of the intermediary located in country i becomes

$$\pi_i = (1-\theta_i)\sum_j(\Lambda^r_{ij} - w_i f_{ij}) + \gamma_i \sum_j \Lambda^m_{ij} + b(\theta_i) - h(\gamma_i)$$

where γ_i is the shares acquired by the intermediary in supplier i and $h(\gamma_i)$ is the price paid by the intermediary, whereas the profit of manufacturer i is expressed as follows

$$\Pi_i = (1-\gamma_i)\sum_j \Lambda^m_{ij} + \theta_i \sum_j \left(\Lambda^r_{ij} - w_i f_{ij}\right) - b(\theta_i) + h(\gamma_i)$$

Under this configuration, prices set by the intermediaries in country j are given by

$$p_{ij} = \left[\frac{\varepsilon}{\varepsilon-1} - \frac{\varepsilon\gamma_i}{(\varepsilon-1)(1-\theta_i)}\left(z_{ij} - \frac{w_i\tau_{ij}}{\varphi}\right)\frac{1}{z_{ij}}\right] z_{ij} \tag{12}$$

Markup also varies among intermediaries. Within each foreign country, markup in retail activities decreases with γ_i and θ_i as long as $z_{ij} > \tau_j/\varphi$ while markup increases with z_{ij} if and only if $1-\gamma_i-\theta_i > 0$. As a result, wholesale price is now such that

$$z_{ij} - \frac{w_i\tau_{ij}}{\varphi} = \frac{(1-\theta_i)^2}{(1-\gamma_i-\theta_i)(\varepsilon-1+\theta_i)}\frac{w_i\tau_{ij}}{\varphi} \tag{13}$$

if $1-\gamma_i-\theta_i > 0$ otherwise $z_{ij} = w_i\tau_{ij}/\varphi$. Hence, the equilibrium price paid by the end consumer is expressed as follows:

$$p_{ij} = \frac{\varepsilon}{\varepsilon-1}\frac{\varepsilon}{\varepsilon-1+\theta_i}\frac{w_i\tau_{ij}}{\varphi}$$

It follows $\partial z^*_{ij}/\partial\gamma_i > 0$ and $\partial p^*_{ij}/\partial\gamma_i = 0$. Stated differently, a rise in γ_i does not affect the demand for the variety (q_{ij}) but increases the operating profits of the manufacturers (Λ^r_{ij}). In other words, *the probability of exporting and export sales increases with γ_i for firms controlled by an intermediary.*

2.5.3 Lower export fixed cost

Another purpose of vertical ownership is to transfer intangible inputs within firms (Atalay, Hortacsu, and Syverson, 2012). Owning distribution network may also help a company to reduce sunk costs associated with exports or to acquire information on foreign markets. Intermediaries such as wholesalers and retailers, by connecting producers with consumers, may have informational superiority about the foreign markets. As underlined by Rey and

Tirole (1986), informational asymmetries exist between the producers and the intermediaries distributing their products. Distributors are better informed than producers about the state of uncertain demand because intermediaries are able to meet face to face consumers. Hence, manufacturers can be motivated to use vertical integration as a business strategy to reduce fixed export costs.

Trade costs may shrink by acquiring an intermediary. Assume that fixed export costs to country j are now given by $f_{ij}(\theta_i)$ where $f_{ij}(\theta_i)$ decreases with θ_i (for simplicity if $\theta_i = 1$, $f_{ij}(1) = f_{ij}^w$ with $f_{ij}^w < f_{ij}$) and trade costs to reach foreign countries borned by a firm related to the fact whether a firm owns an intermediary (for simplicity if $\theta_i = 1$, $\tau_{ij}(1) = \tau_{ij}^w$ with $\tau_{ij}^w < \tau_{ij}$). Hence, the costs associated with exports are not only specific to the destination but also depend on whether the firm producing the variety to be traded controls its intermediary. Hence, the probability of serving country j of a firm is given by $\overline{\varphi}_{ij}^{-\gamma}$ where $\overline{\varphi}_{ij}$ is the cutoff productivity to serve a market (specific to the level of θ_i) given by $\Lambda_i^r(\theta_i, \overline{\varphi}_{ij}) = w_i f_{ij}$ (see Section 2.3). We consider the case where $\theta_i = 1$ or $\theta_i = 0$. Because $\Lambda_i^r(\overline{\varphi}_{ij}(I^v)) = E_j P_j^{\varepsilon-1}[p_{ij}(\overline{\varphi}_{ij}(I^v))]^{1-\varepsilon}/\varepsilon$ (with $I^v = 1$ if manufacturer v owns an intermediary and $I^v = 0$ otherwise) and using the expression of P_j in Appendix A.2.3, we obtain

$$\overline{\varphi}_{ij}(I^v) = \frac{\varepsilon}{\varepsilon-1}\frac{\varepsilon}{\varepsilon-1+I^v}\varepsilon^{\frac{1}{\varepsilon-1}} w_i^{\frac{\varepsilon}{\varepsilon-1}} E_i^{\frac{1}{\gamma}} \Theta_{kj}^{\frac{1}{\gamma}} F_{ij}^{\frac{1}{\varepsilon-1}} T_{ij} \tag{14}$$

where Θ_{kj} corresponds to an adaptation of the multilateral resistance index in Anderson and van Wincoop (2004) and is defined in Appendix A.2.3 and with $F_{ij}^v = \left[f_{ij}\left(1-I^v\right) + f_{ij}^w I^v\right]$ and $T_{ij} = \left[\tau_{ij}\left(1-I^v\right) + \tau_{ij}^w I^v\right]$. Hence,

$$\frac{\overline{\varphi}_{ij}(0)}{\overline{\varphi}_{ij}(1)} = \frac{\varepsilon}{\varepsilon-1}\left(\frac{f_{ij}}{f_{ij}^w}\right)^{\frac{1}{\varepsilon-1}}\frac{\tau_{ij}}{\tau_{ij}^w}$$

Thus, for a same level of productivity, a producer owning its intermediary is more likely to export. In addition, whether export costs are lower for manufacturers owning an intermediary, the probability of acquiring an intermediary increases ($\overline{\varphi}_i$ decreases) so that more firms own intermediaries. However the fall in fixed export costs concerns only the more productive firms. As a consequence, export sales of firms with no participation decline.

3 Data

3.1 The database

This study uses an original database that compiles information on national and foreign acquisitions of French agri-food firms for the year 2008. Data originate from the Amadeus

Table 1: Summary statistics by firm's type

Firm's type	Frequency	Productivity	# of employees	Exporting (%)
Single firm	7488	0.06	0.11	11.12
Acquiring firm	421	0.12	0.04	51.54
Acquiring and acquired firm	444	0.10	0.73	70.95
Acquired firm	1247	0.06	0.06	44.43

database published by Bureau van Dijk (2005), which records comparable financial and business information for public and private firms across Europe. The data are collected from company reports and balance sheets, and are updated weekly. The accounting data include firm-level variables such as sales, value-added or employment among others. Compared to the annual census collected by the French national institute of statistic (*Enquête Annuelle d'Entreprises – EAE*), the Amadeus database has the advantage to cover a larger sample of firms by recording also information of firms of less than 20 employees.

In addition, the Amadeus database provides information on financial links among firms, which is of prior importance for our study. For a given firm, the Amadeus database lists its subsidiaries (if any) and records for each one the value of the equity transaction involved. Using this information, we are able to track the acquisition transactions of French agri-food firms with any firm operating in Europe, whatever the activity sector of the acquired firm. Since we are interested to recover the ownership structure of French agri-food firms, we need to compile their acquisition transactions in order to draw their network. The difficulty arises from the need to consider the transactions originating from them but also those involving their subsidiaries. In that respect, we construct an algorithmic procedure which allows us to identify all the firms belonging to the same group as the French agri-food firm. We then apply this procedure on the Amadeus database (see details in Appendix B.1). It follows that according to firm's ownership structure, a French agri-food firm must belong to one of the following categories: *acquiring firm* when the firm has only participtions in other firms, *acquiring and acquired firm* when in addition to participations in other firms the firm has sold part of its capital to one or more firms, or *acquired firm* when the firm was solely acquired by other firms. However, since this paper focus on the effect of vertical ownership, we exclude from the database the acquisition transactions that do not involved directly a French agri-food firm (i.e., acquiring or acquired firm). By concentrating on direct acquisitions, one ensures that French agri-food firms benefit from the activity sector of the acquiring (acquired) firm. On the other hand, by eliminating the indirect acquisitions we may understate the effect of intermediation because firms that benefit from the existence of intermediaries in their network are treated as single firms (e.g., a French agri-food firm whose parent company owns also an intermediary). Table 1 reports some summary statistics on French agri-food firms according to their type. It is striking to note that French agri-food firms involved in acquisition transactions are, on average, more productive, larger and have a higher probability to export than single firms.

The version of the Amadeus database used in this paper is a cross-sectional sample extracted at the beginning of 2009. Overall, the sample covers 22500 French firms operating in the agri-food sector. To supplement information on the export behavior of firms, we merge the Amadeus database with the French customs dataset for the year 2008. This dataset comes from the register of French Customs and identifies all French exporters, regardless of their size and export destination. The flows were reported in terms of export value and quantity at the 8-digit NACE level but are aggregated at the firm level for the purpose of our study. Moreover, owing to the activity sector of French agri-food firms, we concentrate exlusively on agri-food exports.

3.2 Definition of variables

One key element of our analysis refers to the definition of firms facilitating trade (i.e., intermediary). Departing from the NACE (Revision 2) codes, we classify firms involved in acquisition transactions with French agri-food firms in five activity sectors (upstream activities, horizontal activities, intermediary activities, transport activities and service activities) and twelve activity subsectors. Details on the classification are reported in Appendix B.2. We then consider as intermediate activities the direct links gathered under the activity sector "intermediaries" and the subsector "food and beverage service activities".

In line with our theoretical model, we first concentrate on the effect of downstream acquisitions and investigate the issue of upstream acquisitions in the robustness subsection.

The central prediction of our model is that participation in intermediary firms increases the probability of exporting as well as export sales (see Proposition 2). To confront this prediction to data, we evaluate in the next section the causal effect of acquire an intermediary on these two outcomes. For that purpose, we need to control for selection on confounding factors in order to explain simultaneously the decision to acquire an intermediary and the outcome. The choice of the covariates is guided both by the predictions of our model and by the literatures on M&A and export trade. Following Proposition 1, we expect that more productive firms are more likely to acquire an intermediary. More broadly, the literature on M&A has shown that firm self-selects to become an acquirer of a "horizontal firm" according to its productivity (Stiebale and Trax, 2011; Spearot, 2012). This selection effect was also largely documented when explaining entry into export markets (see, for e.g., Clerides, Lach, and Tybout, 1998). Our empirical model accounts for this selection effect by introducing as a covariate the firm's productivity measured through the value-added per employee (see Table 2). Besides, it has been long

Table 2: Variable descriptions

Variable	Definition
Employment	Number of employees (in thousands)
Productivity	Value-added (in thousand euros) per employee
Nace (XXX)	3-digit NACE (Revision 2) code
Intermediary	Equal to one if the firm has acquired a firm operating in the intermediary sector
Upstream acq.	Equal to one if the firm has acquired a firm operating in the upstream sector
Horizontal acq.	Equal to one if the firm has acquired a firm operating in the same sector as it
Transport acq.	Equal to one if the firm has acquired a firm operating in the transport sector
Finance - Insurance acq.	Equal to one if the firm has acquired a firm operating in the finance - insurance sector
Business services acq.	Equal to one if the firm has acquired a firm operating in the business services sector
Accommodation acq.	Equal to one if the firm has acquired a firm operating in the accommodation sector
Real estate acq.	Equal to one if the firm has acquired a firm operating in the real estate sector
% of exporters	Percentage of exporting firms computed at the 4-digit NACE level
% of intermediary	Percentage of intermediary acquisitions computed at the 4-digit NACE level
Rivals' mean productivity	Mean productivity of a firm's rivals at the 4-digit NACE code level
# of countries from non-intermediary acquisitions	Number of distinct countries associated to acquisitions in other sectors than wholesaling
# of value-added from rivals owning intermediary	Percentage of value-added yielded by rival firms that have acquired an intermediary at the 4-digit NACE code level

demonstrated that firm size constitutes another determinant of the decision to acquire a company. This element participates to the well-know "superstar" effect (i.e., bigger and more productive firms are more likely to take equity and to export). We thus control for firm size through the number of employees. The model accounts also for acquisitions made by a firm in other activity sectors than intermediary sector (for e.g., upstream or transport sector). Lastly, we include some sector fixed-effects to account for unobserved determinants that influence evenly the acquisition decision of firms in a given sector.

Looking at the data, we find various cases behind the simple information of having acquired or not an intermediary. For instance, some French agri-food firms have acquired domestic intermediaries while others own domestic and foreign intermediaries. Moreover, some firms have also participations in other firms operating in sectors distinct from that of wholesaling or retailing. In order to disentangle the various reasons that may be captured by a "raw" causal effect, we consider in the rest of the paper three samples. First, we deal with the whole sample of firms. In this case, firms that have taken equity

Table 3: Number of acquiring firms by firm's type and by nature of acquisitions

	Full sample			Excluding foreign intermediary			Intermediary(ies) exclusively		
	Home	Foreign	Mixed	Home	Foreign	Mixed	Home	Foreign	Mixed
Acquiring firm	231	3	3	231	–	–	188	1	2
Acquiring and acquired firm	167	29	35	167	–	–	74	5	3
Sub-Total	398	32	38	398	–	–	262	6	5
Total		**468**			**398**			**273**	

Notes: This table displays the number of acquiring firms that have several acquired firms in various sectors (and at less one in the wholesale sector) as well as those that have acquired firms that solely operate in the wholesale sector. These figures are both reported by origin of destination and by firms' status.

shares in an intermediary may have also acquisitions in other activity sectors (i.e., *full sample*). Second, in order to analyze whether acquiring a domestic intermediary favor trade, we exclude from the sample firms that have a foreign intermediary in their direct network (i.e., *excluding foreign intermediaries*). A complementary approach would be to investigate the effect of foreign intermediaries on trade without considering domestic intermediary links. However, as shown in Table 3, the dataset contains only 68 firms that have foreign intermediaries which prevent us to conduct a dedicated analysis. Lastly, to deepen our analysis, we focus on firms that have only acquired intermediaries to eliminate trade benefits that may result from acquisitions in other activity sectors (i.e., *intermediary(ies) exclusively*).

4 Participation in intermediary and export performance

4.1 Empirical strategy and identification issues

In order to confront the predictions of our model to the data, we are interested to evaluate the causal effect from an acquisition of an intermediary by a firm on its export decision and on its export sales (if exporting). Let $d_i \in \{0, 1\}$ be an indicator of whether firm i acquires an intermediary, and y_i the outcome variable of interest (i.e., export decision or export sales) of firm i. We denote by y_i^1 the outcome of firm i if it has acquired an intermediary (the firm is thus exposed to the treatment and called a treated firm), and by y_i^0 the outcome if it has not acquired a wholesaler (a control firm or equivalently a non-treated firm). The causal effect of a forward acquisition from firm i on the outcome of interest may be defined as the difference of outcome values depending on whether it has acquired an intermediary or not. Following the microeconometric evaluation literature (Heckman, Ichimura, and Todd, 1997; Dehejia and Wahba, 1999), we define the average treatment effect on the treated (ATT) as:

$$\tau_{ATT} = \mathbb{E}\left\{y_i^1 - y_i^0 | d_i = 1\right\} = \mathbb{E}\left\{y_i^1 | d_i = 1\right\} - \mathbb{E}\left\{y_i^0 | d_i = 1\right\} \tag{15}$$

The problem that arises with the calculation of this expression is that y_i^0 is unobservable for a treated firm. For a firm i that has acquired an intermediary, we cannot observe the outcome value it would have obtained, on average, if it has not acquired an intermediary. At first sight, one possible option might be to substitute the last term of Eq.(15) with the mean outcome of non-acquiring firms. Nonetheless, because firms decide to acquire intermediaries based on factors that also influence their outcome (e.g., productivity or competitive pressure), this approximation inevitably introduces a selection problem. A solution to the selection problem retained in this paper consists of employing a matching method (see Imbens, 2004, for a review). The basic idea behind matching methods is to pair each acquiring firm with firms that have not acquired an intermediary on the basis of similar observable covariates (i.e., firm characteristics). In such a way, differences between a treated firm and its relevant *control group* must be attributed solely to the treatment.

