Retailer-driven value chain in agri-food sector: analysis of the participation of French firms

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Abstract

The present paper investigates the link between the participation of French agri-food firms to retailer-driven value chains and their integration in global value chains (GVCs). We propose an empirical methodology based on the econometric estimation of firms' extensive trade margins with multivariate models. We combine firm-level data from the AMADEUS database, French customs and the exhaustive list of firms certified with the private International Featured Standard (IFS) over the period 2006-2011. Our results show that firms that participate to retailer-driven value chains (IFS-certified firms) are by 8.35% more likely to integrate GVCs, i.e. jointly import and export, than other firms in the sector. This premium is primarily driven by the higher probability to export of these firms.

1. Introduction

Over the past two decades, the development of global value chains (GVCs) in the agri-food sector industry followed a similar dynamics as in the manufacturing sectors. For example, 45% of global agri-food trade target other uses than final household consumption (Beaujeu *et al.*, 2018). This expansion of agri-food GVCs is directly related, not only to trade liberalization, but also and especially to retailers' activities at the global level.

In this paper, we analyze the specific behavior of agri-food firms that participate to retailer-driven chains. More specifically, we question whether firms that participate to retailer-driven chains are more integrated into GVCs than the rest of firms. We measure the integration of firms in GVCs by their joint involvement in import and export activities.

In the agri-food sector, the commitment to respect food safety standards throughout the chain has led to the development of private certification standards. Firms willing to sell their products under private labels (PLs) in retailer outlets must comply with the standards set out by the latter. This is most often done by obtaining a certification from an accredited organization[1]. Certification is mainly used to standardize practices in terms of food safety and product quality. Accordingly, we assume that obtaining such a certification rhymes, *de facto*, with firm's integration in a retailer-driven value chain, since it enables the firm to become a supplier of PL products. We can draw on the theoretical literature on "governance approaches" (Gereffi and Korzeniewicz, 1994) in order to describe GVCs. This literature distinguishes "producer-driven" chains from "buyer-driven" chains that characterize retailer-driven chains. Several recent works have shown that firms participating to retailer-driven value chains are more likely to export and export larger amounts than non-certified firms (Cheptea *et al.*, 2019 ; Giovannetti and Marvasi, 2016). Our paper contributes to this literature by accurately estimating the differences between firms integrated in value chains governed by domestic retailers and the rest of firms, with respect to their joint involvement in import and export activities. This analysis also approaches the work of Head *et al.* (2014) and Emlinger and Poncet (2018), who show that the presence of foreign retailers in Chinese cities promotes the exports and imports of these cities.

The contributions of our analysis to the literature are twofold. First, we use original and detailed data on French agri-food firms that allow us to identify IFS-certified firms and to analyze their international behavior. Indeed, in the specific case of France, the agri-food firms willing to negotiate and sign supply contracts with retailers must comply with the standards set by the latter and obtain the IFS certification. We assume that the identification of French IFS-certified firms permits us to identify firms that supply retailers with PL products. The application to the specific case of France is relevant and representative for the phenomenon of GVCs development, French retail chains being strongly internationalized (both in terms of the share of sales in foreign markets and the number of penetrated markets). Second, we assess the integration of firms into GVCs through their joint import and export activities. Although most of the international trade literature treats separately firms' choices to export and import, recent work shows a strong interdependence of these two decisions (Castellani *et al.*, 2010; Aristei *et al.*, 2013; Bas and Strauss-Kahn, 2014; de Backer and Miroudot, 2014; Elliott *et al.,* 2019; Arnoletto *et al.*, 2020). We show that French IFS-certified firms are significantly more likely to be jointly importers and exporters compared to their non-certified counterparts. Our results

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[1] The other alternative for agri-food firms to sell their products in retailer outlets is to use their own brands.

are particularly robust, since we control for annual and economic activity fixed effects, the self-selection mechanism and the endogeneity of firms' certification and trade decisions.

The rest of the article is organized as follows. Section 2 reviews the literature on the participation of agri-food firms in GVCs, the relationship between import and export activities, and the self-selection mechanisms of firms for engaging in foreign trade. Section 3 describes the used data and presents some stylized facts. Section 4 develops our empirical strategy. Estimation results are presented and discussed in section 5. Our main conclusions are resumed in section 6.

2. Related literature

2.1. Certification, firm internationalization and global value chains

Luo and Tung (2007), consider GVCs as a launch pad for firms. Similarly, Giovannetti *et al.* (2015) show that small and less productive Italian firms from the manufacturing and service sectors significantly improve their export probability and export volume when they integrate a global production chain. Certification also seems to positively affect firms' foreign trade. For instance, Martincus *et al*. (2010) observe over the 1998-2006 period that Argentinian firms certified with the ISO 9001: 2000 standard export to a larger number of destinations and a higher volume than their non-certified counterparts. Otsuki (2011) finds a similar result for firms from 25 European and Central Asian countries between 2002 and 2009. Authors explain these results by the fact that certification reduces costs and information asymmetry between economic agents. Focusing specifically on private standards, Cheptea *et al.* (2019) show that IFS-certified French firms, identified as retailers' suppliers, have a higher probability to export than non-certified firms to destinations where French retailers established outlets. They also export larger amounts to these markets than their non-certified competitors, benefiting from a retailer network effect. Giovannetti and Marvasi (2016) find that participation to retailer-driven chains significantly contributes to the internationalization of agri-food firms, increasing the likelihood of exporting, especially for small firms. Head *et al*. (2014) explore the differences in the exposure of Chinese cities to the activities of large global retailers[2] and find that cities with a strong presence of foreign retailers experience an increase in exports. Emlinger and Poncet (2018) show, using panel data from 1997 to 2012, that the presence of global retailers in Chinese cities leads to a disproportionate increase of their imports from retailers' origin countries.

Despite the strong interconnection of import and export activities, and the key role of imports in the global economy highlighted by Castellani *et al.* (2010), few analyses address the participation of firms in retailer-driven chains and their joint import and export activities. The present paper attempts to fill in this gap. Before analyzing the link between participation in retailer-driven chains and GVCs, it is important to understand the mechanisms by which firms' imports and exports are highly interconnected.

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[2] They use data on the location of supply centers of four main foreign retailers (Walmart, Carrefour, Tesco and Metro) operating in China.

2.2. Relationship between imports and exports

There is increasing evidence in the literature that firms' export performance is highly dependent on activities in import markets (Castellani *et al*., 2010; Aristei *et al.,* 2013; Bas and Strauss-Kahn, 2014; de Backer and Miroudot, 2014; Elliott et *al.,* 2019; Arnoletto *et al.*, 2020). Indeed, de Backer and Miroudot (2014) emphasize that export competitiveness relies on the efficient procurement of inputs in value chains. Several mechanisms explain this point. Greenville *et al*. (2017) argue that import barriers reduce the involvement in GVCs, as well as the added value and revenues of agri-food exports. Kasahara and Lapham (2013) show that trade policies, import barriers on foreign intermediate goods (inputs) can have a significant negative effect on the exports of final goods due to complementarities between imports and exports. Amiti and Konings (2007) use data from Indonesian manufacturing firms from 1991 to 2001 and show that trade liberalization and tariff reduction led to a drop in the price of imported intermediate goods. Imports improve firms' productivity by opening access to a higher variety of inputs, to high quality inputs, and by engaging them into a learning process. Similarly, Pierola *et al*. (2018) use transaction-level data on Peruvian over the 2000-2012 period and show that a stronger use of highly diversified and high quality imported inputs are associated with higher firm productivity. Authors also find a positive link between firms' imports and the level of exports to a wide variety of markets, as well as the rapid growth of exports of higher quality products.

Hummels *et al.* (2001) analyze the sequential production process in 10 OECD countries and 4 emerging markets between 1970 and 1990. Using input-output tables, they find that vertical specialization, reflected by a high level of input imports, explains over 20% of a country's exports and around 30% of its exports' growth over the considered period. Using data on French firms over the 1996-2005 period, Bas and Strauss-Kahn (2014) highlight three channels through which diversified imports of intermediate goods increase firms' exports: (i) imported inputs may enhance productivity, permitting to cover export fixed costs; (ii) low-priced foreign inputs increase expected export revenues; (iii) importing inputs permits to meet quality and technology requirements in export markets. Elliott *et al*. (2019) find similar results using panel data on Chinese firms over the 2002-2006 period. They show that firms make export and import decisions simultaneously and that sunk costs play an important role in this process. Similarly, Arnoletto *et al.* (2020) show, using data on Argentinian exporting firms over the 2007-2017 period, that firms characterized by a high level of imported intermediate inputs experience a stronger growth of their export activity.

2.3. Self-selection mechanism of firms in international trade

The literature explains the strong interconnection between imports and exports by a self-selection mechanism. For instance, Kasahara and Lapham (2013) show that firms face sunk and fixed costs for both exporting and importing, and that only most productive firms, which can bear these costs and earn positive profits, actually engage into exports and import activities. They find that sunk and fixed costs are particularly high in food industries and highlight important cost complementarities allowing firms that simultaneously export and import to save up to 26% of these costs. These assertions are supported by Kraay *et al*. (2002), who argue that before becoming importers, firms incur sunk costs associated with finding foreign suppliers and familiarizing themselves with the customs procedures of origin countries. Moreover, Castellani *et al*. (2010) classify firms according to their economic performance, and show that firms that

simultaneously export and import outperform the other. They find that firms engaged exclusively in import activities are more performant than firms engaged exclusively in export activities, and conclude that self-selection is stronger in the import market than in the export market. Analyzing firms' *ex ante* differences, authors also show that future importers are larger, more productive and more capital intensive than future exporters. Similarly, Kugler and Verhoogen (2008, 2009) provide supporting evidence that importing firms are more productive, and thus suggest that the selection of firms into import activities is stronger than into exporting.

Other factors than fixed costs may also explain the participation of firms to international trade. Goldberg et *al.* (2009) and Amiti and Konings (2007) show that trade liberalization has reduced the price of imported intermediate goods and allowed firms to substitute domestic inputs with more diversified, more affordable and higher quality foreign inputs. This may permit less productive firms to enter the import market, benefit from higher quality inputs, and improve thereby their productivity and the quality and variety of their products. Not surprisingly, when defining participation to GVCs by firms' involvement in both import and export activities, Baldwin and Yan (2014) find that participation to GVCs improves promptly firms' productivity and has a long-lasting effect, relative to exclusive exporters, exclusive importers and domestic firms. Similarly, Giovannetti et *al.* (2015) and Giovannetti and Marvasi (2016) show that small and low productivity firms may start exporting when integrated into a global value chain. This point of view is also shared by Castellani et *al.* (2010), who defend the presence of GVC post-entry effects. Firms without an *ex ante* productivity premium can become more productive after joining a GVC and may therefore engage in international trade activities. These findings fuel the debate on the mechanisms that promote the participation of firms in international trade in general, and in GVCs in particular.

