INTERNATIONAL RELATIONS AND POLITICAL SCIENCE DOCTORAL SCHOOL

THESIS BOOKLET

Borges Aguiar, Giovanna Maria

Trade Patterns of Latin America and the Caribbean: Evidence from the agri-food sector

Pd.D dissertation

Supervisor
Dr. Balogh, Jeremiás Máté
Associate Professor

Budapest, 2022

Institute of International Studies

THESIS ARTICLE

Borges Aguiar, Giovanna Maria

Trade Patterns of Latin America and the Caribbean: Evidence from the agri-food sector

Ph.D dissertation

Supervisor
Dr. Balogh, Jeremiás Máté
Associate Professor

Table of Contents

Trade Patterns of Latin America and the Caribbean:
Evidence from the agri-food sector

Giovanna Maria Borges Aguiar

Abstract

Latin America and the Caribbean (LAC) region is one of the most important players in global agricultural trade, being among the global leaders in the production and exports of agricultural and fisheries commodities and accounting for 15% of the world's average agri-food export from 1995 to 2019. The region have vast potential to strengthen their position as a result of the region's opportunities to increase agricultural production when combined with growing global demand, which could help the region's economy thrive. The purpose of the dissertation is to provide a consistent analysis of the agri-food trade patterns for Latin America and the Caribbean. determinants of LAC agricultural bilateral export for the period 1995-2019 and export competitiveness of the sector in the same period. This research explored the LAC agricultural trade patterns and export competitiveness through the analysis of the Revealed Comparative Advantage (RCA) index in the agricultural sector over the years, indicating which countries in the region are currently competitive and in what agricultural products. Panel data econometrics was used to identify the conditioning factors lying behind trade flow and the gravity model was applied to determine how bilateral cultural characteristics affect LAC agri-food export. Results indicated that Brazil, Argentina, and Mexico were the major agri-food exporters in LAC. Guatemala had the highest RCA index, while coffee, tea, mate and spices (HS-09) was the most competitive group product. In terms of agri-trade flow determinants, findings shows that importers' GDP of LAC countries has a greater impact on agricultural trade compared to LAC exporters. Cultural similarities (common language) and countries' participation in Southern Common Market (MERCOSUR, Mercado Común del Sur) stimulated agri-food export. Conversely, distance (transportation), past colonial links, and the North American Free Trade Agreement (NAFTA) raised trade costs, having a negative impact on the export of agricultural products.

Introduction

The demand for agricultural products, according to the recent food consumption forecasts, will likely increase by 15% over the next decade, with approximately 70% more food required by 2050 globally (FAO, 2009; OECD/FAO, 2019). Although the most agriculturally productive locations are often not the ones with the highest demand concentrations. According to the FAO (2017), considering agriculture-dependent countries with limited land and water resources and based on current trends, “if these countries were to rely exclusively on domestic production for their food supply, they could be confronted with a neo-Malthusian future” (FAO 2017, p. 13). Thus, especially since the early 2000s, agricultural trade development has been boosted, particularly between emerging and developing countries, whilst agri-food tariffs have dropped and many countries have reduced their use of trade-distorting policies as producer support (OECD, 2019).

Latin America and the Caribbean have reinforced their position as global suppliers while its export rates are likely to continue to increase. The region’s agricultural trade surplus has steadily increased, becoming its defence against large economic contractions during periods of recession and times of economic crisis (Arias et al., 2017). Although productivity is projected to drop over time, Latin America and the Caribbean (LAC) is estimated to be responsible for more than 25% of global agriculture and fisheries exports by 2028, emphasizing the favourable influence of trade openness on the area (OECD/FAO, 2019). The prospects for the future are that its abundance of natural resources is likely to continue to play an important role in global agricultural production and trade. As a result, the need of assessing LAC's competitiveness in the agri-food sector as a whole becomes clear.

Despite the relevance of the topic, research on agri-food trade patterns and dynamics in developing regions, such as Latin America and the Caribbean, is scarce compared to other regions in the world, and the agricultural sector analysis is likewise restricted in comparison to industrial product analysis.

The purpose of the dissertation is to provide a consistent analysis of the agri-food trade patterns for Latin America and the Caribbean. First, it presents an overview of the region's agri-food sector and its evolution over the years. Second, it investigates the LAC's competitiveness indicating which countries and products are competitive and how competitiveness has evolved during the past two decades. Finally, this study investigates the determinants of agricultural trade exports from LAC and how bilateral cultural characteristics influences trade flows. More specifically, the dissertation asks the following research questions: (1) *Which LAC countries are currently competitive on the world market and in what agricultural products?* and (2) *What economic factors can influence agricultural trade between LAC and its trading partners?*

This booklet is organized as it follows. Following this Introduction, which provides the motivation, goal and research questions of this research, I provide the literature review and identify the gaps in the field. The third section overviews the research design, establishing the hypothesis to be tested. Section four introduces the material and methods, accentuating the Balassa index and the gravity model methodologies. Empirical analysis and results of LAC trade patterns and agricultural competitiveness are displayed on section five. The last section concludes and provides some recommendations for future research.

Literature Review

Competitiveness: definition and measurement

Being a dynamic and complex concept, it is interpreted either at the micro- (firm) or macro (country) level. At the macro-economic level, while competitiveness is much more weakly defined, one of the most widely accepted definitions nowadays is the one given by the World Economic Forum (WEF, 2016, p. 4), which defines national competitiveness as a *"set of institutions, policies and factors that determine the level of productivity of a country*". To the authors of this given research, it becomes clear that competitiveness is intrinsically linked to international trade performance when evaluated at a macro level, and following Jámbor and Babu (2016), its definition is closely associated with the notion of comparative advantage, which is the economy's ability to produce goods and services at a lower opportunity cost than its trade partners and is based on the higher performance of productivity and in the ability of the economy to enhance it, which can result in high levels of real wages. In this sense, competitiveness at the macro level could be thought of as the capacity of a productive system to maintain and even expand its position in the market, taking into account the analysis of necessary conditions for the maintenance of this competitiveness.

Revealed performance can be determined by measurement, which can rely on indicators such as revealed comparative advantage indicators, market performance and effectiveness, trade success, and others (Latruffe, 2010). Revealed Comparative Advantage (RCA) indices are the most widely used indicators for the trade-based competitiveness of nations and will be the one mainly utilized on this research. The index was first formulated by the Hungarian economist Béla Balassa (1965) and it calculates the ratio of a country's export share of a single commodity in the international market to the exports of all commodities compared to the similar share of a group of countries. Later the Balassa index was modified by several authors such as Vollrath (1991), Dalum et al. (1998), Proudman and Redding (1997), Hoen and Oosterhaven (2006), and Yu et al. (2009).

Relevant literature on competitiveness

Jambor and Babu (2016) analysed the Competitiveness of Global Agriculture and calculated Revealed Comparative Advantage (RCA) for all countries and agricultural products for the period 1991 to 2014. The authors took an average of all years analysed and concluded that the most competitive nations are Netherlands, Spain and Denmark, while Montserrat, Brunei and the Cook Islands were the least competitive, presenting comparative disadvantage. Jambor et al. (2018) analysed spice trade competitiveness worldwide by examining the Balassa Index (RCA) from 1991 to 2015. They observed that the market was concentrated in Guatemala, Sri Lanka, and India, which had the highest indices over the period, while Germany and the Netherlands, despite being the largest exporters, had a comparative disadvantage in the global spices trade. S. Bojnec and Ferto (2018) intended to explore the length of comparative advantage of the European Union's agri-food export. Results indicated that, although the NRCA index was higher than zero for the majority of agri-food items, a substantial percentage of them are of a shorter duration, lasting just a reduced number of years. Aiming to analyze the comparative advantage patterns of agriculture in the Commonwealth of Independent States (CIS), Mizik, et al. (2020) country-level analysis, based on the RCA index, shows that Moldova, Kyrgyzstan and Armenia have the highest Balassa indices in the region, and Belarus, Ukraine and Azerbaijan are also having some comparative advantage. The authors also inferred that RCA stability and duration are limited, suggesting a constant need to adapt and assess updated data to bring novelty to the literature. The first important gap is that most studies on competitiveness are aiming the industrial product analysis over the agricultural sector analysis. Moreover, the number of studies addressing competitiveness on developing regions, such as Latin America and the Caribbean, is scarce compared to other regions in the world.