Since conditioning on firm characteristics can lead to dimensionality problems in case of large sets of characteristics ("curse of dimensionality"), Rosenbaum and Rubin (1983) suggested to summarize all the information in a single scalar (i.e., the *propensity score* in our case). Accordingly to the propensity score method (PSM), we express the firm's probability to acquire an intermediary as a function of all of the relevant covariates and derive this probability through a probit model:

$$p(\mathbf{X}_i) \equiv \Pr\{d_i = 1|\mathbf{X}_i\} = \Phi\{\mathbf{X}_i\} \tag{16}$$

where $\Phi\{\cdot\}$ is the normal cumulative distribution function and $\mathbf{X}_i$ the vector of firm characteristics i. The choice of covariates to be included in the probit model must be guided by their simultaneous explanatory power on the decision to acquire an intermediary and the outcome variable (Caliendo and Kopeinig, 2008). Further, to avoid bias in the ATT estimator, the covariates must satisfy a condition of exogeneity with respect to the decision to acquire an intermediary and the expected value of the outcome conditional to treatment.[1]

Replacing the last term of Eq.(15) by the counterfactual constructed from the PSM allows us to rewrite the ATT estimator as follows:

$$\begin{aligned} \tau_{ATT} &= \mathbb{E}\left\{y_i^1 - y_i^0|d_i = 1\right\} \qquad (17) \\ &= \mathbb{E}\left\{y_i^1|d_i = 1, \mathbf{X}_i\right\} - \mathbb{E}\left\{y_i^0|d_i = 0, \mathbf{X}_i\right\} \\ &= \mathbb{E}\left\{y_i^1|d_i = 1, p(\mathbf{X}_i)\right\} - \mathbb{E}\left\{y_i^0|d_i = 0, p(\mathbf{X}_i)\right\} \end{aligned}$$

[1]Usually, the microeconometric evaluation literature satisfies this condition by introducing covariates measured before treatment. Unfortunately, the cross-sectional nature of our data prevents us to adopt this strategy. In order to address concerns regarding this form of endogeneity issue, we rely on previous findings in the literature and we also conduct some regression-based tests to guarantee the exogeneity assumption of the covariates.

The identification of the causal effect then relies on two central assumptions. First, both treatment assignment and observed covariates must be conditionally independent given the propensity score. This means that for identical propensity scores, treated and non-treated firms are assigned randomly to treatment, which implies that the distribution of the covariates are balanced in both the treated and control groups. Accordingly to Rosenbaum and Rubin (1983, Lemma 1), the *balancing hypothesis* may be expressed as follows:

$$d_i \perp\!\!\!\perp \mathbf{X}_i \quad | \quad p\left(\mathbf{X}_i\right) \tag{18}$$

This assumption is directly testable and we use several statistical tests hereafter to check whether observations within the same propensity score stratum have the same distribution of covariates independently of the firm's status.

Second, we have to ensure that the treatment satisfies some form of exogeneity. This assumption, known as the *unconfoundeness* assumption, implies that treated and non-treated firms with similar observed covariates would not differ in their potential outcome even in the absence of treatment. Put differently, systematic differences between those firms must be attributable to the treatment. This implies that, given a set of covariates, potential outcomes are independent from treatment assignement (Rosenbaum and Rubin, 1983, Lemma 2):

$$y_i^0, y_i^1 \perp\!\!\!\perp d_i \quad | \quad \mathbf{X}_i \tag{19}$$

which combined with the balancing hypothesis (see Eq.(18)) can also be stated as

$$y_i^0, y_i^1 \perp\!\!\!\perp d_i \quad | \quad p\left(\mathbf{X}_i\right) \tag{20}$$

This assumption is strongly restrictive in the sense that it imposes that the data must contain all of the factors which determine the treatment decision and also influence the outcome variable. This implies that there is no confounding factors (i.e. factors which determine the treatment decision and also influence the outcome variable) that are not observable. Unfortunately, this assumption is not testable. To ensure that this condition is satisfied, we rely on theoretical grounds and previous empirical analysis to select the most relevant covariates, but failure to properly control for selection on observables will inevitably generate a selection bias. However, it is possible to test the sensitivity of our result to the possibility of unobserved confounding factors. In the robustness tests sub-section, we apply Rosenbaum (2002) bounds to assess the exposure of our ATT estimator to unobserved confounding factors.

Finally, to ensure that the propensity score matching estimator correctly identifies the treatment effect, the probability of being assigned to treatment, conditional of a set of covariates X, must be bounded away from zero and one (Rosenbaum and Rubin, 1983, Lemma 3)

$$0 < \Pr\left(d_i = 1|\mathbf{X}_i\right) < 1 \tag{21}$$

meaning that there is no perfect prediction of the treatment status given the set of observed covariates. This guarantees that firms with the same characteristics X have a positive probability of being both acquiring and non-acquiring, and consequently that there exists a suitable counterfactual for each treated unit in theory. The results of this study satisfy this condition, known as the common support (or overlap) condition, by excluding firms with a propensity score outside the region of common support of the treated and control groups. The combination of hypotheses Eq. (20) and Eq. (21) refers to what Rosenbaum and Rubin (1983) named the assumption of *strongly ignorable* treatment assignment, and allows to analyze a nonrandomized experiment as if it had come from a randomized experiment by substituting the y_i^0 distribution of acquiring firms (that is unknown) by the y_i^0 distribution of the matched non-acquiring firms.[2]

Assuming these assumptions hold, there is several alternative ways to delimit the neighbourhood of a treated firm wherein looking for valid counterfactuals, and also different ways to weight these neighbors (see Caliendo and Kopeinig, 2008, for an overview of PSM estimators). For notational simplicity, let denote p_i the propensity score of the n_1 firms that belong to the set $I_1 \cap S_P$ of treated firms (i.e., treatment group) and p_j the probability for firms belonging to control group $I_0 \cap S_P$ (both types of firms lying in the region of common support S_P). A standard matching estimator of the causal effect of forward acquisition takes the form

$$\widehat{\alpha}_M = \frac{1}{n_1} \sum_{i \in I_1 \cap S_P} \left[y_i^1 - \sum_{j \in I_0 \cap S_P} g\left(p_i, p_j\right) y_j^0 \right] \tag{22}$$

in such a way that the counterfactual for each treated firm $i \in I_1 \cap S_P$ is constructed as a weighted average over the outcomes of non-treated firms, where the weights $W\left(i, j\right)$ are expressed as a function $g\left(\cdot\right)$ of the propensity scores. There is a wide variety of matching estimators proposed in the literature which differ in the way of calculating the weights. In the rest of the paper, we assess the causal effect of intermediation by using successively radius matching, kernel matching and local linear matching estimators.[3] For instance, in

[2]Heckman, Ichimura, and Todd (1998) have demonstrated that the strongly ignorable assumption can be weakened when we want solely estimate the ATT (and not the ATE). In this case, it is sufficient to require *unconfoundness for controls* (i.e., $y_i^0 \perp\!\!\!\perp d_i|\mathbf{X}_i$) and *weak overlarp* (i.e., $\Pr\left(d_i = 1|\mathbf{X}_i\right) < 1$).

[3]By contrast with matching estimators build upon pairwise comparisons, all of these three estimators use a larger number of counterfactuals. These approaches are particularly well-suited when the number of control units is large, as in our case. The *radius matching* computes the mean outcome of the counterfactuals that satisfy a maximum distance criteria with the propensity score of the treated firm. *Kernel matching* and *local linear matching* are nonparametric matching estimators that construct a weighted average of the outcome over the whole sample of control units. By using all the information available in the control group, these methods diminish the variance of the estimator but, on the other hand, increase the risk of bad matches which might increase the bias of the estimator (Heckman, Ichimura, and Todd,

the case of the kernel matching the weights affected to the non-treated firms are defined according to a weighting function

$$g(p_i, p_j) = \frac{K\left(\frac{p_j - p_i}{a_n}\right)}{\sum_{k \in I_0 \cap S_P} K\left(\frac{p_k - p_i}{a_n}\right)} \tag{23}$$

where $K(\cdot)$ is the kernel function and a_n is a bandwidth parameter.

The key insight of matching procedures consists in finding counterfactuals as similar as possible than the treated firm. In this regard, we decide to restrict the sample of potential control firms to firms belonging to the same industry (2-digit NACE) as the acquiring firm. This allow us to control for unobserved covariates defined at the industry level (e.g., the degree of competition), which can influence both the treatment assignment and the outcome. In a second step, we push the degree of matching a little further by matching within each sector (3-digit NACE).

4.2 Results

We begin by discussing the quality of the matching procedure through the estimates of the propensity scores and the balancing tests. Table 4 displays the estimated coefficients of the probit model for the alternative samples. The first three columns correspond to the causal effect on the probability to export, whereas the last three columns report the estimates for the causal effect on export sales.

Looking at the estimates of column 1, we note that in accordance with Proposition 1, the more productive firms are, the higher the probability they have to acquire an intermediary. However, the significance of this result vanishes once acquisitions of foreign intermediaries and acquisitions made in other activity sectors are removed from the sample (columns 2 and 3). By contrast, when firms export, it appears that their productivity is not significant in the decision to acquire an intermediary. The positive coefficient for employment shows that firm size significantly impacts the decision to acquire an intermediary, as expected. We also note that firms holding equity shares of firms operating in non-intermediary sector, are more likely to take capital participations in intermediary companies. This is particularly marked for the whole sample of firms (not conditioned to the decision to export).

As explained previously, an important issue of PSM methods relies on the validity of the balancing hypothesis. In order to obtain an unbiased estimate of the ATT, we must

1998). They differ in the definition of the weighting function. In addition to the term $(p_i - p_j)$, that allow to interpret kernel matching as a weighted regression on an intercept, local linear matching procedure includes a linear term in p_i to allow more flexibility in the computation of the weights. This variant is more robust when the propensity score's distribution of control units is distributed asymmetrically compared to that of the treated units (Busso, DiNardo, and McCrary, 2009).

Table 4: Propensity score estimates (Probit model)

	Exporting			Sales export (conditional on exporting)		
	Full sample	Excluding foreign intermediary	Intermediary(ies) exclusively	Full sample	Excluding foreign intermediary	Intermediary(ies) exclusively
Upstream acq.	0.6455***	0.5191**		0.6811***	0.4418	
	(0.2002)	(0.2208)		(0.2407)	(0.2783)	
Horizontal acq.	0.8695***	0.8069***		0.6794***	0.5889***	
	(0.0764)	(0.0803)		(0.0941)	(0.1008)	
Transport acq.	1.1335***	1.2365***		0.5777*	0.7262**	
	(0.2762)	(0.2780)		(0.3275)	(0.3389)	
Finance - Insurance acq.	0.3785**	0.4021**		0.2936	0.2738	
	(0.1793)	(0.1938)		(0.2069)	(0.2338)	
Business services acq.	0.8869***	0.5689**		0.8111***	0.3919	
	(0.1942)	(0.2300)		(0.2168)	(0.2681)	
Productivity	0.2742**	0.2049	0.1660	0.2298	0.0543	-0.0145
	(0.1296)	(0.1362)	(0.1364)	(0.1679)	(0.2182)	(0.2215)
Employment	0.7772***	0.5548***	2.7551***	0.5378***	0.3525**	1.6187***
	(0.1227)	(0.1374)	(0.3510)	(0.1230)	(0.1396)	(0.4024)
Constant	-2.0510***	-2.0494***	-2.0651***	-1.5775***	-1.5868***	-1.3529***
	(0.0619)	(0.0625)	(0.0752)	(0.0997)	(0.1009)	(0.1369)
Sector (FE)	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo-R^2	0.2873	0.2379	0.2344	0.1556	0.0965	0.0657
Observations	9600	9530	7761	1919	1857	988

Notes: Standard errors in parentheses.*, **, *** indicate significance at the 10%, 5%, 1% level, respectively. Sector fixed-effects (3-digit NACE) are included.

ensure that firms with identical propensity score have, on average, the same distribution of covariates independently of treatment status. We perform a number of balancing tests suggested in the literature to check whether this hypothesis holds (Dehejia, 2005; Smith and Todd, 2005). Table 5 reports the results of the balancing tests for kernel matching and for the propensity score corresponding to column (1) of Table 4.[4] The first two columns display the mean of the covariates used in the propensity score specification for the matched observations of the treated and control groups. As the t-test shows, the equality of means between the groups is verified for almost all of the covariates, suggesting that the matching procedure succeed to eliminate most of the differences. A much detailed examination of these differences can be carried on through the computation of the standardized differences (% bias). This statistic informs about the difference in means between the treated group and the reweighted comparison group, scaled by the square root of the average of the variances of the unweighted groups.

$$\text{SDIFF(x)} = 100\frac{\frac{1}{n_1}\sum_{i\in I_1}\left(x_i - \sum_{j\in I_0} g\left(p_i, p_j\right) x_j\right)}{\sqrt{\frac{\left(var_{i\in I_1}(x_i)+var_{j\in I_0}(x_j)\right)}{2}}}$$

Despite the absence of a formal criterion, the literature retains a value of 20% as a maximum difference accepted between means (Rosenbaum and Rubin, 1985). All the variables satisfied this criterion. We perform a last test suggested by Smith and Todd (2005) by regressing each covariate on the propensity score $\widehat{P}(X)$, some polynomial of higher order, and interaction terms between the propensity score and the treatment variable D:

$$x = \beta_0 + \sum_{k=1}^{3}\beta_k\widehat{P}(X)^k + \sum_{k=1}^{3}\gamma_k D\widehat{P}(X)^k + \eta$$

The idea of the test relies on the joint null hypothesis such as $\gamma_k = 0$, which implies that the treatment status is independent of the covariate, conditional on the propensity score. We report the F-statistic and the p-value of the joint null hypothesis in the last two columns of Table 5. Again, this test confirms the balance of the covariates between the treated and control groups.

Once confirmed that, conditional on the propensity score, firms are assigned randomly to treatment, we can quantify the causal effect from an acquisition of an intermediary by a firm on its export decision and export sales by comparing the mean value of the outcome between the treatment and control groups. Table 6 presents the ATT estimates on the probability to export (Panel A) and export sales (Panel B) for the three matching estimators retained. Within each panel, we report the ATT estimates computed when one restricts the sample of potential counterfactual firms within the same industry (Panels

[4]The balancing tests for the other specifications and alternative matching procedures are not reported due to space limitations but are avaible upon request from the authors.

Table 5: Balancing tests from kernel matching

Variable	Mean		%	% Bias	t-test		Regression-based test	
	Treated	Control	Bias	reduction	t-stat	(p-value)	F-stat	(p-value)
Upstream acq.	0.04	0.04	1.8	95.0	0.26	(0.80)	2.13	(0.09)
Horizontal acq.	0.27	0.26	3.1	96.2	0.36	(0.72)	3.41	(0.02)
Transport acq.	0.03	0.01	11.2	57.2	1.62	(0.11)	1.23	(0.30)
Finance-Insurance acq.	0.05	0.04	3.1	92.7	0.47	(0.64)	1.41	(0.24)
Business services acq.	0.05	0.03	7.3	81.1	1.06	(0.29)	0.67	(0.57)
Productivity	0.11	0.10	0.6	96.9	0.19	(0.85)	0.73	(0.53)
Employment	0.13	0.12	0.1	99.6	0.08	(0.94)	1.21	(0.31)
Nace (102)	0.02	0.01	1.6	45.5	0.22	(0.82)	0.98	(0.40)
Nace (103)	0.04	0.03	4.6	67.3	0.65	(0.52)	0.44	(0.72)
Nace (104)	0.01	0.01	-0.1	98.4	-0.01	(0.99)	0.29	(0.83)
Nace (105)	0.08	0.07	4.1	70.4	0.56	(0.58)	0.46	(0.71)
Nace (106)	0.05	0.04	4.5	52.2	0.59	(0.56)	1.25	(0.29)
Nace (107)	0.06	0.13	-20.0	82.3	-3.88	(0.01)	0.02	(0.99)
Nace (108)	0.12	0.09	10.3	5.4	1.46	(0.15)	0.87	(0.45)
Nace (109)	0.09	0.09	-0.3	98.9	-0.04	(0.97)	0.47	(0.70)
Nace (110)	0.40	0.40	0.0	100	0.00	(1.00)	0.27	(0.85)

Notes: The balancing tests are performed for the ATT estimate computed over the full sample with kernel matching estimator and matches within the same industry. The first two columns report the mean of the covariate in the treated and control group, respectively. The next two columns present the bias and the percentage bias reduction for the matched sample. The columns associated to the t-test give the t-statictic and the p-value of the mean equality test between the treated and control groups. The last two columns display the F-statistic and the p-value of the regression-based test. Since the balancing tests are reported when matches are realized within the same industry, the tests of equality of means in the matched sample for the NACE code (110) is not relevant.

A.1 and B.1), or within the same sector (Panels A.2 and B.2), as the treated firm.

Considering first the export decision (Panel A), we find that acquiring equity shares of an intermediary impacts significantly the probability to export. Assuming that there exist relevant counterfactual firms within the industry (Panel A.1), we estimate a rise in the probability to export between 15.79% to 20.15%, depending the matching estimator. One possible explanation of this substantial effect may be due to the reduction of market entry costs generating by the acquisition of an intermediary. One obvious reason of the acquisition of an intermediary lies in intermediaries' faculty to facilitate trade by filling administrative tasks and managing more efficiently their distribution network, for instance. By eliminating the acquisitions of foreign intermediaries from the sample, we observe roughly similar results albeit slightly lower. To ensure that our results are not driven by unobserved covariates that may go with the acquisition of firms in other activity sectors, we therefore focus on firms that have acquired solely intermediary firms. By comparing this type of firms with our comparison group, we note that the causal effect substantially increases (21.64% to 27.67%, depending the matching estimator), reinforcing our previous finding. This suggests that acquire firms that operate in other sectors than intermediary (e.g., upstream, transport or business services sectors), alongside to the acquisition of an intermediary, does not diminish the probability to export.

