Global Value Chains' Position and Value Capture: Firm Evidence in Agri-Food Industry

Kossi Messanh Agbekponou and Ilaria Fusacchia

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INRAE
science for people, life & earth

BATModel
better agri-food trade modelling for policy analysis

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Motivation

- **Value creation and distribution** are at the heart of GVCs
  - More productive and strongest firms and those with critical resources capture more value, (Emerson, 1962; Brandenburger and Stuart, 1996; Crook and Combs, 2007; Hillman et al., 2009; Drees and Heugens, 2013)
  - Property rights model (Antràs and Chor, 2013; Alfaro et al., 2019)

    $\Rightarrow$ Final firms organize their production processes upstream, integrating or not their suppliers depending on their hold-up situation

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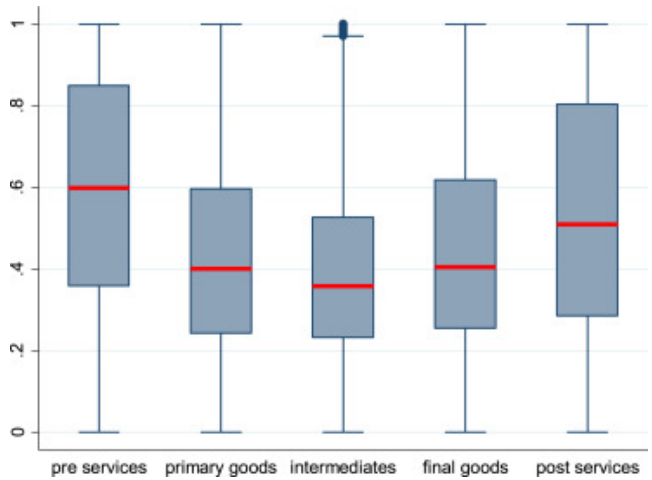
    $\Rightarrow$ Final firms organize their production processes upstream, integrating or not their suppliers depending on their hold-up situation

- How can suppliers act strategically to counterbalancethe power of the final firms?
  - **Suppliers' strategic positioning in GVCs** matters
    - ★ Upper and lower ends of the value chain provide higher value added and profit margins (the *smile curve*: Mudambi, 2008; Rungi and del Prete, 2018; Baldwin and Ito, 2021)



Value added content as share of value added on sales.
Source: Fig. 1 from Rungi and del Prete, 2018

Literature

- Further downstream firms perform more production stages and capture more value
  - Resource dependency theory (Hillman et al., 2009; Drees and Heugens, 2013): Firms dependencies is due to ownership of critical assets in supply chain

    $\Rightarrow$ critical assets in agri-food sector (sales space, consumption patterns, brand) are more downstream (Cox et al., 2001; Burch and Lawrence, 2005)
  - Self-selection mechanism (Melitz, 2003)

    $\Rightarrow$ Productivity is higher downstream than upstream (Costinot et al., 2013)
  - Property rights model (Antràs and Chor, 2013; Alfaro et al., 2019)

    $\Rightarrow$ Hold-up situation determine final producers to integrate or not these suppliers
  - "Value additivity assumption": Most productive firms integrate more production stages and capture higher value (Alfaro et al., 2019; Chor et al., 2021)
  - Further downstream firms monotonically create and capture more value in Italy (Giovannetti and Marvasi, 2018)

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- Further upstream position is monotonically associated with more value creation
  - Self-selection mechanism as fixed capital stocks are higher more upstream (Ju and Yu, 2015)
  - More R&D and innovations in more upstream (Mahy et al., 2021)

Outline of the presentation

Question: How does the **position of suppliers (food processing firms)** affect **power distribution or surplus along GVCs**?

1. Theoretical framework
2. Main prediction, theoretical hypotheses and mechanisms: effect of GVC positioning
3. Data
   - ★ Data sources
   - ★ Bilateral bargaining power and division of surplus
   - ★ Upstreamness / position in GVC
4. Test main hypotheses: OLS, Sub-sample regressions
5. Robustness tests
6. Mechanism
7. Conclusion

Theoretical framework: Importer-Exporter Nash bargaining game

- Timing of the game
  - (i) Exporter and importer bargain over exporter price that maximizes total rents
  - (ii) Importer and Exporter then take exporter price as given, so that:
    - ★ Importer maximizes its profits with respect to final price
    - ★ Exporter minimizes its cots by choosing inputs for a given output level

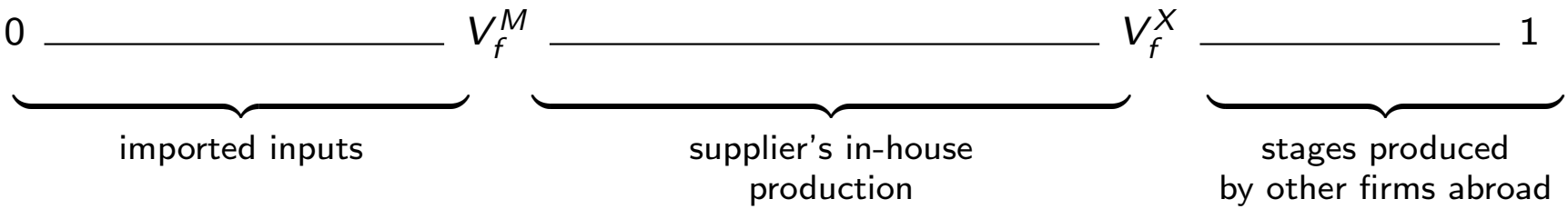
- Importer (buyer) of variety variety υ of product k faces an aggregate demand in country j:

$$q_{jk}(\upsilon) = A_{jk} \left[\lambda_{fjk}(\upsilon)\right]^{\varepsilon_{jk}-1} \left[p_{jk}(\upsilon)\right]^{-\varepsilon_{jk}}$$

- Exporter (suppliers) f of k from country i performs a continuum of tasks ν in GVCs, indexed by their remoteness from final demand (upstreamness), using a CES aggregator:

$$q_{fk} = \varphi_f \, \lambda_{fjk}^{-\gamma} \left(\int_{V_f^M}^{V_f^X} x_f(\nu)^{\frac{\sigma-1}{\sigma}} du + q_{-if}^{M\,\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}$$

Production/value chain



Theoretical framework: Importer-Exporter Nash bargaining game

- Solving the game via backward induction

(ii) suppose that Exporter supplies a compatible good to Importer $q_{fk} = q_{jk} = q_{fjk}$:

★ Knowing p_{fjk}, Importer maximizes π_{jk} with respect to p_{jk}, as follow:

$$\max_{p_{jk}} \pi_{jk} \quad = \quad p_{jk} q_{fjk} - p_{fjk} q_{fjk}$$

★ Exporter minimizes cost for a given output, as follow:

$$\min_{q^M_{-if}, x_f(\nu)} p^M_{-if} q^M_{-if} + \int_{V_f^M}^{V_f^X} c_f(\nu) x_f(\nu) d\nu$$

$$s.t. \qquad \overline{q}_{fjk} = \varphi_f \lambda_{fjk}^{-\gamma} \left(\int_{V_f^M}^{V_f^X} x_f(\nu)^{\frac{\sigma-1}{\sigma}} d\nu + q^{M\,\frac{\sigma-1}{\sigma}}_{-if} \right)^{\frac{\sigma}{\sigma-1}}$$

Theoretical framework: Importer-Exporter Nash bargaining game

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(ii) suppose that Exporter supplies a compatible good to Importer $q_{fk} = q_{jk} = q_{fjk}$:

★ Result of Importer maximization problem:

$$\begin{aligned} p^*_{jk} &= \frac{\varepsilon_{jk}}{\varepsilon_{jk}-1} p_{fjk} \\ q^*_{fjk} &= A_{jk} \lambda_{fjk}^{\varepsilon_{jk}-1} \left(\frac{\varepsilon_{jk}}{\varepsilon_{jk}-1} \right)^{-\varepsilon_{jk}} p_{fjk}^{-\varepsilon_{jk}} \end{aligned}$$

