

## Value-added Exports Through the Development Path

Cecilia Plottier (University of Groningen, Netherlands)

Paper Prepared for the IARIW 33<sup>rd</sup> General Conference

Rotterdam, the Netherlands, August 24-30, 2014

Second Poster Session

Time: Thursday, August 28, Late Afternoon

# Value added exports through the development path

Cecilia Plottier

PhD Student, Global Economics and Management Department, University of Groningen Department of Economics, Universidad Católica del Uruguay

August 2014

### This is a first draft of work in progress. Please do not quote.

### Abstract

This paper explores the evolution of sectorial concentration of value added exports and gross exports through the development path. Using global input-output data from the World Input Output Database, for 39 develop and developing economies between 1995 and 2011 we found that gross exports are more concentrated than value added exports, and that only value added exports follow a U-pattern in relation to the level of income per capita. As countries grow, the local value added embodied in consumption abroad diversifies, although this relation is non monotonic. This result is similar to the findings of Imbs and Wacziarg (2003) for sectorial value added and employment.

#### 1. Introduction

In this paper we provide new empirical evidence on the evolution of sectorial concentration of trade through the development path. In particular, we focus on the evolution of the concentration of value added exports. Analyzing the link between sectorial concentration in production (value added and employment) and income per capita, Imbs and Wacziarg (2003) showed that economies diversify over most of their development path and they start to specialize only at high-income levels. This result motivated literature that studied that relationship in terms of trade, and they found the same U-pattern between exports' concentration and economic growth (Klinger and Lederman, 2006; Parteka, 2007; Cadot et al, 2011; Klinger and Lederman, 2011). This study contributes to expand the understanding of this relationship, analyzing the evolution of value added exports' concentration through the development path. With the increasing fragmentation of production in global value chains countries' gross exports do not necessarily reflect their sectorial specialization in terms of value added or employment. For instance, exporting high tech goods does not imply that producing these goods required high skilled labor (Lederman and Maloney, 2012). Therefore, we want to identify the diversification pattern of value added exports through the development process and compare its evolution with the one from gross exports, calculating both figures using the same data source and sectorial aggregation.

#### 2. Data and measurement

To improve the analysis of sectorial diversification of trade we calculate the concentration indices using value added exports, i.e. the gross domestic product that was generated in a country-sector that is embodied in final consumption abroad. Using value added exports we take into account the whole productive structure of countries, because we use value added data instead of trade data, and calculating the amount of GDP that is embodied in consumption abroad we identify the effect of international integration in the process of value creation within a country.

Following literature that analysis trade in value added in a multilateral setting (Johnson and Noguera, 2012a, 2012b; Baldwin and López-González, 2013; Foster et al., 2013; Koopman et al., 2014) we calculate value added exports using a global input-output model. We base our analysis on the World Input Output Database (WIOD), which provides information about exchanges of intermediate inputs and goods for final consumption for 35 sectors in 40 countries, between 1995 and 2011. The sectorial aggregation level, which includes all sections of NACE and some divisions at 2 digit levels (i.e. all manufacturing industries, sales and retail, real state activities, air transport), is similar to the one used in the seminal work by Imbs and Wacziarg (2003).

We calculate the concentration indices of trade using value added exports and gross exports per sector for every country-year pair. We use the Gini and a Herfindahl Index, both commonly applied in the field (Imbs and Wacziarg, 2003; Cadot et al, 2011; Klinger and Lederman, 2011). To assess the robustness of the results we calculate some additional indices proposed in Imbs and Wacziarg (2003): the coefficient of variation, the max-min spread, the mean-median spread and the biggest share. The correlation between these measures is high and follows the same patterns showed by Imbs and Wacziarg (2003). Taking the high correlation into account and the fact that indices using the entire distribution are better measures of dispersion than the ones that rely only

on two points of it, we perform our study based on the Gini and Herfindahl indices.

Value Added Exports	Gini	HHI	Coefvar	Max- min	Mean- Median	Biggest
Gini	1,000					
HHI	0,832	1,000				
Coefvar	0,905	0,981	1,000			
Max-min	0,789	0,951	0,961	1,000		
Mean-Median	0,915	0,704	0,788	0,668	1,000	
Biggest	0,792	0,951	0,961	0,999	0,670	1,000
Gross Exports	Gini	HHI	Coefvar	Max- min	Mean- Median	Biggest
Gini	1,000					
HHI	0,764	1,000				
Coefvar	0,854	0,977	1,000			
Max-min	0,739	0,957	0,970	1,000		
Mean-Median	0,901	0,608	0,704	0,573	1,000	
Biggest	0,750	0,960	0,972	0,997	0,585	1,000

Table 1 - Correlation matrices for the sectorial concentration indices (680 observations)

Source: Author calculations using WIOD.

