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Trade Patterns of Latin America and the Caribbean:

Evidence from the agri-food sector

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LIST OF ABBREVIATIONS

Abbreviation	Definition
ACP	African, Caribbean and Pacific
ARCA	Index of Additive Revealed Comparative Advantage
ARG	Argentina
BEL	Belgium
BRA	Brazil
BRICS	Brazil, Russia, India, China, and South Africa
CEPII	Centre d'Études Prospectives et d'Informations Internationale
CES	Constant Elasticity of Substitution
CET	Constant Elasticity Transformation
CHL	Chile
CHN	China
CMS	Constant Market Share
COMTRADE	Commodity Trade Statistics Database
CRI	Costa Rica
DEU	Germany
DRC	Domestic Resource Cost
EAS	East Asia and Pacific
ECS	Europe and Central Asia
ECU	Ecuador
ESP	Spain
EU	European Union
FAO	Food and Agriculture Organization
FE	Fixed Effects
GBR	United Kingdom
GCI	Global Competitiveness Index
GDP	Gross National Product
GL	Grubel-Lloyd measure
GTM	Guatemala
HS	Harmonized Commodity Description and Coding System
ICT	Information and Communication Technologies
IIT	Intra-Industry Trade
IMD	Institute for Management Development
IRN	Iran, Islamic Republic
ITA	Italy
JPN	Japan
LAC	Latin America and the Caribbean
LM	Lagrange Multiplier Test
MAPA	Ministério da Agricultura, Pecuária e Abastecimento

MEA	Middle East and North Africa
MERCOSUR	Mercado Común del Sur
MEX	Mexico
MRT	Multilateral Resistance Terms
NAC	North America
NAFTA	North American Free Trade Agreement
NEI	Net Export Index
NLD	Netherlands
NRCA	Index of Normalized Revealed Comparative Advantage
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Squares
OTR	Other Regions
PCR	Private Cost Ratio
PER	Peru
PPML	Poisson Pseudo-Maximum-Likelihood
RC	Index of Revealed Competitiveness
RCA	Index of Revealed Comparative Advantage
RE	Random Effects
RMA	Index of Relative Advantage
RTA	Index of Relative Trade Advantage
RUS	Russian Federation
RXA	Index of Relative Export Advantage
SAS	South Asia
SAU	Saudi Arabia
SCB	Social Cost-Benefit Ratio
SRCA	Index of Symmetric Revealed Comparative Advantage
SSA	Sub-Saharan Africa
TFP	Total Factor Productivity
UN	United Nation
UNSD	United Nation Statistical Division
URY	Uruguay
USA	United States of America
USD	United States Dollar
VWT	Virtual Water Trade
WDI	World Development Indicators
WEF	World Economic Forum
WITS	World Integrated Trade Solutions
WRCA	Index of Weighted Revealed Comparative Advantage
WTO	World Trade Organization

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1. 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).

Agricultural commerce is expected to rise in the upcoming decade, whereas at a smaller rate, as global demand declines, and Latin America and the Caribbean, in particular, have reinforced their position as global suppliers while its export rates are likely to continue to increase. The region has plenty of land and water; 38% of its accessible land is used for agriculture, and 46% is covered in forests, accounting for 14% of worldwide production and 23% of agricultural and fishery commodity exports. 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).

In terms of the world market, competition in the global agri-food trade is fierce and continuously changing (Bojnec & Fertő, 2019b, 2019a; Jámbor et al., 2018). By being a dynamic and complex concept, competitiveness, a central topic in modern economics, has several definitions and measurement methods, at macro and micro levels. At the macro level, it can be defined as a "*set of institutions, policies, and factors that determine the level of productivity of a country*" (World Economic Forum, 2016, p. 4) and can also be related to the concept of comparative advantage, which is the economy's ability to produce goods and services at a lower opportunity cost than its trade partners (Jámbor & Babu, 2016).

In addition to the defining issue, competitiveness involves a wide range of methodologies and measurement techniques. Moreover, revealed performance can be determined by measurement and, in that sense, the Revealed Comparative Advantage (RCA) index formulated by Balassa (1965), which 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, is the most widely used indicator for trade-based competitiveness of nations.

LAC'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). Therefore, competitiveness in the agri-food sectors started to be considered a key issue for many governments in the region as they realised that the sector can contribute to general economic growth and sustainable development. Besides, 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.

In this context, it is also clear that studies analysing the variables that influence agricultural product international commerce are essential. International trade research is crucial because it may favour the aggregation of value and allow trade intensification to have a significant influence on economic growth, contributing to the development of countries. Furthermore, examining the determinants of trade enables the construction of the most effective trade policy plan, which aids in improving decision-making behaviour.

Other personal elements arise in the motivation of my study, in addition to scientific ones. All things considered, agribusiness appears to be the sector that promotes wealth to Latin American and Caribbean countries, even when they are in critical difficulties. As a proud Latin American, it seems natural to investigate such aspects to contribute to the region's economic progress.

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 agro-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, which countries in the region are currently competitive and in what agricultural products. How has competitiveness evolved during the past two decades? Finally, this study investigates the determinants of agricultural trade flow between LAC and their trading partners and how bilateral cultural characteristics affect LAC agri-food export.

There is a strong link between the determinants of general competitiveness and agricultural competitiveness. However, it becomes evident that the latter is more specific, having an additional complexity that makes your in-depth analysis indispensable. By using the Balassa index, based on the Ricardian model of competitiveness, over the years 1995-2019, I intend to identify revealed comparative advantages, by country and product and thus do a systematic analysis of the region's agri-food competitiveness in the long run. Panel data econometrics will be used to identify the conditioning factors lying behind trade flow and the gravity model will be applied to determine the factors that influence trade flow. Regarding the analysed data, this study will use the World Bank WITS software to obtain UN trade data in a worldwide context, which is very reliable and allows for a better evaluation of long-term trends, as well as the construction of a dataset of an econometrically acceptable size.

