The Value Added-Exports Puzzle and Global Value Chains

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Abstract

While most OECD countries experienced declines in manuf. value added relative to GDP over 1970-2001, they have experienced increases in manuf. exports relative to GDP during the same period. Bergoeing, Kehoe, Strauss-Kahn, and Yi (AER 2004) documented this "**value added-exports puzzle**" and predicted that vertical specialization can explain it. Using the 1995-2018 data for 22 OECD countries and 17 manuf. industries, we investigate whether **vertical specialization**, or **global value chain (GVC) participation**, and **GVC position (up/downstreamness)** can explain the puzzle. Our regressions show (1) vertical specialization, measured by the GVC **backward** linkage, increases gross exports and decreases value added at the country-industry level; (2) that measured by the GVC **forward** linkage has the opposite effects; and (3) **less upstreamness** (more downstreamness) also contributes to the puzzle.

1. Introduction

We extend Bergoeing et al.'s (2004) data by using more recent data from 1995-2018 and investigating the puzzle at the industry level and the country-industry level besides the country level.

Figure 1 shows that the puzzle holds (the second quadrant) for many countries/industries/country-industry pairs, while it does not hold for many.

This raises our research question, **"What can explain the puzzle?"**

We consider **vertical specialization**, or **GVC participation**, and **GVC position (up/downstreamness)**, focusing on the country-industry level.
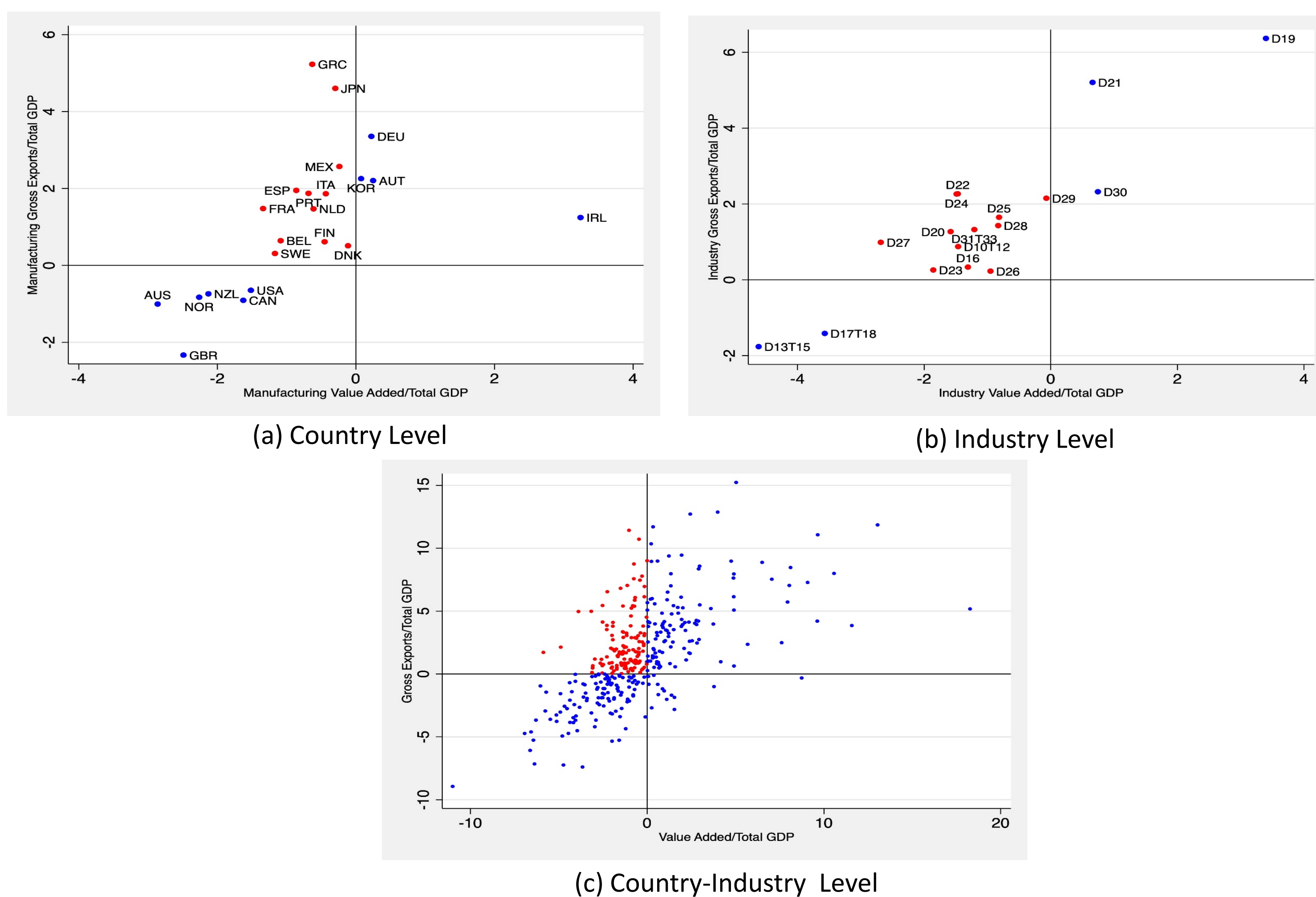

(a) Country Level

(b) Industry Level

(c) Country-Industry Level

Figure 1. Average Annual Changes of Value Added and Gross Exports.

