Demand Shocks and the Dynamics of Comparaive Advantage

Mémoire réalisé par
Daniele Verdini

Promoteur(s)
Prof. Gonzague Vannoorenberghe

Lecteur(s)
Prof. Florian Mayneris

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Ecole d'économie de Louvain/UCL • Place Montesquieu 3 • 1348 Louvain-la-Neuve
Département des Sciences économiques/UNamur • Rempart de la Vierge 8 • 5000 Namur

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Chapter 1

Introduction

This thesis empirically investigates the role that international demand-driven shocks have in the shifts of countries' export advantages. In a world which is the more and more intertwined and complex, globalization presents serious challenges to be faced by both developed and developing countries. As Rodrik (1997) highlights, countries that open their economies to the world market become exposed to external sources of risks that might have significant negative effects on both their domestic income and consumption.

Economic risk, as further discussed by Rodrik (1998), is directly linked with the incentives globalization gives in shaping the production structure of a country. In other words, even though domestic economic integration with foreign markets reduces the exposure to internal sources of risk, it creates the conditions for the domestic industries to reshuffle to take advantage of the new opportunities coming from these markets. Theory suggests that following a process of integration with external markets, resulting patterns of specialization are more concentrated, since firms narrow their production to a small baskets of those goods on which they have a productivity advantage. This reduction in the diversification of production makes domestic industries more vulnerable to external shocks, hence generating greater macroeconomic volatility.

Di Giovanni and Levchenko (2009), using firm-level panel data of manufacturing production, examine the relation between trade openness and output volatility. Their findings are in line with Rodrik's ones: if on the one hand openness reduces the correlation between growth in a certain sector and the aggregate growth within the economy, on the other hand, sectors that are more connected internationally tend to feature a higher volatility and a greater degree of product specialization. Overall, the latter effects dominate the first one, hence there is no trade-off between economic openness and macroeconomic volatility, furthermore evidences show that over time such effect tend to magnifies, suggesting that trade became an increasingly important transmission mechanism of shocks in the world economy.

Nonetheless, the role of industry specialization is pivotal inasmuch it guarantees to gain from trade, as clearly predicted by the classic Ricardian theory of trade. A recent literature, starting with Eaton and Kortum (2002) (EK hereafter), put the comparative advantage explanation of trade flows again at the center of the inquiry. Understanding how comparative advantages change over time becomes therefore crucial, because from them depend how the gainer and the losers from international trade are determined.

As Hanson et al. (2016) document, comparative advantage are far from being stable over time. Conversely, their paper show two important characteristics of countries' export: first, countries tend to concentrate exports in a few sectors, second there is a considerably high turnover in industry export advantage, meaning that top exporters in a country tend to vary permanently over time. These shifts are determined by likewise shifts in a country's comparative advantage, and can be either long-term trends of broad sectors reallocation or fast pace reshuffles concerning particular products. To cite a couple of examples, the North-South reallocation of textile production has been at play since the early '90s, and it can therefore be ascribed to the former case; while the rise and demise of mobile phone production in Finland had completely different characteristics, more in line with the latter case.

The aim of this paper is to complement the work of Hanson et al. (2016) by documenting the effects that external demand shocks exert on the evolution of countries' export capability. The literature identifies many theoretical channels that can account for shifts in comparative advantages, however the present analysis will rely solely on trade data, without imposing strong structural assumptions, so that to characterize the general empirical features of such a dynamic. Following Hanson et al. (2016) a gravity model of trade will be implemented to estimate two specific parameters, from the latter both a measure of countries' export capability and a measure of countries' demand component will be constructed.

As amply discussed in Head and Mayer (2013), the gravity model of trade is an empirical specification encompassing a wide rage of international trade models. Structural gravity arises from an equilibrium condition in which the determinants of industry-year bilateral flows can be decomposed into three general components: a first term identifying the country's capability to export in that industry, a second term identifying the effective demand coming from that country for goods produced in the same industry, and a third term accounting for the accessibility of the importer to the good produced by the exporter. To account for these different components a fixed-effect estimation of the gravity model is adopted.

This paper relates mainly, as previously mentioned, to the empirical literature generating from the work by EK (2002). Costinot et al. (2012), building on EK (2002) to allow for a multi-country, multi-industry model, find strong evidences that productivity differentials are at the core of the manifested patterns of trade, however the focus is on the cross-section property of trade data. Hanson et al. (2016), relying on the theoretical background developed by Costinot et al. (2012), at first retrieve empirically a measure of countries comparative advantage, at second characterize a stochastic distribution able to rationalize the comparative advantage dynamics of the sample consider. The result is that such a dynamics can be quiet well approximated by a continuous-time Ornstein-Uhlenbeck process.