1.1 Research strategy

This dissertation is empirical research organized into five parts with nine chapters altogether. The major empirical chapters follow the first three chapters, which are divided into the following sections: introductory, theoretical framework and methodological approach (Table 1).

Table 1 Dissertation structure

Sections	Chapters	Chapter heading	Content	Applied methods
Introductory	1	Introduction	Importance of the topic, research strategy	
Theoretical framework	2	Literature review	Theoretical background, an overview of relevant literature and hypothesis to be tested	
Methodological approach	3	Material and methods	Data source, econometric methods framework, estimation and specification	
Empirical analysis	4	Analysis of agricultural trade development in LAC countries	Structural analysis of agricultural trade development in the LAC region. Brazil's role is emphasized	Descriptive statistics
	5	Analysis of LAC agricultural competitiveness in global markets	Assessment of the LAC region's competitiveness (by country and product level). Particular attention is placed on Brazil	Revealed Comparative Advantage (RCA) indices and Kaplan-Meier survivor rates
	6	Analysis of LAC bilateral trade pattern	Examination of the factors that impact agricultural trade flows in the Latin American and Caribbean	Gravity model
	7	Conclusions	Draws conclusions comparing hypothesis confirmed with literature	
Implication and discussion	8	Policy implications	Discussion on recommendations and policy implications	
	9	Limitations	Consideration of difficulties and challenges faced	

Source: Own composition.

Following this Introduction, which provides the motivation and goal of this research, chapter two of this study is a Literature Review that includes an overview of competitiveness (including definitions, theories, and measures) as well as an outline of the gravity model (with the

theory that underpins it). In addition, studies on LAC trade patterns and agricultural competitiveness are also presented in this theoretical section and, following previous empirical research, hypotheses to be tested are provided.

The third chapter provides the methodological approach. The data source is declared, followed by the operationalisation of the research questions, highlighting the revealed comparative advantage indices and the gravity model frameworks. The estimation and specification methods that will be applied to the gravity equation are also revealed.

Subsequently, the empirical part of this research will be presented. Chapter four, with descriptive statistics, provides a synopsis of the agricultural trade development of Latin America and The Caribbean region. Special emphasis is given to Brazil, the biggest agri-food exporter in the region.

Chapter five displays an analysis of the competitiveness of the LAC agricultural sector, also giving special focus on Brazil. Revealed comparative advantage indices are calculated for the Top 10 exporters of the region, providing where competitiveness lies in the region, by country and product. In this part, the duration and the stability of RCA indices were also examined.

Chapter six provides an analysis of LAC bilateral trade patterns with the gravity model approach, shedding insight on the determinants of agricultural trade flows. Finally, chapter seven concludes this works, while the last two chapters provide recommendation and policy implications, as well as limitations of this study and further research directions.

2. LITERATURE REVIEW

2.1 Competitiveness

Competitiveness is the foundation of modern economies. Despite its widespread use, it does not have a uniform definition and is also measured in different ways. The different understandings of its definition and its value for policy were never harmonized, the reason why the results from competitiveness analysis can often be open to different interpretations (Sanfey & Zeh, 2012).

As highlighted by the World Economic Forum, there is a sharp deficit in competitiveness that urgently needs to be dealt with, to restore a nation's productivity and economic growth, the latter being a decisive path that can lead regions out of poverty and improve their living standards (World Economic Forum, 2019). Becomes evident that competitiveness, when interpreted at the macro level, is closely related to international trade performance and that there is a strong link between the determinants of general competitiveness and agricultural competitiveness. However, it's also clear that the latter is more specific, having an additional complexity that makes your in-depth analysis indispensable.

2.1.1 Definitions of Competitiveness

Being a dynamic and complex concept, it is interpreted either at the micro- (firm) or macro (country) level. At the micro-economic level, competitiveness can be defined as "*the ability of firms to consistently and profitably produce products that meet the requirements of an open market in terms of price [and] quality*" (Domazet, 2012, pp. 294-295). Likewise, Yap (2004) states that competitiveness, at the firm level, can be associated with the long-run profit achievement of the firm and linked to an investment of higher return. Flanagan et al. (2005) conclude that firm competitiveness and market performance are closely associated, and having high productivity is the key to success.

However, at the macro-economic level, 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*".

Following the theoretical view that takes into account the influence of the environment, competitiveness builds up a system whose parts are interconnected, which means that competition does not occur only in companies, but in production systems, institutional schemes, and social organizations, among others. Thus, collaboration takes place between groups of companies, which establish a partnership relationship based on a common objective, which is competitiveness.

Atkinson (2013) defines competitiveness as the ability of a region to export more in value-added terms than it imports, a calculation that should include all the "*terms of trade*", to reflect all government "*discounts*" (Atkinson 2013, p. 2). In a strictly economic sense, Charlier (2001) defines it as the ability to withstand market competition. In this sense, competitiveness is defined by Ferraz et al. (1996) as the capacity of a given production system to obtain profitability and maintain or increase its market share, either internally or internationally.

A successful trade performance in the international market is one of the elements that compose national competitiveness, which in turn will lead to continued and increasing standards of living, in terms of high income. That is one of the reasons why some countries find that their success and competitiveness positions are associated (Flanagan et al., 2005). According to Bobirca and Miclaus (2007), when I take into consideration the international level "*competitiveness can be defined as the ability of an economy to attract the demand for its exports and the investment to supply that demand, all within social norms that result in an improved standard of living for its citizens*" (Bobirca and Miclaus, 2007, p. 123).

