The Value Added-Exports Puzzle and Global Value Chains

Zhe Chen, Ph.D.1  Yoshinori Kurokawa, Ph.D.2
1University of International Business and Economics  2University of Tsukuba

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 (upstream/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 (upstream/downstreamness), focusing on the country-industry level.

2. Regression Specifications

The main independent variables

(1) GVC backward linkage (FVAshij):

\[ FVAsh_{ij} = \frac{Exgr_{ij} \Delta dCc_{ij}}{Exgr_{ij}} \]

where \( Exgr_{ij} \Delta dCc_{ij} \) 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 (DVAFXshij):

\[ DVAFXsh_{ij} = \frac{Dvaf_{xij}}{Exgr_{ij}} \]

where \( Dvaf_{xij} \) 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) (GVCPOij):

\[ GVCPO_{ij} = \frac{DVAFXsh_{ij}}{FVAsh_{ij}} \]

The regression equation

\[ E_{xij} = \alpha_{0} + \alpha_{1}X_{ij} + \alpha_{2}E_{ij} + \lambda_{t} + \eta_{ij} + \varepsilon_{ij} \]

where \( E_{xij} \) is the gross exports/GDP ratio of industry \( j \) in country \( i \) in year \( t \); \( X_{ij} \) is the value added/GDP ratio; \( E_{ij} \) is the Chinese export competition defined by

\[ EC_{ij} = \sum_{k} W_{ik} Exk_{ij} \]

where \( Exk_{ij} \) is gross exports from China in industry \( k \) in year \( t \) and \( \sum_{k} Exk_{ij} \) 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

Table 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>
<thead>
<tr>
<th>Table 1. Gross Exports and GVC.</th>
<th>Table 2. Value Added and GVC.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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:

\[ FVAsh_{ij} \uparrow \quad \text{and} \quad E_{ij} \downarrow \]

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.

\[ \Rightarrow \text{It is possible that value added} \downarrow \text{and gross exports} \uparrow \text{in country} \ 1. \]

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

\[ DVAFXsh_{ij} \downarrow \]

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.

\[ \Rightarrow \text{It is possible that value added} \uparrow \text{and gross exports} \downarrow \text{in country} \ 1. \]

(3) A country-industry pair is on the less-upstream (more-downstream) stage \( \Rightarrow \text{the forward} \) 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.

<Yoshinori Kurokawa> Email: kurokawa.yoshi@gmail.com
Website: https://sites.google.com/site/kurokawayoshi/