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► **To cite this version:**

Kossi-Messanh Agbekponou, Angela Cheptea, Karine Latouche. Retailer-driven value chains in the agri-food sector. IATRC Annual meeting, IATRC [International Agricultural Trade Research Consortium], Dec 2022, Clearwater, United States. hal-03941386v2

HAL Id: hal-03941386

<https://hal.inrae.fr/hal-03941386v2>

Submitted on 16 Jan 2023 (v2), last revised 19 Jan 2023 (v3)

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Retailer-driven value chains in the agri-food sector

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IATRC Annual meeting

Clearwater Beach, FL and Virtual Platform

December 11 - 13, 2022

- **GVCs** have been longtime analyzed in the international economics literature (FDI, trade in intermediate products). More recently:
 - emphasize **trade in** terms of **value added** rather than in gross value
 - $\approx 45\%$ of global trade in agricultural and food products goes to intermediate consumption
 - increasingly fragmented production process across firm boundaries and country borders
 - account for **indirect connections between industries**
 - the **position in the chain** is important:
Firms on the upper and lower end of the value chain make larger profit margins.

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 - increasingly fragmented production process across firm boundaries and country borders
 - account for **indirect connections between industries**
 - the **position in the chain** is important:
Firms on the upper and lower end of the value chain make larger profit margins.
- The place of **retailers** – particularly important in the food sector
 - Retailers reduce the profit margin of agricultural and food producers.
 - Retailers transform GVCs in the food sector: the **supermarket revolution**.
 - Retailers shift the governance of GVCs: seller-driven chains → **buyer-driven chains**.
 - Multinational retailers **dope the foreign sales of domestic food producers**, especially for retailers' domestic suppliers (of private label products).
(Chepeta et al. 2015, 2019)

Question: Are **retailers'** domestic **suppliers** more likely to **participate in GVCs** than other agrifood firms? Why?

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- Rationale:**
- Focus on French firms; high level of internationalization of French retailers (large share of sales abroad, presence in a large number of foreign markets)
 - Access to retailers' knowledge of and connections in foreign markets
 - ⇒ lower sunk export/import costs (search of partners, information on import/export procedures, ...)
 - ⇒ lower variable trade costs (group shipments, package labeling, supply chain efficiency, ...)
 - Strong pressure to cut production costs due to low bargaining position against retailers
 - ⇒ stronger reliance on cheaper foreign intermediary products
 - Specialization in private label products, closer to final demand
 - ⇒ a larger number of production steps that can be outsourced abroad

- ① **Participation in GVCs** = firm's **joint** involvement in **import and export** activities (Baldwin and Yan, 2014; Antras, 2020)

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② **Retailers' domestic suppliers** = **domestic suppliers of private label (PL)**
certification with the private standard
IFS (International Featured Standard)
(Chepeta et al., 2019)

- required by all French retailers for supplying with PL products
- ensures uniformization of food safety practices and of products' quality
- needs to be renewed each year ⇒ assume that certified firms do supply retailers

⇒ Identify the most regular suppliers that have tight connections with retailers.

- Approach:**
- ➔ Correlation of firm's import and export decisions
e.g. overlap of sunk export and import costs,
lower shipping costs in the opposite direction
 - ➔ Correlation of firm's import & export decisions and IFS certification decision
⇒ multivariate binary choice estimators (biprobit, triprobit)
 - ➔ Explore the (dis)continuity of firms' IFS certification over time of firms
⇒ diff-in-diff estimator, propensity score matching

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Result: Retailers' domestic suppliers 5–6 p.p. more likely to participate in GVCs than other agrifood firms.

Data on French agri-food firms: 2006–2011

AMADEUS	turnover, size (# employees), ... , economic activity (NACE)
French customs	product-level bilateral imports and exports
Retailers' suppliers	exhaustive list of IFS certified firms, by year
Sample	24,351 observations

Number of firms involved in international trade

International trade activity	Agri-food firms	IFS certified firms
Exclusively importing firms	1 269	94 (7.4%)
Exclusively exporting firms	3 060	158 (5.2%)
Jointly importing and exporting firms	4 112	747 (18.2%)
Domestic firms	15 910	158 (1.0%)
Total	24 351	1 157

