

Internal factors and their impacts on countries' performance in Global Value Chains

Carolina Rodrigues Corrêa Ferreira¹
Victor Ramon Oliveira Moraes²

RESUMO ESTRUTURADO

Introdução: em virtude do notável e rápido crescimento dos fluxos de comércio internacional - em especial de bens intermediários (cerca de 80% do total) - advindo da globalização, faz-se necessário que o comércio seja mensurado em termos de valor adicionado e que se compreenda os impactos e as potencialidades da inserção dos países nas Cadeias Globais de valor (CGVs).

Objetivo: o presente trabalho tem como objetivo estimar quais variáveis são determinantes para geração de valor adicionado nacional nas exportações de bens manufaturados dentro das cadeias globais de valor.

Metodologia: estimou-se uma regressão não linear com dados em painel através do Poisson Pseudo Maximum Likelihood (PPML). Utilizou-se dados de valor adicionado doméstico (VAD) nas exportações, para o setor de bens manufaturados, da base Trade in Value Added (TiVA) da OECD (2020), para os anos de 2005 a 2015. Também foram coletados dados para representar as condições internas dos países que afetam sua participação nas cadeias como liberdade comercial, capacidade produtiva e tecnologia, ambiente de negócios, mobilidade de capitais e eficiência logística.

Resultados e discussão: os resultados da pesquisa apontam que países que buscam uma maior agregação de valor em suas exportações devem apresentar maior liberdade comercial, mobilidade de capitais, manter um ambiente favorável para a captação de investimentos estrangeiros e investir em eficiência logística.

Conclusão: é evidente que os governos têm papel importante na ascensão e inserção dos países dentro das cadeias globais de valor, visto que com mudanças políticas e investimentos em áreas estratégicas é possível alcançar maiores retornos no comércio fragmentado. Propõe-se que mais estudos sejam realizados, analisando outras variáveis como qualificação da mão-de-obra, investimentos em pesquisa e desenvolvimento, eficiência das instituições, entre outras, pois espera-se que diferentes fatores também sejam relevantes para uma participação efetiva e vantajosa nas CGVs.

Contribuições do trabalho: este trabalho busca agregar a literatura existente, que ainda é escassa, gerando informações que servirão de instrumento para governos e policy makers tomarem decisões acerca do tema, proporcionando aos países internalizar os benefícios da participação nas CGVs.

Principais Referências:

¹ Doutora em Economia Aplicada pelo PPGEA/DER/UFV. Professora adjunta do departamento de economia da Universidade Federal de Juiz de Fora, campus Governador Valadares. Pesquisadora do Econúcleo – Estudos Socioeconômicos. E-mail: carolina.correa@ufjf.edu.br.

² Graduando em Ciências Econômicas pela Universidade Federal de Juiz de Fora, campus Governador Valadares. Pesquisador do Econúcleo – Estudos Socioeconômicos. E-mail: vi_ramon_@hotmail.com.

HERITAGE FOUNDATION. **Index of economic freedom**. Acesso disponível 19 de agosto de 2020 em: <https://www.heritage.org/index/>.

OLIVEIRA, S. E. C. **Cadeias globais de valor e os novos padrões de comércio internacional: uma análise comparada das estratégias de inserção de Brasil e Canadá**. Brasília: FUNAG, 2015.

SANTOS SILVA, J.M.C.; S.Tenreyro. 2006. The log of gravity. **The Review of Economics and Statistics**, Cambridge, 88, 4, 641-658.

TIVA. **Trade in Value Added database**. < <http://www.oecd.org/sti/ind/measuring-trade-in-value-added.htm>> Acesso em fevereiro de 2020.

Palavras Chave: Cadeias Globais de Valor; Comércio internacional; Valor Adicionado.

1. Introduction

With the constant growth of the globalization movement, stimulated mainly by the technological advancement of telecommunications and transport, there is also an evolution of international trade. Countries are increasingly interdependent, with a new form of trade emerging: the global fragmentation of production.

In this scenario, there is a complete restructuring of commercial relations, which start to divide the productive chain of goods into different phases that are carried out in many countries. Each stage is carried out in countries that have greater efficiency and specialization for the performance of the activity; this new form of organization became known as Global Value Chains (CGVs). The market for intermediate goods increased on an unprecedented scale, so that, as early as 2013, they represented 80% of the total trade between nations (OLIVEIRA, 2015).

It is evident that the alternatives for the growth of a nation become simpler and less generalist with this new form of trade organization. Hermida et al. (2016) point out that, if at other times the idea of economic progress was linked to the development of an entire industrial park, complete and diversified, which produces final goods ready to be sold, at the same time this idea becomes the specialization in stages of the production chain that the nation has a greater aptitude and a lower cost to carry it out. Chain economic growth becomes a much more plausible alternative, since in small economies there are fewer options for specialization, industrial diversification, raw materials and investments.

Global value chains have different value added for each stage of the production process, so that the countries that have better conditions, greater technological development and human capital are concentrated at both ends of the chain (planning, research and development, sales and marketing) manage to capture a greater part of the added value arising from chain production for their economies. Within CGVs, upgrading is sought in order to capture greater benefits, however, this is only possible when there is coordination between commercial policies, incentives for innovation, improvement of infrastructure and training of the workforce (ZHANG, 2014).