★ Result of Exporter minimization problem:

$$C_{fjk} = q_{fjk} \frac{\tau_{ijk} \lambda_{fjk}^{-\gamma}}{\varphi_f} \left(p_{-if}^{M\,1-\sigma} + \int_{V_f^M}^{V_f^X} c_f(\nu)^{1-\sigma} d\nu \right)^{\frac{1}{1-\sigma}}$$

(i) Exporter and Importer reach the equilibrium price that solves the generalized Nash product:

$$\max_{p_{fjk}} \left(p_{fjk} q_{fjk} - C_{fjk} \right)^{\beta_{fjk}} \left(p_{jk} q_{fjk} - p_{fjk} q_{fjk} \right)^{1-\beta_{fjk}}$$

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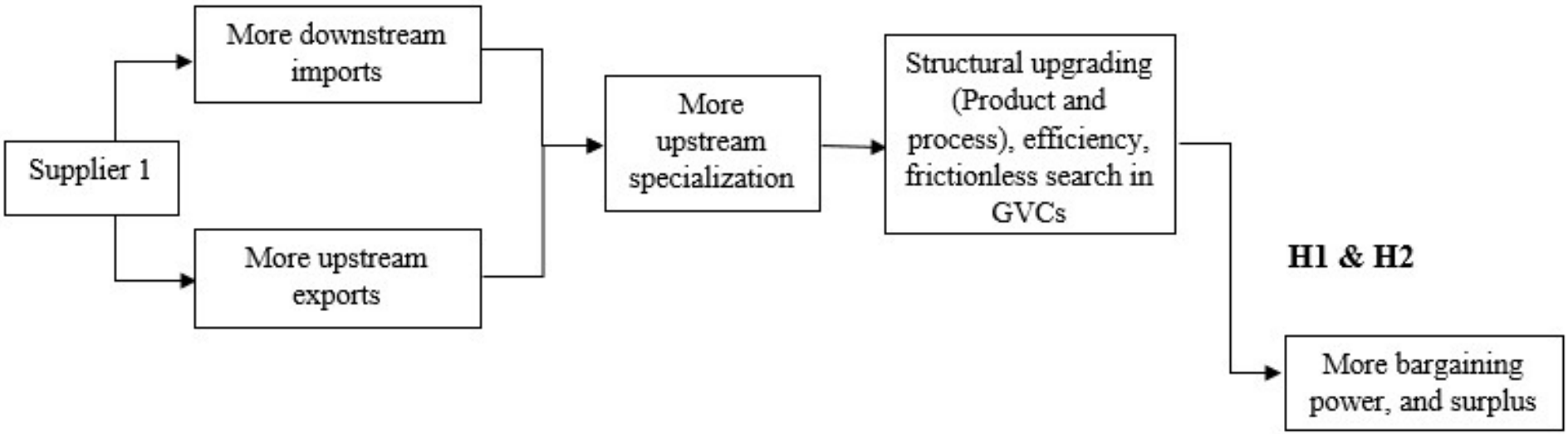
$$C_{fjk} = \frac{\tau_{ijk} q_{fjk} \lambda_{fjk}^{-\gamma}}{\varphi_f} \left(p_{-if}^{M\,1-\sigma} + \int_{V_f^M}^{V_f^X} c_f(\nu)^{1-\sigma} d\nu \right)^{\frac{1}{1-\sigma}}$$

(i) Solving for the generalized Nash product gives the full expression of optimal prices as follows:

$$p^*_{fjk} = \frac{\varepsilon_{ft} - 1 + \boldsymbol{\beta_{fjk}}}{\varepsilon_{ft}-1} \left(p_{-if}^{M\,1-\sigma} + \int_{V_f^M}^{V_f^X} c_f(\nu)^{1-\sigma} d\nu \right)^{\frac{1}{1-\sigma}} \frac{\lambda_{fjk}^{\gamma}}{\varphi_f} \tau_{ijk}$$

Theoretical framework: Positioning in GVCs and bargaining power

- Mechanisms at work and theoretical hypotheses



H1: The division of surplus of a supplier in its export market is positively affected by:

(i) further upstream position of its exports;

(ii) Further downstream position of its imports;

(iii) and, consequently, specialization along agri-food GVCs

H2: The positioning and specialization effects in GVCs is more pronounced in the most upstream position of the production process.

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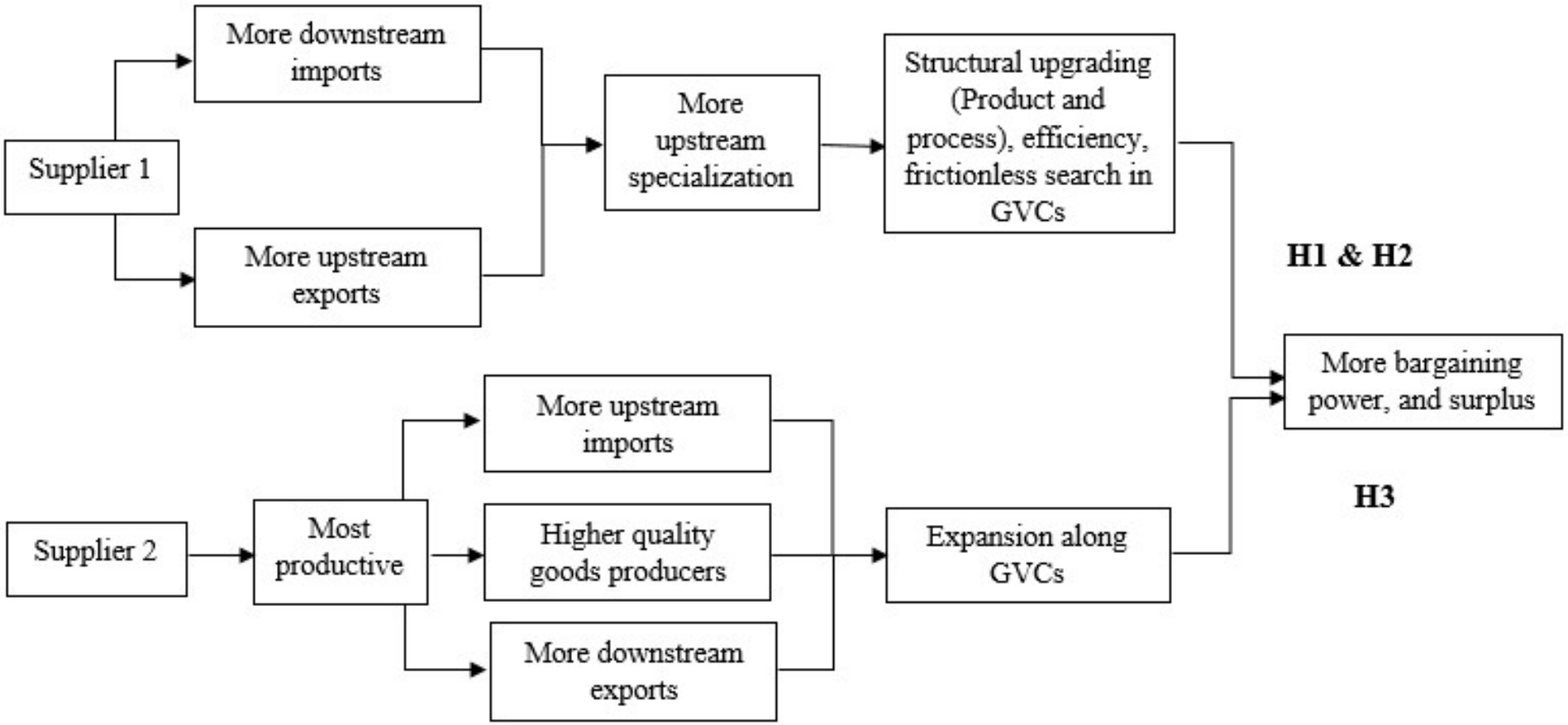