Gravity model theories

The gravity model has become one of the most often utilized empirical models when it comes to international commerce. Its equation aims to explain the volume of trade without focusing on its composition, and it uses an equation framework to predict the volume of trade on a bilateral basis and between any two countries. Thus, it is primarily interested in selecting economic variables that will be able to explain a substantial portion of the volume of trade at least in a statistical sense. Jan Tinbergen was the first to introduce the gravity mode in economics by making an analogy to Newton's law and applying its structure to trade flows thus theorising that bilateral trade flows are determined by forces of attraction, which correspond to the Gross National Product (GDP) of the two trading partners, as well as forces of repulsion, referring to the geographic distance between them, which influences trade costs (Tinbergen, 1962). By building a model assuming Cobb-Douglas type preferences and examining a function with constant substitution elasticity, Anderson (1979) was able to establish theoretical underpinnings for the gravity equation at a product level, exhibiting Constant Elasticity of Substitution (CES). Anderson and Van Wincoop (2003) developed then a more consistent and efficient method, which estimation includes Multilateral Resistance Terms (MRT), variables associated with multilateral and bilateral trade resistances and can capture the costs of trade with other trading partners.

Relevant literature on the gravity model

Over the years, many studies utilized the gravity model in their analysis. Paula and Miranda (2017) sought to analyse and compare the determinants and evolution of trade flows of the BRICS countries (Brazil, Russia, India, China, and South Africa) between 1997 and 2013. Findings suggested that cultural and geographic parameters have a beneficial effect on trade flows between Brazil and the BRICS countries. Cantore and Cheng (2018) analysed if environmental policies affect the imports of environmental goods and in which direction by utilizing the gravity model.

Their findings confirm that environmental regulatory rigidity is a crucial determinant of environmental goods trade and underline that environmental policies could serve both environmental protection and industrial development. To explain the determinants of European Union (EU) intra-industry trade (IIT) in the period 1996 to 2017, Balogh and Leitão (2019) used the gravity model and analysed patterns of the agricultural trade between the EU and its African, Caribbean and Pacific (ACP) trading partners. They found that agricultural export costs are significantly lower if the EU and its external export markets share comparable cultures, embrace the same religion, or have a regional trade agreement. The determinants of intra-industry trade between Brazil, the European Union, and China, from 2006 to 2017, were examined by Bobato et al. (2020) through the gravity model, Ordinary Least Squares (OLS) and Poisson Pseudo-Maximum-Likelihood (PPML). They found that Brazilian intra-industry trade with the European Union and China is very small and has decreased over the period under analysis. It was discovered that the degree of openness of the partner, the economic size of nations, and the similarity of incomes are all favourable aspects, whilst Brazil has significant trade costs, which constrain the expansion of commercial partnerships. The literature on Gravity Model fails to analyse the determinants of agricultural trade exports from Latin America and the Caribbean as whole, whereas the region became the third largest agricultural exporter in the world in 2004, accounting for an average of approximately 15% of all agricultural items shipped internationally from 1995 to 2019.

Research Design

This research uses a wide range of economic methods to analyse trade patterns. First, the collection of agricultural trade data enables the production of some basic descriptive statistics on the overall characteristics and changes of the LAC agri-food trade. Second, a competitiveness index developed by Balassa (RCA) and its latest developments (RTA, SRCA, and RC) will be calculated to identify revealed comparative advantages by country and sector. Third, panel data econometrics will be needed to identify the factors lying behind different country performances. The gravity model will be used so that the determinant factors of LAC's agri-food exports can be investigated.

In accordance with previous empirical research of comparative advantage, the following hypotheses are tested reflecting the research questions:

H_1 The contribution of the LAC's agricultural exports to the region's trade balance and the economy is high.

The LAC territory encompasses more than 2 billion hectares and includes a wide range of agro-ecological zones, topography, and productive and farm structures. All of which operate at varying degrees of technology and complexity. As a result, agriculture in the region is extremally diversified (OECD/FAO, 2019). In line with expanding agricultural land area and intensifying crop yields, increasing the global trade of agricultural products is one mechanism that can lead to a positive combination of booming trade and economic growth. LAC region is expected to see increasing in agricultural exports, which will have an impact on the region's trade balance and economy size (de la Torre et al., 2015; Fischer et al., 2002)

H_2 LAC's agricultural products exports are, in general, competitive in the world market.

Several Latin American and Caribbean nations have had a real exchange rate decline in recent years, which should contribute to making their exports more competitive (World Bank, 2019). LAC had an increment in agri-export, which might be attributed to the sector's increased competitiveness.

H_3 Export competitiveness of LAC's agricultural products was not stable over the years 1995-2019.

The second half of the twentieth century was characterized by prominent changes in the global trade of agri-food, that experienced variations in patterns and structures. One of the most relevant changes was the substantial decline in agricultural and food trade and the increase of trade in manufactured goods, being the growth of processed products in the global market an important aspect that transformed the composition of trade worldwide. Changes in trade liberalization, globalization, climate change, food standards and prices can also be pointed out as possible reasons that influenced the shift in the world food system (FAO, 2018; Jambor & Babu, 2016).

H_4 The higher the LAC exporters and their trading partners' economies are, the higher the value of agricultural export between them is, which is inversely proportional to the distance between the countries.

Empirical research suggests that gravitational features (economic size) between the LAC region and their trading partners enhance trade flows of agricultural products between them. In turn, geographical distance is inversely proportional to agricultural trade. In this sense, sharing common geographical borders, as well as having a short geographic distance between trading partners can encourage bilateral agri-food trade (Head & Mayer, 2014; Balogh & Leitão, 2019; Borges Aguiar & Cossu, 2019).

H_5 Cultural similarity between LAC exporters and their trading partners stimulates bilateral agricultural trade flows between them.

Countries that share relevant cultural characteristics are more likely to make business with each other since they better understand each other's practices (Bacchetta et al., 2012). According to the literature (Braha et al., 2017; Balogh & Jámbor, 2018), culturally similar nations with language commonalities and colonial ties tend to trade more with each other since such characteristics could be linked with reduced information and trade costs.

H_6 Free Trade agreements (NAFTA and MERCOSUR) are positively associated with agricultural export between LAC countries and their export destination markets by boosting agri-food export.

The World Trade Organization (WTO), which has pursued objectives of reducing trade discrimination and fostering unfettered access to markets since 1995, has promoted multilateral trade liberalization over the past 20 years (ECSIP Consortium, 2016). Trade agreements can reduce or even eliminate tariffs, quotas and other barriers between involved partners, diminishing trade costs. Following this statement, the literature reveals a positive connection between trade flows and free trade agreements, indicating that trade integration may lead to better economic outcomes (Lambert & Grant, 2008; Korinek & Melatos, 2009; World Bank, 2019).

H_7 Environmental regulation (Paris Agreement) negatively influences the LAC bilateral agricultural export by restricting trade flow.

Recent literature ((Drabo, 2017; Balogh & Jámbor, 2020) emphasized the detrimental effects of agricultural trade on the environment and stimulating climate change as a result of pollution. In that sense, stricter environmental regulation is associated with higher trade costs due to more expensive procedures and materials, thus with the ability to reduce both probability and volume of export. Nonetheless, the need adhering such rules is seen as a drive for improvements. (ECSIP Consortium, 2016; Jug & Mirza, 2005; Kim, 2016; Shi & Xu, 2018).

Material and Methods

This research uses a wide range of economic methods to analyse trade patterns. First, the collection of agricultural trade data enables the production of some basic descriptive statistics on the overall characteristics and changes of the LAC agri-food trade. Second, a competitiveness index developed by Balassa (RCA) and its latest developments (RTA, SRCA, and RC) will be calculated to identify revealed comparative advantages by country and sector. Third, panel data econometrics will be needed to identify the factors lying behind different country performances. The gravity model will be used so that the determinant factors of LAC's agri-food exports can be investigated.

Agricultural trade data source

To calculate the indices above, this dissertation will use the World Bank (2021) World Integrated Trade Solutions (WITS) software, based on The United Nations Statistical Division (UNSD) Commodity Trade Statistics Database (COMTRADE) Data Base, and the Harmonized Commodity Description and Coding System (HS) – universal nomenclature for the classification of products created by the World Customs Organization – at the two-digit level (HS-2) and the six-digit level (HS-6) as a source of raw data. The catalogue of agricultural products, which covers HS level 1-24 can be found in the following table.

Table 1 Agricultural products codes and associated descriptions at the two-digit level (HS Code 2017)

Product Code	**Description**
HS1	Animals; live
HS2	Meat and edible meat offal
HS3	Fish and crustaceans, mollusks and other aquatic invertebrates
HS4	Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included
HS5	Animal originated products; not elsewhere specified or included
HS6	Trees and other plants, live; bulbs, roots and the like; cut flowers and ornamental foliage
HS7	Vegetables and certain roots and tubers; edible
HS8	Fruit and nuts, edible; peel of citrus fruit or melons

HS9	Coffee, tea, mate and spices
HS10	Cereals
HS11	Products of the milling industry; malt, starches, inulin, wheat gluten
HS12	Oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit, industrial or medicinal plants; straw and fodder
HS13	Lac; gums, resins and other vegetable saps and extracts
HS14	Vegetable plaiting materials; vegetable products not elsewhere specified or included
HS15	Animal or vegetable fats and oils and their cleavage products; prepared animal fats; animal or vegetable waxes
HS16	Meat, fish or crustaceans, mollusks or other aquatic invertebrates; preparations thereof
HS17	Sugars and sugar confectionery
HS18	Cocoa and cocoa preparations
HS19	Preparations of cereals, flour, starch or milk; pastry cooks' products
HS20	Preparations of vegetables, fruit, nuts or other parts of plants
HS21	Miscellaneous edible preparations
HS22	Beverages, spirits and vinegar
HS23	Food industries, residues and wastes thereof; prepared animal fodder
HS24	Tobacco and manufactured tobacco substitutes

Source: Own composition based on UN Comtrade Commodity Classifications (2017)

As a major source, the research will use the World Bank WITS software to download UN trade data in a global setting. The research applies with data from 1995 to 2019 (25 years) to better assess long-term trends as well as to build a dataset of an econometrically acceptable size. Moreover, the research will also use other sources of economic data such as OECD, FAO, CEPII and World Bank for building a set of explanatory variables behind global agri-food patterns.