This literature review emphasizes the importance of evaluating firms' import and export decisions simultaneously. We integrate this aspect in the analysis of the participation of French agri-food firms in retailer-driven value chains.

3. Data and Stylized facts

3.1. Identification of firms involved in retailer-driven value chains

We question whether firms integrated in retailer-driven chains are more likely to participate to GVCs. In other words, we seek to determine whether an agri-food firm that supplies PL products to a retailer (*e.g.* Carrefour) has a higher probability (or not) of buying inputs and jointly selling its products on foreign markets. To this end, we compare the import and export decisions of IFS-certified firms that supply retailers with PL products to the decisions of the agri-food firms that sell their products under own brand.

The IFS certification can be obtained individually by each firm complying with a set of requirements established by the retailer. It is provided separately for each production line and needs to be renewed every year. The complete audit of a firm's production line lasts, on average, two and a half days and costs about 3,500 €. As a results of this audit, the IFS certification is issued to the firm if the inspected production line meets all the requirements of the standard. In case of a negative audit outcome, the firm needs to make additional investments to ensure the compliance of the production line (or abandons the process). A firm with multiple production lines incurs higher audit costs to obtain certification for all its products. A firm willing to

preserve its certification over a longer period of time needs to repeat the audit every year and pay each time the associated costs.

3.2. Data sources and descriptive statistics

The data we use comes from different sources:

(i) The AMADEUS database permits to identify firms in the French agri-food sector and provides information on each firms' type of economic activity, turnover, number of employees, and financial links with other firms. We use this information to account for the size, productivity, and level of independence of firms.

(ii) French customs database includes information on each firms' product-level bilateral imports and exports. For the purposes of our study, we have aggregated import and export data at firm-year level (by summing across products and countries of origin or destination).

(iii) The exhaustive list of French agri-food firms that have the IFS-certification each year from 2003, when certification was introduced, until 2011. This data is provided by an independent accredited certification organization. We use this information to identify firms involved in retailer-driven value chains. The first three years since the official introduction of the IFS certification were marked by a very low participation rate, due to novelty phenomenon and reduced awareness. Accordingly, we focus our analysis on the 2006-2011 period.

Information on the IFS certification of firms is combined with the other two databases via the identification of each firm with a unique SIREN number, an identifier present in all three databases.

Limiting the analysis to a single sector – the agri-food – offers the advantage of reducing the effects of unobserved factors on firms' characteristics and decisions (strategies). Still, the data contains a certain degree of heterogeneity, due to the diversity of firms' economic activities (industries) in the agri-food sector. The latter are captured in the AMADEUS database by an indicator variable reflecting each firm's main type of economic activity according to the NACE Rev. 2 classification. We exclude the firms in industries characterized by a very low rate of IFS certification rate or participation in international trade (*e.g.* bakeries, manufacture of animal feed, manufacture of starch products, manufacture of malt and tobacco products).

Our final database covers the period 2006-2011 and includes 24,351 observations. Out of these, 1,269 (5.2%) represent exclusively importing firms, 3,060 (12.6%) exclusively exporting firms, 4,112 (16.9%) jointly importing and exporting firms, and 15,910 (65.3%) domestic firms. There are 1,157 IFS certified firms in our panel, *i.e.* less than 5%.

Table 1 presents the distribution of firms in the first and last years of the sample, according to their exporter and importer status and IFS certification. It shows a very uneven composition of IFS certified and non-certified firms, according to their participation in international trade. The group of IFS-certified firms is composed predominantly of joint importing and exporting firms (72% in 2006 and 60% in 2011), while the group of non-certified firms contains mainly domestic firms (63% in 2006 and 74% in 2011). Certified firms are more actively engaged in international trade than non-certified firms. As an illustration, in 2006, 88% of IFS certified firms were importing and/or exporting, compared to 37% of non-IFS certified firms. This gap widened by 2011: 86% for certified firms versus 26% for non-certified firms.

Table 1: Frequency of firms participating in international trade by IFS certification status

| Types of firms | Number of firms | | | | | |
| | Agri-food firms | | IFS firms | | Non-IFS firms | |
	2006	2011	2006	2011	2006	2011
Exporting firms	470	738	5	51	465	687
(proportion of total in %)	(13%)	(14%)	(7%)	(19%)	(13%)	(13%)
Importing firms	218	215	6	18	212	197
(proportion of total in %)	(6%)	(4%)	(9%)	(7%)	(6%)	(4%)
Both importing and exporting firms	692	645	49	159	643	486
(proportion of total in %)	(19%)	(12%)	(72%)	(60%)	(18%)	(9%)
Sum of the three categories	1 380	1 598	60	228	1 320	1 370
(proportion of total in %)	(38%)	(30%)	(88%)	(86%)	(37%)	(26%)
Domestic	2 186	3 828	8	37	2 178	3 791
(proportion of total in %)	(61%)	(71%)	(12%)	(14%)	(62%)	(73%)
Total	3 566	5 426	68	265	3 498	5 161

Source: AMADEUS, IFS organization and French customs.

The distribution of firms by size and IFS status (Table 2) shows that, in 2006, most IFS-certified firms were medium-size (50 to 499 employees) or large-size (over 499 employees) firms: 57.35% and respectively 25%. However, by 2011, we note that the share of certified small-size firms (less than 50 employees) has exceeded that of certified large firms. In contrast to certified firms, non-IFS certified firms are mainly small-size firms (85.71% in 2006 and 93.12% in 2011), followed by medium-size firms (12.72% in 2066 and 6.28% in 2011).

Table 2: Frequency and proportion of firms by size and IFS certification status

| Year | Number of employees | Exporting firms (share in %) | | Importing firms (share in %) | | Importing & exporting firms (share in %) | | Domestic firms (share in %) | | Total no. of firms (share in %) | |
		IFS	Non-IFS	IFS	Non-IFS	IFS	Non-IFS	IFS	Non-IFS	IFS	Non-IFS
2 006	<50	S	396 (11.32%)	S	169 (4.83%)	6 (8.82%)	313 (8.95%)	3 (4.41%)	2 120 (60.60%)	12 (17.65%)	2 998 (85.71%)
	50 à 499	4 (5.88%)	68 (1.94%)	4 (5.88%)	43 (1.23%)	27 (39.71%)	277 (7.92%)	4 (5.88%)	57 (1.63%)	39 (57.35%)	445 (12.72%)
	> 499	S	S	S	S	16 (23.53%)	53 (1.52%)	S	S	17 (25.00%)	55 (1.57%)
	Total									68	3 498
2 011	<50	27 (10.19%)	634 (12.28%)	6 (2.26%)	161 (3.12%)	42 (15.85%)	293 (5.68%)	20 (7.55%)	3718 (72.04%)	95 (35.85%)	4 806 (93.12%)
	50 à 499	24 (9.06%)	52 (1.00%)	12 (4.53%)	36 (0.70%)	93 (35.09%)	164 (3.18%)	16 (6.04%)	72 (1.40%)	145 (54.72%)	324 (6.28%)
	> 499	S	S	S	S	24 (9.06%)	29 (0.56%)	S	S	25 (9.43%)	31 (0.60%
	Total									265	5 161

Source: AMADEUS, IFS organization and French customs. S denotes dropped for statistical secret reason.

Regarding the distribution of firms by size with respect to their international trade activity, we note that, in 2006, most IFS-certified firms were medium-size (39.71%) and large-size (23.53%) joint exporters and importers. Medium-size joint exporters and importers were still the dominant group in 2011 (35.09%). However, we see a strong increase in the number of

small-size join exporters and importers (15.85%), that by 2011 outnumber large-size joint exporters and importers. We observe a similar evolution for certified small-size firms engaged exclusively in exporting. The share of these firms increased from low level in 2006 (observation dropped for statistical secret reason) to 10.19% in 2011, reflecting a strong increase in the interest of small firm for IFS certification and/or their capacity to obtain the certification. At the same time, non-certified firms are dominated by small-size domestic firms (60.60% in 2006 and 72.04% in 2011).

3.3. The interconnection of firms' import, export and certification decisions

We pool observations from all years in our panel and analyze the joint and marginal probabilities of firms to engage in international trade and certify, as well as the conditional and unconditional probabilities for each observed choice or combinations of choices.

Table 3 shows that about 29% of firms in our panel are at least exporting, 22% at least importing, and only 4.76% are IFS-certified. Joint exporters and importers are the largest share in our sample (13.82%), after domestic firms. They are followed by exclusively exporting firms (11.92%) and at a great distance by exclusively importing firms (4.82%). The share of firms that participate jointly in import and export markets is even greater in the group of IFS-certified firms, exceeding the share of domestic firms (3.07% vs. 0.65%). These stylized facts indicate that there is a strong correlation between a firm's participation in international trade and relationship with retailers, reflected in its choice to certify or not.

Table 3: Observed joint and marginal probabilities for different types of firms

	Joint probability	Marginal effect (Importer)	Marginal effect (Exporter)	Marginal effect (IFS)
Importer only	4.82	4.82		
Exporter only	11.92		11.92	
IFS and Domestic	0.65			0.65
Importer and Exporter	13.82	13.82	13.82	
Importater and IFS	0.39	0.39		0.39
Exportater and IFS	0.65		0.65	0.65
Importer and Exporter and IFS	3.07	3.07	3.07	3.07
Domestic only	64.68			
Total	100.00	22.10	29.46	4.76

Source: Authors' calculations based on AMADEUS data, IFS organization and French customs.

Based on the statistics listed in Table 3, we compute the observed conditional probabilities for each type of firm. The results reported in Table 4 confirm the strong interdependencies between firms' import, export, and certification decisions. Indeed, 72.69% of the IFS-certified firms are engaged in importing and 78.15% in exporting. These probabilities are much higher than the unconditional probabilities of 22.10% and respectively 29.46% for the whole sample. In addition, certified firms engaged in importing or exporting have a very high probability of engaging in the other trade activity (88.73% and 82.53%). These statistics confirm the strong correlation between the group of importing, exporting and certified firms, and indicate that the probability of a firm that belongs to only one of these groups is quite low. We also note that the

probability of importing and/or exporting firms to certify is relatively low, compared to the probability of certified firms to import and/or export: 15.66% for importers, 12.63% for exporters, and 18.18% for both importing and exporting firms.