One may concern that by finding counterfactuals within the same industry as the treated firm, our results may suffer from bad matches due to not enough similarity be-

Table 6: ATT estimates of intermediation on export decision and log(export sales)

Panel A. Outcome variable: export decision	Full sample			Excluding foreign intermediary			Intermediary(ies) exclusively		
	ATT	S.E.	Obs	ATT	S.E.	Obs	ATT	S.E.	Obs
Panel A.1. Matching within the same industry									
Radius matching	0.2015***	(0.0254)	422(9132)	0.1938***	(0.0266)	378(9132)	0.2767***	(0.0317)	260(7488)
Kernel matching	0.1996***	(0.0255)	422(9132)	0.1869***	(0.0267)	378(9132)	0.2692***	(0.0317)	260(7488)
LL matching	0.1579***	(0.0253)	422(9132)	0.1435***	(0.0266)	378(9132)	0.2164***	(0.0318)	260(7488)
Panel A.2. Matching within the same sector									
Radius matching	0.1416***	(0.0264)	432(9132)	0.1460***	(0.0273)	367(9132)	0.2421***	(0.0320)	256(7488)
Kernel matching	0.1398***	(0.0265)	432(9132)	0.1471***	(0.0274)	367(9132)	0.2386***	(0.0320)	256(7488)
LL matching	0.1304**	(0.0265)	445(9132)	0.1261***	(0.0274)	379(9132)	0.1611***	(0.0335)	260(7488)

Panel B. Outcome variable: log of export sales	Full sample			Excluding foreign intermediary			Intermediary(ies) exclusively		
	ATT	S.E.	Obs	ATT	S.E.	Obs	ATT	S.E.	Obs
Panel B.1. Matching within the same industry									
Radius matching	0.5490***	(0.2066)	285(1619)	0.4360**	(0.2011)	227(1619)	1.0186***	(0.2300)	147(833)
Kernel matching	0.5302**	(0.2072)	285(1619)	0.4368**	(0.2015)	227(1619)	1.0009***	(0.2301)	147(833)
LL matching	0.4328**	(0.2038)	285(1619)	0.3525*	(0.1992)	227(1619)	0.7778***	(0.2326)	148(833)
Panel B.2. Matching within the same sector									
Radius matching	0.5116**	(0.2130)	265(1619)	0.2964	(0.2117)	221(1619)	0.9395***	(0.2335)	145(833)
Kernel matching	0.4815**	(0.2135)	265(1619)	0.3308	(0.2118)	221(1619)	0.9057***	(0.2341)	143(833)
LL matching	0.4570**	(0.2245)	285(1619)	0.2967	(0.2100)	227(1619)	0.0451	(0.2948)	148(833)

Notes: S.E. corresponds to standard errors. The radius matching is performed with a caliper of 0.06. Kernel matching and local linear matching are performed with an Epanechnikov kernel and a bandwidth of 0.8. The region of common support is restricted by applying a trimming procedure at the 5% level. The column Obs reports the number of treated firms and control firms (in brackets) on the region of common support. Stata's command PSMATCH2 is used to perform the estimates.

tween pairing firms. To investigate this issue, we conduct the same estimates by imposing matching within the same sector (3-digit NACE). Overall, we note that the causal effect is still highly significant, albeit its magnitude decreases somewhat (see Panel A.2). For instance, we find that the ATT estimate lies between 13.04% and 14.16% for the full sample.

Turning now to the ATT estimates on the log of export sales, we first comment the results when matching operates within the same industry (Panel B.1). Departing with the original sample, we find that the acquisition of an intermediary raises firm's export sales by 43.28% to 54.90%, depending the matching estimator. Note that belonging to the sample is conditional to exporting, which decreases substantially the size of the control group as well as the number of treated firms. By contrast to the estimates for the causal effect on the export decision, we observe that adopting another definition of the sample (excluding foreign intermediary or intermediary(ies) exclusively) changes dramatically the ATT estimates. When acquisitions of foreign intermediaries are excluded from the sample, we find that the causal effect diminishes approximately by 10% percentage points. One logical explanation is that acquiring a foreign intermediary impacts more firm's export sales. Interestingly, when matching within the same sector (Panel B.2), we find no significant causal effect of acquiring a domestic intermediary on firm's export sales. Finally, when considering firms that have acquisitions solely in intermediary, we observe a higher causal effect as for the export decision. According to the matching estimator, we find that acquiring an intermediary increases firm's export sales between 77.78% and 101.86%. The relevance of the estimated effects may be assessed by comparing their magnitude with the estimation of causal effect of M&A on sales conducted in previous studies. For instance, Stiebale and Trax (2011) evaluate the average causal effect of cross-border M&A on French firms' sales (domestic sales) around 14% for the next two years following the cross-border M&A. Thus, the magnitude of our estimates seems plausible because the effect of acquiring an intermediary could be considered as more important than the effect of a "horizontal" M&A on domestic sales.

4.3 Robustness checks

In this subsection, we perform a series of robustness checks to address two threats of identification that could lead to obtain biased ATT estimates: selection on unobservables and reverse causality. Selection on unobservables occurs when a factor not observed in the data influences simultaneously the treatment assignment and the outcome. Examples of such factors could be numerous in our study. For instance, an unobserved confounding factor could be that firms producing higher quality products are more likely to acquire an intermediary, and simultaneously to cover the fixed costs of exporting. If these correlations are true, the unconfoudness assumption is no more valid and our estimated causal effect is thus pledged with a (unobserved) selection bias (*hidden bias*). We address this concern by applying two approaches that allow to challenge the estimated causal effects with respect to an unobserved confounding factor: Rosenbaum (2002) bounds and an instrumental variables (IV) approach. The second threat of identification is reverse causality. If the decision to acquire an intermediary depends on exporting or must be deemed as opportune once a certain level of export sales is reached, then our ATT estimates are still biased. To give evidence of an absence of reverse causality, an IV approach can be used again.

4.3.1 Rosenbaum bounds

We apply the procedure proposed by Rosenbaum (2002) to test the sensitivity of our matching estimates to a deviation from the unconfoundness hypothesis. In short, the procedure principle consists in determining from what level the hypothetical unobserved factor overturn the estimated ATT. For that, we compute for given unobserved factor values the critical values of the bounds of the deviation in probability (odds ratio) between treated and non-treated firms that have similar observed covariates. The rejection of the hypothesis of no causal effect (null hypothesis) for large values of the unobserved factor will inform about the insensitive of our ATT estimates to an unobserved selection bias. The details of the procedure are provided in Appendix C.1.

We report in Table 7 the sensitivity analyzes performed for the kernel matching estimator over the three samples considered. Overall, the critical level of the unobserved factor Γ is substantially the same among the samples, and does not differ according to the level of matching (industry or sector). For the full sample, we find that the ATT estimate on export decision is overturned for $\Gamma = 7$, i.e. the critical value is attained if an unobserved factor causes the odds ratio of treatment assignment to differ between treated and non-treated firms by a factor of 7. In comparison, the odds ratio for the variables included in the propensity score specification lies between 1.6 (Productivity) and 9.5 (Transport acq.).[5] That means that an unobserved factor might invalidate our causal effect if it is at least 4.3 times larger than the productivity of the mean firm. It is thus unlikely that our causal effects on export decision are sensitive to an unobserved factor. Note that this result is a worse-case scenario. A value of $\Gamma = 7$ does not mean that there is an unobserved confounding factor or no true positive effect of intermediary on export decision. This result means that an unobserved factor would need to increase the treatment probability seven times among treated and non-treated firms as well as completely determine the difference in export probability between the two groups, to

[5]The odds ratio for the variables included in column 1 of Table 4 are: Upstream acq. (3.2), Horizontal acq. (4.9), Transport acq. (9.5), Finance-Insurance acq. (1.9), Business services acq. (5.2), Productivity (1.6) and Employment (4.2). The odds ratio for column 4 are : Upstream acq. (3.3), Horizontal acq. (3.2), Transport acq. (2.8), Finance-Insurance acq. (1.6), Business services acq. (4.2), Productivity (1.5) and Employment (2.6).

Table 7: Results of the Rosenbaum bounds procedure

	Full sample	Excluding foreign intermediary	Intermediary(ies) exclusively
Outcome variable: export decision			
Matching within the same industry	7	6	8
Matching within the same sector	7	6	8
Outcome variable: log of export sales			
Matching within the same industry	1.5	1.2	1.4
Matching within the same sector	1.5	1.2	1.4

Notes: The table displays the critical level of the unobserved factor Γ for which the statistically significant ATT effect starts to be overturned at the 1% level. The critical values are calculated for the kernel matching estimator. We report only the test statistic Q^{+}_{MH} which corresponds to the over-estimated ATT scenario. Stata's command MHBOUNDS is used to compute the critical values of the bounds (see Becker and Caliendo, 2007). We transform the log of export sales in a binary variable in order to compute the MH test statistic, which is calculable only for dichotomous variables.

outweigh our estimated treatment effect.

Considering now the ATT estimate on log of export sales, we find that the ATT estimate for the full sample is overturned for $\Gamma = 1.5$. Compare to the odds ratio of the covariates reported in footnote 5, we conclude that our ATT estimate is questionable regarding the existence of an unobserved confounding factor. Indeed, an unobserved factor that impacts the treatment decision as equally as the productivity of the mean exporting firm could undermine our estimated causal effects. Consequently, the ATT estimates on export sales are more sensitive to a potential unobserved selection bias than the ATT estimates on export decision. These sensitivity analyzes have revealed the uncertainty of the causal effect of acquiring an intermediary on export sales due to selection on unobservables.

4.3.2 IV approach

In what follow, we estimate the causal effect of acquiring an intermediary on firm's export performance (export decision and export sales). By contrast to propensity score methods that assume that information contains in the data is sufficient to explain the treatment decision (*selection on observables*), IV methods address the selection problem by accounting for *selection on unobservables.* In addition, IV approaches are also useful to rule out reverse causality. Nevertheless, inferring causal effect through an IV estimator (e.g., 2SLS) comes at the cost to find "good" instrumental variables, i.e. variables that have no causal effect on the outcome that does not operate through the instrumental variables effect on the treatment decision.

To meet this condition, we employ two sets of instruments that are grounded both on firm acquisitions realized in non-intermediary sectors and on rival characteristics. The first set of instruments includes two binary variables for acquisitions made in accommodation and real estate activity subsectors. Capital participations in these two categories of acquired firms appear to be good markers of the decision to acquire (or not) an interme-

Table 8: OLS and IV/LATE estimates (export decision)

Dependent variable: export decision						
	Full sample		Excluding foreign intermediary		Intermediary(ies) exclusively	
	(OLS)	(IV)	(OLS)	(IV)	(OLS)	(IV)
Intermediary	0.1899***	0.5178**	0.1554***	0.7181***	0.2200***	1.2196***
	(0.0255)	(0.2423)	(0.0273)	(0.2772)	(0.0327)	(0.3231)
Upstream acq.	-0.0186	-0.1106	-0.0599	-0.1590		
	(0.0671)	(0.0973)	(0.0819)	(0.1093)		
Horizontal acq.	0.2866***	0.2250***	0.2655***	0.1850***		
	(0.0238)	(0.0522)	(0.0278)	(0.0491)		
Transport acq.	0.1333	0.0290	0.0461	-0.1403		
	(0.0933)	(0.1326)	(0.1134)	(0.1733)		
Finance - Insurance acq.	0.1126*	0.0439	0.0387	-0.0368		
	(0.0576)	(0.0807)	(0.0794)	(0.0975)		
Business services acq.	0.1366**	0.0453	0.1369	0.0436		
	(0.0585)	(0.0902)	(0.0851)	(0.1091)		
Productivity	0.0247	0.0038	0.0218	-0.0071	0.0346	-0.0154
	(0.0314)	(0.0387)	(0.0518)	(0.0690)	(0.0577)	(0.0898)
Employment	-0.0099***	-0.0113***	0.2007	0.1610	1.3629***	0.7361***
	(0.0034)	(0.0030)	(0.1334)	(0.1220)	(0.2845)	(0.2317)
Constant	0.1621***	0.1570***	0.1657***	0.1577***	0.0852***	0.0742***
	(0.0088)	(0.0095)	(0.0099)	(0.0105)	(0.0093)	(0.0101)
Sector (FE)	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.2647	0.2394	0.2511	0.1808	0.2617	0.1182
Hansen J (p-value)	–	0.4502	–	0.9896	–	0.9911
Exogeneity test (p-value)	–	0.1730	–	0.0288	–	0.0002
Observations	9600	9600	9530	9530	7761	7761

Notes: Robust standard errors in parentheses.*, **, *** indicate significance at the 10%, 5%, 1% level, respectively. Sector fixed-effects (3-digit NACE) are included.

diary while note related to firm's export behavior. For the analysis of firm's export sales, we also account for the number of (distinct) countries where the firm has acquired firms operating in non-intermediary sectors. We expect that exporting firms whose activities are internationally oriented are more likely to acquire an intermediary. The second set of instrument aims at explaining the firm's decision to acquire an intermediary through its surrounding competitive environment. To that respect, we compute the mean productivity of a firm's rivals at the sector level (4-digit NACE). In lines with our model predictions, we expect that firms operating in more productive sectors are also more efficient due to an increase of the exit threshold, which should entail in turn a rise in the probability to acquire an intermediary. Finally, we also account for the percentage of value-added yielded by rival firms that have acquired an intermediary at the sector level (4-digit NACE). We suppose that firms operating in sectors where having an intermediary is an important component of the value-added, are more prompted to acquire an intermediary. By construction of the instrument, this should induce a negative coefficient.

The explanation power of the instruments can be assessed through the F-statistic reported at the first-stage of the estimation procedure. As shown in Table 14, the instruments explain correctly the decision to acquire an intermediary, while successfully pass the rule of thumb for weak instruments.

We first discuss the IV estimates for the export decision reported in Table 8. Instead of estimating a bivariate probit model, we follow the approach suggested by Angrist and Pischke (2009, p.198) and use a 2SLS estimator to measure the causal effect between our binary outcome and our endogenous treatment.[6] Note also that the interpretation of an IV estimator can differ from that of an ATT estimator according to which the causal effect is homogenous or not. In the most likely case of a heterogeneous causal effect among firms, Angrist, Imbens, and Rubin (1996) have shown that the IV estimator estimates the local average treatment effect (LATE), i.e. the average effect of the treatment for the subsample of the population that responds to a change in the instrument (*compliers*).

Considering the three samples, we find that the endogenous nature of the treatment turn out be true for the "Excluding foreign intermediary" and the "Intermediary(ies) exclusively" samples. In other words, the exogeneity-test rejects the hypothesis of selection on unobservables for the full sample, meaning that the unobserved component of the export decision is not correlated with the decision to acquire an intermediary (once controlling for the observed covariates). It results that for the case of the full sample, we refer to the OLS estimates to gain in efficiency. Overall, we note that the OLS and the IV/LATE estimates confirm the statistical significance of the causal effect of acquiring an intermediary on exporting. Even if we control for selection on unobservables, we find that firms that acquire an intermediary enter more frequently into export markets, which may reflect a greater ability to cover fixed costs of exporting. It is however difficult to compute and interpret the estimated LATE because we use several instruments that do not covary evenly with the treatment, and also because the instruments may alter the treatment decision for different subpopulations. Consequently, we confine ourselves to comment the statistical significance of the estimated coefficient.

Turning now to the estimates for the export sales (see Table 9), we find that selection on unobservables is not a issue itself. Notwithstanding, we must be careful with the interpretation of this result owing to the limited explaining power of the instruments (see the J-statistic and the F-statistic in Table 14). The limit with weak instruments is tenuous, which could lead to biased estimates. Looking at the OLS estimates, we obtain very similar results with the ATT estimates reported in Panel B of Table 6. The results confirm the non-significance of the causal effect for the "Excluding foreign intermediary" sample, which suggests that acquire a domestic intermediary does not increase firms' export sales. By contrast, when accounting for foreign acquisitions (Full sample) or when excluding acquisitions made in non-intermediary sectors (Intermediary(ies) exclusively), we confirm the causal effect of owning an intermediary on firms' export sales.

To sum up, the robustness checks conducted in the last two subsections have revealed

[6] The argument in favor of a 2SLS estimator is a gain of robustness by avoiding some strong distributional assumptions but at the expense of an efficiency gain.

Table 9: OLS and IV/LATE estimates (log of export sales)

Dependent variable: log of export sales	Full sample		Excluding foreign intermediary		Intermediary(ies) exclusively	
	(OLS)	(IV)	(OLS)	(IV)	(OLS)	(IV)
Intermediary	0.6635***	0.6210	0.2631	-1.8218	1.0033***	0.8977
	(0.1837)	(1.2697)	(0.1765)	(1.3808)	(0.2244)	(1.0417)
Upstream acq.	1.7789***	1.7899***	1.4998**	1.8517***		
	(0.4923)	(0.5795)	(0.5940)	(0.6662)		
Horizontal acq.	1.3311***	1.3394***	1.0620***	1.3514***		
	(0.1941)	(0.2937)	(0.1806)	(0.2673)		
Transport acq.	0.3346	0.3429	1.0491	1.5221*		
	(0.7650)	(0.7956)	(0.6699)	(0.7838)		
Finance - Insurance acq.	1.8971***	1.9035***	1.2655***	1.4377***		
	(0.4153)	(0.4383)	(0.4196)	(0.4354)		
Business services acq.	0.7438*	0.7546	1.1942**	1.4366***		
	(0.4058)	(0.5209)	(0.5503)	(0.5388)		
Productivity	0.2916	0.2940	0.7927**	0.8182**	0.8333***	0.8330***
	(0.2029)	(0.2150)	(0.3091)	(0.3466)	(0.2867)	(0.2850)
Employment	0.2294	0.2315	2.5189***	2.7285***	7.0610***	7.1127***
	(0.5409)	(0.5520)	(0.4362)	(0.4708)	(2.2900)	(2.4652)
% of exporters	3.3235***	3.3188***	3.0836***	2.8901***	2.6840***	2.6657***
	(0.5886)	(0.6030)	(0.5218)	(0.5390)	(0.7250)	(0.7685)
Constant	4.3413***	4.3445***	4.0723***	4.2167***	3.1541***	3.1677***
	(0.1962)	(0.2142)	(0.1846)	(0.2092)	(0.2682)	(0.2947)
Sector (FE)	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.1516	0.1516	0.1746	0.1143	0.1397	0.1395
Hansen J (p-value)	–	0.2679	–	0.0301	–	0.6465
Exogeneity test (p-value)	–	0.8365	–	0.1547	–	0.9138
Observations	1919	1919	1857	1857	988	988

Notes: Robust standard errors in parentheses.*, **, *** indicate significance at the 10%, 5%, 1% level, respectively. Sector fixed-effects (3-digit NACE) are included.

that our estimates ATT are not equally robust to an endogeneity bias. On the one hand, the causal effect measured for the export decision appears slightly sensitive to selection on unobserved covariates. As we just seen, when the endogeneity hypothesis of the treatment is not rejected, we obtain significant IV/LATE estimates of the causal effect. On the other hand, the Rosenbaum bounds have shown that the ATT estimates for firms' export sales are much more sensitive to an unobserved factor. Nevertheless, it appeared complicated to infer some credible information about the endogeneity nature of the treatment in this last case due to the difficulty to find good instruments.