It is important to note that the insertion in the global value chains is positive not only for the developed countries, but also for emerging countries that are able to adapt to the new requirements of globalized international trade, advancing in the stages of GVC. However, being part of the dynamics of GVCs is a remarkably easier task for developed and industrialized countries, which normally focus on governance of the production chain. Adding value in central countries is easier due to the existing technological level, in addition to being responsible for a large part of imports of final goods (NONNENBERG, 2014).

In view of all the interdependence between countries, Oliveira (2015) points out that restrictive trade policies have adverse effects within the chain of production logic. Protectionism and barriers to trade can hinder the functioning of GVCs since, in this degree of integration between nations, the effect of decisions taken within a country reflects for all other participants in the production chain, which can increase costs and reduce agility in the processes.

Tariffs are the most traditional barriers and have the most direct impact in this context. As intermediate goods cross several borders before being finalized, cascading taxes can be incurred if every time the product crosses borders a tariff is applied. In this perspective, tariff rates have an amplifying effect on the final price, small percentages of taxation may be sufficient to substantially make the final product more expensive, so that tariff measures have

a more costly effect the greater the intensity of the country's participation in the production or export of goods. It can be seen that a globally integrated nation depends on the trade policy of a succession of countries, tariff barriers represent lower shared gains and less social welfare (OECD, 2013).

Non-tariff measures (NTMs), on the other hand, have ambiguous effects: they can be restrictive (configuring barriers) or informative (facilitating trade), as explained by Corrêa and Gomes (2018). When adopted, MNTs can sometimes prevent the sale of goods, since to meet the established requirements there must be coordination between all stages of the chain, sometimes they can be configured as an incentive to trade, because the confidence of the importer in relation to the product abroad may increase through a stricter regulation of production and sale.

Other variables are preponderant for the degree of integration of countries in global value chains. For example, logistical quality is essential since intermediate goods must be transported, distributed and tracked at all times. In this way, the quality of the media and a less costly, more efficient and less time-consuming travel is indispensable for the upgrading of nations (OECD, 2013).

Similarly, the business environment can be a facilitator or a hindrance to investments in the country. In nations where there is no great bureaucracy for opening ventures and the tax legislation is easy to understand, foreign investment is more favorable and, therefore, the deepening of added value in the stages of the production chain. According to UNCTAD (2013a), an improvement in the business environment tends to benefit more significantly the trade in intermediate goods in low and middle income countries, which are those that are relatively more deficient in this area.

When there are many barriers to free capital mobility, the country becomes less participative in the chain, considering that the generation of value within CGVs occurs through national and multinational companies, obstacles to investment, are configured as a discontinuity in the chain productive, preventing full insertion in the new global production model (UNCTAD 2013a).

Sturgeon (2013) found that commercial and industrial policies have undergone radical transformations since the 1970s. Thus, it is clear that the reduction of tariff, non-tariff and customs barriers, together with the liberalization of services and massive investment in the areas transport, infrastructure and means of communication, combined with incentives to improve the business environment and innovation are presented, at the same time, as comparative advantages for the dispute of tasks within CGVs. Specialization allows countries to focus on an activity more efficiently, allowing upgrading to become easier, considering the overflow of knowledge propagated by this new form of production.

Works such as those by Silva (2017) and Oliveira (2019) bring important findings about the fragmentation of production and participation in CGVs.

In order to assess the comparative advantages inherent to the Brazilian agribusiness sector, Silva (2017) used the hypothetical extraction methodology, with data from the World Input-Output Tables (WIOT), between 1995 and 2011. The author constructed indicators aimed at for participation in the global value chains and productive specialization and estimated the total productivity of the factors in order to identify improvements in the productivity of the countries resulting from participation in the GVCs. It was evident that the Brazilian agroindustrial sector has a great tendency towards fragmented global integration, in view of its high competitiveness and added value in the specific stage of the agroindustrial chain, therefore, the insertion in the CGVs based on this sector has economic growth potential, the comparative

advantages that Brazil has in this sector tend to generate a higher vertical specialization accompanied by gains in productivity.

In parallel, the chain pulp and paper production sector was the subject of empirical analysis in Oliveira's (2019) work. It could be inferred that, between the 1970s and the 1990s, several stages of the sector were moved from Europe and the United States towards Asian and Latin American countries, due to the great availability of raw material in forests, productivity and legislation looser environmental conditions. However, the stages shifted to these countries are those intensive in natural resources, while the central countries concentrated on stages of high added value, so that the developing countries were responsible for the majority production of cellulose and the advanced countries concentrated. in the export of the final good. These countries are home to multinationals that exercise chain governance, so they capture the greatest benefits.

Bearing in mind the importance of GVCs for the global productive dynamics, in view of the more efficient use of resources, the relevance of the trade in intermediate goods and because it constitutes an alternative of economic growth for the countries, it is essential to verify which internal factors a nation influences its participation within the chains.

Therefore, the objective of the present work is to evaluate the impact of variables such as commercial freedom (tariffs and non-tariff measures), logistical efficiency, attraction of foreign direct investments and the internal business environment affect the countries' ability to add domestic value to the exports within the chains. For this purpose, a non-linear regression will be estimated with data on domestic added value in bilateral exports of manufactured products to 64 economies available at TiVA for the years 2007, 2010, 2012 and 2014. In addition, a descriptive analysis of value added data, to allow a comparison between the sample countries.