H3: Suppliers in most downstream position increase their surplus in export markets by:

(i) exporting more downstream;

(ii) importing more upstream;

(iii) and, thus performing a larger number of production stages in GVCs. Back

Data

Necessary data (firm and country level):

- GVC bargaining power index or surplus
- upstreamness ($\neg$ transformation) of purchased inputs and produced goods
- firm level controls
- country level controls

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Employed data: French agri-food firms and destination markets, 2000–2018

- AMADEUS
- French customs
- WDI and CEPII

Sample: firms in GVCs: Re-export excluded sample and All transaction sample

US input-output table (BEA)

+ US/French industry correspondences

+ for multiple correspondences, assume equal weights for all industry pairs

⇒ an input-output table at the level of French industries

405 US industries (42 agrifood) ⟶ 604 NACE industries (88 agrifood) NACE I-O table

GVC bargaining power index at firm-product-country-year level

- Two-stage two-tier stochastic frontier model (Polachek and Yoon, 1987, 1996; Kumbhakar and Parmeter, 2009):

$$p_{fjkt} = \mu(x) + \beta_{fjkt}\left(\overline{p_{jfkt}} - \mu(x)\right) - (1 - \beta_{fjkt})\left(\mu(x) - \underline{p_{fjkt}}\right)$$

p_{fjkt}	–	export price (unit value observed in data)
$\overline{p_{jfkt}}$	–	highest import price that the importer is willing to pay
$\underline{p_{fjkt}}$	–	lowest export price that the exporter can accept

- Based on log price equation from the theoretical framework:

$$\begin{aligned} \ln p_{fjkt} &= \mu(x) + \xi_{fjkt}, \\ \mu(x) &= \text{Controls}_{ft} + \text{Controls}_{jt} + \alpha_b b_{fjkt} + \alpha_s s_{fjkt} + FE_t + FE_k + FE_r + FE_j \\ \xi_{fjkt} &= \omega_{fjkt} - u_{fjkt} + e_{fjkt} \end{aligned}$$

$$\begin{aligned} e_{fjkt} &\sim i.i.d.\ N(0, \delta_e^2) \\ \omega_{fjkt} &\sim i.i.d.\ Exp(\delta_\omega, \delta_\omega^2) \\ u_{fjkt} &\sim i.i.d.\ Exp(\delta_u, \delta_u^2) \end{aligned}$$

- Construction of IVs for the bilateral shares (Alviarez et al., 2023)

Buyer share	–	purchases of f 's other importers from exporters other than f
Supplier share	–	sales of j's other exporters to importers other than j

- Estimation of $\ln p_{fjkt}$ by the maximum likelihood (ML) method

$$NS_{fjkt} = \omega_{fjkt} - u_{fjkt}$$

GVC bargaining power index at firm-product-country-year level

Estimation results

Table: Summary of surplus extracted and variance analysis– Two-stage Two-tier frontier

Sample	Panel A: Re-exports excluded		
Summary	# observations= 178,805		
	ω_{fjkt} (Firms)	u_{fjkt} (Countries)	NS_{fjkt}
Mean	56.71	41.93	14.78
Q1	29.37	25.77	-16.49
Q2	40.39	31.82	8.56
Q3	65.01	45.86	39.24
	Variance analysys		
$\delta^2_\omega + \sigma^2_u + \delta^2_\nu$	66.59		
$(\delta^2_w + \delta^2_u)/(\delta^2_\omega + \delta^2_u + \delta^2_\nu)$	74.70		
$\delta^2_w/(\delta^2_\omega + \delta^2_u)$	64.66		
$\delta^2_u/(\delta^2_\omega + \delta^2_u)$	35.34		

Notes: Value expressed in percent.

Upstreamness and position in GVC

- Follow Fally (2012), Antràs et al. (2012), Antràs and Chor (2013)

- Industry upstreamness = weighted average of the number of production stages from final demand for which the industry provides inputs:

$$U_r = 1 \cdot \frac{F_r}{Y_r} + 2 \cdot \frac{\sum_s b_{rs} F_s}{Y_r} + 3 \cdot \frac{\sum_s \sum_k b_{rk} b_{ks} F_s}{Y_r} + \ldots \qquad \in [1, \infty]$$

F_r, Y_r, and b_{rs} from a highly disaggregated input-output table

high U_r: close to production factors; **low U_r**: close to final demand

- Firm-level upstreamness: combine industry-level upstreamness with the product composition of firm's imports and exports

Upstreamness of imports:	$U_f^M = \sum_r \frac{M_{fr}}{M_f} U_r \Rightarrow V_f^M = \frac{1}{U_f^M}$	purchased inputs
Upstreamness of exports:	$U_f^X = \sum_r \frac{X_{fr}}{X_f} U_r \Rightarrow V_f^X = \frac{1}{U_f^X}$	produced output
Position in GVC:	$GVC_f = V_f^X - V_f^M$	span of in-house production stages

Details upstreamness indicators

Empirical strategy

- Setting of linear forms:

$$NS_{fjkt} = \alpha_0 + \alpha_\nu\{\{\mathbf{V}^X_{ft}, \mathbf{V}^M_{ft}\}, \mathbf{V}^X_{ft} - \mathbf{V}^M_{ft}\} + \alpha_c \text{Controls}_{ft} + FE_f + FE_{rt} + FE_{rj} + FE_{jk} + \epsilon_{fjkt}$$

NS_{fjkt}	–	GVC bargaining power index (division of surplus)
V^M_{ft} (V^X_{ft})	=	inverse of upstreamness of imports (exports) of firms
$V^M_{ft} - V^X_{ft}$	=	Intensity of GVC participation
Controls_{ft}	=	time-varying firm characteristics (productivity and size group)
FE_i	–	industry-by-year dummies (firm's main activity NACE Rev.2 4-digit) , firm, industry-by-country and product-by-country fixed effects
ϵ_{fjt}	–	error term

- OLS estimates and sub-sample regressions

Baseline results

Table: Firm's position in GVCs and division of surplus

Sample	Re-exports excluded			
Variable	(1)	(2)	(3)	(4)
V^X_{ft}	-0.2533***	-0.2258***		
	(0.0547)	(0.0528)		
V^M_{ft}	0.0375**	0.0431**		
	(0.0169)	(0.0175)		
$(V^X_{ft} - V^M_{ft})$			-0.0659***	-0.0672***
			(0.0158)	(0.0167)
ln Productivity$_{ft}$		0.0919***		0.0923***
		(0.0084)		(0.0084)
Firm size:				
Small$_{ft}$		reference		reference
Medium$_{ft}$		0.1070***		0.1084***
		(0.0082)		(0.0084)
Large$_{ft}$		0.1892***		0.1909***
		(0.0137)		(0.0138)
Fixed effects	firm, industry-year, industry-country, product-country			
Observations	107,994	107,994	107,994	107,994
R^2	0.684	0.685	0.684	0.685

Notes: Standard errors clustered by country in parentheses. Removal of 2% from the distribution tails of the GVC bargaining power index. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Return

Baseline results: Sub-sample regressions

Table: Firm's position in GVCs and division of surplus – low versus high level of upstreamness of the core activity of firms

Sample	Re-exports excluded							
Sub-sample	More downstream firms		More Uptream firms		More downstream firms		More Uptream firms	
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
V^X_{ft}	0.0052	0.0131	-0.5522***	-0.4988***				
	(0.0536)	(0.0540)	(0.0969)	(0.0931)				
V^M_{ft}	0.0177	0.0040	0.0465	0.0743***				
	(0.0205)	(0.0208)	(0.0285)	(0.0277)				
$(V^X_{ft} - V^M_{ft})$					-0.0149	-0.0020	-0.1115***	-0.1293***
					(0.0169)	(0.0177)	(0.0247)	(0.0245)
ln Productivity$_{ft}$		0.1029***		0.0869***		0.1029***		0.0892***
		(0.0140)		(0.0082)		(0.0140)		(0.0085)
Firm size:								
Small$_{ft}$		reference		reference		reference		reference
Medium$_{ft}$		0.1004***		0.1232***		0.1004***		0.1285***
		(0.0103)		(0.0123)		(0.0103)		(0.0131)
Large$_{ft}$		0.1947***		0.1995***		0.1948***		0.2111***
		(0.0166)		(0.0225)		(0.0166)		(0.0238)
Fixed effects	firm, industry-year, industry-country, product-country							
Observations	52,725	52,725	52,977	52,977	52,725	52,725	52,977	52,977
R^2	0.735	0.736	0.684	0.685	0.735	0.736	0.683	0.685