The OECD Glossary of Statistical Terms defines competitiveness in international trade as a "*measure of a country's advantage or disadvantage in selling its products in international markets*" (OECD, 2001). Establishing a link between the micro and macro level, Garelli (2012) implies that firms would create economic value, while nations can create an environment that emboldens firms to achieve this value. Bhawsar and Chattopadhyay (2015) claim that nations have the capability to create and sustain an environment that can guide firms to flourish, which would be the definition of national competitiveness.

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.

2.1.2 Theories on competitiveness at the macro level

Competitiveness at the macro-level is based on international trade patterns and concepts. Many theories try to explain the export and import patterns of nations. The classical economy theories have observed that there are relations between the nations' commercial practices and their economic development, a factor that is studied through the works of Adam Smith and David Ricardo.

Adam Smith (1776), known as the father of modern economics, proposed the absolute advantage notion, whose theory demonstrates that a country should specialize in producing goods that generate low-cost production, a factor caused by labour compared to other countries, and import high-cost goods. In Adam Smith's point of view, the countries tend to produce and trade goods using fewer inputs in production and tend to import goods that other countries can produce using fewer inputs, which reflects the absolute differences in productivity. Moreover, for the author, international trade has the ability to bring wealth to nations.

David Ricardo (1817) refined Adam Smith's notion of absolute advantage arguing that international trade between nations is based on comparative advantage. According to his theory, trade is based on labour productivity differences between the countries, and the flows of exchange between nations reflect the comparative advantages they have in carrying out these transactions. Ricardo suggests that production and trade are not driven by low cost but by the most effective use of resources. In this sense, a country can still import products that it could produce at a lower cost if it can be more productive in producing other goods and it should specialize in the latter in which it has a comparative advantage.

Thus, as Young (1951) points out, the cost of labour does not control the conditions of exchange in foreign trade, but the comparative costs existing in the production of different goods. Nevertheless, according to the author, this classic model has gaps that are subject to criticism,

primarily directed at the models' assumptions, such as perfect competition within each country, complete immobility of labour and capital between countries, but domestic mobility, and constant costs.

According to Krugman and Obstfeld (2003), the main reasons for the errors of the predictions implicit in Ricardo's model are the assumption of an extreme degree of specialization, which is not observed in the real world, and the presumption that countries as a whole will always gain through trade, and the fact that the role of economies of scale as a cause of trade is ignored, which makes it impractical to explain the large trade flows between apparently similar nations.

Furthermore, Lafay (1992) explains that there are meaningful differences between competitiveness and comparative advantage, as competitiveness usually involves a cross-country comparison of a product, while comparative advantage is measured between products within a country. Also, he states that competitiveness is sensitive to the variations in macroeconomic variables, differently than comparative advantage, which is structural in nature. Bojnec and Fertö (2009) state that the difference between comparative advantage and competitiveness is the inclusion of market distortions related to the latter.

Neoclassical economic theories broadened the premises of these traditional models. Heckscher (1919) and Ohlin (1933) suggested a model which assumes that equivalent technologies are owned by all countries, which allocates the factors of production (such as land, natural resources, labour, and capital) differently. Thus, the comparative advantages come from the different levels of relative stocks of the different factors of production, influencing the production costs of these goods, accordingly, differences in factor endowments are the reason for comparative advantages (Heckscher and Ohlin, 1991). Thus, the Heckscher-Ohlin (H-O) model indicates that countries will specialize in the production of goods using factors of production (labour, land, and capital) that have relative abundance, exporting these goods, and importing others whose intensive productive factors are relatively scarce in their territory. Following Williamson (1983), this model was widely accepted mainly in the political environment, influencing a lot in the determination of government policies, by admitting that governments can change the comparative advantage of factors through various forms of intervention.

For Porter (1998), those comparative advantage theories based on factors of production are not enough to explain patterns of a trade by itself, as basic assumptions of comparative advantage

theories, such as the lack of economies of scale, the fixed pool of national factors and the homogeneity of the technologies and products, are not realistic in many sectors. Moreover, it is also assumed by the standard comparative advantage theory that factors like skilled labour and capital are not relocated between nations, which has no resemblance to real competition.

Krugman and Obstefeld (2003) also pointed out some factors that in their opinion contribute to the inability of the comparative advantage theory to explain the current reality, which includes the growing trade of products whose production involves similar factors proportions; the existence of a large volume of international trade between industrialized countries with the provision of similar factors; and the ascendance of the multinational corporations, which import and export between different subsidiaries of the same firm, creating a new type of trade flow. It is also observed that some countries were able to have an excellent performance in global trade, even when lacking natural resources, which goes against those neoclassical economic growth theories (Bhawsar and Chattopadhyay, 2015).

Porter (1985, 1998, 1999) was the one who put forward the famous theory of competitive advantage, identified by him as a source of competitiveness. He believed that the reason behind the rise or fall of a country was whether it could have a competitive advantage in the international market. According to him, although absolute and relative advantage are necessary for trade, these theories have become inadequate, due to expressive changes in the international competition nature. The author proposed a new approach that focuses on competitive advantage, reflecting the concept of competition, which includes segmented markets, differentiated products, technological diversities and economies of scale.

Porter (1998) focuses on answering the one that seems to him to be the central question: why do companies based in certain nations achieve international success in different segments and industries? For him what should be sought is the essential characteristics of a nation that allow its companies to create and maintain a competitive advantage in certain fields, that is, the competitive advantage of nations.