Revealed Comparative Advantage

To interpret and measure the competitiveness of Latin America and the Caribbean nations, this research will use the Balassa Index (1965) of Revealed Comparative Advantage (RCA), which measures the proportion of a country's exports for a single commodity to the exports of all commodities, and the similar share for a set of selected countries, as it follows:

$$RCA_{ij} = \frac{\left(X_{ij}/X_{it}\right)}{\left(X_{nj}/X_{nt}\right)} \tag{1}$$

Where X represents exports, i indicates a country, j is a commodity, t is a group of commodities, and n is a set of selected countries. On that account, if RCA > 1, the comparative advantage of a country is revealed, compared with the reference selected countries. Otherwise, if RCA < 1, is revealed a comparative disadvantage.

The RCA, however, has been subjected to several critics, particularly for disregarding the impacts of agricultural policy and other economic interventions, which can lead to an overestimation of comparative advantage values. That is why the RCA computation is based on export statistics, where the impact is less than that of imports. Furthermore, the indicator is questioned for providing asymmetric values, which can vary from 1 to infinite, in the case of comparative advantage, and only from 0 to 1 if a country has a comparative disadvantage, overestimating the relative weight of a sector (De Benedictis et al., 2004; Jambor & Babu, 2016; Bojnec & Ferto, 2019; Mizik et al., 2020).

Vollrath (1991) proposed three distinct revealed comparative advantage specifications to overcome the shortcomings of the Balassa index. First, the Relative Import Advantage index, which is analogous to the RCA Equation 2, but incorporates imports rather than exports. The second approach is to calculate the difference between RCA and RMA, thus determining the Relative Trade Advantage (RTA), in which a positive value indicates revealed competitiveness. Vollrath's (1991) third approach calculates the natural logarithm of the RCA and RMA, and measures the difference between them, resulting in the index of Revealed Competitiveness (RC), which shows revealed competitiveness when incorporating a positive value

Dalum et al. (1998) developed an innovative method for dealing with the RCA index's asymmetric value problem and constructed the Symmetric Revealed Comparative Advantage (SRCA) index. When the SRCA assume values between 0 and 1 it is indicated that the country has a comparative export advantage, whereas values between -1 and 0 suggest a comparative export disadvantage. Because the SRCA distribution is symmetric around zero, possible bias is eliminated using this index (Dalum et al., 1998).

It should be mentioned that the methodology described above has several shortcomings. First, one of the most significant complications is the complexity of the world food trading system. Trade nowadays takes place at all levels (individuals, companies, multinationals, and countries) and because agricultural commodities are essential for humanity's survival, their trading is very intense, making it extremely difficult to summarize and consolidate the exact quantity of agricultural trade and, as a result, trade values may not always add up to the total trade value for a particular country set of data. Second, a further challenge arises when there are no observations, such as when two nations do not trade with each other for a while or when the amount of commerce is so little that the value is recorded as null. This can lead to under or overestimated indices. Third, each index has its own set of constraints, such as asymmetry, government-induced distortions, and market interference, to name a few. While RTA, RC, and SRCA all incorporate RMA into their calculations, taking into account import values, which are more likely to be impacted by policy and government interventions, the original Balassa index (RCA) can be preferable since it excludes imports (Torok & Jambor, 2016).

Estimates of Kaplan-Meier survival functions, an empirical, nonparametric technique for survival and hazard function estimation, were also used to examine the duration of revealed competitive advantages.

Those indices, despite their limitations, can provide further insight into a nation's agri-food competitiveness. This research will concentrate on the original Balassa (1965) index, as well as the adjustments elaborated by Vollrath (1991) and Dalum et al. (1998).

The Estimation of the Gravity Model of Trade

Determinant factors of agri-food trade flow can be measured by running econometric regressions and applying the gravity model. Tinbergen (1962) theorized that commerce between two nations is proportional to their GDP and inversely proportionate to their geographical distance and applied the gravity equation structure to the analysis of trade flows as it follows:

$$X_{ij} = \left(\beta_0 \frac{Y_i^{\beta_1} Y_j^{\beta_2}}{D_{ij}^{\beta_3}}\right) \mu_{ij} \tag{2}$$

Where I and j are the nations, and *Xij* represents the volume of trade between them, which is proportional to their incomes *Yi* and *Yj*, and inversely proportional to their geographical distance d. β's are the model's unknown parameters and μ_{ij} represents the error term. The following equation represents the relationship between international trade and equation 2:

$$X_{ij} = \beta_0 Y_i^{\beta_1} Y_j^{\beta} D_{ij}^{\beta_3} \mu_{ij} \tag{3}$$

The equation (10) was transformed into a logarithm form with the goal of linearizing and correcting it. This was also advantageous because the angular coefficient now measures the percentage change in Xij for a percentage change in Yi, i.e., the elasticity of Xij in relation to Yi (Gujarati & Porter, 2008). As a result, the following equation emerged:

$$lnX_{ij} = \beta_0 + \beta_1 \ln Y_i + \beta_2 \ln Y_j + \beta_3 \, ln \, D_{ij} + \mu \tag{4}$$

Binary variables, known as dummy variables, are used to categorize data into mutually exclusive groups by indicating the existence or absence of a "quality" or feature (Gujarati & Porter, 2008). Those types of variables were incorporated into gravity equations to maximize their performance by introducing qualitative characteristics to the model. Moreover, they can identify the existence or absence of a common language, contiguity, colonization, or other bilateral characteristics, which can have a positive or negative impact on the trade between regions (Azevedo, 2004).

Despite its widespread use, the gravity model has been criticised. The model's key parameter, for example, is geographical distance, which is a measure of transportation costs on an economic scale, and hence a powerful predictor of trade flows. As a result, we would anticipate nations with a shared border or a short geographical distance to trade more than regions separated by a large distance. However, geographical distances alone do not tell the whole story because, e.g. water transportation is less expensive than any other way of transportation (Borges Aguiar & Cossu, 2019).

By understanding the model's limitations, the equation has undergone several adjustments over time, strengthening it both theoretically and econometrically, producing then robust and reliable results. Its econometric approach can be carried out in many ways, including fixed effects (FE), random effects (RE), Ordinary Least Squares (OLS), and Poisson Pseudo-Maximum-Likelihood (PPML) estimations.

Baldwin and Taglioni (2006) observed that several specification mistakes in the gravity model were caused by the removal of variables, which led the coefficients associated with cost variables to be overestimated. The authors criticised the use of averaged export values as the dependent variable, which is employed in many works, thus weakening the robustness of the results. They state that the omitted variables cause an erroneous correlation with the regressors, resulting in an endogeneity problem in which the coefficients linked with the cost variables are overestimated. In this sense, multilateral resistance terms, such as temporal and geographic dummies, must be incorporated to correct this concern. Accordingly, zero trade flows of agri-food products are included in our estimations, therefore, missing trade values are substituted with zero. In addition, time and country-pair fixed effects (Anderson & Van Wincoop, 2003) and the remoteness term (Baier & Bergstrand, 2007; Head, 2003) were applied to the model separately.

Since the non-linear PPML estimator is the most consistent (Santo Silva & Tenreyro, 2006), different techniques of this model were applied to estimate the following gravity equation:

$$
\begin{aligned}
&LAC\_agri\_export_{ij} = \beta_0 + \beta_1 \ln(GDP_{reporter_i}) + \beta_2 \ln(GDP_{partner_j}) + \\
&\beta_3 \ln(dist_{ij}) + \beta_4\, comlang\_off_{ij} + \beta_5\, contig_{ij} + \beta_6\, colony_{ij} + \\
&\beta_7\, MERCOSUR_{ij} + \beta_8\, NAFTA_{ij} + \beta_9\, Paris\_agreement_{ij} + \mu_{ij}
\end{aligned} \tag{5}
$$

Where *i* denotes the LAC exporter country, *j* captures the LAC export destination country.