Results show that external demand shocks elicit a reduction in the firms' capability to export. This effect is stable across many identification strategies and can be linked to the presence of diseconomies of scale:firms in industries exposed to foreign demand shocks face short-run capacity constraints leading to increases in the costs of production and subsequently losses in terms of overall industry productivity.

Chapter 2 presents and describes the different sources of data and the empirical methodology, chapter 3 reports and explains the results, moreover it discuss potential extensions to the methodology adopted. Eventually, chapter 4 concludes.

Chapter 2

Data and Methodology

2.1 Data

Data for the analysis is retrieved by different sources: the United Nation Statistics Division Database on Commodity Trade (Comtrade) provides bilateral trade flows based on SITC revision 2 two-digits industries for the period between 1984 and 2007. A consistent set of countries is created by including those country-industries for which trade flows exceed a certain threshold, and aggregating those that unite over the sample period or those for which trade data are kept separated[1].

A set of restrictions is introduced in order to properly estimate importer and exporter fixed effects. First, it is required that destination countries import a product in all years, so that coefficients on exporting-industries dummies are comparable over time. Second, it is necessary to consider only exporters shipping to overlapping groups of importing countries, by doing so it is assured that all importer and exporter fixed effects are separately identified, as shown by Abowd et al. (2002). Combined, these restrictions leave 104 exporters, 55 importers, and 66 industries, which are all list in Appendix B. This one is the sample used to estimate the gravity equation.

Data for gravity control variables are retrieved by CEPII.org and consists of a set of dummy pair variables on the contiguity of the countries, the share of a common language and the existence of a colonial relationship. Egger and Larch (2007) provides data on regional trade agreements (RTA, hereafter) for the period from 1950 to 2015. In such

[1] These countries are West and East Germany, Belgium and Luxembourg, North and South Yemen, and Panama.

database RTAs are defined according to four different, not mutually exclusive, classes: free trade agreements (FTA), customs unions (CU), economic integration agreements (EIA), and partial scope agreement (PS), however the subsequent gravity trade estimation will take into account only the existence of any of these different agreements between two countries. In Appendix A are reported and explained all the codes used to properly take into account the restriction considered, and the merge of the datasets taken from the different sources, along with the econometric estimation procedures adopted hereafter.

2.2 Gravity Model of Trade

Following Hanson et al. (2016), the gravity model structure adopted to consistently estimate the exporter and importer fixed effects is one relying on the standard OLS, and hence the log-linearization of the variables of interest. What is estimated is the following equation:

$$lnX_{isdt} = k_{ist} + m_{idt} + r'_{sdt} b_{it} + v_{isdt} \tag{2.1}$$

where subscripts i refers to the two-digit industry, s to the source country, d to the destination country, and t to time. The bilateral industry-year trade flow, lnX_{isdt}, is therefore explained by a dummy for the exporter-industry-year fixed-effect, k_{ist}, by a dummy for the importer-industry-year fixed-effect, m_{idt}, and by a set of determinants of the bilateral trade costs, r'_{sdt}, with v_{isdt} being the residual of the estimation[2].

Due to collinearity problems, importer and exporter fixed effects are identified up to an industry-year normalization. To correct for this, it is possible to re-express the export capability, k_{ist}, and the effective demand, m_{idt}, as deviations from their global industry mean, hence obtaining cross-country comparable measures of the two. The global industry mean takes the following form: $\frac{1}{\alpha}\sum_{x=1}^{\alpha} k_{ixt}^{OLS}$, with $\alpha \in \{S, M\}$, where S refers to the number of source countries, while M to the number of destination countries. Therefore,

[2] Bilateral trade costs include dummy variables indicating the presence between country s and country d of a border, a common shared first and second language, a colonial past, a common colonizer, a preferential trade agreement, and the natural logarithm of the countries distance. For further details refer to Mayer and Zignago (2011).

we can define:

$$A_{ist} = \frac{exp(k_{ist}^{OLS})}{exp(\frac{1}{S}\sum_{\zeta=1}^{S} k_{i\zeta t}^{OLS})} \tag{2.2}$$

and:

$$D_{idt} = \frac{exp(m_{ist}^{OLS})}{exp(\frac{1}{M}\sum_{\xi=1}^{M} k_{i\xi t}^{OLS})} \tag{2.3}$$

By normalizing using the exponential function, A_{ist} becomes a measure of the *absolute advantage* of a country s in the industry i. The idea is that when A_{ist} increases, either because k_{ist} increases or the global industry mean decreases, country s becomes relatively more capable to export products in the industry i. At the same time, this measure cannot define the comparative advantage of a country s in industry i because it is not informative about the relative capability to export of a country in industry i with respect to a different industry $j \neq i$.