Concerning the productivity, Porter (1999) affirms that the only significant concept of national competitiveness is that of productivity, which defines the value of what is produced by a unit of work or capital, depending on the product quality and characteristics, as well as on the efficiency with which those are produced. In that sense, competitiveness and productivity, at the

national level, are equivalent. It is important to note that no nation can be competitive in everything, as its human resources and capital are not unlimited. The point is that these resources must be used in the most productive activities, which allows productivity gains for the nation through trade. Trade integration between countries has a major impact on their productivity, and that is a principle recognized by Porter (1998), Ricardo (1817), and Smith (1776).

On the other hand, international trade can also threaten productivity growth. Exposure of firms to international standards, if they are not competitive enough, can lead to compromised export capacity and the country's standard of living. Therefore, complements Porter (1998), obtaining a balanced trade or a trade surplus does not imply national competitiveness. the country should be concerned about exporting goods manufactured with high productivity because that is what brings greater national productivity and thus higher income per capita. The aim should therefore be the export of goods manufactured with high productivity since that is what brings greater national productivity and thus higher income per capita.

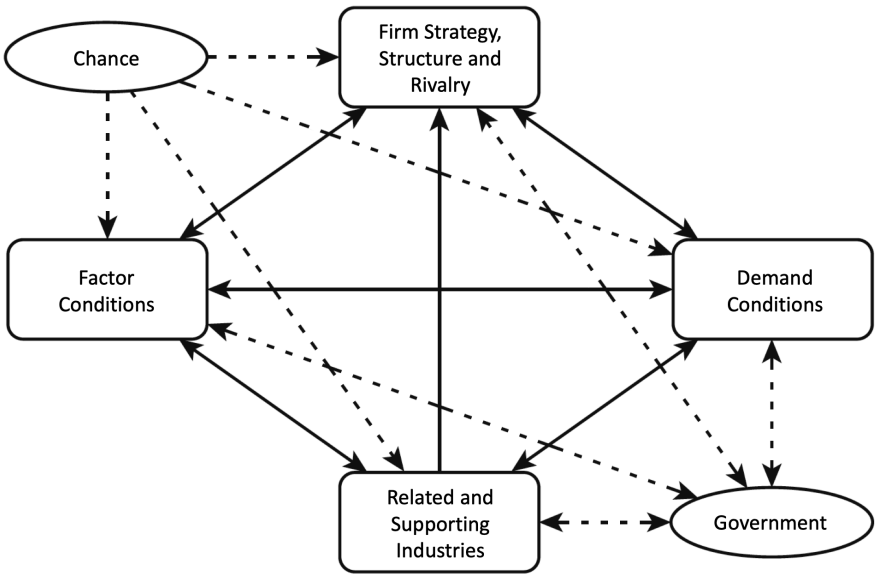
Contrary to the prevailing thinking, which attributes the competitive advantage to labour costs, interest rates, exchange rates and economies of scale, Porter (1998) alleges that the competitive advantage is achieved by increasing the productivity of companies, which takes place through innovations, resulting from investments in knowledge, new technologies, new training methods, new marketing approaches or improvement of production and management processes. Along these lines, a country obtains a high standard of living and manages to maintain it through productivity and its pace of growth. That is, a high per capita income is related to the frequency of innovations in the economy.

Through serious research on nations and industries, Porter (1998) identified the fundamental determinants of competitive advantage in an industry, which depends on four broad country-specific and two exogenous determinants that shape the national environment in which these companies compete. Those determinants, when working as a system, form the so-called *Porter's Diamond Model,* recognized as one of the most influential contemporary theories of national competitive advantages.

According to the Diamond model (Figure 1), the country's position in the 'Factors' of production, such as specialized labour or infrastructure, is the first endogenous determinant. The second is the condition of 'Demand', that is, the essence of domestic demand for the products or

services of the industry. The 'Related and Supporting Industries' is the third determinant, which is the presence or privation, in the country, of internationally competitive related and supplier industries. The fourth is given by 'Firm Strategy, Structure and Rivalry' and is related to the conditions in how firms are generated, structured, and managed, as well as to the nature of the domestic rivalry. Regarding the external determinants, 'Role of Chance' and 'Government' are the determinant described by the author (Porter, 1998).

Figure 1 Porter's Diamond Model – The complete system



Source: Porter (1998, pp 127)

Factor Conditions are correlated with human resources, capital, infrastructure, land, and knowledge, being inputs needed for competition in industries. Those factors are created within the nation and may diverge amid those and over industries, although human resources, knowledge, and capital have mobility between countries. Factor conditions can be subdivided into basic and advanced, being the latter the most significant ones that require investment in human and physical capital, being created through investment and innovation, while the former demands little investments and can even be passively inherited (Porter, 1998)

Ricardo and Heckscher-Ohlin's models are static, that is, labour productivity or the stock of factors are given. Thus, labour, territory, natural resources, capital and infrastructure determine the trade flow. In opposition to this point of view, Porter (1998) believes in the creation of factors.

Thus, the competitiveness of a country or industry will depend on the ability to create, innovate and improve. And this capacity reflects the investments made in highly qualified human resources or on a scientific basis.

Regarding the *Demand Conditions*, Porter (1998) agrees with Linder (1961) in defending the importance of domestic demand in determining the flow of international trade. For the latter author, local demand is needed to allow local companies to learn how to succeed in the sector. Nations with similar per capita income are presumed to have similar demands, and trade will be higher within countries with that similarity. However, the former author points out flaws in this theory, stating that the size of the demand is not the only thing that matters, but also its composition and the sophistication of consumers. From Porter's point of view, the situation of internal demand helps to build a competitive advantage, because, when the demand is more sophisticated and picky, companies need improved products to please those consumers. In addition, the country can observe national buyers and identify a need that may become global, anticipating other competitors and thus obtaining competitive advantages in the production of such.

