

Positioning in Global Value Chains: World Map and Indicators. A new dataset available for GVC analyses

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Summary

- Motivations and main objectives
- Upstreamness and downstreamness indicators
- Descriptive statistics
- An empirical test
- Concluding remarks

Motivations

- Scholars have developed various **indicators** to map and measure the **involvement** of countries and sectors in **GVCs**
 - Hummels et al., 2001; Johnson and Noguera, 2012; Koopman, Wang and Wei, 2014; Borin et al., 2021.
- Recently, a strand of the literature has developed new measures of the **positioning of countries and sectors in GVCs**
 - Fally, 2012; Antràs et al., 2012; Antràs and Chor, 2013; Fally and Hillberry, 2015; Alfaro et al., 2019; Millerand Temurshoev, 2017; Wang et al., 2017
- Using global Input-Output tables it is now possible to compute **upstreamness and downstreamness measures** of specific industries and countries.
- Together with the GVCs participation indicators, these positioning measures: i) *help enrich and complete* empirical analyses on GVCs, ii) *can be included in the economic models* of GVCs, iii) *and can inform policymaking.*

This paper

A new dataset of GVC positioning indicators at the country, sector and country-sector level ready to use and available to scholars

- Measure of distance or **upstreamness** of a production sector from final demand
 - developed by Fally (2012), Antras et al. (2012), and Antras and Chor (2013, 2019)
- Measure of distance or **downstreamness** of a given sector from the economy's primary factors of production (or sources of value-added)
 - originally proposed by Fally (2012)
- **International comparison**, by sectors and regions, of these indicators and their evolution over time.
- Present a pilot test on the **effects** of these indicators **on productivity**.

A new dataset of GVC positioning

Data source

- **EORA26** dataset (189 countries and 26 sectors) for the period 1995-2015.
- **ADB MRIO** database (63 countries and 56 sectors) for the period 2007-2019.

Coming next:

- **Long-run WIOD** dataset (25 countries and 23 sectors for the period 1965-2000)
- **TiVA OECD** dataset (66 countries and 45 sectors for the period 1995-2018)

Added-value of this work: Researchers working on GVCs and belonging to different disciplines – economic sociology, international economics, economic geography, international political economy, international business – will benefit from these ready-to-use indicators.

Computing indicators

- **Upstreamness** (Fally, 2012; Antras et al., 2012; Antras and Chor, 2013)

Captures the **distance** of a given sector **from final demand** (average number of production stages).

A relatively upstream sector is one that sells a **small share of its output to final consumers**, and instead sells disproportionately to other sectors that themselves sell relatively little to final consumers.

- **Downstreamness** (Fally, 2012)

Captures the **distance** of a given sector **from the economy's primary factors of production** (or sources of value-added).

An industry in each country is downstream if its production process **embodies a larger amount of intermediate inputs** relative to its use of primary factors of production.

Formally...

By using the intermediate use matrix (Z), the final demand matrix (FD) and the value-added matrix (VA):

- Upstreamness

$$Y_i^r = \sum_{s=1}^S \sum_{j=1}^J Z_{ij}^{rs} + \sum_{j=1}^J FD_{ij}^r =$$

$$= \sum_{s=1}^S \sum_{j=1}^J a_{ij}^{rs} Y_j^s + FD_i^r$$

where Y_i^r is the gross output in sector r in country i and $a_{ij}^{rs} = \frac{Z_{ij}^{rs}}{Y_j^s}$

$$Y_i^r = FD_i^r + \sum_{s=1}^S \sum_{j=1}^J a_{ij}^{rs} FD_j^s + \sum_{s=1}^S \sum_{j=1}^J \sum_{t=1}^S \sum_{k=1}^J a_{ij}^{rs} a_{ik}^{st} FD_k^t + \dots$$

multiplying each term by its respective production-staging distance from final use +1 and dividing everything by Y_i^r :

$$U_i^r = 1 * \frac{FD_i^r}{Y_i^r} + 2 * \frac{\sum_{s=1}^S \sum_{j=1}^J a_{ij}^{rs} FD_j^s}{Y_i^r} + 3 * \frac{\sum_{s=1}^S \sum_{j=1}^J \sum_{t=1}^S \sum_{k=1}^J a_{ij}^{rs} a_{ik}^{st} FD_k^t}{Y_i^r} + \dots$$

Formally...