It is possible to relate the absolute advantage measure, A_{ist}, to a measure of *comparative advantage* of a country. To make the point clear, let's consider the fact that absolute advantage is a predictor of the industry export of a country towards all the other, net the effects of trade costs and of the proximity to market demand. We can express this relation as follows:

$$ln\bar{X}_{is} \equiv k_{is} + \frac{1}{M}\sum_{d=1}^{M} m_{id} - \frac{1}{M}\sum_{d=1}^{M} \tau_{isd} \tag{2.4}$$

with τ_{isd} broadly defining the structure of trade costs faced by country s to export to country d in industry i. Country s has a comparative advantage over country ζ in industry i relative to industry j if the following condition holds:

$$\frac{\bar{X}_{is}/\bar{X}_{i\zeta}}{\bar{X}_{js}/\bar{X}_{j\zeta}} = \frac{A_{is}/A_{i\zeta}}{A_{js}/A_{j\zeta}} > 1 \tag{2.5}$$

However, this double comparison becomes difficult to manage in a framework with many countries and many industries. To keep the analysis simple, therefore, only the within-industry dimension, A_{ist}, will be used as the response variable in the main identification strategy. It must be noted that assuming a common industry trend over time allows to consider the absolute advantage as a good predictor of the comparative advantage.

The second variable of interest, D_{idt}, measures the intensity of the demand from country d for the products in industry i at time t. In other words, D_{idt} represents an importer-industry-year demand shock, which can be used as an explanatory variable for the absolute advantage variable A_{ist}.

2.3 Econometric Model

In order to pinpoint the direct effect of demand shocks on the absolute advantage measure, it is necessary to take into account the correct foreign demand of d addressed by the exporting country s. Following Berman et al. (2015), it is possible to construct a measure of the effective foreign demand, EFD_{isdt}, faced by country s from country d in industry i at the beginning of the period t. Such a measure is constructed by weighting the demand shock D_{idt} by the share of each destination-industry in the source country's total export at the beginning of the period t:

$$EFD_{ist} = \omega_{isdt} D_{idt} \tag{2.6}$$

$$\omega_{isdt} = \frac{X_{isdt}}{\sum_{d=1}^{M} X_{isdt}} \tag{2.7}$$

The reason behind the choice of the beginning of the period of effective foreign demand lies on the fact that the estimation strategy that will be adopted has to take into account either the simple OLS specification and the long-difference one. In particular it will be considered the effect of EFD_{isdt} on same-period level of A_{ist} , and on the percentage changes of subsequent three years and five years ΔA_{ist}. Formally, the main empirical estimation strategies are:

$$A_{ist} = \beta_1 EFD_{ist} + \upsilon_{ist} \tag{2.8}$$

$$\Delta A_{ist} = \gamma_1 EFD_{ist} + \zeta_{ist} \tag{2.9}$$

The idea at the core of such specification is to assess whether changes in comparative advantage due to demand shocks are followed by a return to the mean, or rather are permanent. The theoretical justification of these two different scenarios has the role of firm-level economies of scale at its basis, in fact if the latter play a significant role within an industry, we should expect the demand shock to have permanent, and therefore medium- and long-run effects, on the comparative advantage of the country in such an industry. Conversely, if the role of economies of scale is negligible, any short term effect due to the demand shock should be reabsorbed.

Chapter 3

Results and Extensions

Summary statistics of the variables are presented in Table 3.1. The distribution of the absolute advantage variables features a non negligible right skewness, which is driven by the presence of several outliers. These values are the results of sudden expansions and contractions of the flows of trade, especially between developing countries and developed countries. In order to avoid a bias in the estimation, the latter will be carried out on a sub-sample that exclude the presence of such values.

Table 3.1: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.
A_{ist}	130.88	778	4e-08	31795
$\Delta_{t+2}\, A_{ist}$	29.06	5189	-0.99	1150178
$\Delta_{t+4}\, A_{ist}$	2.58	326	-538.42	343231
D_{idt}	7.24	34.35	4e-05	2064
EFD_{idt}	1.10	14.57	5.12e-13	2059

Table 3.2 presents summary statistics after excluding the first and the last centile of the distribution of A_{ist}.

Table 3.2: Summary statistics

Variable	Mean	Std. Dev.	Min.	Max.
A_{ist}	67.45	197.75	0.02	2246.834
$\Delta_{t+2}\, A_{ist}$	0.23	0.67	-1	6.53
$\Delta_{t+4}\, A_{ist}$	0.39	0.921	-70.171	6.90
D_{idt}	6.84	29.23	4e-05	1135.15
EFD_{idt}	1.04	13.22	2.94e-12	1112.22

Table 3.3 presents results, adopting the main specification previously discussed.