- Firms choose to export (import) if they earn non-negative profits:

$$\begin{cases} y_{it} = 1 & \text{if } \pi_{it}^*(\mathbf{X}_{it}, \mathbf{Z}_{it}, IFS_{it}, \boldsymbol{\theta}_{it}) \geq 0 \\ y_{it} = 0 & \text{if } \pi_{it}^*(\mathbf{X}_{it}, \mathbf{Z}_{it}, IFS_{it}, \boldsymbol{\theta}_{it}) < 0 \end{cases}$$

- Control for IFS certification being linked to firm's export and import decisions:

$$\begin{cases} IFS_{it} = 1 & \text{if } \pi_{it}^*(\mathbf{X}_{it}, \mathbf{Z}_{it}^{IFS}, \boldsymbol{\theta}_{it}) \geq 0 \\ IFS_{it} = 0 & \text{if } \pi_{it}^*(\mathbf{X}_{it}, \mathbf{Z}_{it}^{IFS}, \boldsymbol{\theta}_{it}) < 0 \end{cases}$$

\mathbf{Z}_{it}^{IFS} share of turnover of rival IFS certified firms from the same industry

- Simultaneous estimation of the three equations: **tri-probit**:

$$\begin{cases} \pi_{it}^{*EXP} & = \beta^{EXP} \cdot \mathbf{X}_{it} + \delta^{EXP} \cdot \mathbf{Z}_{it}^{EXP} + \gamma^{EXP} \cdot IFS_{it} + \boldsymbol{\theta}_{it}^{EXP} + \epsilon_{it}^{EXP} \\ \pi_{it}^{*IMP} & = \beta^{IMP} \cdot \mathbf{X}_{it} + \delta^{IMP} \cdot \mathbf{Z}_{it}^{IMP} + \gamma^{IMP} \cdot IFS_{it} + \boldsymbol{\theta}_{it}^{IMP} + \epsilon_{it}^{IMP} \\ \pi_{it}^{*IFS} & = \beta^{IFS} \cdot \mathbf{X}_{it} + \delta^{IFS} \cdot \mathbf{Z}_{it}^{IFS} + \boldsymbol{\theta}_{it}^{IFS} + \epsilon_{it}^{IFS} \end{cases}$$

$$\begin{pmatrix} \epsilon_{it}^{EXP} \\ \epsilon_{it}^{IMP} \\ \epsilon_{it}^{IFS} \end{pmatrix} \sim \mathcal{N} \left(\begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \right)$$

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$$\begin{pmatrix} \epsilon_{it}^{EXP} \\ \epsilon_{it}^{IMP} \\ \epsilon_{it}^{IFS} \end{pmatrix} \sim \mathcal{N} \left(\begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho & \nu \\ \rho & 1 & \omega \\ \nu & \omega & 1 \end{pmatrix} \right)$$

$\rho \neq 0$: correlation of export and import decisions

$\nu \neq 0$: correlation of export and IFS certification decisions

$\omega \neq 0$: correlation of import and IFS certification decisions

- Predicted probabilities

Probability to	IFS firms (%)	non-IFS firms (%)	Treatment effect (p.p.)
Export	63.61 (0.63)***	22.54 (0.33)***	41.07 (0.00)***
Import	19.34 (0.36)***	13.74 (0.29)***	5.60 (0.00)***
Export and Import	13.59 (2.20)***	7.76 (0.27)***	5.83 (2.09)***
Domestic	59.02 (12.18)***	72.00 (0.47)***	-12.98 (12.16)

- Correlation matrix

	Export	Import	IFS certify
Export	1.000	$\rho = 0.605^{***}$	$v = 0.393^{***}$
Import	$\rho = 0.605^{***}$	1.000	$\omega = 0.084$
IFS certify	$v = 0.393^{***}$	$\omega = 0.084$	1.000

- Export and import decisions strongly correlated.
- Choice to IFS certify correlated to export decision, but not import decision.
 ⇒ The higher probability of PL suppliers to integrate GVCs induced mainly by exports.