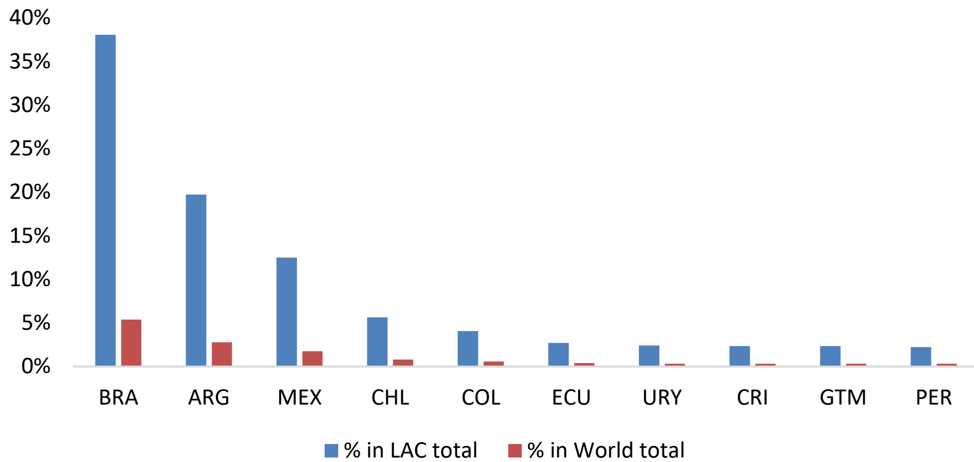
The estimated model takes into account economic size (GDP of LAC exporters and GDP from LAC importers' countries), geographical distances (closest geographical distances between most populated cities in kilometres) and adjacency (sharing common border), cultural aspects (common official language, past colonial relationship), free trade agreements (NAFTA, MERCOSUR), and environmental regulation (Paris agreement).

Empirical Results

Analysis of Agricultural Trade

Although today agriculture has a smaller participation than in 1996-1998, currently, the sector represents an average of 4.7% of the region's total GDP, showing that it is extremely important for the economy across much of LAC (OECD/FAO, 2019). LAC has strengthened its position in the international market as the world's third largest agricultural exporter region, exporting an average of more than 124 billion USD in agricultural products between 1995 and 2019. In the same period, Brazil, Argentina and Mexico were the top three exporters in the region, as Figure 1 suggests, contributing to an average of 70 % of LAC's agricultural exports.

Figure 1 Share of the leading agricultural exporters of the LAC region in LAC and world total agri-exports, 1995-2019, in per cent.



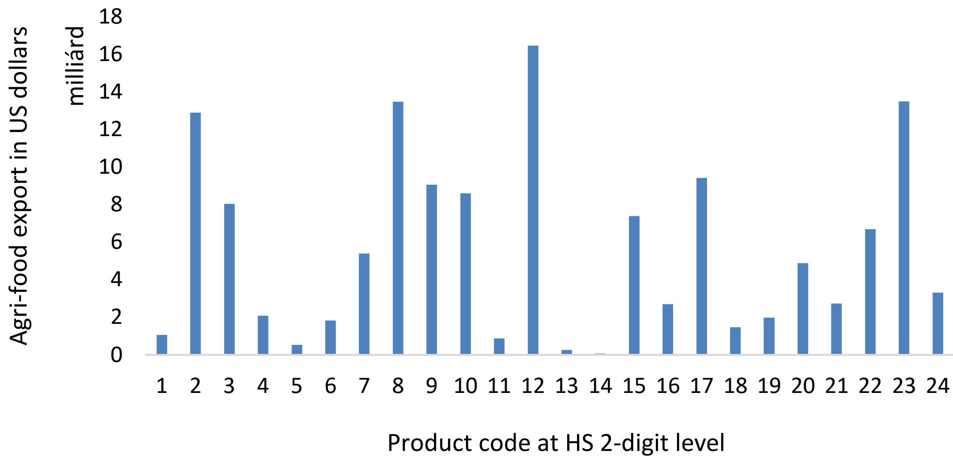
Note: Brazil (BRA), Argentina (ARG), Mexico (MEX), Chile (CHL), Ecuador (ECU), Uruguay (URY), Costa Rica (CRI), Guatemala (GTM), Peru (PER).

Source: Own composition based on World Bank (2021b) WITS database

Although the performance has been distinct across the region, in general, over the past two decades, agriculture and fisheries have grown at a faster pace when compared with OECD countries. The region has become a major exporter of soybeans, maize, sugar, coffee, pork meat, animal feed, and fruits and vegetables. The Top ten exporters accounted for more than 90 % of LAC's total agri-exports during the analysed period. This high concentration persisted throughout the whole period, implying that the agricultural sector is highly concentrated in those nations.

The LAC area encompasses over 2 billion hectares and comprises a diverse spectrum of agri-ecological zones, terrain, and agricultural and farm structures, which generates a wide range of products (H1). For that reason, the product structure of LAC agri-exports is also worth to be investigated (Figure 6). When analysing the agricultural export at the HS 2-digit product level, we can conclude that the most traded chapter category was HS 12 (oil seeds and oleaginous fruits) followed by 08 (fruit and nuts), 23 (food industries, residues and wastes thereof), 2 (meat and edible meat offal) and 17 (sugars and sugar confectionery).

Figure 2 Agricultural products at 2-digit level, exported by Latin America and the Caribbean to the world market in US billion dollars, 1995-2019



Note: See in Table 1

Source: Own composition based on World Bank (2021b) WITS database

Although diverse, the product structure of LAC's agricultural export has altered very slightly over time. In addition, the product concentration was relatively high, to the point that the Top 5 most exported categories at the 2-digit level - product codes 12, 8, 23, 2 and 17 above mentioned - accounted for 50% of total agricultural products exported in the whole region.

In Pérez's view (2010), Latin America can neither compete in the high-technology sectors nor low-skilled manufacturing because it is too far behind in the technological area and, despite being a low-wage region, far exceeds the Asian level of wages and population density. However, according to the author, the region's rich endowment in natural resources and energy offers it a "window of opportunity" to specialize in "process industries" (Pérez, 2010, pp 128). Her analysis also emphasizes that there are plenty of opportunities for growth based on natural resources, as well as on local innovation capacities since there is lots of space for scientific advancements in biotechnology, nanotechnology, custom-made materials, and ecologically friendly products (Pérez, 2010).

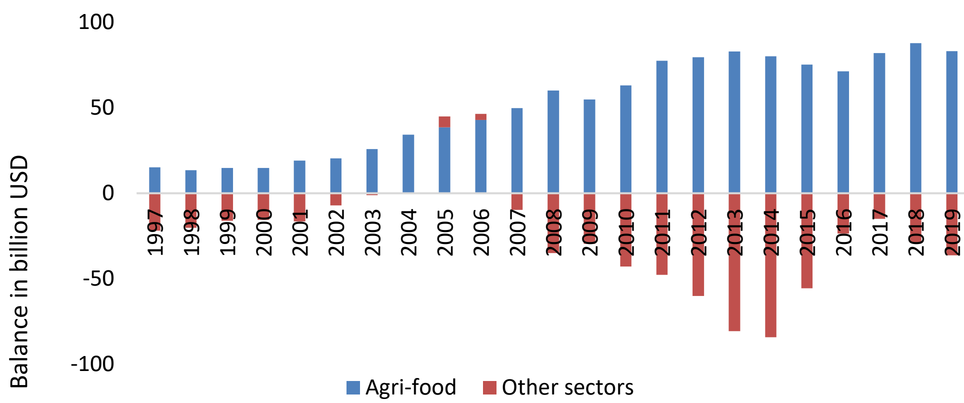
As shown above, the region has a great influence on the global agricultural sector, and the prospect for the future is that its abundance of natural resources is likely to continue to play an important role in global agricultural production and trade. The reason for a positive trade balance is mainly because of the agri-sector export, validating H_1 hypothesis. Whereas the region has abundancy in land, labour and other resources, the economic growth in LAC in the last decade has been quite disappointing and the region is lagging behind the global competitiveness. This contrast makes evident the importance of studying the competitiveness of LAC in agri-food as a whole.

The Brazilian role

It is crucial to emphasize Brazil's dominant role in the agri-food industry of Latin America and the Caribbean. Brazil has long been a key player in international commerce, with significant agricultural food export and market expansion, ranking as the LAC's largest one. Brazil is the 22nd largest export economy in the world, and the fifth world top exporter of agricultural products, exporting an average of more than $46.524 billion in agricultural products, in the period of 1995 and 2019.

The high amount of exported agri-food results in significant trade surpluses, as presented on Figure 3, and the exclusion of agribusiness brings a predominant deficit to the trade balance (except for the years 2005 and 2006), also confirming hypothesis 1.