- Downstreamness

$$Y_j^s = \sum_{r=1}^S \sum_{i=1}^J Z_{ij}^{rs} + VA_j^s =$$

$$= \sum_{r=1}^S \sum_{i=1}^J b_{ij}^{rs} Y_i^r + VA_j^s$$

where $b_{ij}^{rs} = \frac{Z_{ij}^{rs}}{Y_i^r}$

$$Y_j^s = VA_j^s + \sum_{r=1}^S \sum_{i=1}^J b_{ij}^{rs} VA_i^r + \sum_{r=1}^S \sum_{i=1}^J \sum_{t=1}^S \sum_{k=1}^J b_{ki}^{tr} b_{ij}^{rs} VA_k^t + \dots$$

multiplying each term by its respective production-staging distance from primary factors stage +1 and dividing everything by Y_j^s :

$$D_j^s = 1 * \frac{VA_j^s}{Y_j^s} + 2 * \frac{\sum_{r=1}^S \sum_{i=1}^J b_{ij}^{rs} VA_i^r}{Y_j^s} + 3 * \frac{\sum_{r=1}^S \sum_{i=1}^J \sum_{t=1}^S \sum_{k=1}^J b_{ki}^{tr} b_{ij}^{rs} VA_k^t}{Y_j^s} + \dots$$

Economic interpretation

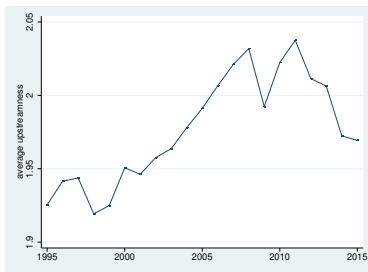
Upstreamness (U) index:

- The U index measures *how many stages of production are left before the goods or services reach final consumers*.
It takes as a point of reference the sources of final demand at the end of each production chain, and compute the upstreamness of the country-industry relative to final use.
- Final goods can be considered 1 step away from demand, inputs directly used to produce final goods are 2 steps away from demand, inputs used to produce inputs are 3 steps away from demand, and so on.
- $U \geq 1$: larger values are associated with relatively higher levels of upstreamness of the output originating from one sector.

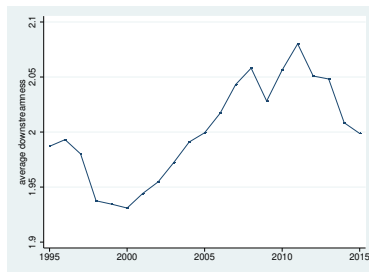
Downstreamness (D) index:

- The D index captures the downstreamness of each country-industry from where production processes commence, namely from primary factors. It measures distance of a given sector from the economy's primary factors of production (or sources of value-added).
- $D \geq 1$: larger values are associated with relatively higher levels of downstreamness of an industry.

GVC Positioning over time (world average)