Countries with greater commercial freedom, favorable business environment and good logistical performance are expected to perform better in the chains, characterized by a greater generation of added value. This would be due to the need that the structure of a CGV has for greater productive efficiency, speed, fluidity, lower transaction costs and greater simplicity in international commercial transactions.

Thus, the present work seeks to aggregate the existing literature, which is still scarce, generating information that will serve as an instrument for governments and policy makers to make decisions on the topic, providing countries with internalizing the benefits of participating in GCCs.

In addition to this introduction, this paper presents the theoretical framework below, where the fundamentals used in the analysis of fragmented trade are discussed. Subsequently, the methodology is presented, followed by the results found and, finally, the conclusion.

2. Theoretical framework

The intense process of international fragmentation of production allowed a greater expansion of GVCs. The integrated production and trade system was a major transformation of international trade, the organization of industry and the inter-industry relationship, representing a significant change in the world economy.

The term “global value chain” has been used to summarize the set of activities that companies and workers develop from the design of a product to its final use, including also after-sales services (GEREFFI and FERNANDEZ - STARK, 2011). According to Oliveira (2015), within this concept is the characterization of the various phases of the production process, which normally include: research and development; obtaining inputs; production;

distribution; final product marketing and after-sales services. The term “global” refers to the fact that there is a great fragmentation of these activities in different locations. The functional integration of activities is an important feature of the concept. The use of the term “value chain” instead of “production chain” explains the idea of adding value inherent to each phase carried out.

According to Flôres Jr. (2010), the fragmentation logic occurred in a radical and sophisticated way, since a specific part of the production moved to more efficient locations in different countries. When analyzing fragmentation from the perspective of production chains, it is pointed out that its phases are clearly identified and the mode of transportation within the chain is important, since the distribution of different portions of added value depends on the nation's position in the same. Therefore, fragmentation has become a necessary condition for a country to enter the flow of international trade, even though this is not a solution adopted by all nations.

The new configurations of trade, which emerged from the process of international fragmentation of production, do not yet have a consolidated theory to explain its dynamics. The traditional theory of international trade, based on comparative advantages and resource allocation, is not satisfactory to explain trade in parts and components.

With the elaboration and updating of the global input-product matrices made available by international organizations, the empirical work involving GVC has evolved. Although the number of works applied on the subject is still small, substantial advances can be seen in understanding the new market paradigms of the 21st century. Some recent studies, such as those of Silva (2017) and Oliveira (2019) mentioned earlier, have empirically shown that greater integration in GVC by countries, in general, is positive for per capita income, productivity and development.

Therefore, the efforts made to incorporate global value chains in the analysis of economic growth and commercial relations, through the databases that measure the commercial flow through the added value, focused their analyzes mainly in the sense of: mapping the position of nations in CGVs and their respective productive structures; analyze the insertion of countries in CGVs compared to other countries; assess which sectors are more prosperous and advantageous compared to competition at a fragmented level; understand how upgrading occurs within chains, and; investigate the relationship between the level of participation in the chains and economic growth (CORRÊA et al., 2019).

The analysis of global value chains occurs in different ways: from top to bottom and from bottom to top. In the first, the focus is on the leading companies and their way of organization. In the second case, the focus is on the strategies used by countries, regions or companies in order to maintain or improve their positions in value chains (GEREFFI AND FERNANDEZ-STARK, 2011).

Also according to the authors, studies on GVCs start from four aspects: 1) Structure of inputs and products: it identifies the agents and their activities along the chain, allowing an analysis of the interconnections between the phases of the production process in order to highlight the steps that most add value to the chain; 2) Geographic reach: local, national, regional and global. The geographical dispersion of global chains is a trend in fragmented international production and makes it possible to analyze the position that a country occupies in international production; 3) Governance: aims to clarify the control and coordination structure of a value chain, elucidating the participation of each of the agents involved, and; 4) Institutional context: this type of analysis considers issues such as infrastructure, legal framework, access to financial resources and specialization, availability and cost of labor and issues directly linked to local conditions.

Hummels et al. (2001) developed the VS (vertical specialization) and VS1 indices, the first representing the share of imported products incorporated in a country's exports, this index started to be used by several later works with a proxy for the degree of vertical specialization of nations. In addition, it was proposed to create the VS1 index that measures the part produced domestically that is added to imported foreign products.

The authors used the interregional input-output matrix of the OECD to examine the fluctuations in the previously mentioned indices for 10 countries from 1970 to 1990. According to the results, in this period, trade linked to GVCs represented about 30% of the total traded, while in this period vertical specialization grew by around 40%. According to the authors, this progress was due to the reduction of trade barriers, reduction of tariffs and costs of transport and services.

Mutually, a new mathematical instrument was proposed for more accurate measurement of trade, the breakdown of gross exports among other more disaggregated categories (value-added exports, value added domestically returns to the original country, foreign added value and double counting terms). In Koopman et al. (2010; 2014), seeks to improve the efforts and theoretical contributions from the VS and VS1 indices, dissociating them from double counting. The work was able to identify the added value that is captured domestically and the portion that represents the double count, taking into account, in this way, the measurement of the sale of intermediate goods in the context of GVC, allowing more appropriate and faithful estimates to the way international trade has been structured since the last few decades.

Finally, the authors propose two new fundamental indices for further work on GVCs, the GVC position, which seeks to capture the position of countries in global value chains and the GVC participation index, which aims to measure the level of countries' participation in global chains. It uses the VS and VS1 indexes, built for 26 countries in 41 different sectors, using the Global Trade Analysis Project (GTAP) database.