Table 4: Observed conditional and unconditional probabilities

	Importer	Exporter	IFS
$P(.)$	22.10	29.46	4.76
$P(.|\text{Importer} = 1)$	100.00	76.43	15.66
$P(.|\text{Exporter} = 1)$	57.33	100.00	12.63
$P(.|\text{IFS} = 1)$	72.69	78.15	100.00
$P(.|\text{Exporter} = 1, \text{IFS} = 1)$	82.53	100.00	100.00
$P(.|\text{Importer} = 1, \text{IFS} = 1)$	100.00	88.73	100.00
$P(.|\text{Importer} = 1, \text{Exporter} = 1)$	100.00	100.00	18.18

Source: Authors' calculations based on observed statistics in the data.

4. Empirical strategy

We model firms' decisions to involve in international trade activities as a function of their choice to participate or not to retailer-driven chains. We propose a multivariate probit estimation procedure tailored to our empirical framework. We draw on the work of Goy and Wang (2016), who analyze the relationship between knowledge tradeability (engagement in licensing agreements) and firms' choice of intellectual property protection strategies (parents vs. secrecy). We adapt this framework to firms' decisions regarding their participation to international trade. We assume that firms' import and export choices reflect the outcome of a maximization program of profits obtained from international trade activities.

We consider that the decision to export or import, noted by binary variables $y_{EXP,i}$ and $y_{IMP,i}$, is the result of maximizing associated profits, $\pi_{EXP,i}(\mathbf{X}_i, \boldsymbol{\theta}_i)$ and $\pi_{IMP,i}(\mathbf{X}_i, \boldsymbol{\theta}_i)$:

$$\pi_{k,i} = \boldsymbol{\beta}'_k \mathbf{X}_i + \boldsymbol{\theta}_i + \varepsilon_{k,i} ; \quad k = EXP, IMP \tag{1}$$

where $\mathbf{X}_i$ is a vector of observed firm-specific variables, $\boldsymbol{\theta}_i$ is a vector of unobservable characteristics but known to the firm, $\boldsymbol{\beta}'_{EXP}$ and $\boldsymbol{\beta}'_{IMP}$ are the vectors of the parameters to be estimated, and $\varepsilon_{EXP,i}$ and $\varepsilon_{IMP,i}$ are zero-mean error terms. Since the profits earned by firms $\pi_{k,i}$ are not directly observed, we consider them as latent variables. Firms choose to export or import if they earn non-negative profits:

$$\begin{cases} y_{k,i} = 1 & \text{if} \quad \pi_{k,i}(\mathbf{X}_i, \boldsymbol{\theta}_i) \geq 0 \\ y_{k,i} = 0 & \text{if} \quad \pi_{k,i}(\mathbf{X}_i, \boldsymbol{\theta}_i) < 0 \end{cases} \quad k = EXP, IMP \ .$$

In reality, a firm's choice to export and import are not mutually exclusive. The decision to export can be linked to the decision to import or *vice versa*. Indeed, Kasahara and Lapham (2013) show that firms that simultaneously export and import face lower overall sunk and fixed costs associated with engaging in international trade activities. This result is explained by the fact that common unobservable factors $\boldsymbol{\theta}_i$ impact both decisions.

In order to take this into account, we first specify a bivariate model of export and import decisions as a function of observed and unobservable firm characteristics:

$$\begin{cases} \pi_{EXP,i} = \boldsymbol{\beta}'_{EXP}\mathbf{X}_i + \delta_{EXP}Inst_{EXP,i} + \theta_i^{EXP} + \varepsilon_{EXP,i} \\ \pi_{IMP,i} = \boldsymbol{\beta}'_{IMP}\mathbf{X}_i + \delta_{IMP}Inst_{IMP,i} + \theta_i^{IMP} + \varepsilon_{IMP,i} \end{cases} ; \ cov(\varepsilon_{EXP,i}, \varepsilon_{IMP,i}) = \rho \ . \qquad (2)$$

The vector of observed characteristics $\mathbf{X}_i$ includes the productivity, size and financial links (degree of independence) of the firm. We compute a firm's productivity as its annual turnover per employee. The size of a firm is reflected in its turnover and number of employees, but these two variables are highly correlated with our productivity measure. To overcome this problem (eliminate a possible multicollinearity bias), we identify three categories of firms based on the number of employees and include in equation (2) three dummies associated with size class: (i) small firms with less than 50 employees; (ii) medium-size firms with 50-499 employees; and (iii) large firms with 500 or more employees. Similarly, we include dummies for the four types of firms' financial linkages: (i) independent firms that don't have any financial linkages with other firms; (ii) heads of group, which hold financial parts in other firms and keep full control over their own parts, (iii) connecting firms, which hold financial parts in other firms and at the same time are partially owned by other firms, and (iv) affiliates, which have no financial parts in other firms and are totally or partially owned by other firms. We include as well industry and year fixed effects in the system of equations (2) in order to capture the impact of unobservable factors $\boldsymbol{\theta}_i$.[3]

The identification of multivariate binary choice models is achieved solely through the non-linear form of the estimator (probit in our case). To reduce this fragility of the model, Wooldridge (2010, pp. 594–599) and Goy and Wang (2016) recommend imposing exclusion restrictions by introducing at least one instrumental variable for each explained variable. We add two instrumental (exclusion) variables – $Inst_{EXP,i}$ and $Inst_{IMP,i}$ –for the two explained variable of system (2). We follow the approach adopted by Cheptea *et al.* (2019) and construct our instruments based on the strategies adopted by competing firms from the same industry. Thus, for firms' decision to export (import) we compute the share of exporting (importing) firms in the overall turnover of competing firms from the same industry. By construction, the two instruments are uncorrelated with the firm's export and import decision because we exclude the analyzed firm and focus only on the activity of its competitors. Accordingly, these instruments can be interpreted as average evaluations by pairs of the profitability of export and import activities.

In system (2), ε_{ki} are bivariate and normally distributed error terms with variance $var(\varepsilon_{ki}) = 1$ and covariance matrix $cov(\varepsilon_{EXPi}, \varepsilon_{IMPi}) = \rho$. When $\rho = 0$, estimating system (2) resumes to estimating separately two univariate models. A $\rho \neq 0$ indicates a correlation between unobserved determinants of export and import decisions and requires the simultaneous estimation of two equations.

Equation system (2) does not differentiate firms' responsiveness according to whether they participate in retailer-driven value chains or not. Yet, the literature shows that becoming a retailer's supplier leads to a stronger internationalization of firms (Giovannetti *et al.,* 2015; Cheptea *et al.,* 2019; Giovannetti and Marvasi, 2016). To capture this effect, we adjust system (2) by allowing certified and non-certified firms to have different export and import strategies. As mentioned in section 3, we use firms' IFS certification as an indicator of

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[3] The best way to capture the effects of unobservable factors would be to include firm-level fixed effects. We cannot implement this solution because of the large number of firms in our sample (about 8,000) and the difficulty of convergence of a probit model with a very large number of fixed effects.

participation in a retailer-driven chain. We introduce the binary variable reflecting firm's certification status, IFS_i, as an explanatory factor of firm's export and import decisions:

$$\begin{cases} \pi_{EXP,i} = \boldsymbol{\beta}'_{EXP}\mathbf{X}_i + \delta_{EXP}Inst_{EXP,i} + \gamma_{EXP}IFS_i + \theta_i^{EXP} + \varepsilon_{EXP,i} \\ \pi_{IMP,i} = \boldsymbol{\beta}'_{IMP}\mathbf{X}_i + \delta_{IMP}Inst_{IMP,i} + \gamma_{IMP}IFS_i + \theta_i^{IMP} + \varepsilon_{IMP,i} \end{cases}. \tag{3}$$

Maddala (1986) posits that, in order to obtain consistent parameter estimators, all explanatory variables in system (3) must be exogenous. This condition is not verified in our case. Indeed, Cheptea *et al* (2019) show that firms' decision to supply retailers with PL products is endogenous to their decision to export. On one hand, to compensate the fixed costs associated with certification, certified firms may try to increase their revenues through exports and/or cut their costs by importing lower-priced inputs. On the other hand, firms operating in international markets may decide to certify in order to benefit from the potential advantages of integrating a retailer's network. The origin of this double causality are unobservable firm-specific factors that simultaneously influence firm's internationalization (export and import) and certification choices. In Appendix B2, we show that, prior to certification, IFS-certified firms have higher productivity than non-certified firms. This *ex ante* difference in productivity levels shows that there is a self-selection of firms into certifying with the IFS.

In order to control for reverse causality and self-selection in the data, and to obtain consistent estimators of the parameters of equation system (3), we follow the procedure proposed by Maddala (1986) and Bhattacharya *et al.* (2006). More specifically, we consider that firms' certification decision, reflected in the binary variable IFS_i, is determined by the value of a latent variable $\pi_{IFS,i}$ that measures the benefits of certification for the firm:

$$\begin{cases} IFS_i = 1 & \text{if} \quad \pi_{IFS,i}(\mathbf{Z}_i, \varphi_i) \geq 0 \\ IFS_i = 0 & \text{if} \quad \pi_{IFS,i}(\mathbf{Z}_i, \varphi_i) < 0 \end{cases}$$

$\pi_{IFS,i}$ is a linear function of observed and unobserved variables:

$$\pi_{IFS,i} = \boldsymbol{\alpha}'\mathbf{Z}_i + \delta_{IFS}Inst_{IFS,i} + \varphi_i + u_i \tag{4}$$

$Inst_{IFS,i}$ is the exclusion variable that explains firms' decision to certify but not its decision to export or import, φ_i reflects the impact of unobservable factors, and u_i is a zero-mean error term. Variable $Inst_{IFS,i}$ is constructed similarly to the exclusion variables for firms' export and import decisions. It corresponds to the share of certified firms in the overall turnover of competing firms from the same industry[4]. Following Cheptea *et al*. (2019), we consider that firms' competition for retailers' shelf space should affect their certification strategies, but not their decisions to export and/or import.