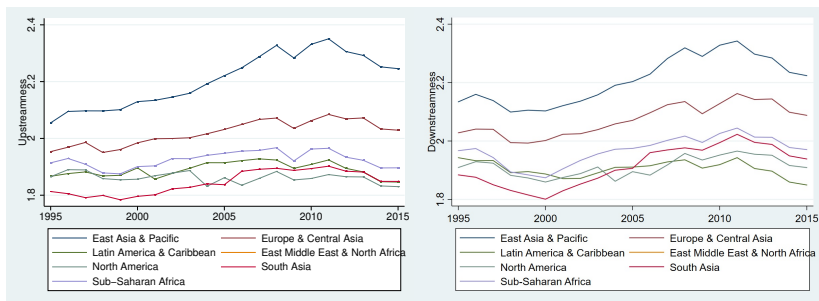


(a) Upstreamness



(b) Downstreamness

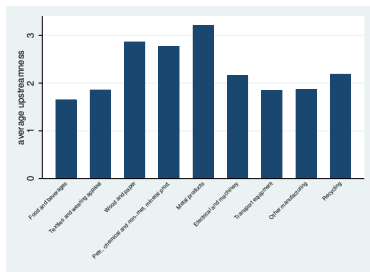
GVC Positioning by region over time



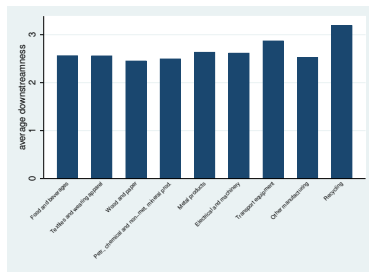
(a) Upstreamness

(b) Downstreamness

GVC Positioning by sector (world average, 1995-2015)



(a) Upstreamness



(b) Downstreamness

Our empirical test: positioning and productivity

Following Constantinescu et al. (2019), Gal and Witheridge (2019), Montalbano et al. (2018), Roy and Yasar (2015), Montalbano and Nenci (2022):

- we adopt a standard Cobb-Douglas production function with L and K , augmented with indicators of GVCs positioning
- we assume that a **technology shifter** is driven by a standard process of economic innovation and a range of trade-related determinants, including trade and **GVC performances**

$$\theta_{cjt} = \alpha_{ct} + \beta_1 k_{cjt} + \beta_2 pos_{cjt} + \eta_{jt} + \omega_{cj} + \epsilon_{cjt}$$

where

θ_{cjt} is the country-sectoral value added per worker of the manufacturing sectors, k_{cjt} is country-sectoral capital intensity and pos_{cjt} is a measure of GVC positioning. α_{ct} , η_{jt} , ω_{cj} are country-time, sector-time, and country-sector effects, respectively.

Results: baseline estimates

DepVar: Labor Productivity (ln)	(1)	(2)	(3)	(4)	(5)	(6)
Capital stock per employee (ln)	0.181*** (0.041)	0.112*** (0.040)	-0.001 (0.022)	-0.000 (0.022)	0.046** (0.018)	0.045** (0.018)
Downstreamness (ln, t-1)	-1.284*** (0.342)		-1.115** (0.492)		-1.319*** (0.426)	
Upstreamness (ln, t-1)		0.448*** (0.108)		-0.103 (0.344)		-0.710** (0.304)
Constant	-3.343*** (0.389)	-4.324*** (0.338)	-1.977*** (0.453)	-2.948*** (0.312)	-2.177*** (0.396)	-2.851*** (0.290)
R^2	0.63	0.63	0.95	0.95	0.97	0.97
N	7,614	7,548	7,598	7,532	7,598	7,532
Country-Year FEs	YES	YES	YES	YES	YES	YES
Country-Sector FEs	NO	NO	YES	YES	YES	YES
Sector-Year FEs	NO	NO	NO	NO	YES	YES