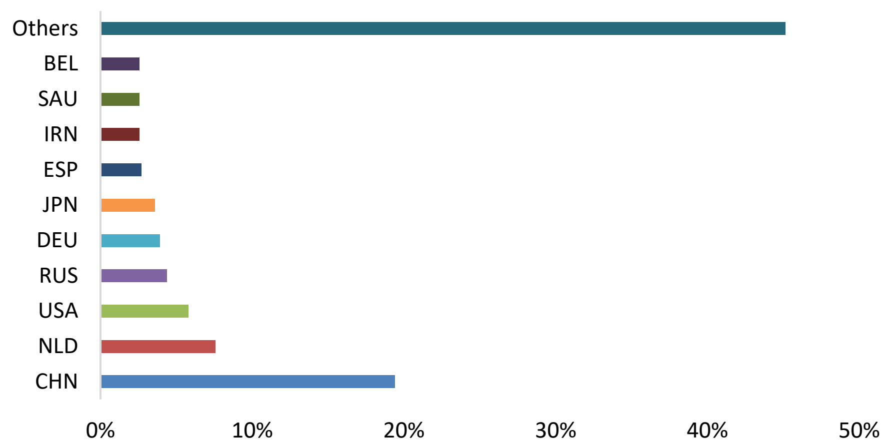
Figure 3 Brazilian trade balance in billions of dollars for the period of 1997 to 2019.



Source: Own composition based on Ministério da Agricultura, Pecuária e Abastecimento database (MAPA, 2022)

In general, the agri-food trade has constantly increased in recent years, complementing strong global economic growth and overall world trade. In the last 25 years, the five largest Brazilian agri-food export destinations accounted for 41% of the total market share of agricultural products, with China computing an average market share of 19.39% in this same period, which is more than $9.021 billion, being Brazil's major partner (Figure 4).

Figure 4 Brazil destination agricultural export share in total Brazil agricultural export by destination in per cent, 1995-2019.



Note: China (CHN), Netherlands (NLD), United States of America (USA), Russian Federation (RUS), Germany (DEU), Japan (JPN)), Spain (ESP), Iran, Islamic Rep. (IRN), Saudi Arabia (SAU), and Belgium (BEL).

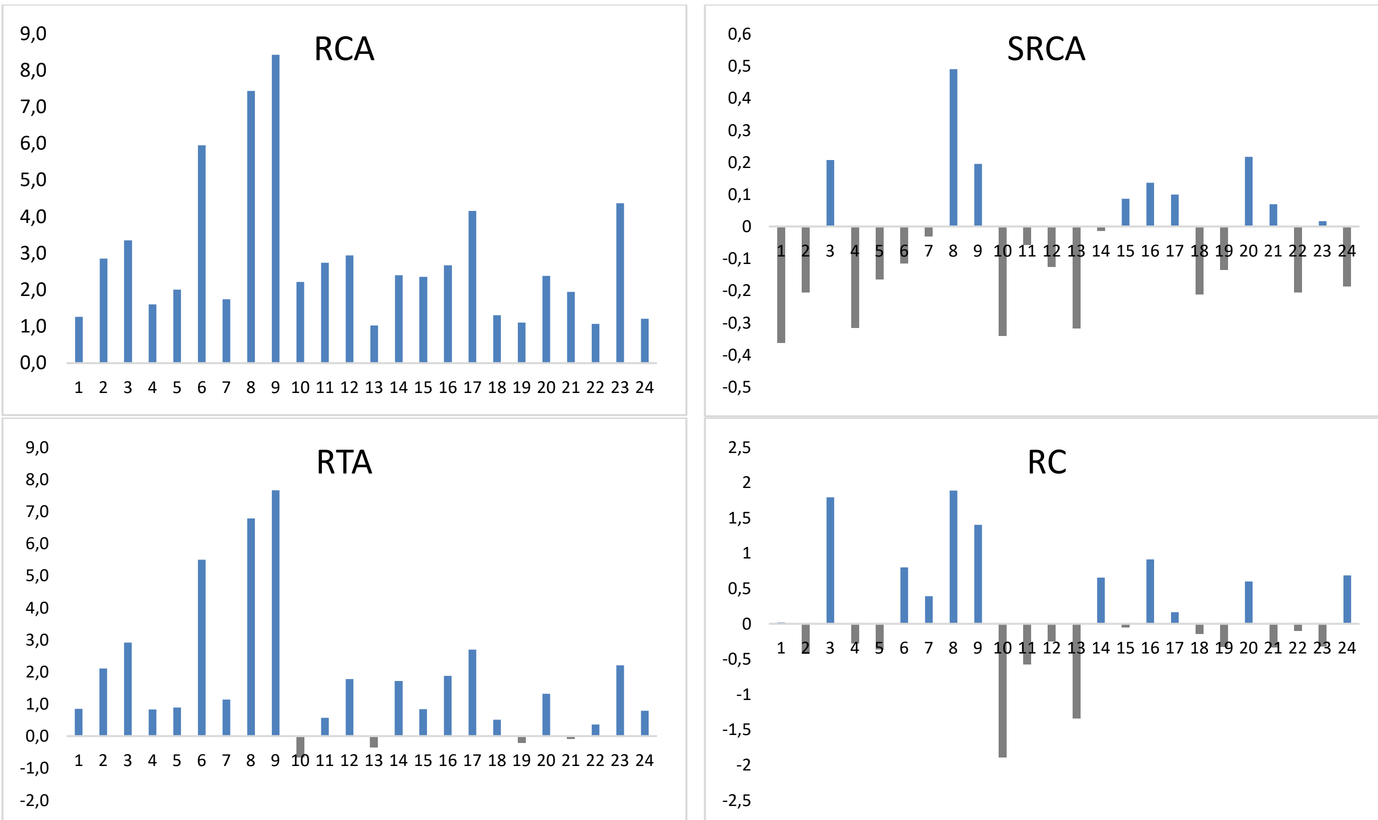
Source: Own composition based on World Bank (2021b) WITS database

China's rise in agricultural imports reflects its demographics; the country is the most populous in the world, and its unceasing economic growth relative to its land resources insufficiency. Therefore, the strategy adopted to supply increasing domestic demand was importation, which benefited Brazil.

Analysis of LAC's agricultural competitiveness in global markets

At the product level, from 1995 to 2019, the highest RCA values were found in *coffee, tea, mate, and spices* (HS 09), followed by *fruit and nuts* (HS 08) and trees and other plants (HS 06). All other products have demonstrated to be competitive in the worldwide market in all of the years analysed, with RCA values higher than 1, confirming hypothesis 2 (Figure 5).

Figure 5 LAC’s Revealed Comparative Advantage Indices by product code at HS 2 digit-level, 1995-2019.