Johnson (2012) proposes a new index, the VAX ratio, which measures the value added in the domestic country to gross exports. The basis used by the authors was also the GTAP. In addition, they use some models with panel data for 42 countries from 1970 to 2009, seeking to identify which are the preponderant variables for determining the VAX. For this purpose, the variable trade barriers and bilateral trade agreements were taken into account. The results obtained showed that most international trade is translated into intermediate goods and that there is a very significant asymmetry between the measurement of trade through exports in gross terms and in terms of added value. Furthermore, it was found that when more trade barriers are imposed, the lower the VAX ratio becomes for that country, on the other hand, trade agreements have proved to be advantageous only when they are more superficial and proposes a softer integration, such as free trade agreements. trade. Finally, the authors argue that the distance between countries is still a major factor for trade between nations and for the index in question, with long distances deteriorating trade relations.

In order to mathematically formalize the incorporation of global value chains into an econometric model of economic growth driven by exports, Almeida (2017) includes Global Value Chains, using the WIOT and TiVA databases, in a multisectoral model of growth focused on Brazil. In this way, a direct causal relationship is established between the rate of participation in global value chains and the growth of the product per capita. Therefore, it is expected that the more countries deepen their participation in GVCs, adding more value in the production stages, the higher the growth rates. Those in the study pointed out that Brazil has possibilities for competitive insertion in sectors involving primary products and low-tech industry. Thus, investments and incentives in these sectors in order to add more value to products would be the

best way for balanced growth. On the other hand, in the medium-tech and high-tech industries, Brazil has comparative disadvantages, limiting itself to the role of supplying inputs.

As noted, there is no consolidated theory or form of analysis defined for studies on CGVs. This article seeks, starting from a bottom-up investigation, to propose a way to analyze which factors positively affect the aggregation of domestic value in exports through an econometric model. Therefore, a non-linear regression was estimated, which is discussed below.

3. Methodology

3.1 Data

Given the differentiated structure of trade in chains, the need for studies in this regard emerges. With this, the World Trade Organization (WTO) and the Organization for Economic Cooperation and Development (OECD), built the Trade in Value-Added database (TiVA, 2020), with bilateral trade flows in added value, creating an international input-product matrix. This new way of measuring international trade provides a more accurate calculation of trade flows, since the simple analysis based on the gross value of imports and exports implies the occurrence of multiple counts due to the large commercialization of intermediate goods.

In order to ascertain the effects of the specific conditions of the countries in the aggregation of value within the CGV, firstly, data on domestic added value (VAD) in exports were collected, for the manufactured goods sector, on the basis of TiVA. This base brings data from 64 countries³ for the years 2005 to 2015. VAD is separated by pairs of countries, that is, how much was added in exports of manufactured goods from country *i* to country *j* in year *t*. The manufactured sector was selected for its importance in international trade (about 70% of total trade, according to the World Trade Organization - WTO, 2017) and for the greater number of production stages.

Subsequently, data were collected to represent the internal conditions of the countries that affect their participation in the chains. Factors such as commercial freedom (lower tariffs and non-tariff measures for international trade), favorable business environment, capital mobility and logistical efficiency are among those that can define the situation of a nation within CGVs.

Regarding tariff and non-tariff measures, the Trade Freedom Index, calculated by the Heritage foundation (2020), was used. This indicator is part of the Index of Economic Freedom (IEF), which seeks to analyze, in a society, how free individuals are to work, produce, consume and invest in any way they want.

Economic freedom is measured based on 12 quantitative and qualitative factors, grouped into four broad categories: 1) Rule of Law (property rights, government integrity, judicial effectiveness); 2) Government size (government spending, tax burden, fiscal health); 3) Regulatory efficiency (commercial freedom, freedom of work, monetary freedom), and; 4) Open markets (commercial freedom, investment freedom, financial freedom). Each of the twelve economic freedoms within these categories is graded on a scale of 0 to 100. A country's overall score is derived from the average of these twelve economic freedoms, with equal weight being given to each.

Specifically, the Trade Freedom Index is a measure composed of the situation of tariff and non-tariff barriers that affect imports and exports of goods and services. The commercial freedom score is based on the weighted average tariff of and on non-tariff barriers (BNT).

³ For more information about countries, see <https://www.oecd.org/sti/ind/measuring-trade-in-value-added.htm>.

The Business Freedom Index and the Financial Freedom Index, also part of the IEF, were used to represent the business environment. That is a general indicator of the efficiency of government business regulation. The quantitative score is derived from a series of measures of the difficulty of starting, operating and closing a company. The Financial Freedom Index is a measure of banking efficiency, as well as a measure of independence from government control and interference in the financial sector⁴.

The flow of Foreign Direct Investment (FDI) was also used to show how attractive the country is in this respect, as well as an indication of the presence of multinational companies. FDI refers to capital flows from direct investment in the economy. It is the sum of share capital, reinvestment of profits and other capital. It is a category of international investment associated with a resident in an economy that has control or a significant degree of influence in the management of a company resident in another nation. Data are in current US dollars. Such data was collected in the World Bank (2020).