Notes: Standard errors clustered by country in parentheses. Removal of 2% from the distribution tails of the GVC bargaining power index. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Return

Mechanism test: role of upgrading of product mix

Theoretical framework

- Estimate of the quality-adjusted GVC bargaining power index, $\tilde{NS}_{fjkt}$
- Use it as an explained variable

Table: Firm's position in GVCs and quality-adjusted surplus

Sample	Re-exports excluded			
Variable	(1)	(2)	(3)	(4)
V_{ft}^X	-0.1470***	-0.1303***		
	(0.0477)	(0.0465)		
V_{ft}^M	0.0102	0.0138		
	(0.0144)	(0.0141)		
$(V_{ft}^X - V_{ft}^M)$			-0.0286*	-0.0294**
			(0.0150)	(0.0146)
ln Productivity$_{ft}$		0.0302***		0.0307***
		(0.0049)		(0.0049)
Firm size:				
Small$_{ft}$		reference		reference
Medium$_{ft}$		0.0631***		0.0641***
		(0.0095)		(0.0096)
Large$_{ft}$		0.1067***		0.1078***
		(0.0110)		(0.0110)
Fixed effects	firm, industry-year, industry-country, product-country			
Observations	104,656	104,656	104,656	104,656
R^2	0.457	0.458	0.457	0.458

Notes: Standard errors clustered by country in parentheses. Removal of 2% from the distribution tails of the GVC bargaining power index. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Compared to to baseline results from the whole samples

Mechanism test: role of upgrading of product mix

Table: Firm's position in GVCs and quality-adjusted surplus – low versus high level of upstreamness of the core activity of firms

Sample	Re-exports excluded							
Sub-sample	More downstream firms		More Uptream firms		More downstream firms		More Uptream firms	
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
V_{ft}^X	-0.1446*	-0.1408*	-0.1353***	-0.1036**				
	(0.0783)	(0.0763)	(0.0410)	(0.0406)				
V_{ft}^M	0.0222	0.0148	0.0100	0.0218				
	(0.0287)	(0.0281)	(0.0194)	(0.0200)				
$(V_{ft} - V_{ft}^M)$					-0.0365	-0.0295	-0.0273	-0.0332*
					(0.0280)	(0.0272)	(0.0174)	(0.0179)
ln Productivity$_{ft}$		0.0418***		0.0244***		0.0418***		0.0251***
		(0.0100)		(0.0059)		(0.0100)		(0.0059)
Firm size:								
Small$_{ft}$		reference		reference		reference		reference
Medium$_{ft}$		0.0708***		0.0594***		0.0710***		0.0605***
		(0.0120)		(0.0095)		(0.0120)		(0.0096)
Large$_{ft}$		0.1136***		0.1085***		0.1129***		0.1108***
		(0.0172)		(0.0125)		(0.0172)		(0.0124)
Fixed effects	firm, industry-year, industry-country, product-country							
Observations	50,396	50,396	51,911	51,911	50,396	50,396	51,911	51,911
R^2	0.465	0.466	0.514	0.514	0.465	0.466	0.513	0.514

Notes: Standard errors clustered by country in parentheses. Removal of 2% from the distribution tails of the GVC bargaining power index. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Compared to to baseline results from the sub-sample regressions

Conclusion

Main findings:

- More upstream position of production process and specialization along GVCs is associated with a higher bargaining power, thus more value capture in agri-food GVCs
- The effects are mainly due to the upgrading of the product mix
- Weak support, mainly downstream, of the "smile curve" hypothesis using the "in-within" upstream/midstream sectors (agri-food sector) anf firms (food processors)

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What strategies for food processors firms?

- Develop dominant positions by specializing further upstream in the value chain.
- Upgrade product quality (position themselves in niche markets)
- Characteristics of each economy, industry and in particular of tasks matters in the design of industrial policies

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Perspectives:

- Building a theoretical framework that endogenizes bilateral bargaining power, by analyzing suppliers in GVCs
- Take into account the selection bias that can potentially arise from focusing on GVC firms.

Results two-stage two-tier stochastic frontier

Back

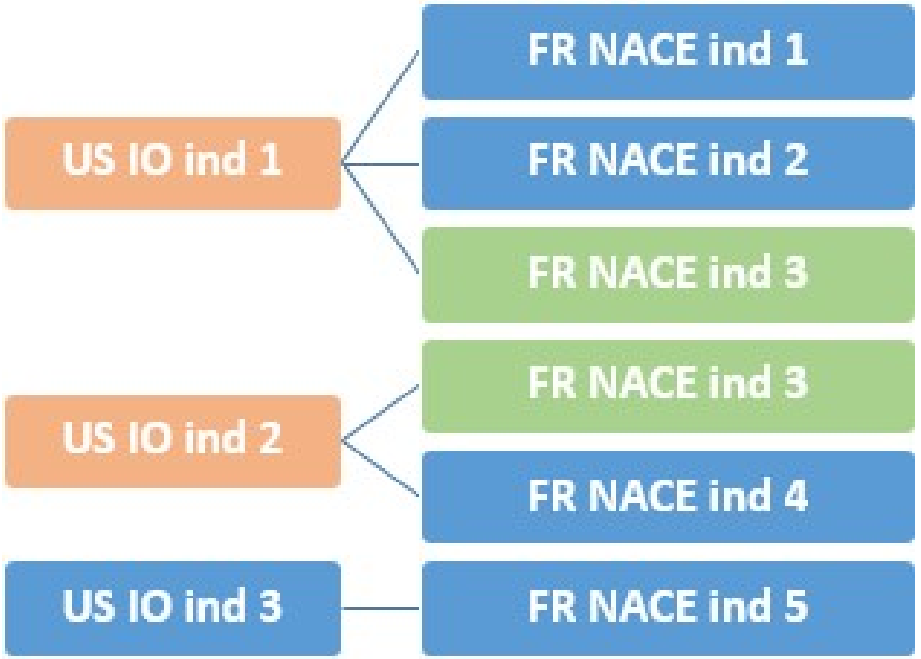
Sample	Re-exports excluded			All		
	Fist stage		Second stage	Fist stage		Second stage
Variables	ln (x_{fjkt}) (1)	ln (s_{fjkt}) (2)	ln p_{fjkt} (3)	ln (x_{fjkt}) (1)	ln (s_{fjkt}) (2)	ln p_{fjkt} (3)
ln $Inst_{fjkt}(x_{fjkt})$	-0.3288***	0.0989***		-0.3488***	0.1023***	
	(0.0026)	(0.0026)		(0.0021)	(0.0021)	
ln $Inst_{fjkt}(s_{fjkt})$	0.1118***	-0.4017***		0.1276***	-0.4250***	
	(0.0024)	(0.0026)		(0.0018)	(0.0020)	
ln Productivity$_{ft\,ft}$	-0.0500***	0.3408***	-0.0927***	-0.0364***	0.4437***	-0.0894***
	(0.0073)	(0.0080)	(0.0028)	(0.0055)	(0.0061)	(0.0022)
Small$_{ft}$	reference	reference	reference	reference	reference	reference
Medium$_{ft}$	-0.2707***	0.4584***	-0.0672***	-0.2938***	0.6497***	-0.0759***
	(0.0119)	(0.0131)	(0.0047)	(0.0095)	(0.0104)	(0.0038)
Large$_{ft}$	-0.6613***	0.9529***	-0.0736***	-0.7773***	1.4124***	0.0349***
	(0.0160)	(0.0175)	(0.0067)	(0.0113)	(0.0124)	(0.0053)
ln GDP per capita	-0.0916*	-0.8456***	-0.0271	0.0550*	-0.6976***	-0.0651***
	(0.0469)	(0.0514)	(0.0181)	(0.0332)	(0.0364)	(0.0126)
Share of industrial value added	-0.0004	0.0066**	-0.0030***	0.0004	0.0084***	-0.0002
in GDP	(0.0028)	(0.0031)	(0.0011)	(0.0020)	(0.0022)	(0.0007)
Share of agricultural value added	0.0142*	0.0011	-0.0144***	-0.0040	-0.0067	-0.0090***
in GDP	(0.0082)	(0.0090)	(0.0032)	(0.0055)	(0.0060)	(0.0021)
ln Buyer share (b_{fjkt})			0.0825***			0.1179***
			(0.0030)			(0.0022)
ln Supplier share (s_{fjkt})			-0.0946***			-0.0888***
			(0.0022)			(0.0016)
Error term decomposition						
ω_{fjkt}			0.5671 ***			0.5988***
			(0.0000)			(0.0000)
u_{fjkt}			0.4193***			0.4190***
			(0.0000)			(0.0000)
ν_{fjkt}			0.4105***			0.4054***
			(0.0000)			(0.0000)
Year fixed effects	YES	YES	YES	YES	YES	YES
Firm's main activity fixed effects	YES	YES	YES	YES	YES	YES
Country fixed effets	YES	YES	YES	YES	YES	YES
4-digit product fixed effets	YES	YES	YES	YES	YES	YES
Observations	181,571	183,165	181,562	329,652	331,762	329,638
R^2	0.279	0.341		0.312	0.372	
Partial R^2	0.0825			0.0801		
F-stat	6007.1002			11457.0474		
Endogeneity test	6922.0862			15743.7082		
p-value	0.0000			0.0000		