The presence of *Related and Supporting Industries*, which in turn have a global competitive advantage, is the third determinant of national advantage in an industry. The existence of related competitive industries in the countries offers opportunities for information and technical exchange, which can lead to the creation of new competitive industries. In addition, the presence of internationally competitive supplier industries creates advantages in other related industries by ensuring efficient and fast access to inputs and by having internal suppliers that provide improvements in terms of constant coordination, promoting innovation and upgrading to the sector.

The fourth determinant of the *national diamond* is Firm Strategy, Structure, and Rivalry. The business environment offered by countries is an important determinant of the strategies and structures of the companies, it sets the odds and possible forms of competition. Concerning rivalry, Porter (1998) identifies its association with a competitive advantage as one of the most solid empirical findings. Going against some arguments that this would be a wasted rivalry, the author analyses it as the first force that boosts firms to quality improvement and innovation. In that way, the stronger domestic companies will be the ones equipped to succeed globally.

Subsequently, the external factors that are also part of *Porter's diamond model* are related to the role of chance and government interventions. The first is related to events that do not occur as a result of the circumstances of nations, not being within the reach of the influence of companies and even the government. The author states that this is an important factor that can bring discontinuity, by modifying the *diamond* conditions and shifting the competitive positions.

For Porter (1998) it is essential to know the real role of the government, which should be to positively induce determinants that can be influenced. Successful government policies are those that create an environment in which, without directly involving the government itself in the process, companies are able to obtain competitive advantage.

Porter's work was very influential and important for the theory of business economy strategy. But it also faced a lot of criticism, especially from Krugman (1994), who described the concept of competitiveness as a "dangerous obsession", being the interest in the empirical matter regarding competitiveness practically speculative and without foundation. For the author, this "obsession" with competitiveness can generate real dangers, such as the increase of excessive expenses of public resources in order to increase competitiveness, the conduction of economic protectionism, and the risk related to the commercial wars that, according to him, could result in bad public policies. Krugman's central point is that competition between companies is not a good analogy for studying national or regional economies (Gorton et al., 2013).

In Krugman's opinion, some arguments can be raised in opposition to the national diamond. Companies and nations compete with each other in distinct ways, as countries cannot be closed and go out of business, unlike uncompetitive firms. His other argumentation is related to the fact that trade is not a zero-sum game, the growth of one country's economy is not necessarily due to the sacrifice of another, therefore, a win-win situation can occur with countries, but not with firms. The author's last point is that when the policies are aimed at increasing the competitiveness of the country itself, the tendency is that those are protectionist policies, which can lead to unnecessary and misguided public spending, and also to trade wars. This closing argument was not very well accepted as, in practice, national competitiveness is usually linked to liberal policies, rather than protectionism and the need for domestic reforms on the supply side, as suggested (Reiljan et al., 2000).

Regardless of the critics and the naysayers, those theories have greatly influenced economic thinking on competitiveness. One of the major differences between traditional theories and the theory of competitive advantage is the static treatment given to the economy by Ricardo, who focuses on productivity as a given, while for Porter the analysis is dynamic, which makes productivity liable to be created through improvements and innovations. Traditional theories deal with a very simplified reality, with factors and productivity given, without anything being done about it. In the real world, it doesn't happen this way. In seeking greater profit, companies tend to innovate, changing both the relative stock of factors and productivity.

Table 2 Summary of theories on competitiveness

Theory		Author	Year	Main Concept
Classical Trade Theories	Absolute Advantage	Adam Smith	1776	Absolute Advantage - Nations will specialize in the production of goods in which they have an absolute advantage, and will trade those for products in which they do not retain such advantage.
	Comparative Advantage	David Ricardo	1817	Comparative Advantage - Nations will specialize in the production of goods in which they have a comparative advantage, in which they can produce with relative efficiency.
Neoclassical Trade Theories	Extended Comparative Advantage	Heckscher and Ohlin	1919 and 1933	A country's comparative advantage is determined from relative endowments of the factors of production (labour, land, and capital)
New Trade Theories	Competitive Advantages	Michael Porter	1998	A country's competitive position is determined by factors and conditions and achieved by increasing productivity, which depends on the ability of companies to innovate and modernize (Diamond Model).
New Trade Theories	Gravity model	Jan Tinbergen and Anderson and van Wincoop	1962 and 2003	Bilateral trade flow between two countries is proportional to the GDP of those countries and inversely proportional to the distance between them.

Source: Own composition

When combining theories of international trade with those of competitiveness at the macro level, we follow the literary strand that argues that the competitiveness of nations is interpreted and measured through trade-based indexes.

2.1.3 Measurements of 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). As well as the definition problem, competitiveness encompasses many different approaches and measurement techniques. At the firm level, the traditional financial indicators can be used to measure competitiveness, such as profitability growth, earnings before interest, taxes, return on assets and others. The microanalysis focuses on the behaviour and performance of the selected firms and the comparison of these indicators can illustrate the competitive position of firms (Jámbor and Babu, 2016).

Another way to measure competitiveness at the micro-level is associated with profitability, which is not related only to costs but also to revenue. Productivity and efficiency are also cited as a measurement of competitiveness. The Total Factor Productivity (TFP), for instance, is used to measure the efficiency in which a firm uses total inputs to produce total outputs (Latruffe, 2010). Cost measures, like Domestic Resource Cost (DRC) ratios, compare the cost opportunity of domestic production with the generated value-added, as proposed by Gordon et al. (2013). Bilateral Resource Cost (BRC), Private Cost Ratio (PCR), and Social Cost-Benefit Ratio (SCB) indices are also suggested by others as alternative measurement methods.