4.3.3 Acquiring and acquired firms

TBD

5 Additional results

5.1 Does participation in intermediary reduce export-market entry/exit?

Because only high productivity firms have prompted to acquire equity shares in an intermediary, this creates a market externality among manufacturers due to a reallocation of market shares from small firms to large firms. In other words, the reduction of negative vertical externalities magnify the negative horizontal externalities. By controlling an intermediary, large firms hurt small firms because the latter firms loose market shares or exit from foreign markets while the former firms enjoy higher foreign demands. Hence, the share of exporting firms is negatively correlated with the number of firms with equity shares.

To confront the prediction of Proposition 3 to data, we regress the percentage of firms with participation in an intermediary on the percentage of exporting firms at the sector level (4-digit NACE).

$$\% \text{ of intermediary} = \underset{(0.0768)}{0.1489} \times \% \text{ of exporters} \tag{24}$$

We obtain a estimated coefficient of 0.1489 that is statistically significant.[7] The positive correlation corroborates the prediction.

5.2 Does participation in intermediary reduces market-access costs?

5.2.1 Empirical strategy

This section aims at testing for another purpose of vertical ownership that is the transfer of intangible inputs within firms (Atalay, Hortacsu, and Syverson, 2012). This transfer may allows acquirers to reduce the access costs to foreign markets and to improve their export performance (see Section 2.5.3). In what follow, we adapt the empirical methodology developed in Chevassus-Lozza and Latouche (2012) to investigate whether participation in intermediary reduces market-access costs. More precisely, the empirical strategy consists in estimating the thresholds for two samples of manufacturers acquiring or not intermediaries.

As previously, the purpose relies on finding valid counterfactuals to firms that have equity shares in an intermediary. We thus follow the same strategy and control for the selection issue by matching each acquiring firm with a counterfactual constructed from the weights computed for kernel matching. Hence, for a given productivity, we test whether

[7] The standard error is clustered at the sector level.

firms acquiring intermediaries have a better access to reach any country compared to single firms (i.e., non-treated firms).

To do so, we generate the productivity threshold to export to country j and test whether this threshold is significantly lower for manufacturers acquiring an intermediary than for non acquiring ones. To estimate the productivity thresholds, we must first express the probability that French agri-food firm v exports to market j. This is based on the dichotomous event (D_j^v) of zero versus positive exports toward country j. For manufacturers, D_j^v is 1 if firm v serves country j, and otherwise 0. We estimate the probability using the maximum likelihood method. Knowing that the productivity of the firms follow a pareto distribution and that there exists a productivity threshold $\overline{\varphi}_{ij}$ above which firms are able to export to country j, we can compute the likelihood of our sample. We consider as explained in section 2.5.3 that the cutoff productivity depends on the equity shares: $\overline{\varphi}_{ij}(\theta_i)$. Hence we expect that $\overline{\varphi}_{ij}(1) < \overline{\varphi}_{ij}(0)$.

Let D_j^v be a dummy variable which is equal to 1 if firm v exports to country j; I^v remains the dummy variable indicating whether the manufacturer acquired an intermediary or not. The likelihood is given by

$$\begin{aligned} L\left(D_j^v, I_j^v; \theta\right) \;=\; & \prod_v \prod_j \left[\left(\overline{\varphi}_j\left(0\right)\right)^{-\gamma}\right]^{(1-I^v)D_j^v} \left[1-\left(\overline{\varphi}_j\left(0\right)\right)^{-\gamma}\right]^{(1-I^v)(1-D_j^v)} \\ & \times \left[\left(\overline{\varphi}_j\left(1\right)\right)^{-\gamma}\right]^{I^v D_j^v} \left[1-\left(\overline{\varphi}_j\left(1\right)\right)^{-\gamma}\right]^{I^v(1-D_j^v)} \end{aligned} \tag{25}$$

where the subscript i is omitted for presentation pupose. We maximize the weighted likelihood expressed by Eq.(25) to compute the productivity threshold to serve each foreign market. It is worth noting that maximizing this likelihood enables us to compute and explain either the probability that a firm serves a foreign market or the values of the threshold $\overline{\varphi}_j$ as γ - the parameter of the Pareto distribution of the firm's productivity - is known in our sample. Here, we choose to work directly on the thresholds. The specification of $\overline{\varphi}_j(\theta)$ is given in Eq.(14) so that:

$$\ln \overline{\varphi}_j^s(\theta) = \alpha_0 + \alpha_1 \ln E_j^s + \alpha_2 \ln \Theta_j^s + \sum_j \alpha_3^j C_j + \alpha_4 Z \tag{26}$$

where s refers to the subsector to which firm v belongs (to introduce enough variablility as we work on French firms) and Z is a set of control variables (subsector fixed effects, distance from the head office of firm v to the capital of country j). In the empirical section we only account for j as european markets. This enables us to limit trade costs to distance. As the european market is integrated, tariffs do not exist any more. Remaining trade costs (which are not related to distance) at entry to country j (F_j and T_j) are proxied by country fixed effects C_j. These country fixed effects distinguish according to the acquisition or not of intermediary(ies) by the firms and the estimated value of the productivity threshold associated to each type of firms should reflect the heterogeneity of the access costs to the different european markets.

5.2.2 The explicative variables

Potential demand of importer: the market size $\left(E_j^s\right)$ Because of lack of data, the total demand of the importing country to proxy size could not be accounted for; only import data were available. Thus, E_j^s was proxied by the share of j in total EU25 imports of subsector s (Comext database). To account for the potential endogeneity of this variable, an instrumental variables method was used with the population size and the GDP as instruments.[8] In addition to the exogenous variables (except distance), the market size and the population of the importing country of the previous year (2007) were chosen. The size of the importing country is expected to reduce the value of the productivity threshold.

Supply of the potential partners of the importing country $(\boldsymbol{\Theta}_j^s)$ We consider that Θ_{ki} obtained form our theoretical model (and expressed in Appendix A.2.3) is a variant of the multilateral resistance index of Anderson and van Wincoop (2004). Owing to lack of data (data on fixed costs notably), this index is hardly computable. Usually, the empirical literature circumvents this issue by introducing country fixed effects are introduced to control for this multilateral resistance index. Here, the method proposed is that used in Chevassus-Lozza and Latouche (2012) and the index is proxied by

$$\Theta_j^s = \left(\sum_{n=1}^{N} (Y_n^s/Y^s) \times \left(\frac{1}{w_n \tau_{nj}}\right)^{\gamma}\right)^{-\frac{1}{\gamma}}$$

This index accounts for the potential supply proposed by partner countries n of the importing country j, accounting for the proximity between partners as explained below.

The components of Θ_j^s are computed as follows: Y_n^s is calculated as the total exports of country n for subsector s, and Y^s as the world exports of subsector s. τ_{nj} was the variable trade costs faced by exporter n at the entry to market j which were conventionally proxied by d_{nj} the distance between the capitals of the two countries n and j. In this step, the information on the proximity between country j and some of its partners was included by computing $d_{nj}^{(1-(\frac{B_{nj}+L_{nj}+Col_{nj}}{3}))}$ where $B_{nj} = 1$ if the two countries shared a common border (otherwise 0), $L_{nj} = 1$ if they shared a common language (otherwise 0), and $Col_{nj} = 1$ if they shared a common history (otherwise 0).[9] Such a structure for the

[8] An Hausman test was performed. The null hypothesis that size was exogeneous, was rejected. Estimations without taking endogeneity of size into account change not only the value of the size coefficients, but also the significance of the theta coefficient. Theta becomes significant in the maximum likelihood estimation when we do not take endogeneity into account.

[9] All these variables were given in the CEPII database.

exponent implies that the impact of the distance between country j and its partner n was reduced when one of these three dummies equaled 1.

Moreover, following Baltagi, Egger, and Pfaffermayr (2007) to scale all τ_{nj} from 0 to 1, the following computation is proposed for τ_{nj}:

$$1/\tau_{nj} = \left(1/(d_{nj}^{(1-(\frac{B_{nj}+L_{nj}+Col_{nj}}{3}))})\right) / \sum_n \left(1/(d_{nj}^{(1-(\frac{B_{nj}+L_{nj}+Col_{nj}}{3}))})\right)$$

Thus, it is computed that

$$\Theta_j^s = \left(\sum_{n=1}^{N} (Y_n^s/Y^s) \times (1/\tau_{nj})^{\gamma}\right)^{-\frac{1}{\gamma}}$$

The variable Θ_j^s, is, in fact, the inverse of the supply of the potential partner countries of the importing market, but takes into account the proximity of these partners. The higher this index, the lower would be the potential supply and the higher the potential opportunities for French exporters. In the productivity threshold equation, the variable Θ_j^s is expected to have a positive impact.[10]

Remaining entry costs ($\mathbf{C}_j$) T_j is for importing country fixed effects that are intended to cover all the remaining costs. These country fixed effects are of particular interest to this study. We distinguish between fixed effects for firms acquiring intermediaries and fixed effects for non-treated firms. The difference in fixed effects across treated and non-treated firms will reveal the benefit (or not) faced by acquiring firms to access european markets. The estimated coefficients of these dummies should capture the heterogeneity of the EU25 markets, once the market size, distance and proximity of the importing market to its potential suppliers were controlled for. Hence, they should capture the impact of the acquisition of an intermediary in remaining trade costs (other than transport costs proxied by distance) to access European markets.

Control variables (Z): Distance and Subsector effects d_{kj} is the distance from the head office of firm k to the capital of country j. Firm locations were obtained from the annual survey of agri-food firms (EAE IAA from INSEE) and distances from the Michelin website. A positive impact is expected. S_s are subsector fixed effects. These dummies allow subsector specificities particularly the price differences to be taken into account.

[10]Following Aiken and West (1996), the variable Θ_j^s was mean-centered to eliminate the colinearity with the distance variable.

5.2.3 Results

Table 10 show the estimations of the thresholds to export to european markets for the three different samples considered previously. Column "Full sample" gather the results for all manufacturers; column "Excluding foreign intermediary" presents the results for the sample of manufacturers excluding those acquiring foreign intermediary; column "Intermediary(ies) exclusively" presents results for the sample of manufacturers that exclusively acquire intermediary(ies). In these three estimations, manufacturers acquiring intermediaries are compared to their matched counterparts.

All the estimations confirm the expected effects of the importing country's size and distance. Size has a significant, negative impact on the productivity threshold. The lower the demand of the importing country, the higher should be the level of productivity to enter this market. As expected, distance had a significant, positive impact. In contrast, the supply of potential competitors had no impact on the accessibility of French exporters to European markets. These results are identical to those obtained in Chevassus-Lozza and Latouche (2012).

After controlling for size, distance and potential competition, the analysis of country fixed effects is of particular interest to this study. We especially compare, for a given country, the fixed effect obtained for manufacturers acquiring intermediary to that obtained for the matched manufacturers.

Because Belgium is the main destination to French exporters (Chevassus-Lozza and Latouche, 2012), it is chosen as the reference for country fixed effects for non-treated firms. In this way, from the French point of view, Belgium is considered as the benchmark for market access in this analysis.

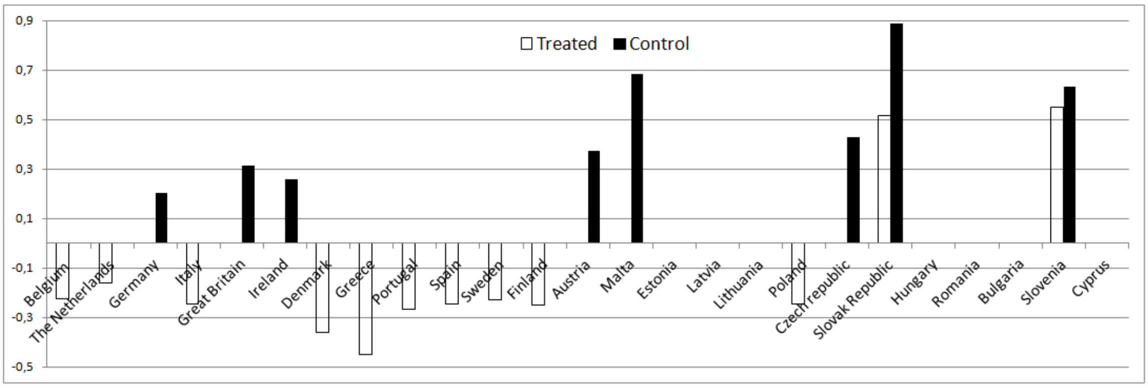
Focusing on column "Intermediary(ies) exclusively" in Table 10, the impact of acquiring exclusively intermediary(ies) appears. Figure 1(c) proposes a graphical representation of the country fixed effects. We see on this graph that for all markets, country fixed effects for manufacturers acquiring intermediary are always lower than those for non acquiring firms. The differences between these two types of firms are significant for each european country. Hence, we confirm that to access all european markets, acquiring an intermediary is a key determinant. Manufacturers acquiring exclusively intermediary(ies) benefit from a net reduction in costs (fixed and/or trade costs) compare to manufacturers with the same productivity and size that do not acquire intermediary(ies). The impact of acquiring exclusively intermediary(ies) is significant to access to each market.

Enlarging the sample to manufacturers that acquire at least one intermediary (excluding foreign intermediaries and accounting for other types of acquisition-column "Excluding foreign intermediary") shows benefits on some markets for acquiring manufacturers. Figure 1(b) shows that all european markets are not concerned by these benefits (when country fixed effects are not significant, they are set to zero on the graph). Access to

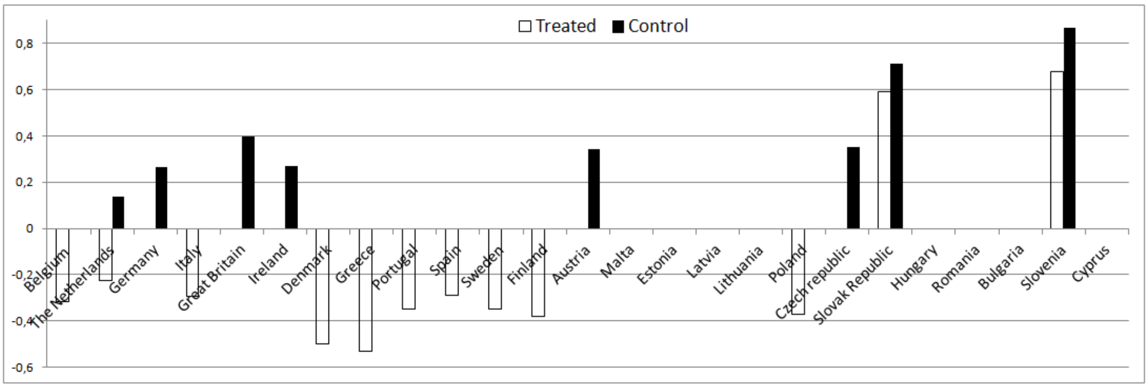
Table 10: ML estimation results of the cutoff productivity thresholds ($\overline{\varphi}_j$)

