

Power and Export Sophistication in Buyer-Supplier Relationships: Insights from Colombian Customs Data

Presented by Tommaso Ciarli²
work by Filippo Bontadini¹

¹SPRU, University of Sussex, f.bontadini@sussex.ac.uk

²SPRU, University of Sussex, t.ciarli@sussex.ac.uk

Workshop on
“Innovation, industrial dynamics, and industrial policy”
Universidad de Bogotá Jorge Tadeo Lozano
Bogotá, October 12, 2018

Motivation

Increases in the sophistication of export is related to country capabilities, and may foster economic development (Lall et al. 2006; Hidalgo et al. 2007; Minondo 2010; Zhu & Fu 2013).

Change in the nature of trade towards GVC

GVCs seen as opportunity to access the global market, tap into foreign knowledge and improve capabilities (Baldwin 2011; Gereffi et al. 2005; Kaplinsky 2004)

Upgrading through GVCs may depend on the governance: power relations (Gereffi et al. 2005; Humphrey & Schmitz 2002; Pietrobelli & Saliola 2008)

Main contributions

Define a measure of governance/power between pairs of trading firms:
dependence between firms

Define a measure of upgrading

Build transaction data between Colombian exporters and RoW importers:
match between each pair – micro I/O

Relate power with the supplier probability of upgrading

Literature: Governance

Governance in GVC (Gereffi et al., 2005) and upgrading (Giuliani et al. 2005)

- Arm's length market relationships no commitment and low switching costs
- Modular supplier delivers a turn-key product
- Relational: high level of mutual dependence, relying on trust
- Captive: small suppliers are dependent on large buyers
- Hierarchical: direct ownership link between headquarters and subsidiaries.

IO: market share as an outcome of market power (e.g. innovation rents):
HHI, Lerner index

Supply chain management (Shervani et al. 2016) power definition

- Market: A firm's bargaining power in product-market or industry – market share
- Inter-firms: a firm's power within the trade relation

Literature: Transaction Data

Exploration of firm heterogeneity in trade (Melitz 2003a; A. B. Bernard et al. 2014; Carballo et al. 2013; Bernard et al. 2011; Eaton et al. 2007) and buyer-supplier matching and switching (Sugita et al. 2015; Dragusanu 2014).

Value of relationships, switching costs and value of traded goods (Macchiavello 2010; Macchiavello & Morjaria 2009; Macchiavello & Morjaria 2016; Macchiavello & Miquel-Florensa 2017): buyer-supplier relationships (and trust) relevant to trade flows and patterns

Learning in trade relations and search for suppliers (Monarch & Schmidt-Eisenlohr; Grossi Cajal, 2016)

Main findings

When a supplier trades with a powerful buyer, the **level of product sophistication** and the **likelihood of upgrading** vary with the type of buyer's power

- Binary dependence (supplier has one or few buyer): trade in unsophisticated goods and lower probability of upgrading;
- Market share (major importer of the supplier's good): trade in more sophisticated goods, and lower probability of upgrading

When a supplier is powerful the **level of product sophistication** and the **likelihood of upgrading** vary with the type of supplier's power

- Market share (major exporter): more likely to introduce new, unsophisticated, products
- Binary dependence (buyer has one or few suppliers): trade in less sophisticated goods, but higher probability of innovating

Data

Transactions

- Colombian Customs (DIAN): all export transactions from Colombia to the RoW 2007-2014 by HS-6 digits product
 - ▶ Supplier uniquely identified. Buyer by name/country: (Cleaning)
- Manufacturing and agriculture – drop oil and mining

Suppliers

- SIREM (financial surveillance of not publicly listed firms): financial balance sheets

Product exchanged

- Atlas of Complexity for Colombia (HS-4 digits) – at $t = 2007$

Price adjustment

- DANE export sector deflators

Post-processing:

- 4,956,935 buyer-supplier-product-country transactions
- 286,225 relations panel of 527,010 observations – importer \times country
- 7,093 exporters

Unit of analysis

Relation: pair of buyer and supplier, trading in a given destination country, in a given year and a *given product*