On the other hand, the measurement of competitiveness at the macro level is generally associated with international trade indices (Table 3). Those can be different kinds of measurements of exports, imports, trade balance and others.

Revealed Comparative Advantage (RCA) indices are the most widely used indicators for the trade-based competitiveness of nations. 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).

Balassa together with Nolan (1989) also made amends to the original RCA and implemented the *Net Export Index* (NEI), which can equally be a measurement of competitiveness.

The NEI is, however, affected by the country's overall trade balance, because it analyses the relationship between exports and imports, instead of the exports alone.

Similarly, the *Grubel-Lloyd measure* (GL) is a measurement that evaluates the exports considering the fact that a product is frequently exported and imported at the same time. This product trade is called intra-industry trade (Grubel & Lloyd, 1971).

Constant Market Share (CMS) on the world market, an analysis method of trading patterns and trends, was firstly introduced by (Tyszynski, 1951) and can also be used as an indicator reflecting the outcome of the international competitive process. The difference is taken between two periods of a country's export share on the world market and the growth rate is measured as the change between the two periods. This fact is seen as a flaw, as small exporters can have a very large growth rate and remain to be small exporters.

Since 2004, the Global Competitiveness Report, made by the World Economic Forum (WEF) ranks countries based on the *Global Competitiveness Index* (GCI), which encompasses a set of factors that determine productivity and is made up of over 110 variables, categorized and organized into 12 pillars: Institutions; Infrastructure; Information and Communication Technologies (ICT) adoption; Macroeconomic stability; Health; Skills; Product market; Labour market; Financial system; Market size; Business dynamism; and Innovation capability. The last GCI Index 4.0 covered 141 economies and was released in 2019 (World Economic Forum, 2019).

The International Institute for Management Development (IMD) also developed an overall competitiveness measurement called *IMD World Competitiveness Ranking*, which covers 63 economies and is based on 332 competitiveness criteria and emphasizes a long-term trend by highlighting countries' progress and decline related to past editions (IMD, 2020).

Table 3 Main indicators measuring competitiveness at the macro level

Macro Level	Author/Organization
Constant Market Shares (CMS)	Tyszynski (1951)
Index of Revealed Comparative Advantage (RCA)	Balassa (1965)
Grubel-Lloyd measure (GL)	Grubel & Lloyd (1971)
Net Export Index (NEI)	Balassa & Noland (1989)
Index of Relative Advantage (RMA)	Vollrath (1991)
Index of Relative Trade Advantage (RTA)	Vollrath (1991)
Index of Revealed Competitiveness (RC)	Vollrath (1991)
Index of Symmetric Revealed Comparative Advantage (SRCA)	Dalum et al. (1998)
Index of Weighted Revealed Comparative Advantage (WRCA)	Proudman and Redding (1997)
Index of Additive Revealed Comparative Advantage (ARCA)	Hoen and Oosterhaven (2006)
Index of Normalized Revealed Comparative Advantage (NRCA)	Yu et al. (2010).
IMD World Competitiveness Ranking	IMD (2020)
Global Competitiveness Index (GCI)	WEF (2019)

Source: Own composition

As noted above, various methods are available for analysing competitiveness both at the micro and macro level. This research focuses exclusively on the macroeconomic level and will mostly concentrate on the original RCA, which will be further on explained and interpreted, as well as its modifications.

2.1.4 Relevant Literature on competitiveness

Measuring agricultural competitiveness is difficult due to the term's complexity and subjectivity, as well as the inherent unpredictability of the agriculture sector and the entanglement of its surroundings. According to Maranhão and Vieira Filho (2017), the international markets for agricultural products are highly complex, with the competitiveness of these goods determined by production process efficiency, logistics and transportation, macroeconomic and marketing variables, and sector support policies.

Jámbor and Babu (2016) calculated the 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.

By analysing the Normalised Revealed Comparative Advantage (NRCA) index and its trends for the EU-27 member states from 2000 to 2011, S. Bojnec and Fertő (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.

Jámbor 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.

To investigate whether Brazilian chicken exports are competitive globally, Galle et al. (2020) calculated the Revealed Comparative Advantage (RCA) and the Symmetric Revealed Comparative Advantage (SRCA) indices for the 2009-2016 period. Although declining, the indices results indicated a comparative advantage during the whole period, revealing that the sector is competitive.

Similarly, Lobzhanidze (2021) calculated the Revealed Comparative Advantage (RCA) and the Relative Export Advantage (RXA) to assess the competitiveness of the Georgian mineral water sector. The research concluded that the sector is competitive and that the rate of growth of mineral water exports is positively associated with the measured competitiveness.

Although extremely important due to the fact the sector can contribute to overall economic growth and sustainable development when compared to the industry sector, studies of competitiveness in the agri-food sector are very modest, and works that analyse underdeveloped nations are much more sparse (Jámbor et al., 2018). In addition, prior research has indicated a constantly changing scenario for global agri-food competitiveness, in terms of market positions (products and countries) (Mizik, et al., 2020). It is inferred that RCA stability and duration are limited, suggesting a constant need to adapt and assess updated data to bring novelty to the literature.

2.2 Analysing bilateral trade pattern

The gravity model, as an econometric tool, has been widely used by scholars working on trade flows, due to the relevant results it provides. The model 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. However, this model also responds to several criticisms, both in terms of its theoretical basis and its application.