	Threshold estimations					
	Full sample		Excluding foreign intermediary		Intermediary(ies) exclusively	
Variable	Coef. (S.E.)		Coef. (S.E.)		Coef. (S.E.)	
Constant	-9.38***(0.27)		-9.31***(0.32)		-10.27***(0.43)	
Size of importing country	-0.16*** (0.05)		-0.23*** (0.05)		-0.33*** (0.09)	
Distance	0.42*** (0.03)		0.50*** (0.04)		0.64*** (0.05)	
Potential supply of the competing countries	0.003 (0.03)		0.02 (0.04)		-0.01 (0.06)	
	Country fixed effects		Country fixed effects		Country fixed effects	
	Treated	Control	Treated	Control	Treated	Control
Belgium	*-0.22*** (0.05)*	*ref.*	*-0.32*** (0.05)*	*ref.*	*-0.66*** (0.06)*	*ref.*
The Netherlands	-0.16** (0.07)	0.08 (0.07)	-0.23*** (0.07)	0.14** (0.06)	-0.61*** (0.09)	0.14* (0.08)
Germany	-0.03 (0.07)	0.20*** (0.07)	-0.06 (0.07)	0.26*** (0.07)	-0.37*** (0.10)	0.32*** (0.10)
Italy	-0.24*** (0.08)	-0.06 (0.09)	-0.29*** (0.09)	-0.09 (0.07)	-0.75*** (0.11)	-0.22** (0.10)
Great Britain	0.06 (0.08)	0.31*** (0.08)	0.10 (0.08)	0.40*** (0.08)	-0.20 (0.13)	0.46*** (0.12)
Ireland	-0.09 (0.11)	0.26** (0.13)	-0.17 (0.13)	0.27** (0.11)	-0.73*** (0.17)	0.12 (0.17)
Denmark	-0.36*** (0.10)	-0.02 (0.12)	-0.50*** (0.11)	-0.12 (0.10)	-1.18*** (0.14)	-0.24* (0.14)
Greece	-0.45*** (0.13)	-0.15 (0.17)	-0.53*** (0.16)	-0.18 (0.16)	-1.21*** (0.22)	-0.09 (0.26)
Portugal	-0.27** (0.13)	-0.09 (0.16)	-0.35** (0.15)	-0.13 (0.15)	-0.89*** (0.23)	0.04 (0.23)
Spain	-0.25*** (0.07)	0.05 (0.08)	-0.29*** (0.08)	-0.01 (0.07)	-0.60*** (0.10)	0.12 (0.10)
Sweden	-0.23* 0.12	0.03 (0.13)	-0.35*** (0.14)	-0.12 (0.11)	-1.03*** (0.17)	-0.28* (0.15)
Finland	-0.25* (0.15)	0.01 (0.18)	-0.38** (0.18)	-0.11 (0.15)	-1.15*** (0.23)	-0.32 (0.22)
Austria	0.14 (0.12)	0.38** (0.15)	0.15 (0.14)	0.34*** (0.12)	-0.35* (0.19)	0.41*** (0.16)
Malta	0.21 (0.25)	0.68* (0.41)	0.25 (0.31)	0.43 (0.36)	-0.51 (0.46)	0.73 (0.45)
Estonia	-0.19 (0.21)	0.20 (0.28)	-0.33 (0.25)	0.10 (0.23)	-1.06*** (0.36)	-0.01 (0.35)
Latvia	-0.03 (0.20)	0.33 (0.26)	-0.18 (0.23)	0.27 (0.21)	-0.85*** (0.32)	0.29 (0.32)
Lithuania	0.08 (0.2)	0.33 (0.26)	-0.10 (0.24)	0.29 (0.21)	-0.93*** (0.33)	0.21 (0.33)
Poland	-0.25** (0.12)	0.09 (0.14)	-0.37*** (0.14)	0.11 (0.13)	-1.04*** (0.18)	0.19 (0.20)
Czech Republic	-0.05 (0.13)	0.43*** (0.16)	-0.13 (0.15)	0.35*** (0.13)	-0.79*** (0.20)	0.16 (0.20)
Slovak Republic	0.52*** (0.20)	0.89*** (0.20)	0.59** (0.26)	0.71*** (0.20)	-0.24 (0.33)	1.06*** (0.35)
Hungary	0.02 (0.16)	0.26 (0.22)	-0.06 (0.19)	0.24 (0.21)	-0.73*** (0.28)	0.49 (0.39)
Romania	0.07 (0.18)	0.09 (0.25)	0.03 (0.22)	0.27 (0.27)	-0.38 (0.36)	1.19*** (0.38)
Bulgaria	-0.07 (0.21)	0.22 (0.26)	-0.12 (0.26)	0.20 (0.24)	-0.83** (0.40)	0.92** (0.44)
Slovenia	0.55** (0.22)	0.63** (0.28)	0.68** (0.24)	0.87*** (0.24)	0.08 (0.43)	1.24*** (0.41)
Cyprus	-0.06 (0.23)	0.24 (0.30)	-0.08 (0.29)	0.04 (0.29)	-0.73* (0.41)	0.31 (0.40)
Sector fixed effects	Yes		Yes		Yes	
Log Likelihood	-7557.30		-5320.0		-2952.1	
Wald $\chi^2_{(33)}$	2293.15		2936.98		2807.30	
Prob¿χ^2	0.000		0.000		0.000	
Observations	224300		222925		182975	

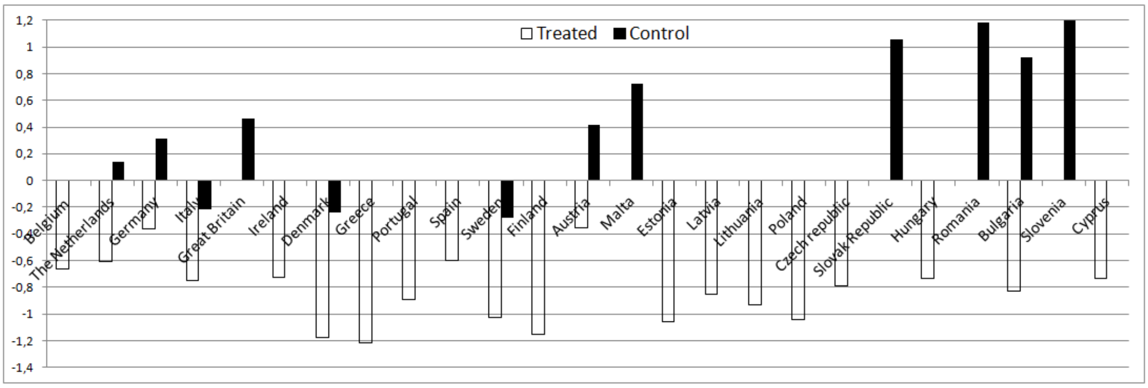
Notes: Standard errors are reported in parentheses.*, **, *** indicate significance at the 10%, 5%, 1% level, respectively. Sector fixed-effects (3-digit NACE) are included. The variable *Size of importing country* is instrumented.



(a) Full sample



(b) Excluding foreign intermediary



(c) Intermediary(ies) exclusively

Figure 1: Country fixed effects estimates for: (a) the full sample; (b) the excluding foreign intermediary sample ; (c) the intermediary(ies) exclusively sample.

some markets as Malta, Estonia or Lithuania is not impacted by the acquisition of at least one intermediary. Similarly, column "Full sample" and Figure 1(a) show that considering the whole sample of intermediary-acquiring manufacturers confirms that certain countries are concerned by the benefit from acquisition of intermediaries.

To sum up, this analysis, and especially the analysis of the sample "Intermediary(ies) exclusively", confirms the transfer of intangible inputs within firms. This transfer is significant concerning the entry costs to access to some markets (european markets in our case).

6 Conclusion

The results call for two comments. The first comment deals with the impact of the measured advantage of firms that own or control intermediaries. This advantage induces lower prices on the destination markets, leading to a decrease in sales of firms with no intermediaries controlled. This can be seen as a barrier to entry for non-investing manufacturers. A deeper knowledge of intermediary in European countries should help to validate this implication

The second comment deals with the concentration of intermediaries on destination markets. In Europe, as in many developed countries, concentration in the distribution sector (as in other sectors) is at play. This fact should impact our results. Extension of our model shows that the higher the concentration of the distribution sector in a destination country, the higher the market shares of firms owning or controlling intermediaries. Once again the need for a better understanding and measurement of the concentration process at play should be done. This could usefully help public authorities to support some exporters in specific sectors to maintain their foreign sales.

To sum up, this paper calls for discussion, regarding first, the export advantage revealed for French agri-food firms to own or control intermediary. This control appears as a key element in export strategy in 2008 and should be increased over time (with the increasing concentration of distribution sector in foreign markets or the impact of low prices on the entry of small exporters). Second, our model shows the role of owning or controlling firms on the neutralization of the double marginalization in a vertical chain. A non-negligible impact of the control is the information that intermediaries give to the investing producer to reduce uncertainty on consumer demand. This point is not developed yet but should be discussed.

References

Aakvik, A. (2001): "Bounding a Matching Estimator: The Case of a Norwegian Training Program," *Oxford Bulletin of Economics and Statistics*, 63(1), 115–143.

Ahn, J., A. K. Khandelwal, and S.-J. Wei (2011): "The role of intermediaries in facilitating trade," *Journal of International Economics*, 84(1), 73–85.

Aiken, L. S., and S. G. West (1996): *Multiple Regression: Testing and Interpreting Interactions*. Sage Publications, Newbury Park, CA.

Akerman, A. (2010): "A Theory on the Role of Wholesalers in International Trade based on Economies of Scope," Mimeo 2010:1, Stockholm University, Department of Economics.

Anderson, J. E., and E. van Wincoop (2004): "Trade Costs," *Journal of Economic Literature*, 42(3), 691–751.

Angrist, J. D., G. W. Imbens, and D. B. Rubin (1996): "Identification of causal effects using instrumental variables," *Journal of the American Statistical Association*, 91, 444–455.

Angrist, J. D., and J.-S. Pischke (2009): *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton university press.

Antràs, P., and A. Costinot (2011): "Intermediated Trade," *The Quarterly Journal of Economics*, 126(3), 1319–1374.

Arkolakis, C., S. Demidova, P. J. Klenow, and A. Rodriguez-Clare (2008): "Endogenous Variety and the Gains from Trade," *American Economic Review*, 98(2), 444–450.

Atalay, E., A. Hortacsu, and C. Syverson (2012): "Why Do Firms Own Production Chains?," NBER Working Papers 18020, National Bureau of Economic Research, Inc.

Baltagi, B. H., P. Egger, and M. Pfaffermayr (2007): "Estimating models of complex FDI: Are there third-country effects?," *Journal of Econometrics*, 140(1), 260–281.

Becker, S. O., and M. Caliendo (2007): "Sensitivity analysis for average treatment effects," *Stata Journal*, 7(1), 71–83.

Bernard, A. B., J. B. Jensen, S. J. Redding, and P. K. Schott (2010): "Wholesalers and Retailers in US Trade," *American Economic Review*, 100(2), 408–13.

Blum, B. S., S. Claro, and I. Horstmann (2009): "Intermediation and the Nature of Trade Costs: Theory and Evidence," Mimeo, Rotman School of Management, University of Toronto.

——— (2010): "Facts and Figures on Intermediated Trade," *American Economic Review*, 100(2), 419–423.

Bureau van Dijk (2005): "Amadeus Database," .

Busso, M., J. DiNardo, and J. McCrary (2009): "Finite Sample Properties of Semiparametric Estimators of Average Treatment Effects," Mimeo, Berkeley University Department of Economics.

Caliendo, M., and S. Kopeinig (2008): "Some Practical Guidance for The Implementation of Propensity Score Matching," *Journal of Economic Surveys*, 22(1), 31–72.

Chevassus-Lozza, E., and K. Latouche (2012): "Firms, markets and trade costs: access of French exporters to European agri-food markets," *European Review of Agricultural Economics*, 39(2), 257–288.

Clerides, S. K., S. Lach, and J. R. Tybout (1998): "Is Learning By Exporting Important? Micro-Dynamic Evidence From Colombia, Mexico, And Morocco," *The Quarterly Journal of Economics*, 113(3), 903–947.

Dehejia, R. H. (2005): "Practical propensity score matching: a reply to Smith and Todd," *Journal of Econometrics*, 125(1-2), 355 –364.

Dehejia, R. H., and S. Wahba (1999): "Causal Effects in Nonexperimental Studies: Reevaluating the Evaluation of Training Programs," *Journal of the American Statistical Association*, 94(448), 1053–1062.

Feenstra, R. C., and H. Ma (2007): *Optimal Choice of Product Scope for Multiproduct Firms*. The Organization of Firms in a Global Economy, Harvard University Press.

Felbermayr, G., and B. Jung (2011): "Trade Intermediation and the Organization of Exporters," *Review of International Economics*, 19(4), 634–648.

Greenlee, P., and A. Raskovich (2006): "Partial Vertical Ownership," *European Economic Review*, 50(4), 1017 – 1041.

Grossman, S. J., and O. D. Hart (1986): "The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration," *Journal of Political Economy*, 94(4), 691–719.

Heckman, J. J., H. Ichimura, and P. Todd (1998): "Matching as an Econometric Evaluation Estimator," *Review of Economic Studies*, 65(2), 261–294.

Heckman, J. J., H. Ichimura, and P. E. Todd (1997): "Matching as an Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Programme," *Review of Economic Studies*, 64(4), 605–654.

Hijzen, A., H. Görg, and M. Manchin (2008): "Cross-border mergers and acquisitions and the role of trade costs," *European Economic Review*, 52(5), 849 – 866.

Imbens, G. W. (2004): "Nonparametric Estimation of Average Treatment Effects Under Exogeneity: A Review," *The Review of Economics and Statistics*, 86(1), 4–29.

Mantel, N., and W. Haenszel (1959): "Statistical aspects of the analysis of data from retrospective studies of disease," *Journal of the National Cancer Institute*, 22(4), 719–748, PMID: 13655060.

Mathewson, G. F., and R. A. Winter (1987): "The Competitive Effects of Vertical Agreements: Comment," *American Economic Review*, 77(5), 1057–1062.

Melitz, M. J. (2003): "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity," *Econometrica*, 71(6), 1695–1725.

Rauch, J. E., and J. Watson (2004): "Network Intermediaries in International Trade," *Journal of Economics & Management Strategy*, 13(1), 69–93.

Rey, P., and J. Stiglitz (1995): "The Role of Exclusive Territories in Producers' Competition," *RAND Journal of Economics*, 26(3), 431–451.

Rey, P., and J. Tirole (1986): "The Logic of Vertical Restraints," *The American Economic Review*, 76(5), 921–939.

Riordan, M. H. (1991): "Ownership without control: Toward a theory of backward integration," *Journal of the Japanese and International Economies*, 5(2), 101–119.

Rosenbaum, P. R. (2002): *Observational studies*, Series in Statistics. Springer, New York and Heidelberg, second edn.

Rosenbaum, P. R., and D. B. Rubin (1983): "The Central Role of the Propensity Score in Observational Studies for Causal Effects," *Biometrika*, 70(1), 41–55.

——— (1985): "The Bias Due to Incomplete Matching," *Biometrics*, 41(1), 103–116.

Smith, J., and P. Todd (2005): "Rejoinder," *Journal of Econometrics*, 125(1-2), 365–375.

Spearot, A. C. (2012): "Firm Heterogeneity, New Investment and Acquisitions," *The Journal of Industrial Economics*, 60(1), 1–45.

Stiebale, J., and M. Trax (2011): "The effects of cross-border M&As on the acquirers' domestic performance: firm-level evidence," *Canadian Journal of Economics*, 44(3), 957–990.

Appendix

A Theoretical model

A.1 Two monopolists with a linear demand

The profit of the intermediary is given by

$$\pi = (1-\theta)[(p-z)q - f] + b(\theta) \tag{27}$$

where q is the foreign demand, p is the price prevailing in the foreign market, z is the price of manufactured product paid by the intermediary and f is a fixed cost of distribution whereas the profit of a manufacturer is

$$\Pi = (z - 1/\varphi - t)q - f_e + \theta[(p-z)q - f] - b(\theta) \tag{28}$$

where φ is labor productivity of the manfacturer, t is trade cost to export the product and f_e is the sunk cost incurred by the producer to reach the foreign country.

We assume that demand is expressed as $q = a - p$ where a is a measure of maximum size of the foreign country. Maximizing π with respect to p leads to $p^* = (a+z)/2$. Knowing $q = a - p^*$, the price of manufacturer maximizing its profit is given by

$$z^* = \frac{a(1-\theta) + 1/\varphi + t}{2-\theta}$$

with $\partial z^*/\partial\theta < 0$. hence, the profit of the intermediary becomes

$$\pi(z^*) = (1-\theta)\left[\frac{(a - 1/\varphi - t)^2}{4(2-\theta)^2} - f\right] + b(\theta) \tag{29}$$

At the first stage, the profit of the manufacturer is $\Pi(z^*(\theta), \theta)$. We determine θ^* the equity share maximizing the profit of the manufacturer. Knowing $b(\theta)$ and $z^*(\theta)$, $\partial\Pi(\theta)/\partial\theta = 0$ is equivalent to

$$-b^{'}(\theta) - f + \frac{(a - 1/\varphi - t)^2}{4(2-\theta)^2} = 0 \tag{30}$$

An interior solution exists if and only if $b^{''}(\theta) > (a - 1/\varphi - t)^2/2(2-\theta)^3$. In this case, by using the envelop theorem, we have $\partial\theta^*/\partial a > 0$ and $\partial\theta^*/\partial\varphi > 0$ as well as $\partial\theta^*/\partial t < 0$. In addition, $\Pi(1) - \Pi(0) > 0$ if and only if $(a - 1/\varphi - t)^2/8 - b^{'}(\theta) - f > 0$. In other words, *the acquisition of an intermediary is more likely to occur when labor productivity and foreign market size are high.* In addition, *trade liberalization promote the acquisition of* *intermediaries.* Note that the profit achieved by the intermediary is positive when $\theta = \theta^*$. By introducing θ^*in $\pi(z^*(\theta), \theta)$ (more precisely Eq.(30) in Eq.(29)) when $1 > \theta^* > 0$ leads to $\pi(\theta^*) = (1-\theta)b^{'}(\theta) + b(\theta)$ which is positive. In addition, we have $\pi(\theta^*) > \pi_0$ where π_0 is the profit of the intermediary when it is not acquired ($\theta = 0$). We have $\pi(\theta^*) > \pi_0$ if and only if

$$f\left(\theta^* - \frac{\theta^{*2}}{4}\right) + b(\theta^*) - \frac{b^{'}(\theta^*)\theta^{*2}}{4} > 0$$

where $\theta^* - \theta^{*2}/4 > 0$ (remember that $1 \geq \theta \geq 1$). Note that b is a linear function with θ is a sufficient condition for $\pi(\theta^*) > \pi_0$.

$$b^{'}(\theta) + f - \frac{\theta}{2-\theta}\frac{(a - 1/\varphi - t)^2}{4(2-\theta)^2} = 0$$

A.2 Equilibrium export sales

A.2.1 Determination of expected profit

Remember that

$$\overline{\Pi}_i = \sum_j \lambda_{ij} \int_{\varphi_{ij}}^{\overline{\varphi}_i} \frac{\Lambda^m_{ij}(0,\varphi)g(\varphi)}{G(\overline{\varphi}_i) - G(\varphi_{ij})} \mathrm{d}\varphi + \lambda^M_i \int_{\overline{\varphi}_i}^{\infty} \frac{\left[\Lambda^r_{ij}(1,\varphi) - w_i f_{ij} - b\right] g(\varphi)}{1 - G(\overline{\varphi}_i)} \mathrm{d}\varphi$$

where $g(\varphi)/[G(\overline{\varphi}_i) - G(\varphi_{ij})]$ is the ex post productivity distribution of firms producing in country i and serving country j, $g(\varphi)/[1 - G(\overline{\varphi}_i)]$ is the ex post productivity distribution of firms owning its intermediary, $\lambda_{ij} = [G(\overline{\varphi}_i) - G(\varphi_{ij})]/[1 - G(\varphi_{ii})]$ the probability to serve country j and to have no equity shares in intermediaries, and $\lambda^M_i = [1 - G(\overline{\varphi}_i)]/[1 - G(\varphi_{ii})]$ the probability to acquire an intermediary and to export.