Pair: pair of buyer and supplier, trading in a given destination country, in a given year and *for all exchanged products*

| | Products traded | Buyers | Suppliers |
|---------|-----------------|--------|-----------|
| Min | 1 | 1 | 1 |
| 1st Qu. | 1 | 5 | 1 |
| Median | 1 | 14 | 4 |
| Mean | 2.034 | 30.41 | 10.83 |
| 3rd Qu. | 2 | 35 | 12 |
| Max | 113 | 324 | 128 |

Pair sophistication

Upper-bound sophistication: the most sophisticated product traded in a given year

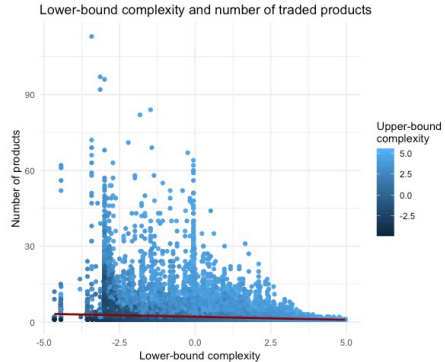
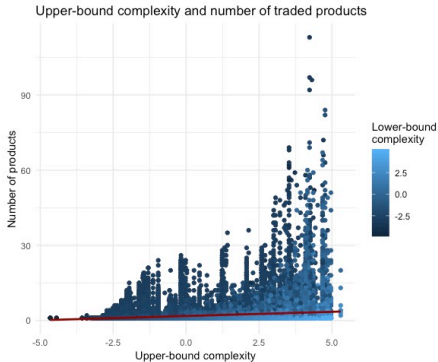
Lower-bound sophistication: the least sophisticated product traded in a given year

Median sophistication: the sophistication of the median product, weighted by the value in the pair's trade – captures the sophistication of the “core” trade

Average sophistication: average across products traded, weighted by the weighted by the value in the pair's trade – influenced by the number of products traded

Data

Multi-product pairs have larger support of product sophistication distribution



Firms' power Data

GVC Literature

Index

Literature

Buyer power

Supplier dependence

$$sdp_{sbp} = \frac{x_{sbp}}{\sum_{bp} x_{sbp}}$$

Supply chain management

Buyer market share

$$bsh_{bp} = \frac{\sum_s x_{sbp}}{\sum_{sb} x_{sbp}}$$

Industrial Organisation

Supplier power

Buyer dependence

$$bdp_{sbp} = \frac{x_{sbp}}{\sum_{sp} x_{sbp}} \times \frac{\sum_s x_{pc}}{I_{pc}^{RoW}}$$

Supply chain management

Supplier market share

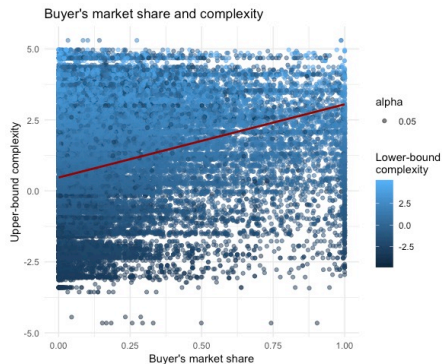
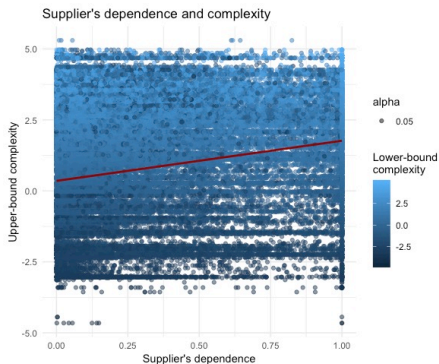
$$ssh_{sp} = \frac{\sum_b x_{sbp}}{\sum_{sb} x_{sbp}} \times \frac{\sum_s x_{pc}}{I_{pc}^{RoW}}$$

Industrial Organisation

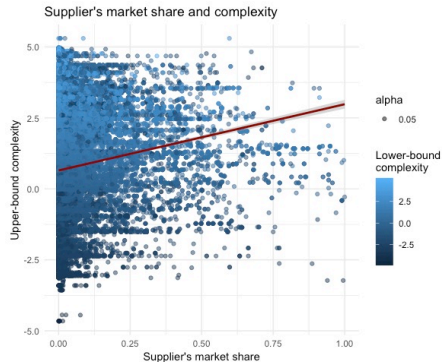
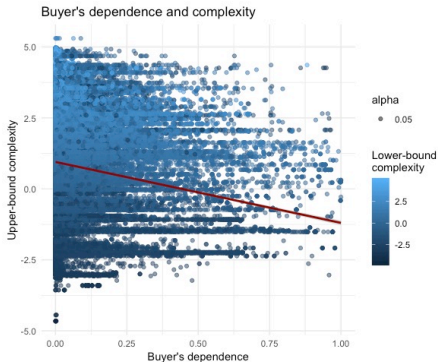
where