Notes: Small: 1 to 49 employees; Medium: 50 to 499 employees; Large: 500 employees or more. The sample comprises all importers and all exporters of French agri-food industry firm-year observations between 2002-2017. Standard errors in brackets. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Build a detailed input-output table for France

		Used inputs and value added			Final use	Total use
		US IO ind 1	US IO ind 2	US IO ind 3		
Supply of inter-mediate inputs	US IO ind 1	a_{11}	a_{12}	a_{13}	F_1	Y_1
	US IO ind 2	a_{21}	a_{22}	a_{13}	F_2	Y_2
	US IO ind 3	a_{31}	a_{21}	a_{33}	F_3	Y_3
Value added		VA_1	VA_2	VA_3		
Total output		Y_1	Y_2	Y_3		

(a) US input-output table



(b) Multiple industry correspondences

Figure: US input-output table structure and correspondences with NACE Rev.2

Data

Build a detailed input-output table for France

		US IO ind 1			US IO ind 2		US IO ind 3
		FR NACE ind 1	FR NACE ind 2	FR NACE ind 3	FR NACE ind 3	FR NACE ind 4	FR NACE ind 5
US IO ind 1	FR NACE ind 1	$\frac{1}{9} a_{11}$	$\frac{1}{9} a_{11}$	$\frac{1}{9} a_{11}$	$\frac{1}{6} a_{12}$	$\frac{1}{6} a_{12}$	$\frac{1}{3} a_{13}$
	FR NACE ind 2	$\frac{1}{9} a_{11}$	$\frac{1}{9} a_{11}$	$\frac{1}{9} a_{11}$	$\frac{1}{6} a_{12}$	$\frac{1}{6} a_{12}$	$\frac{1}{3} a_{13}$
	FR NACE ind 3	$\frac{1}{9} a_{11}$	$\frac{1}{9} a_{11}$	$\frac{1}{9} a_{11}$	$\frac{1}{6} a_{12}$	$\frac{1}{6} a_{12}$	$\frac{1}{3} a_{13}$
US IO ind 2	FR NACE ind 3	$\frac{1}{6} a_{21}$	$\frac{1}{6} a_{21}$	$\frac{1}{6} a_{21}$	$\frac{1}{4} a_{22}$	$\frac{1}{4} a_{22}$	$\frac{1}{2} a_{13}$
	FR NACE ind 4	$\frac{1}{6} a_{21}$	$\frac{1}{6} a_{21}$	$\frac{1}{6} a_{21}$	$\frac{1}{4} a_{22}$	$\frac{1}{4} a_{22}$	$\frac{1}{2} a_{13}$
US IO ind 3	FR NACE ind 5	$\frac{1}{3} a_{31}$	$\frac{1}{3} a_{31}$	$\frac{1}{3} a_{31}$	$\frac{1}{2} a_{21}$	$\frac{1}{2} a_{21}$	a_{33}

Figure: Equal weights for all correspondences within each pair of industry codes

Data

Build a detailed input-output table for France

	FR NACE ind 1	FR NACE ind 2	FR NACE ind 3	FR NACE ind 4	FR NACE ind 5
FR NACE ind 1	$b_{11} = \frac{1}{9} a_{11}$	$b_{12} = \frac{1}{9} a_{11}$	$b_{13} = \frac{1}{9} a_{11} + \frac{1}{6} a_{12}$	$b_{14} = \frac{1}{6} a_{12}$	$b_{15} = \frac{1}{3} a_{13}$
FR NACE ind 2	$b_{21} = \frac{1}{9} a_{11}$	$b_{22} = \frac{1}{9} a_{11}$	$b_{23} = \frac{1}{9} a_{11} + \frac{1}{6} a_{12}$	$b_{24} = \frac{1}{6} a_{12}$	$b_{25} = \frac{1}{3} a_{13}$
FR NACE ind 3	$b_{31} = \frac{1}{9} a_{11} + \frac{1}{6} a_{21}$	$b_{32} = \frac{1}{9} a_{11} + \frac{1}{6} a_{12}$	$b_{33} = \frac{1}{9} a_{11} + \frac{1}{6} a_{12} + \frac{1}{6} a_{21} + \frac{1}{4} a_{22}$	$b_{34} = \frac{1}{6} a_{12} + \frac{1}{4} a_{22}$	$b_{35} = \frac{1}{3} a_{13} + \frac{1}{2} a_{13}$
FR NACE ind 4	$b_{41} = \frac{1}{6} a_{21}$	$b_{42} = \frac{1}{6} a_{21}$	$b_{43} = \frac{1}{6} a_{21} + \frac{1}{4} a_{22}$	$b_{44} = \frac{1}{4} a_{22}$	$b_{45} = \frac{1}{2} a_{13}$
FR NACE ind 5	$b_{51} = \frac{1}{3} a_{31}$	$b_{52} = \frac{1}{3} a_{31}$	$b_{53} = \frac{1}{3} a_{31} + \frac{1}{2} a_{21}$	$b_{54} = \frac{1}{2} a_{21}$	$b_{55} = a_{33}$

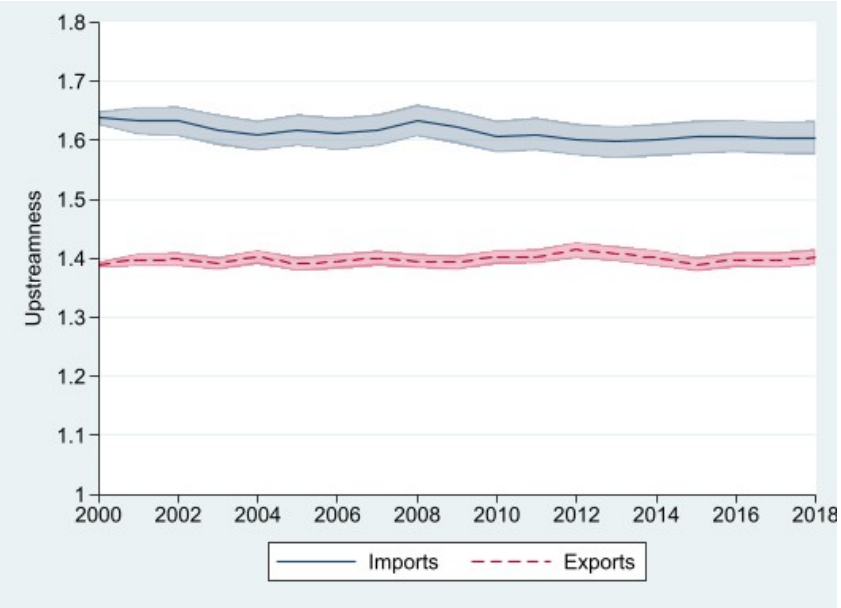
Figure: Group weights across NACE industries