In addition, we have

$$\Lambda^m_{ij}(0,\varphi) = \frac{\varepsilon - 1}{\varepsilon}\frac{\varphi^{\varepsilon-1}}{\varphi^{\varepsilon-1}_{ij}} w_i f_{ij} \quad \text{and} \quad \Lambda^r_{ij}(1,\varphi) = \left(\frac{\varepsilon}{\varepsilon - 1}\right)^{\varepsilon-1} \frac{\varphi^{\varepsilon-1}}{\varphi^{\varepsilon-1}_{ij}} w_i f_{ij}$$

where we have introduced Eq.(9) in $\Lambda^m_{ij}(0,\varphi)$ and $\Lambda^r_{ij}(1,\varphi)$.

Because we use a Pareto distribution with $g(x) = \gamma x^{\gamma}_{\min}/x^{\gamma+1}$ and $G(x) = 1 - x^{\gamma}_{\min}/x^{\gamma}$ (where $x_{\min} = 1$), we have

$$\begin{aligned}\overline{\Pi}_i &= \sum_j \varphi^{\gamma}_{ii}\varphi^{1-\varepsilon}_{ij} \frac{\gamma}{\gamma - (\varepsilon - 1)} \frac{\varepsilon - 1}{\varepsilon} \left(\varphi^{-\gamma+\varepsilon-1}_{ij} - \overline{\varphi}^{-\gamma+\varepsilon-1}_i\right) w_i f_{ij} \\ &\quad + \sum_j \varphi^{\gamma}_{ii}\varphi^{1-\varepsilon}_{ij} \frac{\gamma}{\gamma - (\varepsilon - 1)} \left(\frac{\varepsilon}{\varepsilon - 1}\right)^{\varepsilon-1} \overline{\varphi}^{-\gamma+\varepsilon-1}_i w_i f_{ij} - \sum_j \varphi^{\gamma}_{ii}\overline{\varphi}^{-\gamma}_i (w_i f_{ij} + b)\end{aligned}$$

so that

$$
\begin{aligned}
\overline{\Pi}_i &= \frac{\varphi_{ii}^{\gamma}\gamma}{\gamma-(\varepsilon-1)}\sum_j \varphi_{ij}^{1-\varepsilon} w_i f_{ij}\left[\frac{\varepsilon-1}{\varepsilon}\varphi_{ij}^{-\gamma+\varepsilon-1}+\left[\left(\frac{\varepsilon}{\varepsilon-1}\right)^{\varepsilon-1}-\left(\frac{\varepsilon}{\varepsilon-1}\right)^{-1}\right]\overline{\varphi}_i^{-\gamma+\varepsilon-1}\right] \\
&\quad -\sum_j \varphi_{ii}^{\gamma}\overline{\varphi}_i^{-\gamma}\left(w_i f_{ij}+b\right) \\
&= \frac{\varphi_{ii}^{\gamma}\gamma}{\gamma-(\varepsilon-1)}\sum_j \varphi_{ij}^{1-\varepsilon} w_i f_{ij}\left[\frac{\varepsilon-1}{\varepsilon}\varphi_{ij}^{-\gamma+\varepsilon-1}+\left(\frac{\varepsilon}{\varepsilon-1}\right)^{\varepsilon-1}\left(\frac{\varepsilon}{\varepsilon-1}w_i\right)^{\varepsilon-1}\frac{\varepsilon\sum_j w_i f_{ij}}{\sum_j E_i P_j^{\varepsilon-1}\tau_{ij}^{1-\varepsilon}}\overline{\varphi}_i^{-\gamma}\right] \\
&\quad -\sum_j \varphi_{ii}^{\gamma}\overline{\varphi}_i^{-\gamma}\left(w_i f_{ij}+b\right) \\
&= \frac{\varphi_{ii}^{\gamma}\gamma}{\gamma-(\varepsilon-1)}\sum_j w_i f_{ij}\left[\frac{\varepsilon-1}{\varepsilon}\varphi_{ij}^{-\gamma}+\frac{E_j P_j^{\varepsilon-1}\tau\sum_j\left(w_i f_{ij}+b\right)}{w_j f_{ij}\sum_j E_j P_j^{\varepsilon-1}\tau_{ij}^{1-\varepsilon}}\overline{\varphi}_i^{-\gamma}\right]-\sum_j \varphi_{ii}^{\gamma}\overline{\varphi}_i^{-\gamma}\left(w_i f_{ij}+b\right) \\
&= \frac{\varphi_{ii}^{\gamma}\gamma}{\gamma-(\varepsilon-1)}\sum_j w_i f_{ij}\frac{\varepsilon-1}{\varepsilon}\varphi_{ij}^{-\gamma}+\frac{\varphi_{ii}^{\gamma}\gamma}{\gamma-(\varepsilon-1)}\overline{\varphi}_i^{-\gamma}\sum_j\left(w_i f_{ij}+b\right)-\sum_j \varphi_{ii}^{\gamma}\overline{\varphi}_i^{-\gamma}\left(w_i f_{ij}+b\right) \\
&= \frac{\varphi_{ii}^{\gamma}\gamma}{\gamma-(\varepsilon-1)}\sum_j w_j f_{ij}\frac{\varepsilon-1}{\varepsilon}\varphi_{ij}^{-\gamma}+\frac{\varphi_{ii}^{\gamma}(\varepsilon-1)}{\gamma-(\varepsilon-1)}\overline{\varphi}_i^{-\gamma}\sum_j\left(w_j f_{ij}+b\right)
\end{aligned}
$$

where the second term of the RHS tends to 0 when $\overline{\varphi}_i \to \infty$. Hence, we obtain

$$
\overline{\Pi}_i = \frac{\varphi_{ii}^{\gamma}(\varepsilon-1)}{\gamma-(\varepsilon-1)}\sum_j\left[w_i f_{ij}\frac{\gamma}{\varepsilon}\varphi_{ij}^{-\gamma}+\overline{\varphi}_i^{-\gamma}\left(w_i f_{ij}+b\right)\right]
$$

In addition, we have to take into account that intermediary does know a priori its supplier (and, thus, its productivity). An intermediary enters the market as long as the expected value of entry is higher than the enter sunk cost. The expected profit of an intermediary prior to enter the market is given by $[1-G(\varphi_{ii})]\overline{\pi}_i$ where $[1-G(\varphi_{ii})]$ is the probability to enter market and $\overline{\pi}_i$ is the expected profit conditional on successful entry given by

$$
\overline{\pi}_i = \sum_j \lambda_{ij}\int_{\varphi_{ij}}^{\overline{\varphi}_i}\frac{\left[\Lambda_{ij}^r(0,\varphi)-w_i f_{ij}\right]g(\varphi)}{G(\overline{\varphi}_i)-G(\varphi_{ij})}\mathrm{d}\varphi+\sum_j \lambda_i^M\int_{\overline{\varphi}_i}^{\infty}\frac{b}{G(\overline{\varphi}_i)-G(\varphi_{ij})}\mathrm{d}\varphi
$$

After simplifications, we obtain

$$\begin{aligned}
\overline{\pi}_i &= \frac{\gamma\varphi_{ii}^{\gamma}}{\gamma-(\varepsilon-1)}\sum_j \frac{\varphi_{ij}^{-\gamma+\varepsilon-1}-\overline{\varphi}_i^{-\gamma+\varepsilon-1}}{\varphi_{ij}^{\varepsilon-1}}w_i f_{ij} - \sum_j \varphi_{ii}^{\gamma}\left(\varphi_{ij}^{-\gamma}-\overline{\varphi}_i^{-\gamma}\right)w_i f_{ij} + \varphi_{ii}^{\gamma}\overline{\varphi}_i^{-\gamma} b \\
&= \frac{\varphi_{ii}^{\gamma}(\varepsilon-1)}{\gamma-(\varepsilon-1)}\sum_j \varphi_{ij}^{-\gamma}w_i f_{ij} - \frac{\gamma\varphi_{ii}^{\gamma}}{\gamma-(\varepsilon-1)}\sum_j \overline{\varphi}_i^{-\gamma}\frac{\overline{\varphi}_i^{\varepsilon-1}}{\varphi_{ij}^{\varepsilon-1}}w_i f_{ij} + \sum_j \varphi_{ii}^{\gamma}\overline{\varphi}_i^{-\gamma}\left(w_i f_{ij}+b\right) \\
&= \frac{\varphi_{ii}^{\gamma}(\varepsilon-1)}{\gamma-(\varepsilon-1)}\sum_j \varphi_{ij}^{-\gamma}w_i f_{ij} - \frac{\gamma\varphi_{ii}^{\gamma}}{\gamma-(\varepsilon-1)}\sum_j \overline{\varphi}_i^{-\gamma}\frac{E_j P_j^{\varepsilon-1}\tau_{ij}^{1-\varepsilon}\left(\sum_j w_i f_{ij}+b\right)}{\left[\left(\frac{\varepsilon}{\varepsilon-1}\right)^{\varepsilon-1}-\left(\frac{\varepsilon}{\varepsilon-1}\right)^{-1}\right]\sum_j E_j P_j^{\varepsilon-1}\tau_{ij}^{1-\varepsilon}} \\
&\quad + \sum_j \varphi_{ii}^{\gamma}\overline{\varphi}_i^{-\gamma}\left(w_i f_{ij}+b\right) \\
&= \frac{\varphi_{ii}^{\gamma}(\varepsilon-1)}{\gamma-(\varepsilon-1)}\sum_j \varphi_{ij}^{-\gamma}w_i f_{ij} - \frac{\gamma\varphi_{ii}^{\gamma}}{\gamma-(\varepsilon-1)}\sum_j \frac{\overline{\varphi}_i^{-\gamma}\left(w_i f_{ij}+b\right)}{\left(\frac{\varepsilon}{\varepsilon-1}\right)^{\varepsilon-1}-\left(\frac{\varepsilon}{\varepsilon-1}\right)^{-1}} + \sum_j \varphi_{ii}^{\gamma}\overline{\varphi}_i^{-\gamma}\left(w_i f_{ij}+b\right) \\
&= \frac{\varphi_{ii}^{\gamma}(\varepsilon-1)}{\gamma-(\varepsilon-1)}\sum_j \varphi_{ij}^{-\gamma}w_i f_{ij} + \Upsilon\sum_j \varphi_{ii}^{\gamma}\overline{\varphi}_i^{-\gamma}\left(w_i f_{ij}+b\right)
\end{aligned}$$

with

$$\Upsilon \equiv \left\{1-\frac{\gamma}{\left[\gamma-(\varepsilon-1)\right]\left[\left(\frac{\varepsilon}{\varepsilon-1}\right)^{\varepsilon-1}-\left(\frac{\varepsilon}{\varepsilon-1}\right)^{-1}\right]}\right\}$$

Hence, we have

$$\begin{aligned}
\overline{\Pi}_i &= \frac{\varphi_{ii}^{\gamma}(\varepsilon-1)}{\gamma-(\varepsilon-1)}\frac{\gamma}{\varepsilon}\sum_j \varphi_{ij}^{-\gamma}w_j f_{ij} + \frac{\varphi_{ii}^{\gamma}(\varepsilon-1)}{\gamma-(\varepsilon-1)}\sum_j \overline{\varphi}_i^{-\gamma}\left(w_j f_{ij}+b\right) \\
\overline{\pi}_i &= \frac{\varphi_{ii}^{\gamma}(\varepsilon-1)}{\gamma-(\varepsilon-1)}\sum_j \varphi_{ij}^{-\gamma}w_j f_{ij} + \Upsilon\sum_j \varphi_{ii}^{\gamma}\overline{\varphi}_i^{-\gamma}\left(w_j f_{ij}+b\right)
\end{aligned}$$

Because $\varphi_{ii}^{\gamma}\overline{\Pi}_i = w_i f_e$ and $\varphi_{ii}^{\gamma}\overline{\pi}_i = w_i f_e$, we obtain

$$\begin{aligned}
\frac{\gamma}{\varepsilon}\sum_j \varphi_{ij}^{-\gamma}w_i f_{ij} + \sum_j \overline{\varphi}_i^{-\gamma}\left(w_i f_{ij}+b\right) &= \sum_j \varphi_{ij}^{-\gamma}w_i f_{ij} + \frac{\gamma-(\varepsilon-1)}{\varepsilon-1}\Upsilon\sum_j \overline{\varphi}_i^{-\gamma}(w_i f_{ij}+b) \\
\frac{\gamma-\varepsilon}{\varepsilon}\sum_j \varphi_{ij}^{-\gamma}w_i f_{ij} &= \Upsilon_1\sum_j \overline{\varphi}_i^{-\gamma}(w_i f_{ij}+b) \qquad (31)
\end{aligned}$$

with

$$\Upsilon_1 = \frac{\gamma-(\varepsilon-1)}{\varepsilon-1}\Upsilon - 1$$

Thus,

$$\begin{aligned}
\overline{\Pi}_i &= \frac{\varphi_{ii}^{\gamma}(\varepsilon-1)}{\gamma-(\varepsilon-1)}\frac{\gamma(\Upsilon_1+1)-\varepsilon}{\varepsilon\Upsilon_1}\sum_j \varphi_{ij}^{-\gamma}w_i f_{ij} \\
\text{or} &= \frac{\varphi_{ii}^{\gamma}(\varepsilon-1)}{\gamma-(\varepsilon-1)}\frac{\gamma(\Upsilon_1+1)-\varepsilon}{\gamma-\varepsilon}\sum_j \varphi_{ii}^{\gamma}\overline{\varphi}_i^{-\gamma}(w_i f_{ij}+b)
\end{aligned}$$

and

$$\sum_j \varphi_{ij}^{-\gamma}w_i f_{ij} = \frac{w_i f_e[\gamma-(\varepsilon-1)]\varepsilon\Upsilon_1}{[\gamma(\Upsilon_1+1)-\varepsilon]\,(\varepsilon-1)} \tag{32}$$

$$\text{or}\sum_j \overline{\varphi}_i^{-\gamma}\,(w_i f_{ij}+b) = \frac{w_i f_e[\gamma-(\varepsilon-1)](\gamma-\varepsilon)}{[\gamma(\Upsilon_1+1)-\varepsilon]\,(\varepsilon-1)} \tag{33}$$

$$\sum_j \overline{\varphi}_i^{-\gamma}\,(w_i f_{ij}+b) = \frac{\gamma-\varepsilon}{\varepsilon\Upsilon_1}\sum_j \varphi_{ij}^{-\gamma}w_i f_{ij}$$

$$\overline{\varphi}_i^{-\gamma+\varepsilon-1} = \left\{\frac{w_i f_e[\gamma-(\varepsilon-1)](\gamma-\varepsilon)}{[\gamma(\Upsilon_1+1)-\varepsilon]\,(\varepsilon-1)\sum_j (w_i f_{ij}+b)}\right\}^{-\frac{-\gamma+\varepsilon-1}{\gamma}}$$