In addition, data was included to represent logistical efficiency. The World Bank (2020) calculates the Logistic Performance Index (LPI), whose coefficients determine the logistical quality of a country through six elements: the efficiency of customs management and border freedom, the quality of the transport system infrastructure, the ease to organize shipping prices, the competence of logistical services, the ability to track products and the frequency at which the product reaches the recipients within the established period. Thus, the following indicators were included in the model: 1) Customs, which measure the efficiency of customs procedures, also including legislation; 2) Infrastructure, which measures the quality of transport modes and telecommunications infrastructure. Such indicators are calculated through a questionnaire, where the interviewee (specialists in the area of each country) reports their opinion about the indicator, ranging from 1 (very low) to 5 (very high). The scores were calculated for the years 2007, 2010, 2012, 2014, 2016 and 2018. As the TiVA base brings data up to 2015, the years 2007, 2010, 2012 and 2014 were used in the sample.

Farther the regression described below, a descriptive analysis of domestic added value data on exports was carried out to show an overview of the countries' situation.

3.2 Econometric model

Therefore, the following regression was estimated with panel data:

$$VAD_{ijt} = \alpha + \gamma_i + \delta_j + \mu_t + \gamma_{ij} + \beta_1 \ln IDE_{it} + \beta_2 \ln customs_{it} + \beta_3 \ln infra_{it} + \beta_4 \ln trade_{free}_{it} + \beta_5 \ln business_{free}_{it} + \beta_{13} \ln financial_{free}_{it} + \varepsilon \quad (1)$$

where VAD_{ijt} is the domestic added value in exports of manufactured goods from country i to country j in year t ; α is the constant; γ , δ , μ and γ are variables for controlling the fixed effects of the exporting country, importing country, time and country pairs, respectively; IDE_{it} is the inflow of foreign direct investment into country i in year t ; $Customs_{it}$ is the value of the customs indicator for country i in year t ; $Infra_{it}$ is the value of the infrastructure indicator for country i in year t ; $Trade_{free}_{it}$ is the value of the Trade Freedom Index for i in t ; $Business_{free}_{it}$ is the value of the Business Freedom Index for i in t ; $Financial_{free}_{it}$ is the Financial Freedom Index value for i at t ; ε is the error term.

⁴ For detailed calculation see <https://www.heritage.org/index/trade-freedom>, <https://www.heritage.org/index/business-freedom> and <https://www.heritage.org/index/financial-freedom>.

Equation (1) is similar to the international trade gravity model. Greaney and Kiyota (2020) demonstrated that the structural gravity model performs well to describe bilateral trade in both final goods and intermediate inputs. However, the gravity model may perform poorly due to incorrect model specification or sample selection. Thus, given the limited number of countries in the sample, the estimation performed here fails to capture the full impact of global trade integration on bilateral trade as a traditional gravity model would.

The estimation was performed using the Poisson Pseudo Maximum Likelihood (PPML)⁵ method, the most recommended method for estimating trade flows between pairs of countries (YOTOV et al, 2016). According to Santos Silva and Tenreyro (2006), creators of the method, when applying PPML, consistent results are generated even in the presence of unobservable heteroscedasticity. In addition, sample selection bias is avoided, since, as it is a non-linear model, export values equal to zero are not excluded from the sample.

The Poisson estimator is known as the standard approach for modeling discrete data. However, it has been gaining popularity as a viable alternative for estimating multiplicative models where the dependent variable is non-negative. Usually, these models are estimated by linear regression applied to a dependent variable transformed into a log. But, as with ordinary least squares (OLS), the only necessary assumption for the consistency of the Poisson estimator is the correct specification of the conditional average of the dependent variable (GOURIEROUX ET AL., 1984). Thus, the Poisson's estimator becomes the PPML estimator.

Correia et al. (2020) state that, in the presence of non-negative data with many zeros, PPML seems to be the safest bet. This situation is very likely to occur in many areas of research, especially when working with highly disaggregated data (for example, when modeling a company's R&D expenses, patent citation counts, daily sales of products in stores and bilateral trade).

Panel estimation with fixed effects is always the most efficient in bilateral trade data due to the terms of multilateral resistance⁶, generated by the specificities of nations. According to Fally (2015), estimates with fixed effects and PPML are consistent with the definition of external and internal multilateral resistance indices and with the balance restrictions that need to be satisfied, thus being the most recommended method. In addition, Yotov et al. (2016) state that fixed effects of pairs of countries should also be included in order to correct the endogeneity between trade policy and exports.

4. Results and discussion

4.1 Descriptive analysis

Table 1 shows the means and standard deviations (SD) of the domestic added value (VAD) in general terms and separated by groups of countries, advanced and emerging, according to the classification of the International Monetary Fund (IMF)⁷. This classification occurs under an excellent economy, but includes several variables. This methodology may vary according to the country analyzed, but, in summary, the analysis includes: 1) the level of income per capita; 2) export diversification; and 3) degree of integration into the global financial system (IMF, 2020).

⁵ Correia, Guimarães and Zylkin (2020) developed a faster and more efficient command for estimating with PPML in the stata software, `ppmlhdfe`. The original command developed by Santos Silva and Tenreyro (2006) has problems in including large fixed effects. With `ppmlhdef` this was resolved.

⁶ Multilateral resistance is the effect that the position of exporting and importing countries in the global market and their economic situation has on their own bilateral trade. In other words, the effect of the price of other products from all countries on bilateral trade, according to Yotov et al. (2016).