Furthermore, when it comes to international commerce, the gravity equation has become one of the most often utilized empirical models. It can, among other things, explain the causes of trade flows between two nations and forecast future trade, analyse the impact of agreements on international trade flows, and assess border effects. In this setting, it is clear that a theoretical description of the model is required together with an overview of the recent empirical analysis on trade investigated by the gravity approach.

2.2.1 Gravity model theories

The basis of the gravity model is Newton's Law of Universal Gravitation which states that the attraction between two bodies is proportional to their mass and inversely proportional to the square of their distance:

$$F = k\left(\frac{m_1 m_2}{d^2}\right) \quad (1)$$

Where *F* represents the gravitational force, m1 and m2 are the masses of the bodies, d is the distance and k is the gravitational constant.

In 1962 Jan Tinbergen made an analogy to Newton's law applying its structure to trade flows. He was the first to introduce the gravity model in economics and did so by 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).

Since Tinbergen's fundamental work, many empirical efforts used his approach to analyse and quantify the driving forces of international trade empirically. Despite the reliability of the gravitational model estimations, the application of their conclusions generated concerns owing to the absence of a theoretical foundation for this technique. Multiple studies have been constructed to cover the existed gap, and the gravity equation may now be derived from several theory-consistent estimating approaches. It's important to note that there is no preference for an estimator because it can vary depending on the types of data or research questions, but the methods should be used in tandem to establish robustness (Head & Mayer, 2014).

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). Each country (place of origin), he believes, is the unique source of each commodity. Then Bergstrand (1985), by using the Constant Elasticity Transformation (CET) function, assumed that consumers have preferences that differentiate products by their origin and concluded that domestic and imported goods are not perfect substitutes.

While Eaton and Kortum (2002), also departing from a CES approach, establish a gravity equation from heterogeneous industries theory, in which each country generates a high quantity of homogenous commodities, Chaney (2008) and Helpman et al. (2008) incorporate diversified goods among heterogeneous firms.

When it comes to estimators that are theory-consistent, Anderson and Van Wincoop (2003) demonstrated the gravitational equation of trade performs poorly when used to understand regional trade. They showed that the gravity model estimation suffers from the omission of variables. Thus, the authors developed a more consistent and efficient method, which estimation includes Multilateral Resistance Terms (MRT). These variables are associated with multilateral and bilateral trade resistances, and they can capture the costs of trade with other trading partners. The authors conclude that when these parameters are taken into account, the gravitational model's estimations may be significantly improved.

2.2.2 Relevant literature on applying the gravity model in LAC agriculture

Over the years, many studies utilized the gravity model in their analysis. The study of Figueiredo et al. (2014) confirmed the border effect for Brazilian commercial transactions in the 1998-1999 period with the use of the gravity model and suggested a negative link between geographic distance and commercial flow, which is strongly supported by the existing research. In addition, his work revealed that border regions had more trade between them.

The supply determinants of coffee exports from Brazil, Colombia, and Peru, were examined by Arevalo et al. (2016) from 2000 to 2013. Authors discovered that a rise in the Brazilian GDP, and the increase in the world coffee prices, had a beneficial impact on its commerce. Business freedom had a favourable impact on exports, as well as, currency rate appreciation. The distance between Brazil and its trading partners and the partners' income demonstrated a negative link with the coffee trade. The estimation for Colombian and Peruvian coffee exports shows that the GDP of the exporting and destination country and the international price of coffee all had a positive impact on both nations' coffee exports.

Nonetheless, the increase in distance between commercial partners had a negative impact on trade. 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. The authors also emphasized that the variable related to the country's economy had a significant advantageous impact on trade.

Cantore and Cheng (2018) used the gravity model to test the determinants of bilateral flows of environmental goods, in particular, if environmental policies, such as taxes, affect the imports of environmental goods and in which direction, using trade data over 71 countries from 1999 to 2014. Their findings confirm that environmental regulatory rigidity is a crucial determinant of environmental goods trade and that there is a substitution effect between environmental regulation stringency and trade of environmental goods. They underline that environmental policies could serve both environmental protection and industrial development. An environmental tax, for example, can control emissions and pollution and also decrease the level of imports of environmental goods, indicating that it stimulates the competitiveness of firms and countries and increases the capacity of a domestic firm to satisfy the local demand by replacing imports with

production. In that way, environmental regulations incentives demand and domestic markets for cleaner technologies.

Duarte et al. (2019) utilized the gravity equation to investigate the drivers of global virtual water trade (VWT) flows from 1965 to 2010. Their findings support the long-term economic and population expansion that resulted in a rise in VWT. Additionally, environmental circumstances have an impact on VWT, and commercial agreements boost commerce and water exchanges.

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 not shown a growth trend. On the contrary, it has decreased over the period under analysis. Regarding the determinants of intra-industry trade, 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. Nevertheless, the authors observed that Brazil continues to have significant trade costs, which constrain the expansion of commercial partnerships.

2.3 Research Questions

1. Which LAC countries are currently competitive on the world market and in what agricultural products? How has this competitiveness developed during the past two decades?
2. What economic factors can influence agricultural trade between LAC and its trading partners?

First, the aim is to identify revealed comparative advantages in the LAC region by using Balassa (1965) and thus to investigate the competitiveness of all countries in the region in the agricultural

and food trade. This part would set the scene and visualise the most and least competitive countries by country and product. Such an analysis would give a better understanding of which countries have comparative advantages in which products.

Second, this research aims to understand the factors lying behind trade flows. For this purpose, a gravity model is established to investigate the bilateral agricultural trade of LAC and their trading partners. It will be investigated to what extent variables such as GDP, geographic distance, contiguity, common official language and others affect LAC agri-food export.