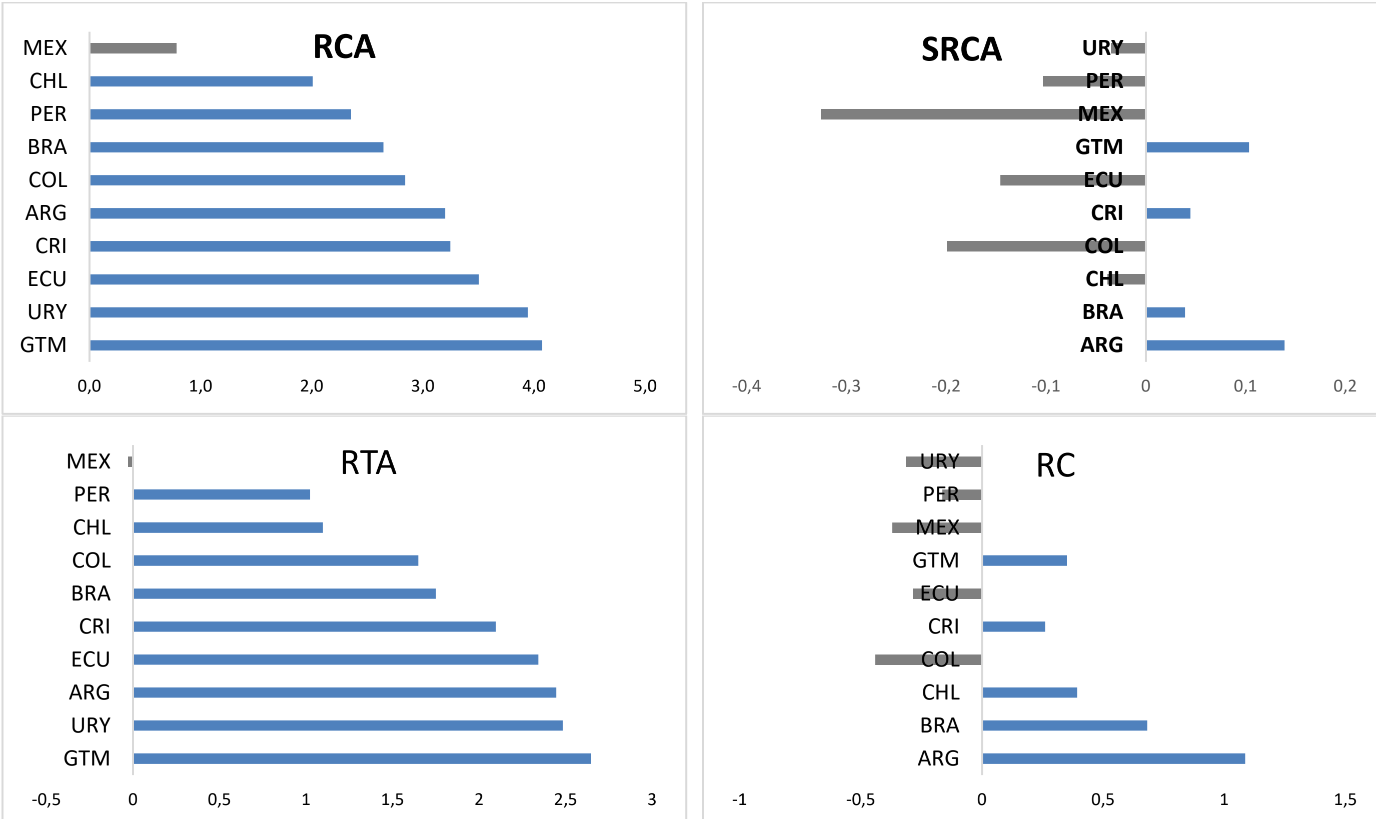
Note: See in Table 1

Source: Own composition based on World Bank (2021b) WITS database

When analysing the RCA modifications (RTA, SRCA and RC) we could conclude that some of the product groups are not competitive in the world market. It's worth noting that the RTA, RC, and SRCA indexes all incorporate RMA in their calculations, which take account of imports. Because it eliminates imports, which are more likely to be impacted by policy interventions, the original Balassa index (RCA) is the most recommended indicator (Torok & Jambor, 2016).

At the country level (Figure 6), Guatemala, Uruguay, and Ecuador are the most competitive countries among the LAC 10 highest ranked agricultural and food exporters from 1995 to 2019 (based on an average of the RCA for all years investigated), while Peru, Chile, and Mexico are the least competitive.

Figure 6 LAC's Revealed Comparative Advantage Indices by country, from 1995-2019.

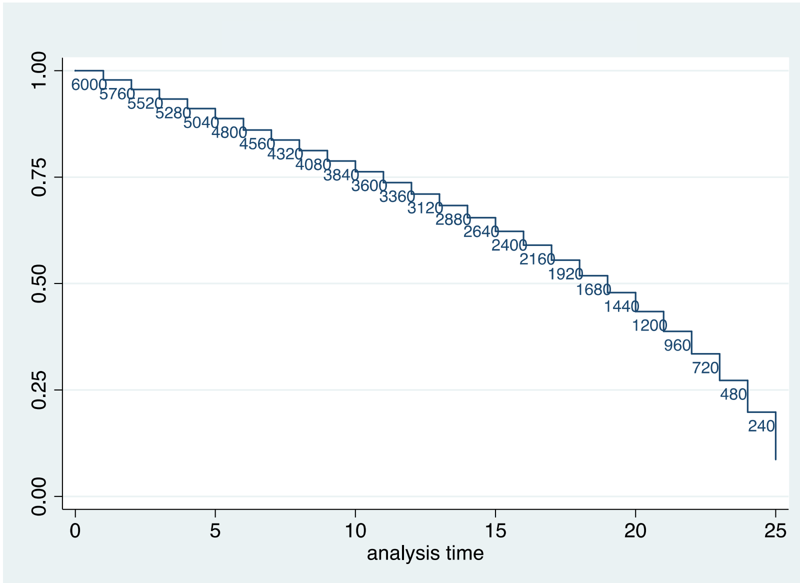


Source: Own composition based on World Bank (2021b) WITS database

The duration and the stability of RCA indices were examined. Firstly, the Markov transition probability index is investigated, which assesses changes of RCA indices across nations and over time, then the Kaplan–Meier survival function was estimated. The degree of transition mobility of all indices was estimated with the Markov transition probabilities and for all the Top 10 economies analysed, more than 90% of product groups' comparative advantages remained stable.

The non-parametric Kaplan–Meier product limit estimator was used to calculate the length at which the product groups have maintained a revealed comparative advantage, during the 25 years (Figure 7).

Figure 7 Kaplan-Meir survival rates of RCA indices in LAC for the period of 25 years (1995-2019).



Source: Own composition based on World Bank (2021b) WITS database

In general, the findings show that survival times of RCA indices do not endure over time, corroborating with hypothesis 3 that LAC's agricultural products competitiveness was not stable over the years. Survival prospects decreased from 98 per cent at the beginning of the period to 9 per cent at the end, implying that the worldwide market is continually changing and that there is fierce competition in the global agri-food trade, accordingly to Jámbor et al. (2017) and Bojnec & Ferto (2018).

Analysing Brazilian Competitiveness

The Brazilian agricultural export performance can be evaluated by the calculation of the Revealed Comparative Advantage (RCA) indices. At the product level (Figure 8) we can conclude that, considering the original Balassa index, all agricultural products are competitive in the world market, also confirming the H_2 hypothesis. *Tobacco and manufactured tobacco substitutes* (HS 24) had the highest Balassa indices from 1995 to 2019, followed by *sugar and sugar confectionery* (HS17) and *meat and edible meat offal* (HS02), respectively.

Figure 8 Brazilian Revealed Comparative Advantage Indices by product code at HS 2 digit-level, 1995-2019

Note: See in Table 1

Source: Own composition based on World Bank (2021b) WITS database

The time analysis was also performed and it was observed that Brazil's agriculture sector exports remained competitive throughout the whole period of 1995 to 2019 (H2), with positive RCA and RTA indices.

Analysis of LAC bilateral trade pattern

Latin American and Caribbean nations have seen substantial positive trends in agricultural development, notably in the rise of agricultural commerce, which has been accompanied by policy and production modifications, as well as more global connectivity. (OECD, 2019). The agricultural trade surplus in LAC has continuously risen, acting as a protection against major economic contractions during recessions and times of economic crisis (Arias et al., 2017).

In order to provide the necessary treatment for zero trade flows observations, since, due to the economic implications of zero trade values, estimating a shortened data sample might result in biased conclusions, Multilateral Resistance Terms (MRT) such as temporal and geographic dummies were added to the dataset. In this sense, Table 8 presents the final gravity regression results for trade obtained using PPML calculations between LAC countries and their trading partners (export destinations) for the period 1995 to 2019.

Table 2 Final Gravity estimation results for Latin America and the Caribbean region, 1995-2019.

	(1)	(2)
VARIABLES	Agri_export	Agri_export
ln(GDP_reporter)	0.335***	0.914***
	(0.000)	(0.0135)
ln(GDP_partner)	0.949***	0.848***
	(0.000)	(0.0150)
ln(dist)	-0.008***	-0.146***
	(0.000)	(0.0385)
comlang_off	0.097***	0.676***
	(0.000)	(0.0604)
contig	-0.234***	0.793***
	(0.000)	(0.133)
colony	0.081***	-0.613***
	(0.000)	(0.0603)
MERCOSUR	2.191***	1.432***
	(0.718)	(0.0832)
NAFTA	-1.142***	-0.974***
	(0.155)	(0.0590)
Paris_Agreement	0.0003***	-0.0112
	(0.000)	(0.0681)
Remoteness_exp		-0.0007***
		(0.000)
Remoteness_imp		-0.00002***
		(0.000)
Constant	1.820***	-23.88***
	(0.017)	(1.052)
Observations	103,822	103,822
R-squared	0.824	0.534

zero	yes	yes
country pair fixed	yes	no
time fixed	yes	no

*Legend: * p<0.05; ** p<0.01; *** p<0.001. Robust standard errors in parenthesis.*
Note: Share of zero trade flows is 52% in the sample.

Source: Own composition based on World Bank (2021a) World Integrated Trade Solutions (WITS) database

The first and second column refers to PPML estimations that include zero trade flows. Time and country-pair fixed effects were also included in model (1) while model (2) comprised the remoteness terms (Remoteness_exp, Remoteness_imp) as GDP-weighted distance averages suggested by Head (2003), Baier and Bergstrand (2007). These remoteness terms are a linear approximation of the multilateral resistance terms.

The H_4 hypothesis of this work is here confirmed, meaning that agri-food trade flows between LAC and their export destinations are directly proportional to the size of economies their (*GDP_reporter*, *GDP_partner*). Furthermore, agri-food exports fall when the distance between the two most populous cities in each trading partner grows.

On the contrary, while model 2 indicates that contiguity has a positive effect, model 1, influenced by the effect of the remoteness term, indicates the opposite, which makes its implication debatable. The negative value for contiguity could be explained by the fact that main export destinations (USA, China, Netherland, Germany, and Spain) do not have common borders with LAC, and the export is realized on maritime transport, which can be cheaper.