2. Regression Specifications

The main independent variables
(1) GVC **backward** linkage ($FVAsh_{ij}$):

$$FVAsh_{ij} = 1 - \frac{Exgrddc_{ij}}{Exgr_{ij}}$$

where $Exgrddc_{ij}$ is the direct domestic industry value added content of gross exports of industry j from country i and $Exgr_{ij}$ is the gross exports.
(2) GVC **forward** linkage ($DVAFXsh_{ij}$):

$$DVAFXsh_{ij} = \frac{Dvafx_{ij}}{Exgr_{ij}}$$

where $Dvafx_{ij}$ is the domestic value added in gross exports of industry j from country i that are further re-exported to third countries.
(3) GVC position (**upstreamness**) ($GVCPO_{ij}$):

$$GVCPO_{ij} = \frac{DVAFXsh_{ij}}{FVAsh_{ij}}$$

The regression equation

$$Ex_{ijt} \text{ or } VA_{ijt} = \alpha_0 + \alpha_1 X_{ijt} + \alpha_2 EC_{ijt} + \lambda_{ij} + \theta_{it} + \eta_{jt} + \varepsilon_{ijt}$$

where
Ex_{ijt} is the gross exports/GDP ratio of industry j in country i in year t;
VA_{ijt} is the value added/GDP ratio;
X_{ijt} is $FVAsh_{ijt}$, $DVAFXsh_{ijt}$ or $GVCPO_{ijt}$;
EC_{ijt} is the Chinese export competition defined by

$$EC_{ijt} = \frac{Ex_{cjt}}{\sum_{k \neq i} Ex_{kjt}}$$

where Ex_{cjt} is gross exports from China in industry j in year t and $\sum_{k \neq i} Ex_{kjt}$ is the world gross exports except gross exports from country i.

3. Data

The 2021 release of OECD **Trade in Value-Added (TiVA)** database, which covers the years 1995 to 2018.

To be consistent with Bergoeing et al. (2004), we focus on 22 OECD countries and 17 manuf. industries.

4. Results

Tables 1 and 2 show:
(1) $FVAsh$: The GVC **backward** linkage significantly increases gross exports and decreases value added at the country-industry level.

(2) $DVAFXsh$: The GVC **forward** linkage has the opposite effects.

(3) $GVCPO$: **Less upstreamness**, that is, more downstreamness also significantly increases gross exports and decreases value added.

Table 1. Gross Exports and GVC.

	Gross Exports		
FVAsh	0.009** (0.004)		
DVAFXsh		-0.014*** (0.002)	
GVCPO			-0.005*** (0.010)
EC	0.951*** (0.008)	0.929*** (0.084)	0.940*** (0.084)
Observations	7,854	7,854	7,854
R-squared	0.909	0.909	0.909

Table 2. Value Added and GVC.

	Value Added		
FVAsh	-0.025*** (0.002)		
DVAFXsh		0.010*** (0.001)	
GVCPO			0.006**** (0.001)
EC	0.335*** (0.053)	0.360*** (0.055)	0.355*** (0.055)
Observations	7,854	7,854	7,854
R-squared	0.938	0.931	0.932

Note: All regressions control for country-industry FE, country-year FE, and industry-year FE.

5. Discussion

Intuitive explanations for the results
(1) The greater GVC **backward** linkage is compatible with the increase in gross exports and the decrease in value added:

$$FVAsh_{ij} \uparrow = 1 - \frac{Exgrddc_{ij} \downarrow}{Exgr_{ij} \uparrow}$$

Example: *From domestic to* **backward**
Domestic: Country 1's industry j produced inputs and assembled them in country 1 and sold the finished products (= inputs + assembly) to the domestic market.
Backward: Country 1's industry j now imports inputs from country 2 and assembles them in country 1 and exports the finished products.
➔ It is possible that value added ↓ and gross exports ↑ in country 1.

(2) The greater GVC **forward** linkage is compatible with the decrease in gross exports and the increase in value added:

$$DVAFXsh_{ij} \uparrow = \frac{Dvafx_{ij} \uparrow}{Exgr_{ij} \downarrow}$$

Example: *From backward to forward*
Backward: Country 1's industry j imported inputs and assembled them in country 1 and exported the finished products.
Forward: Country 1's industry j now produces inputs in country 1 and exports them to country 2, and country 2 assembles them and exports the finished products.
➔ It is possible that value added ↑ and gross exports ↓ in country 1.

(3) A country-industry pair is on the **less-upstream** (more-downstream) stage ➔ the **forward** GVC linkage is smaller and the **backward** GVC linkage is greater.

6. Conclusions

The GVC **backward** linkage and **less upstreamness** (more downstreamness) contribute to the puzzle, supporting the prediction by Bergoeing et al. (2004). We, however, must be careful that the two measures of vertical specialization, the GVC **backward** and **forward** linkages, have the opposite effects.

Next steps
(1) Show how much important the GVC **backward** linkage and **less upstreamness** are for the puzzle compared with other factors that can contribute to the puzzle.

(2) Investigate whether changes in the degree of the GVC **backward** linkage and the degree of **upstreamness** can explain the fact that some countries have changed from the puzzle country to the non-puzzle country.

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