- Separate the *between* and the *within* components of the IFS effect:

$$GVC_{it} \left[= y_{it}^{IMP} \cdot y_{it}^{EXP} \right] = \lambda' \cdot \mathbf{X}_{it} + \eta \cdot IFS\text{-}ible_{it} + \mu \cdot IFS_{it} + v_{it}$$

IFS-ible = dummy for firms ever obtaining the IFS certification (treatment group)

Robustness checks: Difference-in-difference (1)

- Separate the *between* and the *within* components of the IFS effect:

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IFS-ible = dummy for firms ever obtaining the IFS certification (treatment group)

	Linear probability model			Probit model, marginal effects		
	EXPORT	IMPORT	GVC	EXPORT	IMPORT	GVC
IFS-ible firms (treatment group)	0.162*** (0.017)	0.130*** (0.017)	0.144*** (0.018)	0.522*** (0.067)	0.394*** (0.067)	0.420*** (0.064)
IFS	-0.051*** (0.002)	-0.013 (0.019)	-0.030 (0.021)	-0.207** (0.082)	-0.007 (0.080)	-0.087 (0.077)
R ²	0.374	0.410	0.406	0.338	0.406	0.429
Observations	24,351	24,351	24,351	24,351	24,351	24,351

Notes: Estimations include all firm-specific controls, and year and industry fixed effects.

- ⇒ The *between component* explains most of the previous positive IFS effect.
- ⇒ The effect comes from differences between firms, not changes in certification strategy.
- ⇒ Unbalanced data panel. Similar results on balanced sub-samples.

- Separate *IFS starters* and *IFS continuers*:

$$GVC_{it} = \lambda' \cdot \mathbf{X}_{it} + \xi \cdot \text{startIFS}_{it} + \zeta \cdot \text{continuelIFS}_{it} + u_{it}$$

*startIFS*_{it} = {1 | *IFS*_{it-1} = 0; *IFS*_{it} = 1} = firms that acquire IFS certification

*continuelIFS*_{it} = {1 | *IFS*_{it-1} = 1; *IFS*_{it} = 1} = firms that renew IFS certification

Robustness checks: Difference-in-difference (2)

- Separate *IFS starters* and *IFS continuers*:

$$GVC_{it} = \lambda' \cdot \mathbf{X}_{it} + \xi \cdot \text{startIFS}_{it} + \zeta \cdot \text{continueIFS}_{it} + u_{it}$$

startIFS_{it} = {1 | *IFS_{it-1}* = 0; *IFS_{it}* = 1} = firms that acquire IFS certification

continueIFS_{it} = {1 | *IFS_{it-1}* = 1; *IFS_{it}* = 1} = firms that renew IFS certification

	Linear probability model			Probit model, marginal effects		
	EXPORT	IMPORT	GVC	EXPORT	IMPORT	GVC
Starter IFS firms (acquire certification)	0.132*** (0.026)	0.097*** (0.027)	0.131*** (0.028)	0.457*** (0.115)	0.301*** (0.111)	0.392*** (0.107)
Continuer IFS firms (renew certification)	0.068** (0.020)	0.104** (0.019)	0.088*** (0.021)	0.174** (0.079)	0.395*** (0.077)	0.269*** (0.077)
R ²	0.359	0.396	0.390	0.329	0.399	0.424
test $\xi \neq \zeta$	0.039	0.819	0.191	0.470	0.330	0.642
Observations	20,447	20,447	20,447	20,447	20,447	20,447

Notes: Estimations include all firm-specific controls, and year and industry fixed effects.

⇒ Acquiring IFS certification is more likely to lead to participation in GVCs than renewing IFS certification, but difference not statistically significant.

- Match IFS certified firms with non-certified competitors from the same industry, in the same year, with similar levels of covariates.
 - ⇒ permits to better specify / chose the control group of firms
 - ⇒ permits to correct for treatment (IFS certification) not entirely exogenous
 - ⇒ the *between component of ATT* of IFS certification on firms' participation in GVCs
- Few firms in some industries ⇒ difficult to find a good match
 - ⇒ match firms within more broad industries

Robustness checks: Propensity score matching (1)

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- Few firms in some industries ⇒ difficult to find a good match
 - ⇒ match firms within more broad industries

Matching methodology	Change in the probability to participate in GVCs			
	4-digit NACE		3-digit NACE	
	ATT	t-stat	ATT	t-stat
Mahalanobis	0.0156	0.81	0.0467***	2.29
Radius	0.0594***	3.72	0.0586***	3.72
3 nearest neighbors	0.0472***	2.36	0.0349*	1.77
One to one matching	0.0527***	2.2	0.0182	0.77

- ⇒ IFS certified firms 5–6 p.p. more likely to participate in GVCs than non certified firms.
- ⇒ Similar results with different matching techniques, and with time-delayed effects.