The beneficial effect of a common official language (comlang_off) on LAC trade flow is observed in all estimation results, with a 1% significance level, demonstrating that cultural similarity between LAC and its trading partner appears to have a positive impact on trade flow, as it can reduce information and trade costs, partially confirming H_5 hypothesis and in accordance with Balogh and Jámbor (2018) and Braha et al. (2017). Despite model 1 indicating that the former colonial relationship (colony) has a positive significant effect on agricultural export between LAC and its trading partners, model 2 shows a negative effect, making its interpretation ambiguous, so hypothesis 5 is only partially confirmed.

Impacts of free trade were analysed by H_6. In this context, the influence of MERCOSUR was positive and significant, indicating that the Southern Common Market increases the value of bilateral commerce between its member nations in accordance with the findings of the World Bank (2019). According to Graf and Azevedo (2013), this was accomplished by the elimination of intra-bloc tariffs and non-tariff barriers, as well as the establishment of a common external tariff (TEC) for most extra-bloc imported items. NAFTA had a negative impact on LAC agricultural export suggesting that it did not encourage agri-food export from Mexico to the USA and Canada (H_6 was only partly accepted).

The Paris Agreement, under which ratifying countries have decided to reduce their greenhouse gas emissions, including in the agricultural sector, was also added to the analysis in order to discover the effect of environmental regulation on LAC agri-food exports. The variable was positive significant in model 1, which made hypothesis 7 to be rejected, contrary to the previous empirical literature. Although the variable was negative in model 2, which would be consistent with other studies, the result was not statistically significant, suggesting that we cannot make inferences about it (Aichele & Felbermayr, 2013; Kim, 2016).

Conclusion

By examining the characteristics of LAC's agri-food trade, it was revealed that Brazil, Argentina, and Mexico were the leading exporters throughout the study period, accounting for 67 per cent of all agri-food products exported, whereas the TOP 10 nations accounted for 92 per cent of the total agricultural products. In summary, from 1995 to 2019, Latin America and the Caribbean accounted for around 15% of all agricultural commodities exported in the global market, becoming the world's third-largest agricultural exporting area in 2004. The huge amount of exported agri-food leads to significant and rising surpluses, and agribusiness has shown to be critical to the region's prosperity, playing a key role in its economic dynamics, validating the first hypothesis (H_1).

The RCA, RTA, SRCA, and RC indices were calculated and compared with the assumption that, despite their limitations, the indices can give further insight into a country's agri-food competitiveness. As a result, the index analyses might expose revealed competitive advantages, both national and product levels, validating hypothesis 2 (H_2).

At the country level, the calculation of Balassa indices revealed that among the major agricultural exporters in LAC, Guatemala, Uruguay, and Ecuador had the highest comparative advantages (RCA) in all periods analysed. At the product level, our study revealed that oil seeds and oleaginous fruits and miscellaneous grains, seeds and fruit, industrial or medicinal plants, and straw and fodder (HS12) were the most exported items by LAC at the 2-digit level from 1995 to 2019, accounting for more than 12% of total agri-food exports. It's worth noting that RTA, SRCA, and RT all integrate import values into their calculations, being more likely to be influenced by policy and government interventions, the reason why some authors favour the original RCA.

Furthermore, the results demonstrate that all indices in global agri-food trade are persistent for the TOP 10 countries in LAC, implying stable competitive potentials for those nations. According to Kaplan-Meier survival rates, RCA indices in LAC do not endure over time, corroborating with the third hypothesis (H_3). Survival prospects of 98 per cent at the start of the time plummeted to 9 per cent at the end of the term, implying that global agricultural commerce is particularly competitive.

This work gave a special emphasis was to Brazil nation, which is the world's 22nd biggest export economy, the biggest agri-food exporter in the LAC region, and the fifth largest exporter of agricultural products in the world, high exported volume that results in considerable trade surpluses, also confirming H_1. The performance of Brazilian agricultural exports demonstrated that, when taking into consideration the RCA, all agricultural product groups are competitive in the global market, additionally verifying H_2.

This work also employed the gravity model approach to analyse the main determinants of Latin American and Caribbean bilateral agricultural export patterns. The study utilized an econometric approach using Poisson Pseudo-Maximum Likelihood estimation for LAC agri-food exports with all trading partners for the period 1995-2019, accounting for zero trade flows, time, and country fixed effect. The estimated models proved that the LAC trading partners' GDP and the geographic distance between them affect international commerce of agricultural products (H_4). Linguistic similarities (common official language spoken) have positive while border effects and past colonial links are ambiguous impacts on the LAC agri-food trade, confirming that cultural similarity stimulates trade (H_5).

Estimations explored the favourable impact of LAC involvement in MERCOSUR on agri-food commerce. By contrast, the trade costs of shipping products from LAC (Mexico) to NAFTA destinations (the USA and Canada) were higher, diminishing the value of export. It reveals that this trade relationship is not mutually advantageous for both partners in terms of agricultural products (H_3 was only partly accepted). Finally, the negative impact of environmental regulations

(Paris Agreement) on agri-food export was not confirmed (H_7 is rejected).

In short, the LAC agri-food export industry continues to be dynamic and successful in the international market, playing an important role in the commercial and international trade sectors worldwide. LAC have promising prospects to boost its agricultural production when combined with expanding global demand, which may help to stimulate the region's economic development. Finally, in the future, my research can be expanded to focus on additional major drivers of competitiveness and determining factors of agri-food trade flow at a more disaggregated level.

Bibliography

Anderson, J. E., & Van Wincoop, E. (2003). Gravity with gravitas: A solution to the border puzzle. *American Economic Review*, *93*(1), 170–192. https://doi.org/10.1257/000282803321455214

Azevedo, A. F. Z. (2004). Mercosur: ambitious policies, poor practices. *Brazilian Journal of Political Economy*, *24*(4), 594–612. https://doi.org/10.1590/0101-35172004-1604

Bacchetta, M., Beverelli, C., Cadot, O., Fugazza, M., Grether, J.-M., Helble, M., Nicita, A., & Piermartini, R. (2012). *A Practical Guide to Trade Policy Analysis*. World Trade Organisation and United Nations. https://doi.org/10.30875/131552a5-en

Baier, S. L., & Bergstrand, J. H. (2007). Do free trade agreements actually increase members' international trade? *Journal of International Economics*, *71*(1), 72–95. https://doi.org/10.1016/j.jinteco.2006.02.005

Balassa, B. (1965). Trade Liberalisation and "Revealed" Comparative Advantage. *The Manchester School*, *33*(2), 99–123. https://doi.org/doi:10.1111/j.1467-9957.1965.tb00050.x

Baldwin, R. & Taglioni, D. (2006). Gravity for Dummies and Dummies for Gravity Equations. *Centre for Economic Policy Research Discussion Paper*, *5850*, 1–23. https://doi.org/10.3386/W12516

Balogh, J. M. & Jámbor, A. (2018). The Role of Culture, Language and Trade Agreements in Global Wine Trade. *AGRIS On-Line Papers in Economics and Informatics*, *10*(3), 17–29. https://doi.org/10.22004/AG.ECON.281642

Balogh, J. M. & Jámbor, A. (2020). The environmental impacts of agricultural trade: A systematic literature review. *Sustainability (Switzerland)*, *12*(3), 1–16. https://doi.org/10.3390/su12031152

Balogh, J. M. & Leitão, N. C. (2019). A gravity approach of agricultural trade: The nexus of the EU and African, Caribbean and Pacific countries. *Agricultural Economics*, *65 (2019)*(No. 11), 509–519. https://doi.org/10.17221/131/2019-AGRICECON

Bojnec, Š. & Fertő, I. (2019). European Union countries agri-food trade structures and main competitors on the internal and global agri-food markets. *Ekonomika Poljoprivrede*, *66*(2), 635–650. https://doi.org/10.5937/ekopolj1902635b

Borges Aguiar, G. M. & Cossu, E. (2019). The Gravity Model for Trade Theory. *Köz-Gazdaság*, *14*(3), 293–299. https://doi.org/10.14267/retp2019.03.25

Braha, K., Qineti, A., Cupák, A., & Lazorčáková, E. (2017). Determinants of Albanian Agricultural Export: The Gravity Model Approach. *AGRIS On-Line Papers in Economics and Informatics*, *09*(2). https://doi.org/10.22004/AG.ECON.262457

Dalum, B., Laursen, K., & Villumsen, G. (1998). Structural change in OECD export specialisation patterns: de-specialisation and 'stickiness'. *International Review of Applied Economics*, *12*(3), 423–443. https://doi.org/10.1080/02692179800000017

De Benedictis, L., Tamberi, M., De Benedictis, L., & Tamberi, M. (2004). Overall Specialization Empirics: Techniques and Applications. *Open Economies Review*, *15*(4), 323–346. https://econpapers.repec.org/RePEc:kap:openec:v:15:y:2004:i:4:p:323-346

De la Torre, A., Didier, T., Ize, A., Lederman, D., & Schmukler, S. L. (2015). Latin America and the Rising South: Changing World, Changing Priorities. In World Bank (Ed.), □□□□□□ (World Bank). https://doi.org/10.1596/978-1-4648-0355-0

Drabo, A. (2017). Climate change mitigation and agricultural development models: Primary commodity exports or local consumption production? *Ecological Economics*, *137*, 110–125. https://doi.org/10.1016/J.ECOLECON.2017.03.014

ECSIP Consortium. (2016). *The competitive position of the European food and drink industry* (Issue February). European Competitiveness and Sustainable Industrial Policy Consortium.