A.2.2 The mass of firms

Labor market clearing in country i:

$$L_i = L_i^v + 2M_e f_e + \sum_j M_i\varphi_{ii}^{\gamma}\varphi_{ij}^{-\gamma}f_{ij}$$

where $M_e = M_i\varphi_{ii}^{\gamma}$ and

$$\sum_j \varphi_{ij}^{-\gamma}f_{ij} = \frac{f_e[\gamma-(\varepsilon-1)]\varepsilon\Upsilon_1}{[\gamma(\Upsilon_1+1)-\varepsilon]\,(\varepsilon-1)}$$

as well as

$$
\begin{aligned}
L_i^v &= \sum_i M_i \varphi_{ii}^{\gamma} \left[\int_{\varphi_{ij}}^{\overline{\varphi}_i} \frac{\tau_{ij} q_{ij}(0,\varphi)}{\varphi} g(\varphi) \mathrm{d}\varphi + \int_{\overline{\varphi}_i}^{\infty} \frac{\tau_{ij} q_{ij}(1,\varphi)}{\varphi} g(\varphi) \mathrm{d}\varphi \right] \\
&= \frac{\varepsilon - 1}{w_i} M_i \sum_j \varphi_{ii}^{\gamma} \left[\int_{\varphi_{ij}}^{\overline{\varphi}_i} \frac{z(0,\varphi) q(0,\varphi)}{\varepsilon} g(\varphi) \mathrm{d}\varphi + \int_{\overline{\varphi}_i}^{\infty} \frac{p(1,\varphi) q(1,\varphi)}{\varepsilon} g(\varphi) \mathrm{d}\varphi \right] \\
&= \frac{\varepsilon - 1}{w_i} M_i \left[\overline{\Pi}_i + \sum_j \varphi_{ii}^{\gamma} \overline{\varphi}_i^{-\gamma} (w_i f_{ij} + b) \right] \\
&= \frac{\varepsilon - 1}{w_i} M_i \left[\frac{\varphi_{ii}^{\gamma} \gamma}{\gamma - (\varepsilon - 1)} \sum_j w_i f_{ij} \frac{\varepsilon - 1}{\varepsilon} \varphi_{ij}^{-\gamma} + \frac{\varphi_{ii}^{\gamma} \gamma}{\gamma - (\varepsilon - 1)} \sum_j \overline{\varphi}_i^{-\gamma} (w_i f_{ij} + b) \right] \\
&= \frac{\varepsilon - 1}{w_i} M_i \frac{\varphi_{ii}^{\gamma} \gamma}{\gamma - (\varepsilon - 1)} \left[\sum_j w_i f_{ij} \frac{\varepsilon - 1}{\varepsilon} \varphi_{ij}^{-\gamma} + \sum_j \overline{\varphi}_i^{-\gamma} (w_i f_{ij} + b) \right] \\
&= \frac{\varepsilon - 1}{w_i} M_i \frac{\varphi_{ii}^{\gamma} \gamma}{\gamma - (\varepsilon - 1)} \left[\frac{\varepsilon - 1}{\varepsilon} \sum_j w_i f_{ij} \varphi_{ij}^{-\gamma} + \frac{\gamma - \varepsilon}{\varepsilon \Upsilon_1} \sum_j \varphi_{ij}^{-\gamma} w_i f_{ij} \right] \\
&= \frac{\varepsilon - 1}{\varepsilon w_i} M_i \frac{\varphi_{ii}^{\gamma} \gamma}{\gamma - (\varepsilon - 1)} \left(\varepsilon - 1 + \frac{\gamma - \varepsilon}{\Upsilon_1} \right) \sum_j w_i f_{ij} \varphi_{ij}^{-\gamma} \\
&= M_i \varphi_{ii}^{\gamma} f_e \frac{[(\varepsilon - 1) \Upsilon_1 + \gamma - \varepsilon] \gamma}{[\gamma(\Upsilon_1 + 1) - \varepsilon]}
\end{aligned}
$$

Hence,

$$
\begin{aligned}
L_i &= M_i \varphi_{ii}^{\gamma} f_e \frac{[(\varepsilon - 1) \Upsilon_1 + \gamma - \varepsilon] \gamma}{[\gamma(\Upsilon_1 + 1) - \varepsilon]} + 2 M_i \varphi_{ii}^{\gamma} f_e + M_i \varphi_{ii}^{\gamma} f_e \frac{[\gamma - (\varepsilon - 1)] \varepsilon \Upsilon_1}{[\gamma(\Upsilon_1 + 1) - \varepsilon] (\varepsilon - 1)} \\
&= M_i \varphi_{ii}^{\gamma} f_e \left\{ \frac{[(\varepsilon - 1) \Upsilon_1 + \gamma - \varepsilon] \gamma}{[\gamma(\Upsilon_1 + 1) - \varepsilon]} + 2 + \frac{[\gamma - (\varepsilon - 1)] \varepsilon \Upsilon_1}{[\gamma(\Upsilon_1 + 1) - \varepsilon] (\varepsilon - 1)} \right\}
\end{aligned}
$$

so that

$$
M_i = \frac{L_i}{\varphi_{ii}^{\gamma} f_e \Psi} \tag{34}
$$

A.2.3 Price index

Because

$$
\begin{aligned}
P_i^{1-\varepsilon} &= \sum_k M_k \lambda_{ki} \int_{\varphi_{ki}}^{\overline{\varphi}_k} \frac{p_{ki}(0,\varphi)^{1-\varepsilon} g(\varphi)}{G(\overline{\varphi}_k) - G(\varphi_{ki})} \mathrm{d}\varphi + M_k \lambda_k^M \int_{\overline{\varphi}_k}^{\infty} \frac{p_{ki}(1,\varphi)^{1-\varepsilon} g(\varphi)}{1 - G(\overline{\varphi}_k)} \mathrm{d}\varphi \\
&= \sum_k \frac{\gamma L_k \left(\frac{\varepsilon}{\varepsilon - 1} \frac{\varepsilon}{\varepsilon - 1} w_k \tau_{ki} \right)^{1-\varepsilon}}{f_e \Psi [\gamma - (\varepsilon - 1)]} \varphi_{ki}^{-\gamma + \varepsilon - 1} + \sum_k \frac{\gamma L_k \left(\frac{\varepsilon}{\varepsilon - 1} w_k \tau_{ki} \right)^{1-\varepsilon}}{f_e \Psi [\gamma - (\varepsilon - 1)]} \overline{\varphi}_k^{-\gamma + \varepsilon - 1} \left[1 - \left(\frac{\varepsilon}{\varepsilon - 1} \right)^{1-\varepsilon} \right] \\
&= \sum_k \frac{\gamma L_k \left(\frac{\varepsilon}{\varepsilon - 1} \frac{\varepsilon}{\varepsilon - 1} w_k \tau_{ki} \right)^{1-\varepsilon}}{f_e \Psi [\gamma - (\varepsilon - 1)]} \varphi_{ki}^{-\gamma + \varepsilon - 1} \left\{ 1 + \frac{\overline{\varphi}_k^{-\gamma + \varepsilon - 1}}{\varphi_{ki}^{-\gamma + \varepsilon - 1}} \left[\left(\frac{\varepsilon}{\varepsilon - 1} \right)^{\varepsilon - 1} - 1 \right] \right\}
\end{aligned}
$$

Using $\varphi_{ki}^{-\gamma+\varepsilon-1}$, we get

$$P_i^{-\gamma} = E_i^{\frac{\gamma-(\varepsilon-1)}{\varepsilon-1}} \sum_k \eta_k \left\{ 1 + \frac{\overline{\varphi}_k^{-\gamma+\varepsilon-1}}{\varphi_{ki}^{-\gamma+\varepsilon-1}} \left[\left(\frac{\varepsilon}{\varepsilon-1} \right)^{\varepsilon-1} - 1 \right] \right\}$$

$$P_i = E_i^{-\frac{\gamma-(\varepsilon-1)}{(\varepsilon-1)\gamma}} \left\{ \sum_k \eta_k \left\{ 1 + \frac{\overline{\varphi}_k^{-\gamma+\varepsilon-1}}{\varphi_{ki}^{-\gamma+\varepsilon-1}} \left[\left(\frac{\varepsilon}{\varepsilon-1} \right)^{\varepsilon-1} - 1 \right] \right\} \right\}^{-\frac{1}{\gamma}}$$

with

$$\eta_k = \frac{\gamma L_k \left(\frac{\varepsilon}{\varepsilon-1} \frac{\varepsilon}{\varepsilon-1} w_k \tau_{ki} \right)^{-\gamma} (\varepsilon w_k f_{ki})^{\frac{-\gamma+\varepsilon-1}{\varepsilon-1}}}{f_e \Psi \left[\gamma - (\varepsilon - 1) \right]}$$

Because,

$$\overline{\varphi}_k^{\varepsilon-1} = \frac{\left(\frac{\varepsilon}{\varepsilon-1}\right)^{\varepsilon-1} \left(\frac{\varepsilon}{\varepsilon-1} w_k\right)^{\varepsilon-1}}{\left[\left(\frac{\varepsilon}{\varepsilon-1}\right)^{\varepsilon-1} - \left(\frac{\varepsilon}{\varepsilon-1}\right)^{-1} \right]} \frac{\varepsilon \left(\sum_j w_k f_{kj} + b \right)}{\sum_j E_j P_j^{\varepsilon-1} \tau_{kj}^{1-\varepsilon}}$$

$$\Leftrightarrow \overline{\varphi}_k^{\varepsilon-1} = \frac{\frac{\gamma-\varepsilon}{\varepsilon}}{\left[\left(\frac{\varepsilon}{\varepsilon-1}\right)^{\varepsilon-1} - \left(\frac{\varepsilon}{\varepsilon-1}\right)^{-1} \right]} \frac{\overline{\varphi}_k^{\gamma} \sum_j \varphi_{kj}^{-\gamma} w_k f_{kj}}{\sum_j \varphi_{kj}^{1-\varepsilon} w_k f_{kj}}$$

$$\Leftrightarrow \overline{\varphi}_k^{-\gamma+\varepsilon-1} = \frac{\gamma - \varepsilon}{\varepsilon \left[\left(\frac{\varepsilon}{\varepsilon-1}\right)^{\varepsilon-1} - \left(\frac{\varepsilon}{\varepsilon-1}\right)^{-1} \right]} \sum_j \varphi_{kj}^{-\gamma+\varepsilon-1}$$

we obtain

$$P_i = E_i^{-\frac{\gamma-(\varepsilon-1)}{(\varepsilon-1)\gamma}} \Theta_{ki}^{-\frac{1}{\gamma}} \tag{35}$$

with

$$\Theta_{ki} \equiv \sum_k \eta_k \left\{ 1 + \frac{(\gamma - \varepsilon) \left[\left(\frac{\varepsilon}{\varepsilon-1}\right)^{\varepsilon-1} - 1 \right]}{\varepsilon \left[\left(\frac{\varepsilon}{\varepsilon-1}\right)^{\varepsilon-1} - \left(\frac{\varepsilon}{\varepsilon-1}\right)^{-1} \right]} \frac{\sum_j \varphi_{kj}^{-\gamma+\varepsilon-1}}{\varphi_{ki}^{-\gamma+\varepsilon-1}} \right\}$$

B Data

B.1 Procedure to determine the direct firm's network

Our dataset is obtained after an extraction of specific information from Amadeus database. Data originate from the Amadeus database published by Bureau van Dijk (2005), which records comparable financial and business information for public and private firms across Europe. The data are collected from company reports and balance sheets, and are updated weekly. Firms are distinguished by a unique identification number. The accounting data include firm-level variables such as sales, value-added or employment among others. The database also inform about financial links between firms. Accounting for all information concerning French agri-food firms we are able to know which firm invest to which firm, in France or abroad, in agri-food sector or not.

Table 11: Number of upward and downward links (direct and indirect)

Link level	Upward link	Downward link
1	2965	3325
2	1725	1654
3	1271	1105
4	924	650
5	674	405
6	475	249
7	297	191
8	241	220
9	193	324
10	199	470

Notes: The total number of direct and indirect links is 17557. Source: Authors' calculation from Amadeus database.

The version of the database used is a cross-sectional sample corresponding to the 9^{th} week of 2009, which covers 22500 French firms operating in the agri-food sector.[11] The key input of this extraction is French agri-food firms.

To retrace the network of a firm, we use several information. First, we have the list of the subsidiaries of the firms up to ten levels. For each level of subsidiaries, we know the entire set of firms acquired by a French agri-food firm, whatever their nationality or activity sector. These subsidiaries define the "downstream" network of a firm. Second, we use the name of the ultimate owner (head of group) of the French agri-food firm and all its subsidiaries to retrace the "upstream"' network from which the French agri-food firm belongs to. Regarding the issue addresses in this paper, we solely concentrate on direct links (i.e., the first level) among French agri-food firms and their subsidiaries (downward links) or their owners (upward links). Consequently, we do not consider firms that have common owners but no cross-shareholdings. By doing so, we must be aware that we understate the effect of acquiring an intermediary because firms that have an intermediary at a higher level than the first in their network are considered as single firms. Overall, our study covers 35.8% over the 17557 links that originate from the French agri-food firms (see Table 11). By considering direct links only, we are able to classify firms according to their position in the network: French agri-food firms that are ultimate owners are named *acquiring firms*, those that have both owners and subsidiaries are named *acquiring and acquired firms*, those that only have owners are named *acquired firms*, while firms without any financial links are named *single firms*.

Two limitations of the data must be pointed out. First, the data do not provide information on the date of the acquisition, and the nature of the data (cross-section) does not allow us to back out this information. Consequently, we are not able to account for how long the acquisition transactions have occured, and so, of their effect over time. Second, the data do not inform about the percentage of equity held by each acquiring firm,

[11] Our data access permits us to solely observe the data for one week at a time.

for a given transaction. It results that the estimated causal effect is assumed independent of the equity share.

B.2 Activity sector classification of direct links

Following the determination of firm's direct network, we count 3102 French agri-food firms with a total of 6290 direct links, associated to upstream or downstream firms. For each upstreamor downstream firm, we know its nationality and its activity sector (at the 4-digit NACE level). Since we are interested to qualify the nature of the acquisition, we suppress upstream and downstream firms whose activity sector is missing. This corresponds to 897 observations and therefore 459 French agri-food firms. Departing from this dataset, we create 5 classes of activity sector based on the NACE (Revision 2) classification: upstream activities, horizontal activities, intermediary activities, transport activities and service activities.[12] In addition, we split these activity sectors in subsectors. We present in Table 12 the classification of the direct links according to the NACE classification. Table 13 details the number of (direct) downward links according to the proposed classification.

[12] As Hijzen, Görg, and Manchin (2008), we define "horizontal" acquisition as an acquisition between firms within the same industry.

Table 12: Classification of NACE codes in activity sectors and subsectors

Activity sector	Subsectors	NACE	Heading
Section A: Agriculture, Forestry and fishing			
Upstream	Agricultural	01	Crop and animal production, hunting and related service activities
Upstream	Agricultural	02	Forestry and logging
Upstream	Agricultural	03	Fishing and aquaculture
Section B: Mining and quarrying			
Upstream	Non-Agricultural	05	Mining of coal and lignite
Upstream	Non-Agricultural	06	Extraction of crude petroleum and natural gas
Upstream	Non-Agricultural	07	Mining of metal ores
Upstream	Non-Agricultural	08	Other mining and quarrying
Upstream	Non-Agricultural	09	Mining support service activities
Section C: Manufacturing			
Horizontal	Agricultural	10	Manufacture of food products
Horizontal	Agricultural	11	Manufacture of beverages
Upstream	Agricultural	12	Manufacture of tobacco products
Upstream	Non-Agricultural	13	Manufacture of textiles
Upstream	Non-Agricultural	14	Manufacture of wearing apparel
Upstream	Non-Agricultural	15	Manufacture of leather and related products
Horizontal	Non-Agricultural	16	Manufacture of wood and of products of wood and cork, except furniture, manufacture of articles of straw and plaiting materials
Horizontal	Non-Agricultural	17	Manufacture of paper and paper products
Horizontal	Non-Agricultural	18	Printing and reproduction of recorded media
Horizontal	Non-Agricultural	19	Manufacture of coke and refined petroleum products
Horizontal	Non-Agricultural	20	Manufacture of chemicals and chemical products
Horizontal	Non-Agricultural	21	Manufacture of basic pharmaceutical products and pharmaceutical preparations

Continued on next page

Table 12 - Classification of NACE codes in activity sectors and subsectors (*continued from previous page*)

Activity sector	Subsectors	NACE	Heading
Horizontal	Non-Agricultural	22	Manufacture of rubber and plastic products
Horizontal	Non-Agricultural	23	Manufacture of other non-metallic mineral products
Horizontal	Non-Agricultural	24	Manufacture of basic metals
Horizontal	Non-Agricultural	25	Manufacture of fabricated metal products, except machinery and equipment
Horizontal	Non-Agricultural	26	Manufacture of computer, electronic and optical products
Horizontal	Non-Agricultural	27	Manufacture of electrical equipment
Horizontal	Non-Agricultural	28	Manufacture of machinery and equipment n.e.c.
Horizontal	Non-Agricultural	29	Manufacture of motor vehicles, trailers and semi-trailers
Horizontal	Non-Agricultural	30	Manufacture of other transport equipment
Horizontal	Non-Agricultural	31	Manufacture of furniture
Horizontal	Non-Agricultural	32	Other manufacturing
Horizontal	Non-Agricultural	33	Repair and installation of machinery and equipment
Section D: Electricity, gas, steam and air conditioning supply			
Horizontal	Non-Agricultural	35	Electricity, gas, steam and air conditioning supply
Section E: Water supply, sewerage, waste management and remediation activities			
Horizontal	Non-Agricultural	36	Water collection, treatment and supply
Horizontal	Non-Agricultural	37	Sewerage
Horizontal	Non-Agricultural	38	Waste collection, treatment and disposal activities, materials recovery
Horizontal	Non-Agricultural	39	Remediation activities and other waste management services
Section F: Construction			
Horizontal	Non-Agricultural	41	Construction of buildings
Horizontal	Non-Agricultural	42	Civil engineering
Horizontal	Non-Agricultural	43	Specialised construction activities
Section G: Wholesale and retail trade, repair of motor vehicles and motorcycles			
Intermediary	Non-Agricultural	45	Wholesale and retail trade and repair of motor vehicles and motorcycles
		46	Wholesale trade, except of motor vehicles and motorcycles
		46.1	Wholesale on a fee or contract basis