⁷ See the countries of each group at <https://www.imf.org/external/pubs/ft/weo/2020/02/weodata/groups.htm>.

Table 1: VAD averages and standard deviations between 2007 and 2014

Year	General		Advanced		Emerging	
	Avarage	SD	Avarage	SD	Avarage	SD
2007	90840.4	154413.5	111476.9	162193.2	63325.0	141665.1
2010	97489.8	175009.7	110856.8	164159.6	79667.1	190218.4
2012	114003.7	219011.7	122804.9	184946.7	102268.7	260930.9
2014	121877.6	246245.4	128599.4	193938.2	112915.2	306297.0

Source: Own elaboration.

In general, the VAD average has been growing over the years of the sample. It is important to note that the standard deviations are quite high, much higher than the average values. This shows the great VAD discrepancy between countries participating in the global value chains (GVCs) of the manufactured sector. This confirms the above, that participation alone does not guarantee the internalization of great benefits. It is essential to be in parts of the chain that add more value to production.

The countries with the lowest values in all years are Brunei Darussalam, Cyprus, Malta, Cambodia, Iceland and Latvia, all part of the group of emerging countries. Those with the highest values are South Korea, Japan, Germany, the United States and China, all high-income and classified as advanced by the IMF, except China (which is one of the countries with the highest Gross Domestic Product in the world). This fact corroborates Nonnenberg (2014), when he affirms that central countries find it easier to capture the benefits of international productive fragmentation.

Regarding the values separated by groups, it is possible to observe that the averages of advanced countries are higher than those of emerging countries in all years of the sample, which also confirms the referred author. This was expected since chain governance, to a large extent, occurs in central countries. The greatest added value occurs at the ends of the chains, as shown by Zhang (2014), stages that are part of their governance.

Saes (2017) also states that, in general, activities that focus on intermediate stages of GVCs capture a lower added value, with an emphasis on the raw material supply sector, which is the most deficient sector for adding value, so that the steps that concentrate the greatest added value refer to the pre and post manufacturing phases, where activities related to services in general and intangible assets are concentrated. The above can be seen through Stan Shih's smiling curve, in figure 1:

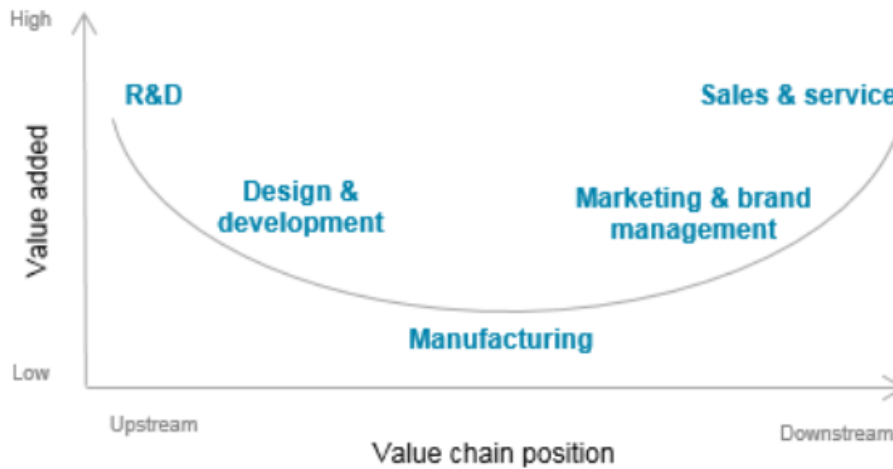


Figure 1: Smiling curve.
Source: Adapted from SHIH, S. (1992).

There is a higher growth of the average in the emerging countries over the years, which shows great potential for them. There is ample space for insertion and upgrading, especially for developing countries. However, it is necessary to provide the necessary internal conditions for this.

Again, the standard deviations are quite high for both groups, which demonstrates that the great heterogeneity between countries remains even among those more developed.

4.2 Estimation results

Table 2 below shows the model results, coefficients and standard errors, estimated by Poisson Pseudo Maximum Likelihood (PPML), using the `ppmlhdfc` command from the Stata software.

Table 2: Estimation Results

Variable	Coefficient	Standard-errors
ln IDE	0.0255277**	0.0060612
ln customns	-0.0261414 ^{ns}	0.2302165
ln infra	1.391984**	0.223625
ln tradefree	1.419524**	0.211266
ln businessfree	0.2624174*	0.1245528
ln financialfree	-0.1279122 ^{ns}	0.0945329
Constante	-0.2189913 ^{ns}	1.334861
Pseudo R ²	0.8068	
Observations	13608	
Countries fixed effects	Yes	
Year fixed effects	Yes	
Pair fixed effects	Yes	

** , * and ns represent, respectively, 1%, 5% and non-significant significance. Standard errors were adjusted (cluster) for country pairs.

Source: own elaboration.

The flow of foreign direct investment to the exporting country showed a significant and positive coefficient, which corroborates the hypothesis that with greater foreign investments, mainly in the form of multinationals, the participation of countries in the production chains tends to improve. An increase of 10% in the IDE results in an increase of about 2.5% in the VAD.

As expected, the relationship between quality of logistics infrastructure and VAD was positive and significant, in addition to being elastic (13.9%). This can be explained by the fact that a better transport and communications infrastructure generates more agility in commercial transactions, as well as lower costs, which is essential for fragmented production.