A statistically significant correlation of error terms ε_{ki} and u_i indicates that variable IFS_i is endogenous and that the separate estimation of each equation would produce inconsistent estimators. In this case, the use of a multivariate model remains the best solution (Maddala, 1986; Bhattacharya *et al.,* 2006). To account for the possible endogeneity of firms' decision to certify, we construct a trivariate probit model by combining system (3) and equation (4):

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[4] It is computed as the ratio between the sales of competing certified firms from the same industry as the analyzed firm and the overall sales of all competing firms in the industry.

$$\begin{cases} \pi_{EXP,i} = \boldsymbol{\beta}'_{EXP}\mathbf{X}_i + \delta_{EXP}Inst_{EXP,i} + \gamma_{EXP}IFS_i + \theta_i^{EXP} + \varepsilon_{EXP,i} \\ \pi_{IMP,i} = \boldsymbol{\beta}'_{IMP}\mathbf{X}_i + \delta_{IMP}Inst_{IMP,i} + \gamma_{IMP}IFS_i + \theta_i^{IMP} + \varepsilon_{IMP,i} \\ \pi_{IFS,i} = \boldsymbol{\alpha}'\mathbf{Z}_i + \delta_{IFS}Inst_{IFS,i} + \varphi_i + u_i \end{cases} \quad (5)$$

The trivariate error terms $(\varepsilon_{EXPi}, \varepsilon_{IMPi}, u_i)$ are assumed to follow joint normal distributions, and the terms of the variance-covariance matrix: $var(\varepsilon_{EXPi}) = var(\varepsilon_{IMPi}) = var(u_i) = 1$, $cov(\varepsilon_{EXP,i}, \varepsilon_{IMP,i}) = \rho_1$, $cov(\varepsilon_{EXP,i}, u_i) = \rho_2$ and $cov(\varepsilon_{IMP,i}, u_i) = \rho_3$. As in the case of system (2), the relevance of the trivariate probit model is confirmed by obtaining estimates of parameters ρ_1, ρ_2 and ρ_3 statistically different from zero.

We use a simulated maximum likelihood estimator (SML) to obtain the estimated values of model parameters. This estimator is a multivariate normal probability simulation computed with the Geweke-Hajivassiliou-Keane (GHK) simulator. We employ this estimator because of its suitable properties: simulated probabilities are unbiased and in the interval (0,1), the simulator is a continuous and differentiable function of model parameters, and estimators are asymptotic in the sense that they become more consistent as the number of draws and the number of observations tend to infinity (Cappellari and Jenkins, 2003).

5. Results and discussions

5.1. Interconnection of import and export decisions

First, we estimate system (2) with a bivariate probit model and analyze the correlation of firms' import and export decisions. The objective is not to estimate the effect of certification on firms' import and export decisions, as it may be subject to a bias induced by the potential endogeneity of firms' certification decision. Instead, we aim to identify the differences between the strategies of IFS-certified and non-certified firms.[5]

Estimation results on the full sample (Table 5) shows the presence of a strong interconnection between firms' import and export decisions, reflected by the highly significant estimate of covariance parameter $\rho = 0.61$. It is worth noting that all the tables in this section list average marginal effects of variables on predicted univariate, conditional and joint probabilities.[6] Productivity has a positive and significant effect on the univariate probabilities (specification 1 – Table 5) and on the conditional probabilities (columns 2 and 3 – Table 5) of exporting and importing. The marginal effect of productivity is the strongest on the probability to import for an exporting firms: 12.60%. We obtain similar results for firms' size. In line with the empirical trade literature, we find that large firms are more likely to engage in foreign trade than smaller firms. The effect is once again the strongest on the probability to import for an exporting firms: 52%.

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[5] Tables A1 and A2 of Appendix A present the descriptive statistics and correlation of the model variables.

[6] Average predicted probabilities permit to compare results obtained on different sub-samples, as opposed to predicted probabilities at sample mean because the later may differ across subsamples.

Table 5: Average marginal effects on firms' export and import probabilities, biprobit estimator

VARIABLES	Univariate probabilities		Conditional probabilities		Joint probabilities			
	(1)		(2)	(3)	(4)	(5)	(6)	(7)
	P(EXP=1)	P(IMP=1)	P(EXP=1|IMP=1)	P(IMP=1|EXP=1)	P(EXP=1, IMP=1)	P(EXP=1,IMP=0)	P(EXP=0,IMP=1)	P(EXP=0,IMP=0)
ln *productivity*	0.086***	0.096***	0.042***	0.126***	0.072***	0.014***	0.024***	-0.110***
	(0 .003)	(0 .003)	(0.005)	(0.004)	(0.002)	(0.002)	(0.001)	(0.003)
Financial linkages :								
Independent firm	reference	reference	reference	reference	reference	reference	reference	reference
Head of group	0.161***	0.119***	0.142***	0.118***	0.105***	0.056***	0.014***	-0.174***
	(0.009)	(0.008)	(0.074)	(0.015)	(0.006)	(0.007)	(0.004)	(0.009)
Connecting firm	0.227***	0.198***	0.169***	0.226***	0.163***	0.064***	0.035***	-0.262***
	(0.008)	(0.007)	(0.014)	(0.013)	(0.005)	(0.004)	(0.004)	(0.008)
Affiliate	0.155***	0.142***	0.109***	0.167***	0.115***	0.040***	0.027***	-0.182***
	(0.005)	(0.004)	(0.009)	(0.008)	(0.003)	(0.004)	(0.002)	(0.005)
Firm size :								
1 to 49 employees	reference	reference	reference	reference	reference	reference	reference	reference
50 to 499 employees	0.231***	0.218***	0.155***	0.261***	0.174***	0.057***	0.044***	-0.275***
	(0.007)	(0.006)	(0.012)	(0. 010)	(0.004)	(0.005)	(0.003)	(0.007)
500 employees or more	0.387**	0.407***	0.216***	0.520***	0.312***	0.074***	0.094***	-0.481
	(0.025)	(0.0212)	(0.043)	(0.042)	(0.014)	(0.019)	(0.012)	(.024)
Share of competing exp. firms in the same ind. $Inst_{EXP}$	-0.037		-0.062	0.026	-0.011	-0.027	0.011	0.027
	(0.045)		(0.074)	(0.031)	(0013)	(0.032)	(0013)	(0.032)
Share of competing imp. firms in the same ind. $Inst_{IMP}$		-0.078**	0.080**	-0.151**	-0.038**	0.038**	-0.039**	0.039**
		(0.037)	(0.038)	(0.071)	(0.018)	(0.018)	(0.019)	(0.019)
Year fixed effects	YES	YES						
Industry fixed effects	YES	YES						
Likelihood ratio	-16573.804							
ρ (correlated decisions)	0.609***							
Observations	24,351	24,351	24,351	24,351	24,351	24,351	24,351	24,351

Notes: Average marginal effects of variables on predicted univariate, conditional and joint probabilities. *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses.

When we turn to effects on joint probabilities (columns 4 to 7), we see that productivity and firm size have a strong positive effect on firms' probability to engage simultaneously in exporting and importing, a moderate positive effect on the probability of firms to exclusively export or import, and a strong negative effect on firms' probability to operate only on the domestic market. These results are consistent with the theoretical and empirical literature on firms' self-selection in international markets and the interconnection of their import and export decisions (Melitz, 2003; Castellani *et al.,* 2010; Aristei *et al.,* 2013; Bas and Strauss-Kahn, 2014; Elliott *et al.,* 2019).

Regarding the financial links between firms, we find that *connecting firms* are much more likely to internationalize than the rest, regardless of the nature of the internationalization (exports or imports). This result is due to the strong connections of these firms with the *head-of-group* firm and their *affiliates*, which may be domestic or foreign. Note also that *head-of-group* firms and *affiliates* are more likely to internationalize than *independent* firms.

Let us look at the effect of our exclusion (instrumental) variables. Estimation results in Table 5 show that the export strategy of competing firms from the same industry ($Inst_{EXP}$, i.e. the Share of competing exporting firms in the same industry) has no significant effect on the export strategy of a firm. In contrast, the import strategy of competing from the same industry ($Inst_{IMP}$, i.e. the Share of competing importing firms in the same industry) significantly affects the import strategy of the firm. Indeed, the import equation in specification (1) of Table 5 shows that, the larger the share of competing importing firms in the same industry, the less likely the firm engages in importing. The partial marginal effect of the import exclusion variable in columns (4) and (6) of Table 5 confirm this negative effect. This shows that firms that face strong competition from their importing counterparts find it difficult to enter the import market or to continue to import. This negative effect does not mean that these firms completely disengage from import activities. The impact of the import strategy of competing firms is much stronger on importing firms than on exporting and domestic firms. According to results in column (2), when all the competitors of an importing firm are also importers, this increases the probability of the firm to engage in exporting by 8%. Differently, results in columns (5) and (7) point out that when all the competitors of a non-importing firm are engaged in import activities, this increases the probability of the firm to be exclusively export or operate solely on the domestic market by 4%.

Next, we estimate system (2) separately on the sub-sample of certified firms and of non-certified firms (Tables A3 and A4 of Appendix A). The main message we retain from these results is that an equal increase in firm productivity has different effects on the import and export strategies of the two types of firms, especially on their probability to engage jointly in importing and exporting (column 4) or exclusively in one of these two activities (columns 5 and 6). Productivity has a strong and positive effect on the joint probability to export and import for IFS certified firms (column 4 of Table A3). More surprisingly, it has a negative effect on the probability for IFS certified firms to engage exclusively in exporting or importing (columns 5 and 6 of Table A3), but positive for non IFS firms (column 5 and 6 of Table A4). These findings suggest that IFS firms are more likely to engage simultaneously in import and export activities and less likely to engage only in exporting or only in importing. This self-selection of certified firms is a first evidence that participation in retailer-driven value chains increases firms' odds to integrate GVCs.