Data

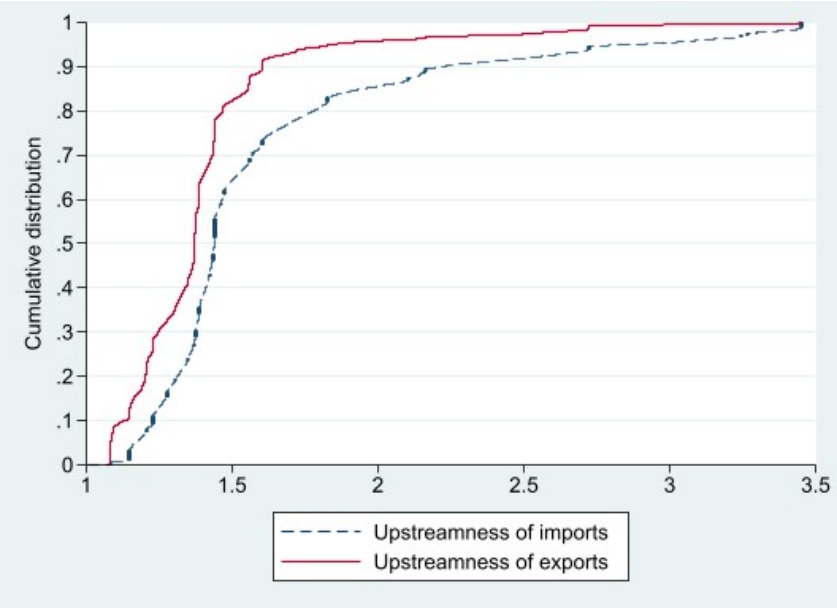
Upstreamness and position in GVC

back

NACE industry	Upstreamness
Seed processing for propagation	3.61
Growing of cereals (except rice), leguminous crops and oil seeds	3.45
Raising of dairy cattle	2.98
Manufacture of oils and fats	2.72
Manufacture of starches and starch products	2.16
Processing of tea and coffee	1.47
Processing and preserving of meat	1.44
Manufacture of wine from grape	1.23
Manufacture of prepared meals and dishes	1.20
Manufacture of bread; manufacture of fresh pastry goods and cakes	1.10
Retail sale of bread, cakes, flour confectionery and sugar confectionery in specialised stores	1.01
Retail sale of fruit and vegetables in specialised stores	1.01



(a) Sector-level average

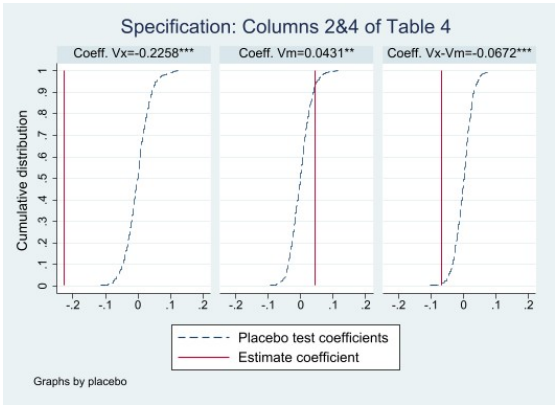


(b) Cumulative distribution of French firms

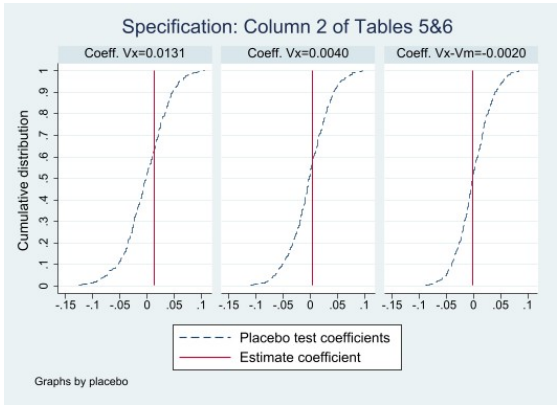
Robustness check

back to baseline

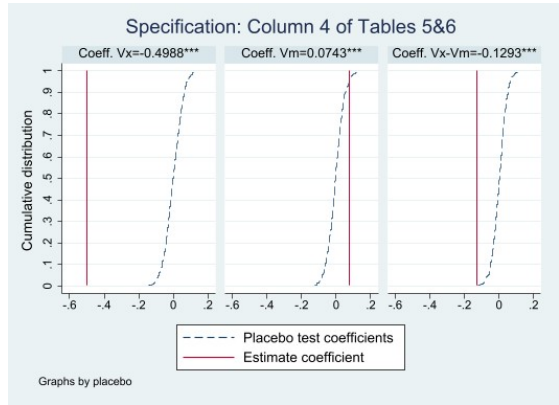
1. **Placebo test**
2. All transaction sample
3. Upstreamness from GTAP input-output table of France
4. Sub-sample regressions using upstreamness of exports



(a) Regressions with whole Re-export excluded sample



(b) Sub-sample regressions on more downstream firms in the Re-export excluded sample



(c) Sub-sample regressions on more upstream firms in the Re-export excluded sample

Figure: Distribution of V_{ft}^X and V_{ft}^M, and $V_{ft}^X - V_{ft}^M$ **placebo coefficients** versus **estimated coefficients**

Robustness check

back to baseline

1. Placebo test
2. All transaction sample
3. Upstreamness from GTAP input-output table of France
4. Sub-sample regressions using upstreamness of exports

Table: Robustness test II: Firm's position in GVCs and division of surplus

Sample	All transactions			
Variable	(1)	(2)	(3)	(4)
V_{ft}^X	0.0755	0.0816		
	(0.0576)	(0.0560)		
V_{ft}^M	0.0053	0.0130		
	(0.0165)	(0.0177)		
$(V_{ft}^X - V_{ft}^M)$			0.0058	-0.0000
			(0.0175)	(0.0183)
ln Productivity$_{ft}$		0.1028***		0.1028***
		(0.0033)		(0.0033)
Firm size:				
Small$_{ft}$		reference		reference
Medium$_{ft}$		0.1369***		0.1366***
		(0.0048)		(0.0048)
Large$_{ft}$		0.1452***		0.1444***
		(0.0087)		(0.0087)
Fixed effects	firm, industry-year, industry-country, product-country			
Observations	258,160	258,160	258,160	258,160
R^2	0.660	0.662	0.660	0.662

Notes: Standard errors clustered by country in parentheses. Removal of 2% from the distribution tails of the GVC bargaining power index. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Robustness check

back to baseline

1. Placebo test
2. All transaction sample
3. Upstreamness from GTAP input-output table of France
4. Sub-sample regressions using upstreamness of exports

Table: Robustness test II: Firm's position in GVCs and division of surplus – low versus high level of upstreamness of the core activity of firms