Commercial freedom, measured by the Trade Freedom Index, proved that the lower the barriers to trade, the greater the capture of value in the chains. An increase of 10% in the commercial freedom indicator generates an increase of approximately 14.2% in VAD. Such elastic effect shows the great relevance of the adequate commercial policy (and also of the logistics infrastructure, as previously analyzed) for the beneficial participation in the CGVs.

Finally, freedom in the business environment, measured by the Business Freedom Index, revealed a positive and significant coefficient, as signaled by UNCTAD (2013a), that an improvement in the business environment tends to significantly benefit the trade in intermediate goods.

The customs and financial freedom variables were not significant in the model. This does not mean that they are not important for adding value in fragmented commerce, however, for the data structure used here, it was not possible to draw conclusions.

McFadden's R² (pseudo R²) shows a high adjustment, but this always occurs with the presence of multilateral resistance terms, which explain most of the trade. Therefore, it should not be used to assess the explanatory power of the equation, but rather to compare the quality of adjustment in relation to similar equations (VEALL; ZIMMERMANN, 1996).

Such findings are in line with the UNCTAD report on GVCs (2013b), in which some points stand out: 1) Trade openness policies and policies to ensure a transparent and predictable environment for investments are very important and must be thought to extend the benefit to the entire nation; 2) An appropriate approach for countries to upgrade could be the inclusion of GVCs in industrial development policies, particularly through the creation of an enabling environment for trade and investments, by building strong productive capacity in local firms and by training the labor; 3) Importance of a well developed and applied competition defense policy, in addition to an attractive business environment, and; 4) the fundamental role of competitive and efficient service sectors to make international trade viable (highlighting the role of logistics services).

Therefore, it is evident that countries that wish to have a more effective and beneficial participation in GVCs, with great added value, must present greater commercial freedom, capital mobility, maintain a favorable business environment and invest in logistical efficiency.

5. Conclusions

Countries are increasingly interconnected and interdependent, a situation that has been stimulated mainly by technological advances in telecommunications and transport, which has also led to a change in international trade. A new form of commercialization has emerged and is becoming increasingly important: the worldwide fragmentation of production.

There is a complete transformation of trade relations, where countries begin to divide the productive chain of goods into different phases that are carried out in different locations. Each stage is performed in the nations that have the best efficiency and lowest costs for the

performance of the activity; this new form of organization became known as Global Value Chains (CGVs).

The stages of GVCs allow different levels of added value for each stage of the production process, so that the countries with the most favorable conditions are concentrated in the positions that manage to capture a greater part of the added value for their economies.

Therefore, it is important to assess which characteristics are relevant for a country to participate in chains in positions that provide greater added value. Factors such as commercial freedom (lower tariffs and non-tariff measures to international trade), favorable business environment, capital mobility and logistical efficiency are among those that can define the situation of a nation within the chains.

The present work, by estimating an econometric model with panel data for 64 countries, showed that greater commercial freedom, maintaining a favorable atmosphere for attracting foreign investments, efficiency in logistics infrastructure and freedom in the business environment allow the generation of higher domestic added value in exports, that is, higher returns within the CGVs.

Therefore, it is evident that governments have an important role in the rise and insertion of countries within global value chains, since with political changes and investments in strategic areas it is possible to achieve greater returns in fragmented trade.

It is proposed that more studies be carried out, analyzing other variables such as qualification of the workforce, investments in research and development, efficiency of the institutions, among others, as it is expected that different factors are relevant for an effective and advantageous participation in CGVs.

References

ALMEIDA, F., F. Inserção nas cadeias globais de valor como uma estratégia para o crescimento brasileiro: teoria, modelo e evidências empíricas. 2017. 78 f. **Dissertação** (Mestrado em Economia) - Universidade Federal de Uberlândia, Uberlândia, 2017.

BANCO MUNDIAL. **World Bank Open data**. Acesso em 19 de agosto de 2020. Disponível em: <https://data.worldbank.org/>.

CORRÊA, C. R.; GOMES, M. F. M. Tariff and technical international trade measures: a look at advanced and emerging countries. **Austral: Brazilian Journal of Strategy & International Relations**, v. 7, n. 13, p. 288–316, 2018.

CORRÊA, L., M., CASTILHO, M.; PINTO, E. C. Mapeamento dos padrões de atuação dos países nas Cadeias Globais de Valor e os ganhos em termos de mudança estrutural. **Economia e Sociedade** (Unicamp), v. 28, p. 89-122, 2019.

CORREIA, S.; GUIMARÃES, P.; ZYLKIN, T. Z. Fast Poisson estimation with high-dimensional fixed effects. **Stata Journal**, v. 20, n. 1, p. 95–115, 2020.

FALLY, T., **Structural gravity and fixed effects**, **Journal of International Economics**, v. 97, n. 1, p. 76-85, 2015.

FLÔRES JR., R. G. A fragmentação mundial da produção e comercialização: conceitos de questões básicas. In: ALVAREZ, R.; BAUMANN, R.; WOHLERS, M. (Orgs.). **Integração Produtiva: caminhos para o Mercosul**. Brasília: Agência Brasileira de Desenvolvimento Industrial, 2010. Série Cadernos da indústria ABDI XVI. Cap. 2, p. 56-114.

FMI. **World Economic Outlook**. Disponível em: <<https://www.imf.org/external/pubs/ft/weo/2020/02/weodata/groups.htm>>. Acesso em julho de 2020.