According to previous studies, concentration is higher in exports than in production (Cadot et al, 2013) and our results are aligned with that evidence. For the six calculated measures, sectorial concentration in gross exports is bigger than in value added exports. Additionally, the between variation is higher than the within, hence the variability of concentration degree across countries is bigger than the variation of the concentration level during the period.

Variable		Gini				HHI				
			Std.				Std.			Obs.
		Mean	Dev.	Min	Max	Mean	Dev.	Min	Max	
Value Added Exports	overall	0.530	0.080	0.368	0.773	0.073	0.033	0.041	0.259	N = 680
	between		0.077	0.398	0.726		0.030	0.045	0.208	n = 40
	within		0.025	0.452	0.648		0.014	0.016	0.186	T = 17
Gross Exports	overall	0.647	0.079	0.458	0.854	0.109	0.062	0.050	0.477	N = 680
	between		0.075	0.502	0.821		0.059	0.063	0.394	n = 40
	within		0.028	0.503	0.743		0.022	-0.030	0.252	T = 17

 Table 2 – Summary statistics of sectorial concentration, 40 countries, 1995 - 2011

Source: Author calculations using WIOD.

### 3. Analysis

Several studies analyse the relation between concentration of exports and economic growth. Ricardian trade theory and economic geography support the specialization of economies during the growth process (Imbs and Wacziarg, 2003), but empirical findings show that along the development process countries diversify their trade patterns (Cadot et al, 2011; Klinger and Lederman, 2011). Additionally, the natural resources curse literature was challenged by research showing that the concentration of exports is what negatively affects growth, and not the kind of products a country exports (Lederman and Maloney, 2007). This result supported policies that

foster exports' diversification in medium and low-income countries, which are the ones with less diversified export structures (Klinger and Lederman, 2011; Cadot et al, 2013; Parteka and Tamberi, 2013a).

Recent research that studies the link between trade concentration and economic growth is based on the export of goods. Considering the increasing international fragmentation of the production processes and its growing complexity, we think that it is important to identify the concentration of the activities that a country is performing in order to satisfy its external demand. Using value added exports we identify the income generated at a local level to satisfy an external demand, therefore we expand previous analysis going beyond goods and including services and intermediate linkages at all industry levels.

To illustrate the development process we calculate the evolution of the yearly GDP per capita, using the real GDP at constant 2005 national prices from the Penn World Tables 8.0. The sample includes 39 developed and developing countries included in WIOD<sup>1</sup>. A scatterplot graph<sup>2</sup> of concentration indices provides some evidence of a U-shape of value added exports but we do not find signs of this kind of evolution in gross exports.



Graphic 1 – Value Added Exports: concentration indices and income per capita

Source: Author calculations using WIOD and Penn World Tables 8.0

<sup>&</sup>lt;sup>1</sup> Australia, Austria, Belgium, Bulgaria, Brazil, Canada, China, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, India, Indonesia, Ireland, Italy, Japan, Korea, Latvia, Lithuania, Malta, Mexico, Netherlands, Poland, Portugal, Romania, Russia, Slovak Republic, Slovenia, Spain, Sweden, Taiwan, Turkey, United Kingdom, United States. Because it is an outlier, we exclude Luxembourg for the analysis.

<sup>&</sup>lt;sup>2</sup> We find similar shapes for the control concentration indices.



Graphic 2 – Gross Exports: concentration indices and income per capita

Source: Author calculations using WIOD and Penn World Tables 8.0

As a first estimation strategy we assume a quadratic model and regress the concentration indices to income levels. To control for country-specific factors that could affect the process of concentration of trade, like factor endowments, idiosyncratic risks to invest in new activities, size or geographical characteristics, we estimate a panel with country fixed effects. We found significative coefficients to income per capita and its square, which means that value added exports diversify over most of the growth path and to a certain point they start to specialize again. This result is similar to the findings for value added and employment by Imbs and Wacziarg (2003).

	Value Adde	d Exports	Gross Exports			
	Gini	HHI	Gini	HHI		
GPD per						
capita	-0.629**	-0.248*	0.04	0.008		
	(0.183)	(0.102)	(0.176)	(0.156)		
GDP per						
capita <sup>2</sup>	0.036***	0.015*	-0.001	0.001		
	(0.01)	(0.006)	(0.01)	(0.009)		
_cons	3.203***	1.093*	0.321	-0.074		
	(0.855)	(0.465)	(0.799)	(0.705)		
N	663	663	663	663		
r2_a	0.205	0.152	0.023	0.049		

Table 3 – Estimation results, fixed effects (39 countries, 1995-2011)

GDP per capita is in logarithms.