FAO. (2017). The future of food and agriculture: trends and challenges. In *The future of food and agriculture: trends and challenges* (Vol. 4, Issue 4). www.fao.org/publications%0Ahttp://www.fao.org/3/a-i6583e.pdf%0Ahttp://siteresources.worldbank.org/INTARD/825826-1111044795683/20424536/Ag_ed_Africa.pdf%0Awww.fao.org/cfs%0Ahttp://www.jstor.org/stable/4356839%0Ahttps://ediss.uni-goettingen.de/bitstream/han

FAO. (2018). *The State of Agricultural Commodity Markets: Agricultural Trade, Climate Change, and Food Security*. Food and Agriculture Organization.

Fischer, G., van Velthuizen, H. T., Shah, M. M., & Nachtergaele, F. O. (2002). *Global Agro-ecological Assessment for Agriculture in the 21st Century: Methodology and Results*. http://pure.iiasa.ac.at/id/eprint/6667/

Gujarati, D. N., & Porter, D. C. (2008). *Basic Econometrics* (5th ed.). McGraw-Hill Inc.

Head, K. (2003). Gravity for Beginners. *Rethinking the Line: The Canada-U.S. Border Conference*, *January*, 1–11.

Head, K., & Mayer, T. (2014). Gravity Equations: Workhorse, Toolkit, and Cookbook Appendix. *Handbook of International Economics*, 131–195.

Jambor, A., & Babu, S. (2016). *The Competitiveness of Global Agriculture: Policy Lessons for Food Security*. Springer. https://doi.org/10.1007/978-3-319-44876-3_6

Jug, J., & Mirza, D. (2005). Environmental Regulations in Gravity Equations: Evidence from Europe. *World Economy*, *28*(11), 1591–1615. https://doi.org/10.1111/J.1467-9701.2005.00748.X

Kim, H. S. (2016). The effect of the Kyoto Protocol on international trade flows: evidence from G20 countries. *Applied Economics Letters*, *23*(13), 973–977. https://doi.org/10.1080/13504851.2016.1167820

Korinek, J., & Melatos, M. (2009). Trade Impacts of Selected Regional Trade Agreements in Agriculture. *OECD Trade Policy Working Papers*, *No. 87*.

Lambert, D. M., & Grant, J. H. (2008). Do regional trade agreements increase members' agricultural trade? *American Journal of Agricultural Economics*, *90*(3), 765–782. https://doi.org/10.1111/J.1467-8276.2008.01134.X

MAPA. (2022). *AGROSTAT (Estatisticas de Comércio Exterior do Agronegócio Brasileiro)*. https://indicadores.agricultura.gov.br/agrostat/index.htm

Mizik, T., Gál, P., & Török, Á. (2020). Does agricultural trade competitiveness matter? The case of the CIS countries. *Agris On-Line Papers in Economics and Informatics*, *12*(1), 61–72. https://doi.org/10.7160/aol.2020.120106

OECD/FAO. (2019). *OECD-FAO Agricultural Outlook 2019-2028*. OECD Publishing. https://doi.org/https://doi.org/10.1787/agr_outlook-2019-en. This

OECD. (2019). The changing landscape of agricultural markets and trade : prospects for future reforms. *OECD Food, Agriculture and Fisheries Papers, OECD Publishing, Paris*, *118*. https://doi.org/http://dx.doi.org/10.1787/7dec9074-en

Pérez, C. (2010). Dinamismo tecnológico e inclusión social en América Latina: Una estrategia de desarrollo productivo basada en los recursos naturales. *Revista de La CEPAL*, *2010*(100), 123–145. https://doi.org/10.18356/0b1cb6b0-es

Shi, X., & Xu, Z. (2018). Environmental regulation and firm exports: Evidence from the eleventh Five-Year Plan in China. *Journal of Environmental Economics and Management*, *89*, 187–200. https://doi.org/10.1016/J.JEEM.2018.03.003

Torok, A., & Jambor, A. (2016). Determinants of the revealed comparative advantages: The case of the European ham trade. *Agric. Econ. – Czech*, *62*(10), 471–481. https://doi.org/10.17221/177/2015-AGRICECON

United Nations. (2017). *Harmonized Commodity Description and Coding Systems (HS)*. United Nations International Trade Statistics Knowledgebase.

https://unstats.un.org/unsd/tradekb/Knowledgebase/50018/Harmonized-Commodity-Description-and-Coding-Systems-HS

Vollrath, T. L. (1991). A Theoretical Evaluation of Alternative Trade Intensity Measures of Revealed Comparative Advantage. *Weltwirtschaftliches Archiv*, *127*(2), 265–280. https://doi.org/10.1007/BF02707986

World Bank. (2019). *Trade Integration as a Pathway to Development?* https://doi.org/10.1596/978

World Bank. (2021a). *World Development Indicators - DataBank.* https://databank.worldbank.org/source/world-development-indicators

World Bank. (2021b). *World Integrated Trade Solution (WITS)*. Commodity Trade Database. https://wits.worldbank.org/

Publications

English-language peer-reviewed journal articles and book reviews

Borges Aguiar, Giovanna, Maria & Cossu, Elena (2019) The Gravity Model for Trade Theory. The Public Economy (Köz-gazdaság) (ISSN 1788-0696) : 14 (3) pp 293-299.

Borges Aguiar, Giovanna Maria (2021) Populism in Times of Crisis: The Brazilian Case of Bolsonaro. AARMS – Academic and Applied Research in Military and Public Management Science (ISSN 2498-5392) : Vol. 20, Special Edition 19–32.

Borges Aguiar, Giovanna, Maria & Balogh, Jeremiás Máté (2022) Analysis of Competitiveness in the Agri-food sector: The case of Latin America and the Caribbean Region. Competitio Vol 21. Issue 1-2 - University of Debrecen Publishing Platform.

Balogh, Jeremiás Máté & Borges Aguiar, Giovanna Maria (2022) Determinants of Latin American and the Caribbean agricultural trade: A gravity model approach. Agric. Econ. – Czech, 68: 127–136.

English-language books, chapters

Cossu , Elena, & Borges Aguiar; Giovanna Maria (2020) Traditions, Institutions, and Growth: the Case of Hungary In: Szerényi, Zsuzsanna; Kaponyi, Erzsébet; Benczes, István (szerk.) Contemporary global challenges in geopolitics, security policy and world economy Budapest, Magyarország : Corvinus University of Budapest, International Relations Multidisciplinary Doctoral School. 489 p. pp. 220-233. , 14 p.

Conference papers

Borges Aguiar, Giovanna Maria & Balogh, Jeremiás Máté (2022) Agri-Food Trade Competitiveness in the Latin America and the Caribbean Region. 182nd EAAE Seminar

"Sustainability via biodiverse agri-food value chains": Abstracts Book. Hania , Greece. CIHEAM Mediterranean Agronomic Institute of Chania pp. 21-21 (2022)

Borges Aguiar, Giovanna Maria & Balogh, Jeremiás Máté (2022) Exploring the Environmental Pollution of Agricultural trade in the Non-European countries. In: 16th International European Forum (Igls-Forum) Abstracts. Garmisch-Partenkirchen, Germany. pp. 1-2. , 2 p.

Borges Aguiar, Giovanna Maria & Balogh, Jeremiás Máté (2022) Agri-food Competitiveness of Latin America and the Caribbean: the Revealed Comparative Advantage Approach. In: Thomázy, Gabriella (eds.) South America, South Europe International Conference -2022: Book of Abstracts : „Aspects of Defense and Security in South America and Southern Europe: borders, conflicts, and international cooperation" Budapest, Hungary: Association of Hungarian PHD and DLA Students 90 p. pp. 58

Borges Aguiar, Giovanna Maria (2021) Populism in Time of Crisis. South America, South Europe International Conference - "New Approaches to Defense and Security in South America and Southern Europe", April 17, 2021 Budapest, Hungary (ISBN: 9786155586910) Association of Hungarian PHD and DLA Students (2021) 63 p. p. 35

Borges Aguiar, Giovanna Maria & Balogh, Jeremiás Máté (2021) Export competitiveness of Latin America and the Caribbean: the agricultural sector analysis. 10th Jubilee Interdisciplinary Doctoral Conference 12-13th of November 2021 Book of Abstracts

Borges Aguiar, Giovanna Maria & Jámbor, Attila. (2019) Brazil's agri-food trade profile (ISBN: 9789633066539) Hódmezővásárhely: University of Szeged Faculty of Agriculture , p. 39.