Table 6: Average marginal effects on firms' export and import probabilities and controlling for IFS certification, biprobit estimator

VARIABLES	Univariate probabilities		Conditional probabilities		Joint probabilities			
	(1)		(2)	(3)	(4)	(5)	(6)	(7)
	P(EXP=1)	P(IMP=1)	P(EXP=1|IMP=1)	P(IMP=1|EXP=1)	P(EXP=1, IMP=1)	P(EXP=1,IMP=0)	P(EXP=0,IMP=1)	P(EXP=0,IMP=0)
IFS Certification	0.055***	0.059***	0.029	0.077***	0.045***	0.010	0.014***	-0.069***
	(0.011)	(0.009)	(0.017)	(0.017)	(0.006)	(0.008)	(0.005)	(0.010)
ln *productivity*	0.085***	0.095***	0.042***	0.125***	0.071***	0.014***	0.024***	-0.109***
	(0.003)	(0.003)	(0.005)	(0.005)	(0.002)	(0.002)	(0.001)	(0.003)
Financial linkages :								
Independent firm	reference	reference	reference	reference	reference	reference	reference	reference
Head of group	0.159***	0.116***	0.142***	0.115***	0.103***	0.056***	0.013***	-0.172***
	(0.009)	(0.008)	(0.015)	(0.015)	(0.006)	(0.007)	(0.004)	(0.009)
Connecting firm	0.223***	0.194***	0.167***	0.222***	0.160***	0.064***	0.034***	-0.258***
	(0.008)	(0.007)	(0.014)	(0. .013)	(0.005)	(0.006)	(0.004)	(0.008)
Affiliate	0.153***	0.139***	0.108***	0.164***	0.112***	0.040***	0.027***	-0.179***
	(0.005)	(0.004)	(0.009)	(0.008)	(0.003)	(0.004)	(0.002)	(0.005)
Firm size :								
1 to 49 employees	reference	reference	reference	reference	reference	reference	reference	reference
50 to 499 employees	0.221***	0.207***	0.150***	0.249***	0.165***	0.055***	0.042***	-0.262***
	(0.007)	(0.006)	(0.012)	(0.011)	(0.004)	(0.005)	(0.003)	(0.007)
500 employees or more	0.363***	0.381***	0.204***	0.488***	0.293***	0.071***	0.089***	-0.452***
	(0.026)	(0.022)	(0.043)	(0.042)	(0.014)	(0.019)	(0.012)	(0.024)
Share of competing exp. firms in the same ind. $Inst_{EXP}$	-0.040		-0.066	0.028	-0.012	-0.029	0.012	0.029
	(0.045)		(0.074)	(0.031)	(0.013)	(0. 032)	(0.013)	(0. 032)
Share of competing imp. firms in the same ind. $Inst_{IMP}$		-0.082**	0.085**	-0.160**	-0.040**	0.040**	-0.041**	0.041**
		(0.037)	(0.038)	(0.071	(0.018)	(0.018)	(0.019)	(0.019)
Year fixed effects	YES	YES						
Industry fixed effects	YES	YES						
Likelihood ratio	-16548.367							
ρ (correlated decisions)	0.607***							
Observations	24,351	24,351	24,351	24,351	24,351	24,351	24,351	24,351

Notes: Average marginal effects of variables on predicted univariate, conditional and joint probabilities. *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses.

In the next step, we integrate the IFS certification variable as a potential determinant of firms' export and import decisions. Table 6 displays the results from estimating equation system (3) on the entire sample using a biprobit model. Adding IFS certification only slightly affects the magnitude and statistical significance of other coefficients (compared to Table 5). We find that IFS certification has a positive effect on firms' probability to export and/or import, highly significant in most cases. When we consider jointly the export and import decisions of firms (last four columns of Table 6), we conclude that IFS certified firms are more likely to engage in both export and import activities (column 4). These results confirm the fact that certification increases firms' chances of internationalizing and integrating GVCs.

5.2. Self-selection of IFS certified firms into joint import and export

To confirm our results on the effect of certification on GVCs integration decisions, we propose to control for a possible bias in the previous results and estimate the system (5) with a trivariate probit. Indeed a potential bias may arise due to the endogeneity of the certification decision (see Appendix B1 for details of the Durbin-Wu-Hausman augmented endogeneity test) and to the self-selection of the most productive firms towards certification (see Appendix B2 for details).

The results of the triprobit presented in Table 7 confirm the importance of the correlation between the decisions to import and to export ($rho\ IMP - EXP = 0.60$). The positive sign of the error correlation coefficient between export status and IFS status ($rho\ IFS - EXP = 0.40$) and its significance indicate that there are factors improving the probability of being IFS certified and the probability of to export. In contrast, the non-significance of the error correlation coefficient between IFS and importer status ($rho\ IFS - IMP$) suggest that the decisions to be certified and to import are not directly linked. The link between these two decisions, if it exists, may pass through other channels. The factors that explain the error correlations are not directly observable through the model estimation.

Taking into account the correlations between the unobserved factors of the three choice variables leads to a change in the estimates (Table 7 versus Table 6). The effect of certification becomes negative on the probability of exporting and non-significant on the probability of importing. We observe a general increase in the effect of all control variables, indicating the importance of unobserved factors. The correlation of the effects of unobservable factors makes it insufficient to interpret the results for specification 1, in Table 7. To better understand the effect of certification, we calculate the conditional probabilities of importing and exporting separately for IFS and non-IFS firms. These conditional probabilities allow us to calculate the treatment effect of IFS certification on the decision to import and/or export (Table 8) and thus complete the interpretation of the triprobit results (Table 7).

Table 7: Partial marginal effects on firms' probabilities to export and import, computed at the sample mean, triprobit estimator

VARIABLES	Univariate probabilities (1)			Conditional probabilities			
	P(EXP=1)	P(IMP=1)	P(IFS=1)	(2) P(EXP=1|IMP=0)	(3) P(EXP=1|IMP=1)	(4) P(IMP=1|EXP=0)	(5) P(IMP=1|EXP=1)
IFS Certification	-0.151***	0.041		-0.152***	-0.274***	0.056**	0.183**
	(0.050)	(0.042)		(0.039)	(0.063)	(0.025)	(0.071)
ln *productivity*	0.117***	0.120***	0.004***	0.067***	0.052***	0.063***	0.162***
	(0.004)	(0.003)	(0.000)	(0.003)	(0.006)	(0.002)	(0.006)
Financial linkages :							
Independent firm	reference	reference	reference	reference	reference	reference	reference
Head of group	0.224***	0.147***	0.019***	0.155***	0.187***	0.063***	0.146***
	(0.013)	(0.011)	(0.002)	(0.011)	(0.019)	(0.007)	(0.020)
Connecting firm	0.312***	0.246***	0.021***	0.203***	0.218***	0.116***	0.284***
	(0.012)	(0.009)	(0.002)	(0.010)	(0.017)	(0.006)	(0.017)
Affiliate	0.217***	0.176***	0.021***	0.140***	0.147***	0.085***	0.208***
	(0.007)	(0.006)	(0.001)	(0.006)	(0.011)	(0.004)	(0.011)
Firm size :							
1 to 49 employees	reference	reference	reference	reference	reference	reference	reference
50 to 499 employees	0.333***	0.266***	0.029***	0.216***	0.229***	0.127***	0.311***
	(0.012)	(0.011)	(0.002)	(0.010)	(0.017)	(0.007)	(0.019)
500 employees or more	0.560***	0.492***	0.044***	0.347***	0.338***	0.244***	0.612***
	(0.036)	(0.032)	(0.004)	(0.032)	(0.054)	(0.022)	(0.060)
Share of competing exp. firms in the same ind. $Inst_{EXP}$	-0.061 (0.060)			-0.056 (0.055)	-0.093 (0.092)	0.011 (0.011)	0.041 (0.040)
Share of competing imp. firms in the same ind. $Inst_{IMP}$		-0.103** (0.046)		0.035** (0.015)	0.108** (0.048)	-0.072** (0.032)	-0.206** (0.092)
Share of competing certified firms in the same ind. $Inst_{IFS}$			-0.016*** (0.004)				
Year fixed effects	YES	YES	YES				
Industry fixed effects	YES	YES	YES				
Likelihood ratio		-19426.521					
$\rho\ IMP - EXP$		0.605***					
$\rho\ IFS - EXP$		0.393***					
$\rho\ IFS - IMP$		0.084					
Observations	24,351	24,351	24,351	24,351	24,351	24,351	24,351

Notes : *** p<0.01, ** p<0.05, * p<0.1 ; Standard errors in parentheses.

Table 8: Conditional predicted probabilities and treatment effects

	Average conditional probabilities (%)	
	IFS certified and non-certified firms	
P(EXP = 1|IMP = 1) Probability of exporting if importer	58.34 (0.005)***	
P(EXP = 1|IMP = 0) Probability of exporting if not importer	20.98 (0.003)***	
P(IMP = 1|EXP = 1) Probability of importing if exporter	39.67 (0.004)***	
P(IMP = 1|EXP = 0) Probability of importing if not exporter	13.53 (0.002)***	
	IFS Certified	*Not IFS certified*
P(EXP = 1) Probability of exporting	59.43 (0.006)***	28.22 (0.002)***
P(IMP = 1) Probabilité of importing	26.11 (0.002)***	21.90 (0.002)***
P(EXP = 1, IMP = 1) Probability of both exporting and importing	24.35 (0.176)***	16.01 (0.153)***
P(EXP = 0, IMP = 0) Probability of being domestic	38.82 (0.170)***	65.89 (0.189)***
P(EXP = 1, IMP = 0) Probability of exporting without importing	35.07 (0.124)***	12.21 (0.079)***
P(EXP = 0, IMP = 1) Probability of importing without exporting	1.75 (0.016)***	5.89 (0.041)***
	Average treatment effect (%)	
P(EXP = 1|IMP = 1) − P(EXP = 1|IMP = 0) Probability of exporting: importer vs. non-importer	37.36 (0.000)***	
P(IMP = 1|EXP = 1) − P(IMP = 1|EXP = 0) Probability of importing: exporter vs non-exporter	26.13 (0.000)***	
P(EXP = 1|IFS = 1) − P(EXP = 1|IFS = 0) Probability of exporting: IFS certified vs. not IFS certified	31.21 (0.000)***	
P(IMP = 1|IFS = 1) − P(IMP = 1|IFS = 0) Probability of importing: IFS certified vs. not IFS certified	4.21 (0.000)***	
P(EXP = 1, IMP = 1| IFS = 1) − P(EXP = 1, IMP = 1| IFS = 0) Probability of both exporting and importing: IFS certified vs. not IFS certified	8.35 (0.043)***	
P(EXP = 0, IMP = 0| IFS = 1) − P(EXP = 0, IMP = 0| IFS = 0) Probability of being domestic: IFS certified vs. not IFS certified	-27.07 (0.083)***	

Notes : *** p<0.01, ** p<0.05, * p<0.1 ; Standard errors in parentheses.