Sample	All transactions							
Sub-sample	More downstream firms		More Uptream firms		More downstream firms		More Uptream firms	
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
V^X_{ft}	0.2520***	0.2453***	-0.1920**	-0.1723**				
	(0.0574)	(0.0567)	(0.0879)	(0.0823)				
V^M_{ft}	-0.0329**	-0.0345**	0.0398	0.0745**				
	(0.0146)	(0.0155)	(0.0314)	(0.0320)				
$(V^X_{ft} - V^M_{ft})$					0.0591***	0.0600***	-0.0633**	-0.0896***
					(0.0164)	(0.0169)	(0.0295)	(0.0299)
ln Productivity$_{ft}$		0.0947***		0.1063***		0.0954***		0.1066***
		(0.0063)		(0.0051)		(0.0063)		(0.0052)
Firm size:								
Small$_{ft}$		reference		reference		reference		reference
Medium$_{ft}$		0.1100***		0.1673***		0.1087***		0.1672***
		(0.0078)		(0.0084)		(0.0078)		(0.0084)
Large$_{ft}$		0.1425***		0.1546***		0.1397***		0.1548***
		(0.0099)		(0.0154)		(0.0098)		(0.0154)
Fixed effects	firm, industry-year, industry-country, product-country							
Observations	120,880	120,880	133,401	133,401	120,880	120,880	133,401	133,401
R^2	0.727	0.728	0.641	0.643	0.727	0.728	0.641	0.643

Notes: Standard errors clustered by country in parentheses. Removal of 2% from the distribution tails of the GVC bargaining power index. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Robustness check

back to baseline

1. Placebo test
2. All transaction sample
3. **Upstreamness from GTAP input-output table of France**
4. Sub-sample regressions using upstreamness of exports

Table: Robustness test III: Firm's position in GVCs and division of surplus

Sample	Panel A: Re-exports excluded				Panel B: All			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
V_{ft}^X	-0.2207***	-0.1326*			-0.1685	0.0132		
	(0.0713)	(0.0714)			(0.1073)	(0.1090)		
V_{ft}^M	0.0357	0.0405*			0.1626***	0.1631***		
	(0.0221)	(0.0219)			(0.0308)	(0.0298)		
$(V_{ft}^X - V_{ft}^M)$			-0.0531**	-0.0491**			-0.1631***	-0.1493***
			(0.0208)	(0.0204)			(0.0326)	(0.0314)
$Controls_{ft}$	NO	YES	NO	YES	NO	YES	NO	YES
Fixed effects	firm, industry-year, industry-country, product-country							
Observations	107,994	107,994	107,994	107,994	258,160	258,160	258,160	258160
R^2	0.684	0.685	0.684	0.685	0.660	0.662	0.660	0.662

Notes: Standard errors clustered by country in parentheses. Removal of 2% from the distribution tails of the GVC bargaining power index. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Robustness check

back to baseline

1. Placebo test
2. All transaction sample
3. **Upstreamness from GTAP input-output table of France**
4. Sub-sample regressions using upstreamness of exports

Table: Robustness test III: Firm's position in GVCs and division of surplus – low versus high level of upstreamness of the core activity of firms

Sample	Panel A: Re-exports excluded				Panel B: All			
Sub-sample	More downstream firms		More Uptream firms		More downstream firms		More Uptream firms	
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
V_{ft}^X	-0.3688***	-0.2472**	-0.1188	-0.0997	-0.1565	0.1496	-0.0480	-0.0356
	(0.1274)	(0.1203)	(0.1161)	(0.1159)	(0.1567)	(0.1576)	(0.1801)	(0.1800)
V_{ft}^M	-0.0225	0.0028	0.1151***	0.1232***	0.1135***	0.1033***	0.2748***	0.2940***
	(0.0320)	(0.0299)	(0.0400)	(0.0390)	(0.0324)	(0.0319)	(0.0562)	(0.0528)
$Controls_{ft}$	NO	YES	NO	YES	NO	YES	NO	YES
Fixed effects	firm, industry-year, industry-country, product-country							
Observations	43,278	43,278	63,305	63,305	112,362	112,362	143,654	143,654
R^2	0.751	0.752	0.646	0.648	0.738	0.739	0.613	0.615

Notes: Standard errors clustered by country in parentheses. Removal of 2% from the distribution tails of the GVC bargaining power index. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Robustness check

back to baseline

1. Placebo test
2. All transaction sample
3. **Upstreamness from GTAP input-output table of France**
4. Sub-sample regressions using upstreamness of exports

Table: Robustness test III: Firm's expansion along GVCs and division of surplus – low versus high level of upstreamness of the core activity of firms

Sample	Panel A: Re-exports excluded				Panel B: All			
Sub-sample	More downstream firms		More Uptream firms		More downstream firms		More Uptream firms	
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
$(V_{ft}^X - V_{ft}^M)$	-0.0044	-0.0190	-0.1155***	-0.1203***	-0.1160***	-0.0891***	-0.2486***	-0.2640***
	(0.0308)	(0.0287)	(0.0397)	(0.0399)	(0.0330)	(0.0329)	(0.0591)	(0.0560)
$Controls_{ft}$	NO	YES	NO	YES	NO	YES	NO	YES
Fixed effects	firm, industry-year, industry-country, product-country							
Observations	43,278	43,278	63,305	63,305	112,362	112,362	143,654	143,654
R^2	0.751	0.752	0.646	0.648	0.738	0.739	0.613	0.615

Notes: Standard errors clustered by country in parentheses. Removal of 2% from the distribution tails of the GVC bargaining power index. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Robustness check

back to baseline

1. Placebo test
2. All transaction sample
3. Upstreamness from GTAP input-output table of France
4. **Sub-sample regressions using upstreamness of exports**

Table: Robustness test IV: Firm's position in GVCs and division of surplus – low versus high level of upstreamness of exports

Sample	Panel A: Re-exports excluded				Panel B: All			
Sub-sample	More downstream firms		More Uptream firms		More downstream firms		More Uptream firms	
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
V_{ft}^X	-0.3327	-0.3736	-0.4498***	-0.3573***	0.0743	-0.1570	-0.4182***	-0.0851
	(0.2832)	(0.2700)	(0.1241)	(0.1271)	(0.2264)	(0.2163)	(0.0980)	(0.1045)
V_{ft}^M	-0.0356	-0.0613**	0.1937***	0.1903***	0.0066	0.0039	0.1443***	0.1160**
	(0.0321)	(0.0302)	(0.0386)	(0.0385)	(0.0210)	(0.0216)	(0.0539)	(0.0521)
$Controls_{ft}$	NO	YES	NO	YES	NO	YES	NO	YES
Fixed effects	firm, industry-year, industry-country, product-country							
Observations	18,055	18,055	21,476	21,476	41,802	41,802	53,414	53,414
R^2	0.729	0.730	0.741	0.741	0.715	0.717	0.725	0.726

Notes: Standard errors clustered by country in parentheses. Removal of 2% from the distribution tails of the GVC bargaining power index. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Robustness check

back to baseline

1. Placebo test
2. All transaction sample
3. Upstreamness from GTAP input-output table of France
4. **Sub-sample regressions using upstreamness of exports**

Table: Robustness test IV: Firm's expansion along GVCs and division of surplus – low versus high level of upstreamness of exports

Sample	Panel A: Re-exports excluded				Panel B: All			
Sub-sample	More downstream firms		More Uptream firms		More downstream firms		More Uptream firms	
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
$(V_{ft} - V_{ft}^{M})$	0.0250	0.0494	-0.2271***	-0.2112***	-0.0063	-0.0046	-0.2016***	-0.1101**
	(0.0322)	(0.0299)	(0.0339)	(0.0353)	(0.0209)	(0.0214)	(0.0451)	(0.0446)
Controls_{ft}	NO	YES	NO	YES	NO	YES	NO	YES
Fixed effects	firm, industry-year, industry-country, product-country							
Observations	18,055	18,055	21,476	21,476	41,802	41,802	53,414	53,414
R^2	0.729	0.730	0.741	0.741	0.715	0.717	0.725	0.726

Notes: Standard errors clustered by country in parentheses. Removal of 2% from the distribution tails of the GVC bargaining power index. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Quality-adjusted GVC bargaining power