- x : sales; p : product; s : supplier; b : buyer; c : buyer country (USA, ECU, VEN); I^{RoW} : total import

Buyer power and product sophistication



Supplier power and product sophistication



Relation between power and product sophistication (OLS)

$$y_{mt} = \alpha + \beta_2 sdp_{mt-1} + \beta_3 bsh_{mt-1} + \beta_4 bdp_{1mt-1} + \beta_5 ssh_{mt-1} + \Gamma X_{mt-1} + \Xi Z_{st} + \mu_m + \tau_t + \epsilon_{mt} \quad (1)$$

where

- y_{mt} : sophistication of product basket traded by pair m in year t
- X_{mt-1} : pair controls – number of traded goods ($nhs4$), total transactions ($ntrans$) and duration of relation with on breaks (age)
- Z_{st} : supplier controls – TFP estimated with balance sheets (tfp)
- τ_t time dummies
- μ_m pair FE

High-dimensionality categorical variables (μ_m): Abowd et al. (1999) and Gaure (2013)

Product innovation (LPM)

$$y_{mt} = \alpha + \beta_2 sdp_{mt-1} + \beta_3 bsh_{mt-1} + \beta_4 bdp_{1mt-1} + \beta_5 ssh_{mt-1} + \Gamma X_{mt-1} + \Xi Z_{st} + \mu_m + \tau_t + \epsilon_{mt} \quad (2)$$

where

- y_{mt} : probability that pair m introduces a product in year t new to the pair or to the firm (conditional to new to pair)
- X_{mt-1} : pair controls – number of traded goods ($nhs4$), total transactions ($ntrans$), duration of relation with on breaks (age), upper-bound sophistication (pci)
- Z_{st} : supplier controls – TFP estimated with balance sheets (tfp)
- τ_t time dummies
- μ_m pair FE

Product/GVC upgrading (LPM)

$$y_{mt} = \alpha + \beta_2 sdp_{mt-1} + \beta_3 bsh_{mt-1} + \beta_4 bdp_{1mt-1} + \beta_5 ssh_{mt-1} + \Gamma X_{mt-1} + \Xi Z_{st} + \mu_m + \tau_t + \epsilon_{mt} \quad (3)$$

where

- y_{mt} : probability that pair m increase the sophistication of traded basket in year t
- X_{mt-1} : pair controls – number of traded goods ($nhs4$), total transactions ($ntrans$), duration of relation with on breaks (age) and lagged level of upper/lower/median/average sophistication
- Z_{st} : supplier controls – TFP estimated with balance sheets (tfp)
- τ_t time dummies
- μ_m pair FE

Power and Product Sophistication

| | Upper-bound | Lower-bound | Median |
|---------------|-------------|-------------|-------------|
| <i>sdp</i> | -0.0835 *** | -0.0475 * | -0.0442 ** |
| <i>bsh</i> | 0.1119 ** | 0.0948 ** | 0.0707 ** |
| <i>bdp</i> | -0.0045 | -0.0702 | -0.0575 † |
| <i>ssh</i> | -0.0094 | -0.0882 | -0.2238 *** |
| <i>nsh4</i> | 0.0096 *** | -0.0133 *** | -0.0006 |
| <i>tfp</i> | 0.0685 *** | -0.0038 | -0.0057 |
| <i>ntrans</i> | 0.0038 ** | -0.0025 * | -0.0011 |
| <i>age</i> | -0.0009 | 0.0018 | -0.0041 |
| N. obs. | 42741 | 42741 | 42758 |
| R2 | 0.94 | 0.94 | 0.97 |