The results in Table 8 confirm, first and foremost, the strong relationship between the importing and exporting status of firms, which we have captured so far through the correlation coefficients of the errors of the importing and exporting decisions. Indeed, the status of exporter significantly increases the probability to import on average by 26.13% (i.e., from table 8, P(IMP = 1|EXP = 1) - P(IMP = 1|EXP = 0)= 39.67 – 13.53=26.13%). Moreover, results show that being an importer increases the average probability to export by 37.36% and this effect is significant. This suggests that integration into GVCs is driven by being an exporter, but more so when the firm is an importer, regardless of IFS status. These results are consistent with the literature and are mainly explained by self-selection mechanisms but also by post-entry effects (Castellani *et al.,* 2010; Kasahara and Lapham, 2013; Aristei *et al.,* 2013; Bas and Strauss-Kahn, 2014; Elliott *et al.,* 2019). Indeed, the self-selection mechanism is explained by the fact that only the most productive firms (those that have reached a productivity threshold)[7]

[7] See Chevassus-Lozza and Latouche (2012).

import and/or export. Thus, a firm that enters the import or export market is assumed to have reached a productivity threshold that allows it to participate in international trade and to enter the import and export markets jointly. The post-entry effect is due to the fact that some firms may participate in international trade (import and/or export) with a productivity below the threshold. This can be explained by some other factors, not necessarily observable, as the implementation of an internationally oriented management or managers' knowledge of foreign markets. Such factors allow small and less productive firms to participate into international trade, which then become more productive and have the opportunity to engage jointly in import and export markets.

We seek to determine the effects of certification status on the other system-dependent variables in order to compare them to the coefficients obtained directly with the trivariate model estimation. The results in Table 8 show that certification increases, on average, the probability to import by 4.21% and that to export by 31.21% and decreases the probability to operate only on the domestic market by 27%. These effects are different from the effects of IFS status estimated directly by our model. This confirms the role of unobservable factors at play in the importer, exporter and certification status. Moreover, this shows that certified firms are primarily concerned with engaging in the export market, compared to participating in the import or domestic markets. Certified exporting firms integrate GVCs by engaging in the import market jointly. This result is confirmed by the partial marginal effects on the conditional probabilities of importer and exporter status (Table 7). Indeed, a certified non-exporting firm is 5.6% more likely than non-certified firms to become an importer (column 4 - Table 7). This probability rises to 18.30% for exporting firms (column 5 - Table 7). Certification reduces the conditional probability for the firm to be an exporter, whether it is an importer or not (columns 2 and 3 - Table 7). This is also consistent with the previous bivariate probit analysis (Table 6): the effect of the IFS status variable on the conditional probability $P(EXP=1|IMP=1)$ was not significant and was significant on the conditional probability $P(IMP=1|EXP=1)$ (i.e. columns 2 and 3 of Table 6). This also corroborates the fact that the link between importer and certification status operates indirectly through the channel of exporter status, which is not directly observed with the trivariate model estimation. This is consistent with the results of Bas and Strauss-Kahn (2014) who highlighted the needs for exporters to improve their performance in the export market through diversified sourcing of inputs in foreign markets through imports, seeking inputs with better quality-cost ratio abroad. The core question of this analysis is to determine whether certification allows firms to integrate GVCs by jointly importing and exporting. Our results show that certification significantly improves the probability of jointly import and export, by 8.35% (Table 8) on average. This confirms our hypothesis that participation in retailer-driven chains is a springboard for firms to integrate GVCs. This result is far from trivial. Elliott *et al.* (2019) find that there is a substitution effect between importing and exporting, i.e., firms that import (export) in the past are less likely to become exporters (importers) in subsequent periods. Elliott *et al.* (2019) explain this result by the importance of fixed and sunk entry costs caused by decisions to import or export. These costs make exports (imports) less likely in subsequent years due to a lack of sufficient funds to invest in a new type of international market penetration. In our analysis, we show the fundamental role that certification plays in the participation of agri-food firms in GVCs. Our result can be explained by the network effect of retailers that certified firms benefit from, as shown by Cheptea *et al.* (2019), to access foreign export markets. This mechanism operates through the presence of

retailers brands in foreign markets, which facilitates the penetration of these markets by agri-food firms (Head *et al.,* 2014; Emlinger and Poncet, 2018; Cheptea *et al.,* 2019)

To check that the selection bias was correctly accounted for in the triprobit estimation, we illustrate the effect of productivity for different categories of certified and non-certified firms (Graph 1). This graphical illustration of the triprobit results shows in details the path of the effect of productivity and certification on the conditional probabilities of participating in international trade. We show that for a given productivity, certified firms are more likely to become joint importers and exporters compared to non-certified firms. This highlights the obvious effect of certification and confirm that our results are not driven by the self-selection of certified firms.

Graph 1: Predicted conditional probabilities against firm productivity, by IFS status
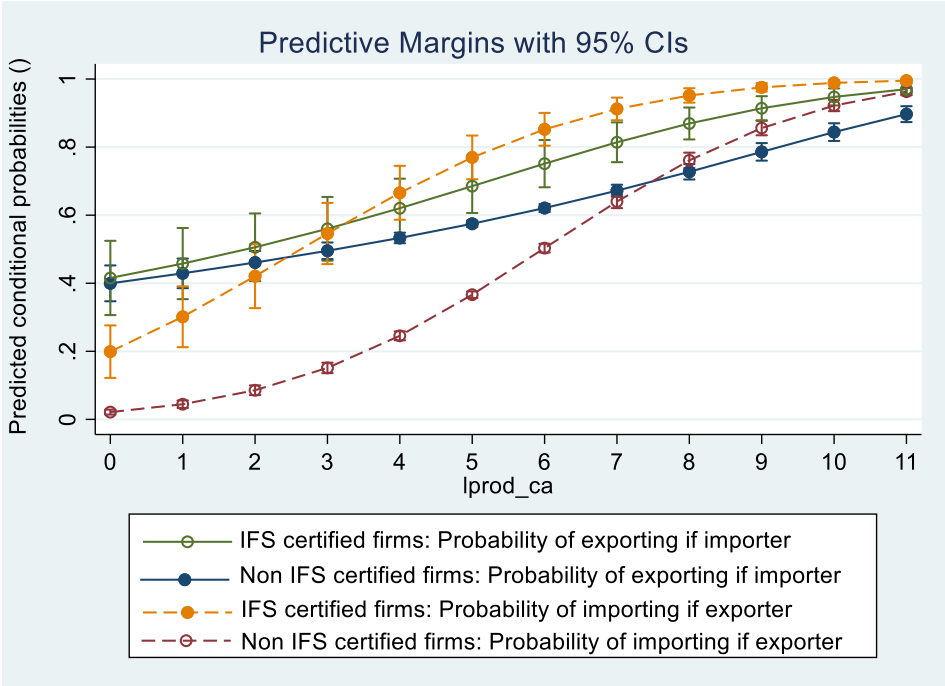
Source: Triprobit estimates between importer, exporter and certification status

Moreover, we can see on the graph that above a certain productivity threshold (which is lower for IFS-certified firms than for non-certified firms), the curve of the conditional probability to import for exporting firms rises above the curve of the conditional probability to export of an importing firm. This confirms the link at firm level between imports and higher productivity of exporters. This also shows that certified firms have important facilities to enter international markets and benefit from a lower productivity threshold than non-certified firms.

6. Conclusion

This paper shows that firms involved in retailer-driven chains (certified firms) are much more likely to enter GVCs. More precisely, we show that this result occurs mainly through the channel of firms' export status. This result shows the importance of retailers in the coordination and dynamics of agri-food GVCs. The participation into retailer-driven value chains necessarily

plays an important role in the international strategies of agri-food firms and in their integration into the GVCs. Any economic policy that aims to encourage firms to participate in GVCs should account for the role that retailers play in agri-food GVC. In the specific context of this study, our results highlight the potential benefit for agri-food firms to integrate retailer-driven chains because of the induced benefits for internationalization. However, as reported by Dudás *et al.* (2020), participation in retailer-driven chains also entails disadvantages for agri-food firms. The three most important disadvantages are the low profitability of PL products, the substitutability between these products, and the vulnerability of agri-food firms to retailers.

This study has some potential limitations. First, it should be noted that non-certified firms can also sell their products in retailer outlet, under their own brands. We do not have the means to identify these firms. Therefore, the estimated effects of the participation in retailer driven chains for IFS-certified firms may be underestimated. Second, the choice of our indicator of participation in GVCs at firm level, i.e. jointly import and export, may reflect a simple search for new markets to expand their market share. This is different from a more specialized and advanced configuration of GVCs where we observe a sequentially integrated production process across countries, as shown by Beugelsdijk *et al.* (2009). An alternative way to control for this limitation would be to have additional information on the specialization of firms in specific productions within GVCs, the continuity of firms' participation in GVCs, and the proportion of firms' turnover from participation in GVCs, following Giovannetti and Marvasi (2016).

These limitations offer perspectives to this paper with respect to the analysis of value-added creation which is the central concept of GVCs. To go further in this direction, it is necessary to focus on the product dimension by distinguishing between intermediate and final goods in order to measure the position of firms and their intensity of participation in GVCs. This may allow for a better understanding of the positions that generate more value added. This would help in better defining trade policies. Finally, understanding the financial acquisition strategies of agri-food firms upstream and/or horizontally in the value chain is also important. This will allow us to verify whether certified firms are more integrated upstream and/or horizontally in the value chain and whether this type of integration generates market power to counterbalance the ever-increasing weight of retailers.

Références

Amiti, M., Konings, J., 2007. Trade Liberalization, Intermediate Inputs, and Productivity: Evidence from Indonesia. Am. Econ. Rev. 97, 1611–1638. https://doi.org/10.1257/aer.97.5.1611

Aristei, D., Castellani, D., Franco, C., 2013. Firms' exporting and importing activities: is there a two-way relationship? Rev. World Econ. 149, 55–84. https://doi.org/10.1007/s10290-012-0137-y

Arnoletto, M., Franco Bedoya, S., Reyes, J.-D., 2020. Exporters Dynamics and the Role of Imports in Argentina, Policy Research Working Papers. The World Bank. https://doi.org/10.1596/1813-9450-9218

Baldwin, J., Yan, B., 2014. Global Value Chains and the Productivity of Canadian Manufacturing Firms, Economic Analysis (EA) Research Paper Series. Statistics Canada – Catalogue no.11F0027M, no. 090.

Bas, M., Strauss-Kahn, V., 2014. Does importing more inputs raise exports? Firm-level evidence from France. Rev. World Econ. 150, 241–275. https://doi.org/10.1007/s10290-013-0175-0

Beaujeu, R., Emlinger, C., Greenville, J., Jouanjean, M.-A., 2018. Contribution des Þlières internationalisées et du commerce à l'emploi dans les secteurs agricole et agro-alimentaire 40.