Results - Elasticities between D and labor productivity by industrial sector

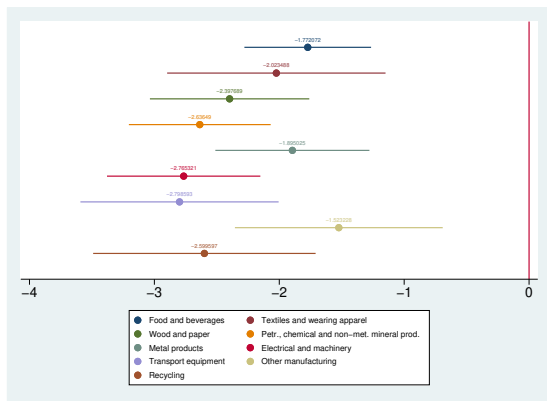


Figure: Elasticities between downstreamness and labor productivity

Results - Elasticities between U and labor productivity by industrial sector

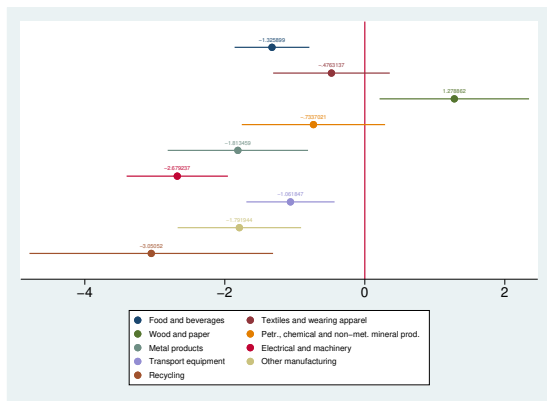


Figure: Elasticities between upstreamness and labor productivity

Results - Elasticities between D and labor productivity by region

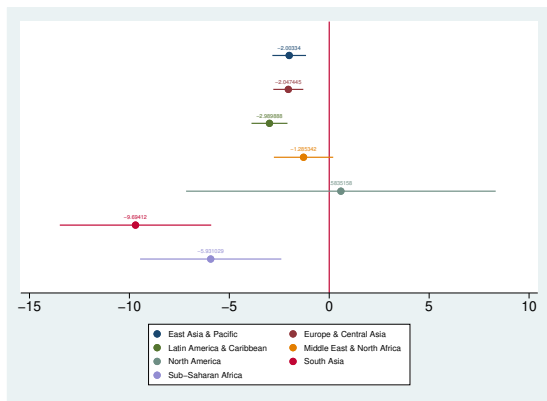


Figure: Elasticities between downstreamness and labor productivity

Results - Elasticities between U and labor productivity by region

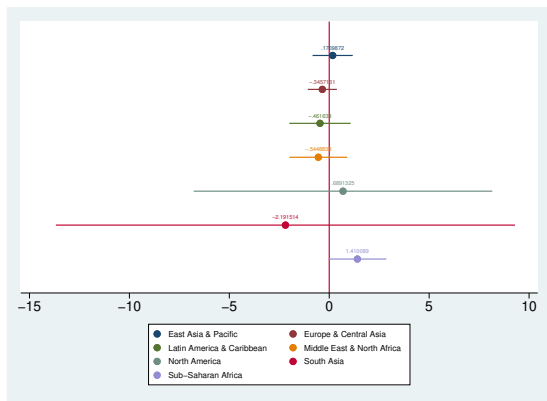


Figure: Elasticities between upstreamness and labor productivity

Results

- General robust **negative association** between **downstreamness** and value added performances.
 - focusing on manufacturing sectors → cut of the right end of the standard “smiling curve”.
 - elasticity between D and LP is negative for all regions
 - elasticities are negative for all the sectors.
- **Mixed evidence** for **upstreamness**.
 - controlling for the full set of fixed effects → negative association.
 - excluding sector-specific fixed effects → coefficient turns positive
 - no significance at regional level.
 - elasticity between U and LP is negative for all sectors except for Wood and Paper.

Concluding remarks

- We compute and provide **access to a new dataset of GVC positioning indicators** - now well established in the literature- at the country-sector level for a large number of countries and a long time span
- We show that U and D are strongly **correlated** overtime, in line with Antràs and Chor (2018) work on WIOD data.
- We present **some pilot tests** starting from one of the most intriguing and important relationship, namely that between productivity and GVC positioning
- We find that **positioning along the GVCs matters** in determining changes in value added.

Availability of new indicators of GVCs positioning at the country and sectoral level provided by this work

→ Unprecedented **opportunity to carry out** qualitative and quantitative **analyses** on economic aspects related to GVCs.

Thank you for your attention!
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