Table 3.3: **Effective Foreign Demand on Absolute Advantage Level and Long Changes**

	Dependent variable:		
	A_{ist}	$\Delta_3 A_{ist}$	$\Delta_5 A_{ist}$
EFD_{ist}	-8.35^{***}	-0.06^{***}	1.91
	(0.202)	(0.0008)	(1.62)
Constant	54.61	0.006	4.81
	(0.900)	(0.163)	(0.379)
Observations	1,759,584	1,556,776	543,736
R^2	0.355	0.365	0.424
Adjusted R^2	0.0008	0.0007	0.0008
Note:			*p<0.1; **p<0.05; ***p<0.01

There are two main aspects arising from the resulting estimation: first, positive demand shocks are correlated with simultaneously deterioration of absolute advantage; second, this effect it is persistent in the short run. This results is robust to a series of specifications including importer, exporter, two-digit industry, and year fixed effects, moreover to a further sub-sampling aimed at balancing the panel database.

The effect is non-negligible, in fact a standard deviation change in the effective foreign demand produces a decrease on the absolute advantage in the same year by a half of a standard deviation. These results seem to run against the hypothesis that firms are able to take advantage of the favorable demand conditions arising in foreign markets. However, a recent body literature (Vannoorenberghe, 2011; Berman et al., 2015) has shown how firms facing convex costs in the short-run, need to reshuffle production in order to properly address the home and the foreign demand. A possible explanation of such a result, hence, can be attributed to the presence of diseconomies of scale, along with the firms' propensity to undergo short-run cost increments to acquire the share of foreign demand. As discussed by Hanson et al. (2016), the exporter capability measure theoretically based on the model by Eaton and Kortum (2002) is related to the country-industry productivity and the country's unit production cost, and there are evidences that positive export shocks lead to increases in the sources of such production costs (*e.g.* Hummels et al. (2010) assess increases in employment and wages in Danish industries following a foreign demand shock).

Hereafter, two possible extensions of the empirical specification will be considered. The analysis developed hitherto relies on the OLS identification strategy, however the linear regression specification is inconsistent with the presence of zeros in bilateral trade flows. A possible solution to the shortcomings of this approach, presented in the recent empirical trade literature (Head and Mayer, 2013), is to adopt Poisson Pseudo-Maximum-Likelihood to estimate the model coefficients. This method, stemming from the work by Silva and Tenreyro (2006), deals with the presence of zeros, by loosening the constraint requiring to log-linearize the model, moreover, it is robust to the presence of heteroskedasticity of the error term. Such biases are present both in the traditional specification than in the one augmented with country-specific fixed effects. Furthermore, as shown by Fally (2015), Poisson Pseudo-maximum-likelihood estimated by mean of country-specific fixed effects is consistent with the structural approach developed by Anderson and van Wincoop (2003), which consider the multilateral resistance terms as long as data are consistent. Therefore, in a future extension, employing Poisson-PML estimation might be used as a robustness check in order to assess the validity of the results previously determined.

A second aspect to consider is to allow for a specification relying on SITC three-digits industry level trade flow. This might refine the analysis and obtain a more stable empirical relation, moreover it could be used to disentangle external and internal sources of comparative advantage, by considering the effects of the external economies of scale (Grossman and Rossi-Hansberg, 2010).

Chapter 4

Conclusion

This essay applies the identification strategy developed by Hanson et al. (2016), which exploits the gravity model of trade to retrieve country-industry-year specific measures of export capability and foreign demand proximity, in order to build an empirical model capable to identify the effects of external demand shocks on a country's export capability.

Results show that firms in those industries exposed to foreign demand shocks face short-run capacity constraints leading to increases in the costs of production and subsequently losses in terms of overall industry productivity. This mechanism can be better understood in light of a recent body literature in trade featuring short-run convex costs function of firms.

Limitations in the methodology adopted are present. There are drawbacks worth to account for when relying on a OLS specification for the empirical gravity model of trade, which are extensively discussed in Silva and Tenreyro (2006; 2011). An important extension would be to adopt the Poisson Pseudo-Maximum-Likelihood estimation, which importance is increasingly recognized in the empirical trade literature. Hanson et al. (2016) show that OLS gravity results do not different significantly from those identified by using PPML, however many recent papers, among which Fally (2015) document that under certain conditions, PPML outperform the log-linearized version.

Furthermore, such analysis will have to open the black box of firms and assess which are the main channels through which external demand shocks can have an impact. The theory identify three of them: exogenous factors, external to firms, reflecting catch-up processes or changing in the natural conditions; increasing returns to scale that are internal to the firm, following the literature developed by Krugman (1979); finally, increasing returns to scale that are external to firms, as in Redding (1999) and Melitz (2005). The reason to pursue such an inquiry is twofold: first, there is no work in the literature identifying the relative importance of these three different channels generating shifts in comparative advantages; second, to come back to the issues raised by Rodrik (1997), such an understanding would allow for drawing and implementing effective policies to reduce the volatility generated by the process of economic globalization, and the reason lays on the fact that direct government support would not be desirable not in each of the three previously mentioned cases.

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