Signif. Codes: 0 *** ; 0.001 ** ; 0.01 * ; 0.05 †

Product innovation

| | New to the pair | New to the supplier | New to the supplier |
|---------------|-----------------|---------------------|---------------------|
| <i>sdp</i> | 0.0149 | 0.1083 *** | 0.0983 *** |
| <i>bsh</i> | -0.0375 † | -0.048 * | -0.0228 † |
| <i>bdp</i> | 0.0219 | -0.0197 | -0.0344 † |
| <i>ssh</i> | -0.0295 | 0.0705 | 0.0903 ** |
| <i>nhs4</i> | -0.0109 *** | -0.0069 *** | 0.0004 |
| <i>tfp</i> | 0.0395 *** | 0.0365 *** | 0.01 † |
| <i>ntrans</i> | -0.0001 | -0.0002 | -0.0001 |
| <i>age</i> | -0.0122 ** | -0.0084 * | -0.0002 |
| <i>pci</i> | -0.0818 *** | -0.0413 *** | 0.0137 *** |
| <i>nhs_d</i> | | | 0.6718 *** |
| N. obs. | 42739 | 42739 | 42739 |
| R2 | 0.37 | 0.37 | 0.73 |

Signif. Codes: 0 *** ; 0.001 ** ; 0.01 * ; 0.05 †

Product/GVC upgrading

| | Upper-bound | Lower-bound | Median |
|---------------------|----------------------|----------------------|-------------|
| <i>sdp</i> | -0.0193 ^b | -0.0201 ^b | -0.0555 *** |
| <i>bsh</i> | -0.0103 | 0.0214 | -0.0126 |
| <i>bdp</i> | 0.0569 * | -0.1067 *** | -0.1281 *** |
| <i>ssh</i> | -0.0163 | -0.0095 | -0.0568 |
| <i>nsh4</i> | -0.0056 *** | 0.0071 *** | 0.0102 *** |
| <i>tfp</i> | 0.0218 ** | -0.0109 | 0.0035 |
| <i>ntrans</i> | 0.0006 | -0.0006 | -0.0005 |
| <i>age</i> | -0.0024 | 0.0049 | 0.0036 |
| <i>lagged_level</i> | -0.2223 *** | -0.2425 *** | -0.3769 *** |
| N. obs. | 42724 | 42724 | 42758 |
| R2 | 0.24 | 0.28 | 0.32 |

Signif. Codes: 0 *** ; 0.001 ** ; 0.01 * ; 0.05 ^b

Conclusions

Do power relation international trade (GVC) influence opportunities for upgrading?

Yes, depending on who holds the power

- A pair in which the supplier depends on the buyer is likely to trade in less sophisticated products, introduce more new goods, but less sophisticated
- When the buyer's market share is high, sophistication depends on destination
 - ▶ HIC: less sophisticated, introduce fewer goods, less soph. (top)
 - ▶ MIC: more sophisticated, introduce same goods, more soph (med)
- When suppliers tie buyers to them, they upgrade top and bottom products (increase range) only in MIC
- Suppliers with large market shares trade in less sophisticated goods, introduce new goods, reducing mix soph.

Thanks
Suggestions most welcome!

Cleaning of importers' names ([Back](#))

Pair sophistication ([Back](#))

| | Upper-bound | Lower-bound | Median | Average |
|--------|-------------|-------------|---------|---------|
| Min | -4.656 | -4.656 | -4.656 | -4.656 |
| 1st Qu | -1.5106 | -2.2427 | -2.1339 | -2.0857 |
| Median | 1.1494 | 0.272 | 0.686 | 0.9186 |
| Mean | 0.7371 | 0.1469 | 0.3317 | 0.4235 |
| 3rd Qu | 2.6369 | 1.9461 | 2.08 | 2.1646 |
| Max | 5.3018 | 4.9684 | 4.9684 | 5.0313 |

Power indices ([Back](#))

Suppliers are on average less powerful (more dependent on their buyers) than buyers

| | <i>sdp</i> | <i>bsh</i> | <i>bdp</i> | <i>ssh</i> |
|---------|------------|------------|------------|------------|
| Min. | 0 | 0 | 0 | 0 |
| 1st Qu. | 0.01408 | 0.002606 | 0.002567 | 0.000963 |
| Median | 0.0904 | 0.019883 | 0.023596 | 0.005093 |
| Mean | 0.2717 | 0.10289 | 0.098896 | 0.037449 |
| 3rd Qu. | 0.44111 | 0.110813 | 0.122374 | 0.02547 |
| Max. | 1 | 1 | 1 | 1 |