- Differentiate the effects of **acquiring** and **renewing IFS certification**

Matching methodology	Change in the probability to participate in GVCs			
	Starter IFS firms (acquire IFS certification)		Continuer IFS firms (renew IFS certification)	
	ATT	t-stat	ATT	t-stat
Mahalanobis	0.0905***	2.26	0.0000	0.00
Radius	0.0965***	3.05	0.0495***	2.13
3 nearest neighbors	0.1001***	2.71	0.0394	1.39
One to one matching	0.1235***	2.71	0.0433	1.27

- ⇒ ATT effect for starter IFS firms is twice the effect on the entire sample.
- ⇒ ATT effect on continuer IFS firms is rarely different from zero.
- ⇒ Similar results when allow for time gaps between firms' decisions to certify and to participate in GVCs, and matching criteria.
- ⇒ Similar results with different matching techniques.

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 - ⇒ Similar results when allow for time gaps between firms' decisions to certify and to participate in GVCs, and matching criteria.
 - ⇒ Similar results with different matching techniques.
- Alternative estimation techniques (dif-in-dif, PS matching) confirm the results obtained with rigid multivariate estimators (tri-probit).

Question:

- Retailers' domestic suppliers more likely to participate in GVCs?

Approach:

- multivariate binary estimators
- alternative estimation techniques: dif-in-dif, PS matching
- explore the variability of firms' certification strategies over time
- reduce the heterogeneity of treatment and control groups
- differentiate between acquiring and renewing IFS certification

Take-home message

- Firms' export, import, and IFS certification decisions are mutually correlated
- Retailers' suppliers 5–6 p.p. more likely to integrate GVCs
 - ⇒ Effect due to differences between firms rather than changes in certification strategy.
 - ⇒ Robust finding, confirmed by different approaches, sub-samples, ...
- The effect of acquiring IFS certification is stronger than that of renewing it.

The geographic dimension of GVCs: firms participating in GVCs only

- PL suppliers trade with a larger number of countries.

	No. trade partners			No. EU partners			No. RTA partners		
	exports	imports	exp&imp	exports	imports	exp&imp	exports	imports	exp&imp
Firms with no IFS	1.69	0.62	0.21	0.88	0.42	0.18	0.29	0.06	0.01
Firms with IFS	10.51	4.20	1.94	5.33	2.94	1.71	1.83	0.39	0.09

- PL suppliers have higher shares of exports and imports with same/similar countries.

	destination = origin		EU partners		RTA partners		neighbors		main partner	
	exports	imports	exports	imports	exports	imports	exports	imports	exports	imports
Firms with no IFS	0.05	0.07	0.15	0.15	0.05	0.01	0.13	0.11	0.17	0.14
Firms with IFS	0.34	0.40	0.61	0.60	0.07	0.04	0.46	0.43	0.44	0.45

- PL suppliers import slightly more from remote and richer countries.

	Ave distance		Ave partners' GDP/cap	
	exports	imports	exports	imports
Firms with no IFS	2552.593	863.0096	29224.34	15618.46
Firms with IFS	2459.122	1040.011	28711.72	20033.36

The product dimension of GVCs: firms participating in GVCs only

- PL suppliers export and import a **larger number of products**.

	No. traded HS6 products			No. traded HS4 products		
	exports	imports	exp&imp	exports	imports	exp&imp
Firms with no IFS	1.96	1.88	0.46	0.70	0.86	0.29
Firms with IFS	10.56	11.91	3.04	3.42	5.35	1.86

- PL suppliers import and export **higher shares of same/similar products**.

	HS6 products				HS4 products			
	destination = origin		main partners		destination = origin		main partners	
	exports	imports	exports	imports	exports	imports	exports	imports
Firms with no IFS	0.06	0.06	0.20	0.13	0.10	0.09	0.23	0.15
Firms with IFS	0.29	0.27	0.50	0.40	0.47	0.39	0.65	0.50



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European Association of Agricultural Economists

XVII EAAE CONGRESS

AGRI-FOOD SYSTEMS IN A CHANGING WORLD:
CONNECTING SCIENCE AND SOCIETY

AUGUST 29TH - SEPTEMBER 1ST 2023
RENNES, FRANCE

INRAE  



Agri-food systems in a changing world: connecting science and society

When
Where
Official Language

August 29th - September 1st 2023
Couvent des Jacobins, Rennes, France
English

Website

<https://eaae2023.colloque.inrae.fr>

Video teaser

https://youtu.be/OVgI0HP_VWA

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