Standard errors in parentheses. Significance levels: \* p<0.05; \*\*p<0.01; \*\*\* p<0.001 Source: Author calculations using WIOD and Penn World Tables 8.0

However, our sectorial gross exports data does not follow a quadratic model. The reasons of these differences need further study, but up to this point we can think of some hypothesis. On the

one hand, we calculated gross exports on a sectorial level based on input-output tables, adding the final intermediates that are directly used abroad and the final consumption demand from abroad. We use a sectorial de-aggregation and include the external consumption of goods and services. In this sense, the approach taken is completely different as the one commonly used in the literature and so the results do not have to be similar. Previous research is focused on the exports of goods and diversification is analysed in the intensive and extensive margin, showing that diversification occurs especially at the extensive margin, mostly early in the development process, and exports start to re-concentrate at high-income levels (above PPP \$25,000) (Cadot et al, 2011). It is possible that countries stopped to diversify their exports' basket at some point, but there is no respecialization in terms of sectorial gross exports, at least at the level of de-aggregation that we can identify. On the other hand, Parteka and Tamberi (2013b) showed that a majority of countries tend to diversify exports and imports as they develop and that re-specialisation is related only to some specific countries, providing evidence to support the models of 'love-for-variety'. In this sense, they provide some challenging results to the re-concentration side of the U-shape in exports diversification of goods.

Finally, it is worth thinking about the different pattern founded in gross exports and value added exports. According to our results, gross exports are more concentrated than value added exports and value added exports follow a U-pattern through the development path that gross exports do not. We are working on the identification of these differences and their implications for the better understanding of the link between diversification of trade and economic growth.

### 4. Conclusions

To the best of our knowledge this is the first attempt to explore the evolution of value added exports through the development path. Seminal work by Imbs and Wacziarg (2003) showed that countries diversify value added and employment during the development process. We added a trade component to this result, focusing on the activities that are developed on a local level to satisfy external demand. We showed that during the growth process countries expand the activities devoted to trade and at certain income level they start to specialize again. These results expand the literature of trade concentration and growth, which is commonly performed with data at a product level and analyses diversification in terms of the intensive and extensive margin. Our results provide valuable insights for the understanding of the evolution of production and trade in the development process.

### 5. References

Baldwin, R. and Lopez-Gonzalez, J. (2013). Supply-Chain Trade: A Portrait of Global Patterns and Several Testable Hypotheses. NBER Working Paper 18957, NBER, Cambridge MA.

Cadot, O., Carre're, C. and Strauss-Kahn, V. (2011). Export diversification: what's behind the hump? *Review of Economics and Statistics*, 93(2), 590–605.

Cadot, O., Carre're, C. and Strauss-Kahn, V. (2013). Trade diversification, income and growth: What do we know? *Journal of Economic Surveys*, 27(4), 790-812.

Foster, N., Stehrer, R and Timmer, M. (2013). International Fragmentation of Production, Trade and Growth: Impacts and Prospects for EU Member States. Research Report 387, The Vienna Institute for International Economic Studies.

Imbs, J. and Wacziarg, R. (2003). Stages of diversification. *American Economic Review*, 93, 63–86.

Johnson, R. and Noguera, G. (2012a). Accounting for Intermediates: Production Sharing and Trade in Value Added. *Journal of International Economics*, 86(2), 224-236.

Johnson, R. and Noguera, G. (2012b). Fragmentation and Trade in Value Added over Four Decades. NBER Working Paper 18186.

Klinger, B. and Lederman, D. (2006). Diversification, innovation, and imitation inside the global technology frontier, World Bank Policy Research Working Paper #3872, The World Bank.

Klinger, B. and Lederman, D. (2011). Export discoveries, diversification and barriers to entry. *Economic Systems*, 35(1), 64-83.

Koopman, Robert, Zhi Wang and Shang-Jin Wei (2014). Tracing Value-Added and Double Counting in Gross Exports. *American Economic Review*, 104, 459-494.

Lederman, D. and Maloney, W. (2007). Trade structure and growth. In D. Lederman and W. Maloney, (eds), *Natural Resources: Neither Curse Nor Destiny*. Washington, DC: The World Bank.

Lederman, D. and Maloney, W. (2012). *Does what you export matters? In search of empirical guidance for industrial policies.* The World Bank, Washington DC, United States.

Parteka, A. (2007). Employment and export specialization patterns versus GDP per capita performance: unifying approach. Working Paper #302, Universita Politecnica delle March.

Parteka, A. and Tamberi, M. (2013a). What Determines Export Diversification in the Development Process? Empirical Assessment. *The World Economy*, 36(6), 807-826.

Parteka, A. and Tamberi, M. (2013b). Product diversification, relative specialisation and economic development: Import–export analysis. *Journal of Macroeconomics* 38,121-135.