Beugelsdijk, S., Pedersen, T., Petersen, B., 2009. Is there a trend towards global value chain specialization? — An examination of cross border sales of US foreign affiliates. J. Int. Manag., Global Sourcing and Value Creation: Opportunities and Challenges 15, 126–141. https://doi.org/10.1016/j.intman.2008.08.002

Bhattacharya, J., Goldman, D., McCaffrey, D., 2006. Estimating probit models with self-selected treatments. Stat. Med. 25, 389–413. https://doi.org/10.1002/sim.2226

Castellani, D., Serti, F., Tomasi, C., 2010. Firms in International Trade: Importers' and Exporters' Heterogeneity in Italian Manufacturing Industry. World Econ. 33, 424–457. https://doi.org/10.1111/j.1467-9701.2010.01262.x

Cheptea, A., Emlinger, C., Latouche, K., 2019. Exporting firms and retail internationalization: Evidence from France. J. Econ. Manag. Strategy 28, 561–582. https://doi.org/10.1111/jems.12294

Chevassus-Lozza, E., Latouche, K., 2012. Firms, markets and trade costs: access of French exporters to European agri-food markets. Eur. Rev. Agric. Econ. 39, 257–288. https://doi.org/10.1093/erae/jbr009

de Backer, K., Miroudot, S., 2014. Mapping Global Value Chains (SSRN Scholarly Paper No. ID 2436411). Social Science Research Network, Rochester, NY.

Dudás, G., Kürthy, G., Darvasné, E.Ö., Székelyhidi, K., Radóczné, T.K., Takács, E., Vajda, Á., 2020. Hungarian Food Manufacturers' Experiences with the Production of Private Label Products. EuroChoices n/a. https://doi.org/10.1111/1746-692X.12256

Elliott, R.J.R., Horsewood, N.J., Zhang, L., 2019. Importing exporters and exporting importers: A study of the decision of Chinese firms to engage in international trade. Rev. Int. Econ. 27, 240–266. https://doi.org/10.1111/roie.12374

Emlinger, C., Poncet, S., 2018. With a little help from my friends: Multinational retailers and China's consumer market penetration. J. Int. Econ. 112, 1–12. https://doi.org/10.1016/j.jinteco.2018.01.007

Gereffi, G., Korzeniewicz, M., 1994. Commodity Chains and Global Capitalism. ABC-CLIO.

Giovannetti, G., Marvasi, E., 2016. Food exporters in global value chains: Evidence from Italy. Food Policy 59, 110–125. https://doi.org/10.1016/j.foodpol.2015.10.001

Giovannetti, G., Marvasi, E., Sanfilippo, M., 2015. Supply chains and the internationalization of small firms. Small Bus. Econ. 44, 845–865. https://doi.org/10.1007/s11187-014-9625-x

Goldberg, P., Khandelwal, A., Pavcnik, N., Topalova, P., 2009. Trade Liberalization and New Imported Inputs. Am. Econ. Rev. 99, 494–500. https://doi.org/10.1257/aer.99.2.494

Goy, F., Wang, C., 2016. Does knowledge tradeability make secrecy more attractive than patents? An analysis of IPR strategies and licensing. Oxf. Econ. Pap. 68, 64–88. https://doi.org/10.1093/oep/gpv051

Greenville, J., Kawasaki, K., Beaujeu, R., 2017. How policies shape global food and agriculture value chains. https://doi.org/10.1787/aaf0763a-en

Head, K., Jing, R., Swenson, D.L., 2014. From Beijing to Bentonville: Do multinational retailers link markets? J. Dev. Econ., Land and Property Rights 110, 79–92. https://doi.org/10.1016/j.jdeveco.2014.04.007

Hummels, D., Ishii, J., Yi, K.-M., 2001. The nature and growth of vertical specialization in world trade. J. Int. Econ., Trade and Wages 54, 75–96. https://doi.org/10.1016/S0022-1996(00)00093-3

Kasahara, H., Lapham, B., 2013. Productivity and the decision to import and export: Theory and evidence. J. Int. Econ. 89, 297–316. https://doi.org/10.1016/j.jinteco.2012.08.005

Kraay, A.S., Isidro Tybout, James, 2002. Product Quality, Productive Efficiency, and International Technology Diffusion: Evidence from Plant-Level Panel Data, Policy Research Working Papers. The World Bank. https://doi.org/10.1596/1813-9450-2759

Kugler, M., Verhoogen, E., 2009. Plants and Imported Inputs: New Facts and an Interpretation. Am. Econ. Rev. 99, 501–507. https://doi.org/10.1257/aer.99.2.501

Kugler, M., Verhoogen, E., 2008. The Quality-Complementarity Hypothesis: Theory and Evidence from Colombia (Working Paper No. 14418), Working Paper Series. National Bureau of Economic Research. https://doi.org/10.3386/w14418

Luo, Y., Tung, R.L., 2007. International expansion of emerging market enterprises: A springboard perspective. J. Int. Bus. Stud. 38, 481–498. https://doi.org/10.1057/palgrave.jibs.8400275

Maddala, G.S., 1986. Limited-Dependent and Qualitative Variables in Econometrics. Cambridge University Press.

Martincus, C.V., Castresana, S., Castagnino, T., 2010. ISO Standards: A Certificate to Expand Exports? Firm-Level Evidence from Argentina. Rev. Int. Econ. 18, 896–912. https://doi.org/10.1111/j.1467-9396.2010.00915.x

Melitz, M.J., 2003. The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity. Econometrica 71, 1695–1725. https://doi.org/10.1111/1468-0262.00467

Otsuki, T., 2011. Effect of ISO Standards on Exports of Firms in Eastern Europe and Central Asia: An Application of the Control Function Approach 11.

Pierola, M.D., Fernandes, A.M., Farole, T., 2018. The role of imports for exporter performance in Peru. World Econ. 41, 550–572. https://doi.org/10.1111/twec.12524

Wooldridge, J.M., 2010. Econometric Analysis of Cross Section and Panel Data, second edition. MIT Press.

Appendix A

Table A1: Variables, descriptions and descriptive statistics

Variable	Types of variable	No. Obs.	Mean	Std. Err.	Min	Max
IFS $Certification$	Binary (1 if the firm is IFS certified; 0 otherwise)	24,351	0.048	0.213	0	1
IMP	Binary (1 if the firm is importer; 0 otherwise)	24,351	0.221	0.415	0	1
EXP	Binary (1 if the firm is exporter; 0 otherwise)	24,351	0.295	0.456	0	1
ln $Productivity$	Continue	24,351	5.115	0.985	0	10.910
Independent firm	Binary (1 if the firm has the independent status; 0 otherwise)	24,351	0.629	0.483	0	1
Head of group	Binary (1 if the firm has the Group head status; 0 otherwise)	24,351	0.046	0.210	0	1
Connecting firm	Binary (1 if the firm has Maillon status; 0 otherwise)	24,351	0.089	0.284	0	1
Independent	Binary (1 if the firm has the Affiliate status; 0 otherwise)	24,351	0.236	0.425	0	1
1-49 employees	Binary (1 if the number of employees of the firm is between 1 and 49 included; 0 otherwise)	24,351	0.868	0 .339	0	1
50-499 employees	Binary (1 if the number of employees of the firm is between 50 and 499 included; 0 otherwise)	24,351	0.116	0.320	0	1
≥500 employees	Binary (1 if the number of employees of the firm is strictly greater than 499; 0 otherwise)	24,351	0.016	0.126	0	1
$Inst_{IMP}$	Continue	24,351	0.815	0.128	0	1
$Inst_{EXP}$	Continue	24,351	0.831	0.105	0	1
$Inst_{IFS}$	Continue	24,351	0.305	0.191	0	0.971

Table A2: Correlation coefficients and dependency test between explanatory variables

Variables	ln $Prod$	$Inst_{IMP}$	$Inst_{EXP}$	$Inst_{IFS}$	1-49 empl	50-499 empl	≥500 empl	Indep.	Head	Connecting
ln $Productivity$	1.00									
$Inst_{IMP}$	-0.12***	1.00								
$Inst_{EXP}$	0.12***	0.59***	1.00							
$Inst_{IFS}$	-0.10***	0.13***	-0.11***	1.00						
1-49 employees	-0.18***	-0.06***	-0.10***	-0.01	1.00					
50-499 employees	0.15***	0.05***	0.09***	0.02**	-0.93***	1.00				
≥500 employees	0.09***	0.03***	0.05***	-0.01	-0.33***	-0.05***	1.00			
Independent firm	-0.28***	-0.09***	-0.18***	0.06***	0.42***	-0.39***	-0.15***	1.00		
Head of group	0.14***	-0.07***	0.06***	-0.07***	-0.01**	0.01*	0.01	-0.29***	1.00	
Connecting firm	0.21***	0.03***	0.10***	-0.04***	-0.42***	0.34***	0.27***	-0.41***	-0.07***	1.00
Affiliate	0.12***	0.12***	0.12***	-0.00	-0.19***	0.21***	-0.01	-0.72***	-0.12***	-0.17***

Notes : *** p<0.01, ** p<0.05, * p<0.1

Table A3: Average marginal effects on the export and import probabilities of *IFS-certified* firms, biprobit estimator

VARIABLES	Univariate probabilities		Conditional probabilities		Joint probabilities			
	(1)		(2)	(3)	(4)	(5)	(6)	(7)
	P(EXP=1)	P(IMP=1)	P(EXP=1|IMP=1)	P(IMP=1|EXP=1)	P(EXP=1, IMP=1)	P(EXP=1,IMP=0)	P(EXP=0,IMP=1)	P(EXP=0,IMP=0)
ln *productivity*	0 .141***	0 .175***	0 .071***	0 .142***	0 .201***	-0.059***	-0.025**	-0.116***
	(0 .018)	(0 .016)	(0 .017)	(0 .016)	(0 .017)	(0 .012)	(0.010)	(0 .011)
Financial linkages :								
Independent firm	reference	reference	reference	reference	reference	reference	reference	reference
Head of group	0 .250***	0 .029	0 .210***	-0.031	0.161***	0.089**	-0.133***	-0.118***
	(0 .064)	(0 .046)	(0 .057)	(0 .046)	(0.054)	(0.037)	(0.037)	(.034)
Connecting firm	0 .079**	0.101***	0 .039	0 .082**	0.114***	-0.035	-0.013	-0.066***
	(0 .040)	(0 .036)	(0 .034)	(0 .034)	(0.038)	(0.025)	(0.022)	(0.023)
Affiliate	0 .060	0 .077**	0 .030	0 .062**	0.087**	-0.026	-0.010	-0.050**
	(0 .037)	(0 .033)	(0 .031)	(0 .031)	(0.035)	(0.023)	(0.020)	(0.022)
Firm size :								
1 to 49 employees	reference	reference	reference	reference	reference	reference	reference	reference
50 to 499 employees	0 .121***	0.170***	0 .054**	0 .141***	0.185***	-0.064***	-0.015	-0.105***
	(0 .025)	(0 .021)	(0 .022)	(0 .021)	(0.023)	(0.016)	(0.014)	(0.015)
500 employees or more	0 .355***	0 .452***	0 .175***	0 .367***	0.512***	-0.157***	-0.060**	-0.295***
	(0 .047)	(0 .041)	(0 .045)	(0 .041)	(0.042)	(0.031)	(0.026)	(0.030)
Share of competing exporting firms in the same industry. $Inst_{EXP}$	-0.360		-0.314	0 .086	-0.203	-0.156	0.203	0.156
	(0 .225)		(0197)	(0.055)	(0 .127)	(0 .098)	(0 .127)	(0 .098)
Share of competing importing firms in the same industry. $Inst_{IMP}$		-0.106	0 .032	-0.106	-0.073	0.073	-0.033	0.033
		(0.190)	(0 .057)	(0190)	(0.131)	(0.131)	(0.059)	(0.059)
Year fixed effects	YES	YES						
Industry fixed effects	YES	YES						
Likelihood ratio	-826.100							
ρ (correlated decisions)	0.558***							
Observations	1,157	1,157	1,157	1,157	1,157	1,157	1,157	1,157