Back to results

- Purge of the export unit prices, and thus the division of surplus from quality components Khandelwal et al., 2013; Fan et al., 2015
  1: Estimate the the following linear form with OLS, using the demand elasticities from Ossa (2015)

$$\ln q_{fjkt} + \varepsilon_k \ln p_{fjkt} = FE_{jkt} + e_{fjkt}$$

  2: Recover the quality measure from residual e_{fjkt} as follow

$$\ln \widehat{\lambda}_{fjkt} = \frac{\widehat{e}_{fjkt}}{\varepsilon_k - 1} \tag{1}$$

  3: Compute the quality-adjusted prices

$$\ln \tilde{p}_{fjkt} = \ln p_{fjkt} - \ln \widehat{\lambda}_{fjkt}$$

  4: Estimation of quality-adjusted GVC bargaining index, $\tilde{NS}_{fjkt}$, using $\ln \tilde{p}_{fjkt}$

Quality-adjusted GVC bargaining power

Back to results

- Two-stage two-tier stochastic frontier model (Polachek and Yoon, 1987, 1996; Kumbhakar and Parmeter, 2009):

$$p_{fjkt} = \mu_{fjkt}(x) + \beta_{fjkt}\left(\overline{jfkt} - \mu_{fjkt}(x)\right) - (1-\beta_{fjkt})\left(\mu_{fjkt}(x) - \underline{p_{fjkt}}\right)$$

- Based on price equation from the theoretical framework:

$$\begin{aligned}
\ln \tilde{p}_{fjkt} &= \tilde{\mu}_{fjkt}(x) + \tilde{\xi}_{fjkt}, \\
\tilde{\mu}_{fjkt}(x) &= \text{Controls}_{ft} + \text{Controls}_{jt} + \alpha_b b_{fjkt} + \alpha_s s_{fjkt} + FE_t + FE_k + FE_r + FE_j \\
\tilde{\xi}_{fjkt} &= \tilde{\omega}_{fjkt} - \tilde{u}_{fjkt} + \tilde{e}_{fjkt}
\end{aligned}$$

$$\begin{aligned}
\tilde{e}_{fjkt} &\sim i.i.d.\ N(0, \delta_e^2) \\
\tilde{\omega}_{fjkt} &\sim i.i.d.\ Exp(\delta_\omega, \delta_\omega^2) \\
\tilde{u}_{fjkt} &\sim i.i.d.\ Exp(\delta_u, \delta_u^2)
\end{aligned}$$

- Construction of IVs for the bilateral shares (Alviarez et al., 2023)

Buyer share	–	purchases of f 's other importers from exporters other than f
Supplier share	–	sales of j's other exporters to importers other than j

- Estimation of $\ln \tilde{p}_{fjkt}$ by the maximum likelihood (ML) method

$$\tilde{NS}_{fjkt} = \tilde{\omega}_{fjkt} - \tilde{u}_{fjkt}$$

Mechanism test: role of upgrading of product mix

Theoretical framework

- Estimate of the quality-adjusted GVC bargaining power index, $\tilde{NS}_{fjkt}$
- Use it as an explained variable

Table: Firm's position in GVCs and quality-adjusted surplus

Sample	Panel A: Re-exports excluded				Panel B: All			
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
V^X_{ft}	-0.1470***	-0.1303***			0.0159	0.0343		
	(0.0477)	(0.0465)			(0.0353)	(0.0353)		
V^M_{ft}	0.0102	0.0138			0.0073	0.0214		
	(0.0144)	(0.0141)			(0.0163)	(0.0162)		
$(V^X_{ft} - V^M_{ft})$			-0.0286*	-0.0294**			-0.0040	-0.0134
			(0.0150)	(0.0146)			(0.0163)	(0.0162)
ln Productivity$_{ft}$		0.0302***		0.0307***		0.0469***		0.0468***
		(0.0049)		(0.0049)		(0.0030)		(0.0030)
Firm size:								
Small$_{ft}$		reference		reference		reference		reference
Medium$_{ft}$		0.0631***		0.0641***		0.0899***		0.0897***
		(0.0095)		(0.0096)		(0.0059)		(0.0059)
Large$_{ft}$		0.1067***		0.1078***		0.1471***		0.1466***
		(0.0110)		(0.0110)		(0.0063)		(0.0063)
Fixed effects	firm, industry-year, industry-country, product-country							
Observations	104,656	104,656	104,656	104,656	250,451	250,451	250,451	250,451
R^2	0.457	0.458	0.457	0.458	0.415	0.416	0.415	0.416

Notes: Standard errors clustered by country in parentheses. Removal of 2% from the distribution tails of the GVC bargaining power index. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Mechanism test: role of upgrading of product mix

Table: Firm's position in GVCs and quality-adjusted surplus – low versus high level of upstreamness of the core activity of firms

Sample	Panel A: Re-exports excluded				Panel B: All			
Sub-sample	More downstream firms		More Uptream firms		More downstream firms		More Uptream firms	
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
V_{ft}^X	-0.1446*	-0.1408*	-0.1353***	-0.1036**	0.0265	0.0367	0.0196	0.0386
	(0.0783)	(0.0763)	(0.0410)	(0.0406)	(0.0596)	(0.0590)	(0.0560)	(0.0525)
V_{ft}^M	0.0222	0.0148	0.0100	0.0218	-0.0128	-0.0065	0.0404	0.0672**
	(0.0287)	(0.0281)	(0.0194)	(0.0200)	(0.0194)	(0.0192)	(0.0270)	(0.0266)
ln Productivity$_{ft}$		0.0418***		0.0244***		0.0526***		0.0453***
		(0.0100)		(0.0059)		(0.0055)		(0.0037)
Firm size:								
Small$_{ft}$		reference		reference		reference		reference
Medium$_{ft}$		0.0708***		0.0594***		0.0847***		0.0985***
		(0.0120)		(0.0095)		(0.0093)		(0.0077)
Large$_{ft}$		0.1136***		0.1085***		0.1412***		0.1610***
		(0.0172)		(0.0125)		(0.0115)		(0.0143)
Fixed effects			firm, industry-year, industry-country, product-country					
Observations	50,396	50,396	51,911	51,911	116,225	116,225	130,249	130,249
R^2	0.465	0.466	0.514	0.514	0.445	0.447	0.450	0.452

Notes: Standard errors clustered by country in parentheses. Removal of 2% from the distribution tails of the GVC bargaining power index. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Mechanism test: role of upgrading of product mix

Table: Firm's expansion along GVCs and quality-adjusted surplus – low versus high level of upstreamness of the core activity of firms

Sample	Panel A: Re-exports excluded				Panel B: All			
Sub-sample	More downstream firms		More Uptream firms		More downstream firms		More Uptream firms	
Variable	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
$(V_{ft} - V_{ft}^{M})$	-0.0365	-0.0295	-0.0273	-0.0332*	0.0145	0.0104	-0.0304	-0.0496**
	(0.0280)	(0.0272)	(0.0174)	(0.0179)	(0.0194)	(0.0191)	(0.0249)	(0.0248)
ln Productivity$_{ft}$		0.0418***		0.0251***		0.0527***	0.0447***	
		(0.0100)		(0.0059)		(0.0056)	(0.0037)	
Firm size:								
Small$_{ft}$		reference		reference		reference		reference
Medium$_{ft}$		0.0710***		0.0605***		0.0846***		0.0984***
		(0.0120)		(0.0096)		(0.0092)		(0.0077)
Large$_{ft}$		0.1129***		0.1108***		0.1408***		0.1605***
		(0.0172)		(0.0124)		(0.0114)		(0.0142)
Fixed effects	firm, industry-year, industry-country, product-country							
Observations	50,396	50,396	51,911	51,911	116,225	116,225	130,249	130,249
R^2	0.465	0.466	0.513	0.514	0.445	0.447	0.450	0.452

Notes: Standard errors clustered by country in parentheses. Removal of 2% from the distribution tails of the GVC bargaining power index. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.