GEREFFI, G. FERNANDES-STARK, K. **Global Value Analysis: a primer**. Center on Globalization, Governance & Competitiveness, Duke University, maio de 2011.

GOURIEROUX, C.; MONFORT, A.; TROGNON, A. Pseudo Maximum Likelihood Methods: Theory. **Econometrica**, v. 52, n. 3, p. 681, maio 1984. Acesso em: 9 nov. 2020.

GREANEY, T. M.; KIYOTA, K. The gravity model and trade in intermediate inputs. **World Economy**, 43(8), 2034–2049, 2020.

HERMIDA, C. DO C.; XAVIER, C. L.; SILVA, G. J. C. DA S. Fragmentação Internacional da Produção, Cadeias Globais de Valor e Crescimento Econômico: Uma Nova Abordagem Empírica. **44th National Economics Meeting (ANPEC)**, p. 1–20, 2016. Disponível em: <https://www.anpec.org.br/encontro/2016/submissao/files_I/i74f1ceab756e7ebc7f669b69fa3b5d752.pdf>.

HERITAGE FOUNDATION. **Index of economic freedom**. Acesso disponível 19 de agosto de 2020 em: <https://www.heritage.org/index/>.

HUMMELS, D., J. ISHII, AND K. YI. The Nature and Growth of Vertical Specialization in World Trade. **Journal of International Economics**. 54, p. 75–96, 2001.

JOHNSON, R.C.; NOGUERA, G. Accounting for Intermediates: Production Sharing and Trade in Value Added. **Journal of International Economics**. 86(2), p. 224–236, 2012.

KOOPMAN, R, W. POWERS, Z. WANG, USITC, S.Wei. Give Credit Where Credit Is Due: Tracing Value Added in Global Production Chains. NBER Working 16426, NBER, 2010.

KOOPMAN, R.; WANG Z.; WEI, S.J. Tracing value-added and double counting in gross exports. **The American Economic Review**, v. 104, n. 2, p. 459–94, 2014.

NONNENBERG, M. Participação em cadeias globais de valor e desenvolvimento econômico. IPEA: **Boletim de Economia e Política Internacional (BEPI)**, n. 17, 2014.

OCDE - Organisation for Economic Co-operation and Development. **Trade policy implications of global value chains: contribution to the reporte on global value chains**, 2013. Disponível em: <http://www.oecd.org/sti/ind/Trade_Policy_Implicatipns_May_2013.pdf>. Acesso em dezembro de 2019.

OLIVEIRA, S. E. C. **Cadeias globais de valor e os novos padrões de comércio internacional: uma análise comparada das estratégias de inserção de Brasil e Canadá**. Brasília: FUNAG, 2015.

OLIVEIRA, K. Análise da dinâmica e do funcionamento da cadeia global de valor da indústria de papel e celulose: um foco sobre a decomposição do valor adicionado e das parcerias bilaterais do Brasil. 413 p. **Tese (Doutorado em Economia)** Universidade Federal da Bahia (UFBA), Salvador, 2019.

OMC. **World Trade Statistical Review**, 2017. Disponível em: https://www.wto.org/english/res_e/statis_e/wts2017_e/wts2017_e.pdf. Acesso em 09/04/2019.

SAES, B. M. Comércio Ecologicamente Desigual no Século XXI: Evidências a Partir da Inserção Brasileira no Mercado Internacional de Minério de Ferro. 213 p. **Tese** (Doutorado em Economia) Universidade Estadual de Campinas (Unicamp). São Paulo, 2017.

SANTOS SILVA, J.M.C.; S.Tenreiro. 2006. The log of gravity. **The Review of Economics and Statistics**, Cambridge, 88, 4, 641-658.

SHIH, S. **Millenium transformation: change management for new acer**. Aspire Academy Séries. 1992.

SILVA, I. C. O Brasil e as cadeias agroindustriais de valor: integração, espacialização e dispersão concentrada. 156 f. **Dissertação** (Mestrado em economia) Universidade Federal de Juiz de fora (UFJF). Juiz de Fora, 2017.

STURGEON, T., GEREFFI, G., GUINN, A., & ZYLBERBERG, E. O Brasil nas cadeias globais de valor: implicações para a política industrial e de comércio. **Revista Brasileira de Comércio Exterior**, 2013, 115, 26-b41.

TIVA. **Trade in Value Added database**. < <http://www.oecd.org/sti/ind/measuring-trade-in-value-added.htm>> Acesso em fevereiro de 2020.

UNCTAD. **World Investment Report 2013: global value chain – trade and investment for development**. Geneva: Unctad, 2013a.

UNCTAD. **Global Value Chains and Development: Investment and Value Added Trade in the Global Economy**. United Nations Publications, 2013b.

VEALL, M. R.; ZIMMERMANN, K. F. Pseudo-R2 measures for some common limited dependent variable models. **Journal of Economic surveys**, v. 10, n. 3, p. 241-259, 1996.

YOTOV, Y. V., PIERMARTINI, R., MONTEIRO, J. A., LARCH, M. **An advanced guide to trade policy analysis: The structural gravity model**. Geneva, World Trade Organization, 2016.

ZHANG, L., & SCHIMANSKI, S. **Cadeias Globais de Valor e os países em desenvolvimento**. Repositório IPEA, 2014.