Notes : *** p<0.01, ** p<0.05, * p<0.1 ; Standard errors in parentheses

Table A4: Average marginal effects on the export and import probabilities of *non-certified firms*, biprobit estimator

VARIABLES	Univariate probabilities		Conditional probabilities		Joint probabilities			
	(1)		(2)	(3)	(4)	(5)	(6)	(7)
	P(EXP=1)	P(IMP=1)	P(EXP=1|IMP=1)	P(IMP=1|EXP=1)	P(EXP=1, IMP=1)	P(EXP=1,IMP=0)	P(EXP=0,IMP=1)	P(EXP=0,IMP=0)
ln *productivity*	0 .081***	0 .090***	0 .041***	0 .123***	0 .066***	0 .016***	0 .024***	-0.106***
	(0.003)	(0.003)	(0.005)	(0.005)	(0.002)	(0.002)	(0.001)	(0.003)
Financial linkages :								
Independent firm	reference	reference	reference	reference	reference	reference	reference	reference
Head of group	0 .150***	0 .115***	0 .130***	0 .124***	0.096***	0.054***	0.019***	-0.169***
	(0.009)	(0.008)	(0 .016)	(0 .016)	(0.006)	(0.007)	(0.004)	(0.009)
Connecting firm	0 .231***	0 .197***	0 .179***	0 .231***	0.158***	0.073***	0.039***	-0.270***
	(0.009)	(0.007)	(0 .015)	(0 .014)	(0.005)	(0.006)	(0.004)	(0.008)
Affiliate	0 151***	0 137***	0 .108***	0 .166***	0.107***	0.044***	0.030***	-0.180***
	(0.005)	(0.004)	(0.009)	(0.008)	(0.003)	(0.004)	(0.002)	(0.005)
Firm size :								
1 to 49 employees	reference	reference	reference	reference	reference	reference	reference	reference
50 to 499 employees	0 .232***	0 .209***	0 .167***	0 .254***	0.164***	0.068***	0.045***	-0.277***
	(0.008)	(0.006)	(0 .013)	(0 .012)	(0.004)	(0.005)	(0.003)	(0.007)
500 employees or more	0 .371***	0 .367***	0 .233***	0 .472***	0.278***	0.093***	0.089***	-0.460***
	(0 .034)	(0 .028)	(0 .058)	(0 .055)	(0.018)	(0.025)	(0.015)	(0.032)
Share of competing exporting firms in the same industry. $Inst_{EXP}$	-0.017 (0 .046)		-0.030 (0 .078)	0 .013 (0 .033)	-0.005 (0 .012)	-0.013 (0 .034)	0.005 (0 .012)	0.013 (0 .034)
Share of competing importing firms in the same industry. $Inst_{IMP}$		-0.076** (0 .037)	0 .082** (0 .040)	-0.154** (0 .076)	-0.037** (0.018)	0.037** (0.018)	-0.039** (0.019)	0.039** (0.019)
Year fixed effects	YES	YES						
Industry fixed effects	YES	YES						
Likelihood ratio	-15549.087							
ρ (correlated decisions)	0.608***							
Observations	23,194	23,194	23,194	23,194	23,194	23,194	23,194	23,194

Notes : *** p<0.01, ** p<0.05, * p<0.1 ; Standard errors in parentheses.

Appendix B

Appendix B1: Durbin-Wu-Hausman Test of Endogeneity on the IFS Status Variable

The certification variable is our main variable of interest for assessing the extensive margin of participation in GVCs. To this end, we seek to ensure that the coefficients associated with this variable in our estimations do not suffer from any form of bias. To do this, we test its endogeneity using the augmented Durbin-Wu-Hausman test of endogeneity, which is carried out in two steps. First, we regress the IFS status variable individually on all the explanatory variables of the system of equations (5). We then recover the residuals from these estimates and introduce them into the other equations of the system (5) for the estimation of augmented regressions of each of the equations (importer and exporter status). The decision rule is that if the coefficients of the residuals are significantly different from zero, then the IFS status variable is endogenous and this endogeneity must be taken into account when estimating the models.

Table B1: Durbin-Wu-Hausman test of endogeneity on the IFS certification variable

	Extensive margin: Sample of all firms		
	First step	Second step	
	(1)	(2)	(3)
VARIABLES	P(IFS=1)	P(EXP=1)	P(IMP=1)
ln *productivity*	0.007***	0.089***	0.091***
	(0.002)	(0.004)	(0.004)
Financial linkages :			
Independent firm	référence	référence	référence
Head of group	0.037***	0.234***	0.129***
	(0.011)	(0.026)	(0.023)
Connecting firm	0.054***	0.301***	0.287***
	(0.014)	(0.021)	(0.021)
Affiliate	0.043***	0.201***	0.192***
	(0.005)	(0.013)	(0.012)
Firm size :			
1 to 49 employees	référence	référence	référence
50 to 499 employees	0.192***	0.327***	0.380***
	(0.013)	(0.018)	(0.017)
500 employees or more	0.399***	0.424***	0.540***
	(0.0445)	(0.029)	(0.028)
Share of competing exporting firms in the same industry. $Inst_{EXP}$	0.031	-0.058	
	(0.027)	(0.039)	
Share of competing importing firms in the same industry. $Inst_{IMP}$	0.036		-0.085***
	(0.025)		(0.033)
First-stage residue term		0.087***	0.098***
		(0.021)	(0.020)
Year fixed effects	YES	OUI	OUI
Industry fixed effects	YES	OUI	OUI
R^2	0.202	0.371	0.408
Fisher test (P-value)		0.000	0.000
Observations	24,351	24,351	24,351

Notes : *** p<0.01, ** p<0.05, * p<0.1 ; Standard errors in parentheses.

The test results presented in Table B1 above, show that the p-value<1% of Fisher's test on the coefficients associated with the residuals in the second stage estimates do not reject the hypothesis of the non-exogeneity of the IFS certification variable.

Appendix B2: Certification self-selection test: Ex ante firm productivity premium by certification status

We seek to test the self-selection of IFS certified firms. We test whether firms that obtain IFS certification at time t were more productive when they were still non-certified at an earlier time $t - \tau$ ($0 \leq \tau \leq 2$) than their non-certified counterparts at that time. To do so, we draw on the methodology used by Castellani *et al.* (2010) to determine the self-selection of Italian firms in international trade. We test for the presence of a productivity gap between firms that obtained IFS certification in t and the others, one and two years before obtaining certification. More precisely, we estimate the following equation:

$$\ln \text{Productivity}_{i,t-\tau} = \alpha_0 + \alpha_1 \text{IFSstarter}_{i,t-\tau} + \phi_{i \in APE} + T_t + \varepsilon \qquad (6)$$

where $\ln \text{Productivity}_{i,t-\tau}$ is the logarithm of firm i's productivity in $t - \tau$, $0 \leq \tau \leq 2$, and the binary variable $\text{IFSstarter}_{i,t-\tau}$ indicates the certification status of that firm in the same year. The variable $\text{IFSstarter}_{i,t}$ takes the value 1 if firm i was certified in t, regardless of its certification status in previous years. $\text{IFSstarter}_{i,t-1}$ is equal to 1 if the firm was certified in t but not certified in $t - 1$ and is equal to 0 in the rest of the cases. By the same rule, $\text{IFSstarter}_{i,t-2}$ takes the value 1 if the firm was certified in t but not certified in $t - 1$ and $t - 2$ and the value 0 in the rest of the cases. In equation (6) we include fixed effects by APE activity code $\phi_{i \in APE}$ to control for heterogeneity in firm performance by specific activity. We add year fixed effects T_t to capture annual shocks that hit the economy as a whole. α_0 and α_1 are the parameters to be estimated and ε is a zero expectation error term.

Table B2: Evaluation of the ex-ante productivity premiums of IFS firms

	Explained variable : $\ln productivity$					
	All firms			Firms involved in international trade		
	(1)	(2)	(3)	(4)	(5)	(6)
IFSstarter$_{i,t}$	0.501***			0.212***		
	(0.035)			(0.033)		
IFSstarter$_{i,t-1}$		0.421***			0.176***	
		(0.047)			(0.049)	
IFSstarter$_{i,t-2}$			0.420***			0.177***
			(0.0403)			(0.042)
Year fixed effects	YES	YES	YES	YES	YES	YES
Industry fixed effects	YES	YES	YES	YES	YES	YES
Observations	24,351	16,089	15,084	8,441	5,910	5,672
R²	0.182	0.209	0.219	0.202	0.202	0.197

Notes : *** $p<0.01$, ** $p<0.05$, * $p<0.1$; Standard errors in parentheses.

We estimate equation (6), on all firms (columns 1 to 3) and on firms that participate only in international trade (columns 4 to 6), by ordinary least squares and present the results in Table B2. The results in column (1) indicate that certified firms are on average 50% more productive than non-certified firms. IFS certified firms also have an ex ante productivity premium over their non-certified counterparts. Indeed, firms that obtain certification were on average 42% more productive than non-certified firms one and two years before certification. The contemporaneous and ex ante productivity premium of certified firms over non-certified firms is about half as large if we restrict the analysis to firms that participate in international trade.