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Table 12 - Classification of NACE codes in activity sectors and subsectors (*continued from previous page*)

Activity sector	Subsectors	NACE	Heading
Intermediary	Agricultural	46.11	Agents involved in the sale of agricultural raw materials, live animals, textile raw materials and semi-finished goods
Intermediary	Non-Agricultural	46.12	Agents involved in the sale of fuels, ores, metals and industrial chemicals
Intermediary	Non-Agricultural	46.13	Agents involved in the sale of timber and building materials
Intermediary	Non-Agricultural	46.14	Agents involved in the sale of machinery, industrial equipment, ships and aircraft
Intermediary	Non-Agricultural	46.15	Agents involved in the sale of furniture, household goods, hardware and ironmongery
Intermediary	Non-Agricultural	46.16	Agents involved in the sale of textiles, clothing, fur, footwear and leather goods
Intermediary	Agricultural	46.17	Agents involved in the sale of food, beverages and tobacco
Intermediary	Non-Agricultural	46.18	Agents specialised in the sale of other particular products
Intermediary	Non-Agricultural	46.19	Agents involved in the sale of a variety of goods
Intermediary	Agricultural	46.2	Wholesale of agricultural raw materials and live animals
Intermediary	Agricultural	46.3	Wholesale of food, beverages and tobacco
Intermediary	Non-Agricultural	46.4	Wholesale of household goods
Intermediary	Non-Agricultural	46.5	Wholesale of information and communication equipment
Intermediary	Non-Agricultural	46.6	Wholesale of other machinery, equipment and supplies
Intermediary	Non-Agricultural	46.7	Other specialised wholesale
Intermediary	Non-Agricultural	46.9	Non-specialised wholesale trade
		47	Retail trade, except of motor vehicles and motorcycles
Intermediary	Agricultural	47.1	Retail sale in non-specialised stores
Intermediary	Non-Agricultural	47.3	Retail sale of automotive fuel in specialised stores
Intermediary	Non-Agricultural	47.4	Retail sale of information and communication equipment in specialised stores
Intermediary	Non-Agricultural	47.5	Retail sale of other household equipment in specialised stores
Intermediary	Non-Agricultural	47.6	Retail sale of cultural and recreation goods in specialised stores
		47.7	Retail sale of other goods in specialised stores
Intermediary	Non-Agricultural	47.71	Retail sale of clothing in specialised stores
Intermediary	Non-Agricultural	47.72	Retail sale of footwear and leather goods in specialised stores
Intermediary	Non-Agricultural	47.73	Dispensing chemist in specialised stores

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Table 12 - Classification of NACE codes in activity sectors and subsectors (*continued from previous page*)

Activity sector	Subsectors	NACE	Heading
Intermediary	Non-Agricultural	47.74	Retail sale of medical and orthopaedic goods in specialised stores
Intermediary	Non-Agricultural	47.75	Retail sale of cosmetic and toilet articles in specialised stores
Intermediary	Agricultural	47.76	Retail sale of flowers, plants, seeds, fertilisers, pet animals and pet food in specialised stores
Intermediary	Non-Agricultural	47.77	Retail sale of watches and jewellery in specialised stores
Intermediary	Non-Agricultural	47.78	Other retail sale of new goods in specialised stores
Intermediary	Non-Agricultural	47.79	Retail sale of second-hand goods in stores
Intermediary	Agricultural	47.81	Retail sale via stalls and markets of food, beverages and tobacco products
Intermediary	Non-Agricultural	47.82	Retail sale via stalls and markets of textiles, clothing and footwear
Intermediary	Non-pertinent	47.9	Retail trade not in stores, stalls or markets
Section H: Transportation and storage			
		49	Land transport and transport via pipelines
Transport	Passenger	49.1	Passenger rail transport, interurban
Transport	Freight	49.2	Freight rail transport
Transport	Passenger	49.3	Other passenger land transport
Transport	Freight	49.4	Freight transport by road and removal services
Transport	Freight	49.5	Transport via pipeline
		50	Water transport
Transport	Passenger	50.1	Sea and coastal passenger water transport
Transport	Freight	50.2	Sea and coastal freight water transport
Transport	Passenger	50.3	Inland passenger water transport
Transport	Freight	50.4	Inland freight water transport
		51	Air transport
Transport	Passenger	51.1	Passenger air transport
Transport	Freight	51.2	Freight air transport and space transport
Transport	Freight	52	Warehousing and support activities for transportation
Services	Postal	53	Postal and courier activities
Section I: Accomodation and food service activities			

Continued on next page

Table 12 - Classification of NACE codes in activity sectors and subsectors (*continued from previous page*)

Activity sector	Subsectors	NACE	Heading
Services	Accomodation	55	Accommodation
Services	Agricultural	56	Food and beverage service activities
Section J: Information and communication			
Services	Communication	58	Publishing activities
Services	Communication	59	Motion picture, video and television programme production, sound recording and music publishing activities
Services	Communication	60	Programming and broadcasting activities
Services	Communication	61	Telecommunications
Services	Communication	62	Computer programming, consultancy and related activities
Services	Communication	63	Information service activities
Section K: Financial and insurance activities			
Services	Finance – Insurance	64	Financial service activities, except insurance and pension funding
Services	Finance – Insurance	65	Insurance, reinsurance and pension funding, except compulsory social security
Services	Finance – Insurance	66	Activities auxiliary to financial services and insurance activities
Section L: Real estate activities			
Services	Real estate	68	Real estate activities
Section M: Professional, scientific and technical activities			
Services	Business services	69	Legal and accounting activities
Services	Business services	70	Activities of head offices, management consultancy activities
Services	Business services	71	Architectural and engineering activities, technical testing and analysis
Services	Business services	72	Scientific research and development
Services	Business services	73	Advertising and market research
Services	Business services	74	Other professional, scientific and technical activities
Services	Business services	75	Veterinary activities
Section N: Administrative and support service activities			
Services	Business services	77	Rental and leasing activities
Services	Business services	78	Employment activities

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Table 12 - Classification of NACE codes in activity sectors and subsectors (*continued from previous page*)

Activity sector	Subsectors	NACE	Heading
Services	Business services	79	Travel agency, tour operator and other reservation service and related activities
Services	Business services	80	Security and investigation activities
Services	Business services	81	Services to buildings and landscape activities
Services	Business services	82	Office administrative, office support and other business support activities
Section O: Public administration and defense, compulsory social security			
Services	Other	84	Public administration and defence, compulsory social security
Section P: Education			
Services	Other	85	Education
Section Q: Human health and social work activities			
Services	Other	86	Human health activities
Services	Other	87	Residential care activities
Services	Other	88	Social work activities without accommodation
Section R: Arts, entertainment and recreation			
Services	Other	90	Creative, arts and entertainment activities
Services	Other	91	Libraries, archives, museums and other cultural activities
Services	Other	92	Gambling and betting activities
Services	Other	93	Sports activities and amusement and recreation activities
Section S: Other service activities			
Services	Other	94	Activities of membership organisations
Services	Other	95	Repair of computers and personal and household goods
Services	Other	96	Other personal service activities
Section T: Activities of households as employers, undifferentiated goods and services producing activities of households for own use			
Services	Other	97	Activities of households as employers of domestic personnel
Services	Other	98	Undifferentiated goods- and services-producing activities of private households for own use
Section U: Activities of extraterritorial organisations and bodies			
Services	Other	99	Activities of extraterritorial organisations and bodies

C Econometric details

C.1 Rosenbaum bounds

The Rosenbaum (2002)'s procedure is applied to test the sensitivity of our ATT estimates to a bias resulting from selection on unobservable factors.

Let us assume that firm i's decision to take equity shares in an intermediary can be explained by a set of observed covariates $\mathbf{X}$ and an unobserved factor u_i such as $p(d_i = 1) = \Lambda\{\mathbf{X}_i\beta + \gamma u_i\}$ where $\Lambda(\cdot)$ is the logistic distribution function. When the participation decision is only driven by selection on observables, γ is equal to zero and we are back to the baseline specification of the propensity score. Conversely, if a hidden bias exists $\gamma \neq 0$, and the probability that two firms i and j, with similar observable covariates, acquire an intermediary differs by a value corresponding to the odds ratio:

$$\frac{p_i(1-p_j)}{p_j(1-p_i)} = \frac{\exp(\mathbf{X}\beta + \gamma u_i)}{\exp(\mathbf{X}\beta + \gamma u_j)} = \exp(\gamma(u_i - u_j))$$

Two conditions may thus lead to an absence of hidden bias. If firms i and j have identical unobserved factors ($u_i = u_j$) or if unobserved factors have no influence in the decision to acquire an intermediary ($\gamma = 0$), then the odds ratio is one. Consequently, by changing the value of γ or $(u_i - u_j)$, one can evaluate the sensitivity of the odds ratio. Following Aakvik (2001), let's assume for the sake of simplicity that u is a binary variable. With this assumption, Rosenbaum (2002) shows that the odds ratio is bounded by:

$$\frac{1}{e^{\gamma}} \leq \frac{p_i(1-p_j)}{p_j(1-p_i)} \leq e^{\gamma}$$

which implies that firms i and j could differ in their probability to be treated as long as $e^{\gamma} \neq 1$. For instance, if $e^{\gamma} = 2$, firms with similar observed covariates can differ in their odd of receiving the treatment by as much as a factor of 2. More generally, if e^{γ} close to one changes the inference about the treatment effect, then the ATT is said to be sensitive to a hidden bias. However, if a large value of e^{γ} does not alter inferences about the treatment effect, the ATT is said insensitive to a hidden bias.

The Rosenbaum (2002) bounds procedure consists to compute critical values of e^{γ}, noted $\Gamma \equiv e^{\gamma}$, based on the Mantel and Haenszel (1959) nonparametric test statistic. The MH test principle consists in comparing the number of exporting firms in the treatment group (Y^1) against the same expected number, under the null hypothesis that the treatment effect is zero. Under the null hypothesis, the distribution of Y^1 is hypergeometric. Let us consider that the propensity score distribution is split into S strata. The test can be used to test for no treatment effect both within each stratum and as a weighted average between strata (Aakvik, 2001). Denote n_s^1 and n_s^0 the numbers of treated and

Table 13: Number of acquisitions by activity sector, subsector and acquirer's type

	Upward		Horizontal		Intermediaries			Transport	
	Agri.	Non-Agri.	Agri.	Non-Agri.	Agri.	Non-Agri.	Not Relev.	Passenger	Freight
Acquiring firm	9	1	188	13	241	28	4		9
Acquiring and acquired firm	53	20	519	65	370	114	3	1	20

	Services							
	Agri.	Postal	Accommodat.	Communicat.	Finance/Insur.	Real Est.	Business Serv.	Other
Acquiring firm	13				18	20	14	2
Acquiring and acquired firm	11		5	12	97	46	73	8

Notes: The number of downward direct links are computed from the 9600 firms of the dataset.

non-treated firms in stratum s, n_s the total number of firms in stratum s, and Y_s the total number of exporting firms in stratum s. The MH test statistic Q_{MH} is given by:

$$Q_{MH} = \frac{\left|Y^1 - \sum_{s=1}^{S} \mathbb{E}(Y_s^1)\right| - 0.5}{\sqrt{\sum_{s=1}^{S} Var(Y_s^1)}} = \frac{\left|Y^1 - \sum_{s=1}^{S} \left(\frac{n_s^1 Y_s}{n_s}\right)\right| - 0.5}{\sqrt{\sum_{s=1}^{S} \frac{n_s^1 n_s^0 Y_s (n_s - Y_s)}{n_s^2 (n_s - 1)}}}$$

and is asymptotically distributed as the standard normal distribution. The MH test requires that the data comes from a random sampling, which is the case here. Indeed, a PSM procedure paired treated and non-treated firms based on their propensity score, which means that firms with identical propensity scores have similar covariates. It results that, conditional on the propensity score, firms are randomly distributed in the treated and comparison groups (balancing hypothesis). For fixed $\Gamma \geq 1$ and u supposed to be a binary variable, Rosenbaum (2002) shows that the test statistic Q_{MH} is bounded by two known distributions. If $\Gamma = 1$, the bounds are equal to one and one can reject the hypothesis of hidden bias. With increasing Γ, the bounds move apart reflecting uncertainty about the test statistics in the presence of unobserved selestion bias.

Two scenarii are concevable according to the sign of the hypothetical selection bias. In case of positive unobserved selection bias, i.e. firms most likely to acquire an intermediary are also those that have a higher probability to export, then the estimated ATT overestimates the true treatment effect. Conversely, with negative unobserved selection bias, the estimated ATT underestimates the true treatment effect. Let Q_{MH}^{+} be the test statistic in case of a positive unobserved selection bias, and let Q_{MH}^{-} be the test statistic in case of a negative unobserved selection bias. The two bounds are then given by

$$Q_{MH}^{+} = \frac{\left|Y^1 - \sum_{s=1}^{S} \tilde{\mathbb{E}}_s^{+})\right| - 0.5}{\sqrt{\sum_{s=1}^{S} Var(\tilde{\mathbb{E}}_s^{+})}}$$

and

$$Q_{MH}^{-} = \frac{\left|Y^1 - \sum_{s=1}^{S} \tilde{\mathbb{E}}_s^{-})\right| - 0.5}{\sqrt{\sum_{s=1}^{S} Var(\tilde{\mathbb{E}}_s^{-})}}$$

where $\tilde{\mathbb{E}}_s$ and $Var(\tilde{\mathbb{E}}_s)$ are the large-sample approximations to the expectation and variance of the number of exporting firms in stratum s when u is binary and for given γ.[13]

[13]The large-sample approximation of $\tilde{\mathbb{E}}_s^{+}$ is the unique root of the following quadratic equation: $\tilde{\mathbb{E}}_s^2 (e^\gamma - 1) - \tilde{\mathbb{E}}_s \left\{(e^\gamma - 1)\left(n_s^1 + Y_s\right) + n_s\right\} + e^\gamma Y_s n_s^1$, with the addition of $\max\left(0, Y_s + n_s^1 - n_s\right) \leq \tilde{\mathbb{E}}_s \leq \min\left(Y_s, n_s^1\right)$ to decide which root to use. $\tilde{\mathbb{E}}_s^{-}$ is determined by replacing e^γ with $1/e^\gamma$. The large-sample approximation of the variance is given by $Var(\tilde{\mathbb{E}}_s) = \left\{1/\tilde{\mathbb{E}}_s + 1/\left(Y_s - \tilde{\mathbb{E}}_s\right) + 1/\left(n_s^1 - \tilde{\mathbb{E}}_s\right) + 1/\left(n_s - Y_s - n_s^1 + \tilde{\mathbb{E}}_s\right)\right\}^{-1}$.

D Additional tables

Table 14: First-stage IV/LATE estimates

Dependent variable: Intermediary	Exporting			Sales export (conditional on exporting)		
	Full sample	Excluding foreign intermediary	Intermediary(ies) exclusively	Full sample	Excluding foreign intermediary	Intermediary(ies) exclusively
Upstream acq.	0.2816***	0.1809***		0.2295***	0.1617**	
	(0.0278)	(0.0319)		(0.0605)	(0.0701)	
Horizontal acq.	0.1853***	0.1417***		0.1814***	0.1459***	
	(0.0097)	(0.0097)		(0.0225)	(0.0227)	
Transport acq.	0.3191***	0.3210***		0.1743**	0.2155**	
	(0.0381)	(0.0401)		(0.0787)	(0.0842)	
Finance - Insurance acq.	0.2084***	0.1298***		0.1411***	0.0927*	
	(0.0235)	(0.0260)		(0.0500)	(0.0550)	
Business services acq.	0.2843***	0.1683***		0.2224***	0.1389**	
	(0.0266)	(0.0307)		(0.0550)	(0.0659)	
Productivity	0.0484***	0.0270	0.0344**	0.0395	-0.0310	-0.0187
	(0.0135)	(0.0174)	(0.0165)	(0.0290)	(0.0489)	(0.0553)
Employment	0.0037**	0.0691***	0.5932***	0.0240	0.0930***	0.4638***
	(0.0019)	(0.0118)	(0.0485)	(0.0170)	(0.0316)	(0.1150)
% of exporters				-0.0985	-0.1115*	-0.5051***
				(0.0758)	(0.0630)	(0.1102)
Accommodation acq.	-0.2786***	-0.3213**				
	(0.0990)	(0.1329)				
Real estate acq.	0.1326***	0.1207***		0.1909***	0.1899***	
	(0.0261)	(0.0267)		(0.0581)	(0.0603)	
Rivals' mean productivity	0.8707***	0.8417***	0.5293***	1.1670***	1.1601***	0.5434
	(0.0986)	(0.0949)	(0.1061)	(0.2405)	(0.2335)	(0.3332)
# of distinct countries from non-intermediary acquisitions				0.0878***	-0.0774	
				(0.0326)	(0.0579)	
% of value-added from rivals owning intermediary			-3.2882***			-5.0090***
			(0.2888)			(0.8001)
Constant	-0.0272***	-0.0275***	0.2995***	0.0187	0.0109	0.6256***
	(0.0066)	(0.0064)	(0.0292)	(0.0274)	(0.0262)	(0.0943)
Sector (FE)	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.1971	0.1391	0.1280	0.1735	0.1043	0.1027
F-stat	123.7683	85.3605	94.7915	19.9177	11.2553	8.5798
Observations	9600	9530	7761	1919	1857	988

Notes: Standard errors in parentheses.*, **, *** indicate significance at the 10%, 5%, 1% level, respectively. Sector fixed-effects (3-digit NACE) are included.