Finally, this research will focus on best practices and policy recommendations based on the results obtained. Exploring the region's agricultural international trade can motivate trade intensification and have a significant influence on economic growth, supporting a country's development. Furthermore, this sort of study may aid in the construction of the most effective trade policy programs, which can help improve decision-making behaviour.

2.4 Hypothesis to be tested

The following hypotheses are examined here in accordance with past empirical research:

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; Jámbor & 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).

3. 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.

3.1 Agricultural trade data source

The World Customs Organization developed a universal nomenclature for the classification of products called Harmonized Commodity Description and Coding System (HS), a six-digit code system commonly used internationally since 1988.

As stated by the United Nations (2017), the HS encompasses approximately 5,300 article/product characterizations, organized into 99 chapters, which are grouped in 21 sections. The six-digit, which is the high level of data disaggregation, can be fragmented into three parts:

The first two digits (HS-2) identify the chapter the goods are classified in, e.g. 09 = Coffee, Tea, Mate and Spices. The next two digits (HS-4) identify groupings within that chapter, e.g. 09.02 = Tea, whether or not flavoured. The next two digits (HS-6) are even more specific, e.g. 09.02.10 Green tea (not fermented). Up to the HS-6 digit level, all countries classify products in the same way (a few exceptions exist where some countries apply old versions of the HS).

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, at the Harmonized System Code 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 4 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)

It is noteworthy to understand that the version used here is the 2017 edition of HS1988, which divides the agricultural sector into 24 product groups HS Codes 1 to 5 related to *Animal & Animal Products*, 6 to 15 *Vegetable Products*, and 16 to 24 *Foodstuffs*.

As a major source, the research will use the World Bank WITS software to download UN trade data in a global setting. The HS1998 system is planned to be used at the two-digit and six-digit breakdown, with all the amendments that the 2017 edition brought, providing the highest coverage of the data currently possible. 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.

3.1 Measuring Revealed Comparative Advantages

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:

$$RCA_{ij} = \frac{\left(X_{ij} / X_{it}\right)}{\left(X_{nj} / X_{nt}\right)} \tag{2}$$

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; Jámbor & Babu, 2016; Bojnec & Fertő, 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:

$$RMA_{ij} = \frac{\left(M_{ij} / M_{it}\right)}{\left(M_{nj} / M_{nt}\right)} \quad (3)$$

Where *M* denotes import, *i* indicates a given country, *j* is a given product, *t* is a group of products and *n* is the group of selected countries. In opposition to the RCA, when the RMA index is lower than 1, there is a comparative advantage, suggesting more competitiveness.

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:

$$RTA_{ij} = RCA_{ij} - RMA_{ij} \quad (4)$$

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:

$$RC_{ij} = (ln\ RCA_{ij}) - (\ln RMA_{ij}) \quad (5)$$

Dalum et al. (1998) developed an innovative method for dealing with the RCA index's asymmetric value problem. By changing the original index as follows, he constructed the Symmetric Revealed Comparative Advantage (SRCA) index:

$$SRCA_{ij} = \frac{(RCA_{ij} - 1)}{(RMA_{ij} + 1)} \quad (6)$$

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 & Jámbor, 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. The function, according to Greene (2012) is given as follows: consider that the time observations are sorted in ascending order, with t_1 being smaller than t_2 and so on, and that no observations are suppressed for the time being. Assume that the data contains K distinct survival times, abbreviated T_k; K will equal n unless there are ties. The number of individuals whose observed time is at least T_k is denoted by n_k. At this time, the risk set is defined as the group of individuals whose duration is at least T_k. As a result, n_k represents the size of the risk set at time

Tk. The number of observed spells finished at time *Tk* is denoted by h_k. A survival function estimate based only on empirical evidence would be:

$$\widehat{S}\,(T_k) = \prod_{i=1}^{k} \frac{n_i - h_i}{n_i} \tag{7}$$

In a like manner as Bojnec and Fertő (2008), given that many observations are censored, the Kaplan–Meier estimator of the survival function is then:

$$\widehat{S}\,(t) = \prod_{i(i)<t} \frac{n_i - h_i}{n_i} \tag{8}$$

Assuming $\widehat{S}\,(T_k) = 1$, if $t < t(1)$, it is noted that the Kaplan–Meier estimator is robust to censoring and uses information from both censored and non-censored observations.

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).

3.2 The Estimation of the Gravity Model of Trade

Regarding the determinant factors of agri-food competitiveness, they can be measured by running econometric regressions and applying the gravity model, which usually aims to explain the volume of trade without focusing on the composition of trade. In 1962 Tinbergen employed Newton's Law of Universal Gravitation in economics, by applying the gravity equation structure to the analysis of trade flows. He theorized that commerce between two nations is proportional to their GDP and inversely proportionate to their geographical distance.

$$X_{ij} = \left(\beta_0 \frac{Y_i^{\beta_1} Y_j^{\beta_2}}{D_{ij}^{\beta_3}}\right)\mu_{ij} \tag{9}$$

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 1:

$$X_{ij} = \beta_0 Y_i^{\beta_1} Y_j^{\beta} D_{ij}^{\beta_3} \mu_{ij} \quad (10)$$

The equation (1) 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:

$$lnX_{ij} = \beta_0 + \beta_1 \ln Y_i + \beta_2 \ln Y_j + \beta_3 \, ln \, D_{ij} + \mu \quad (11)$$

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.

The Lagrange Multiplier Test (LM), formulated by Breush and Pagan (1980), can be executed in order to confront the OLS Pooled and Random Effects (RE) methods. The test examines the hypothesis that the variance of the intercept is equal to zero. In this sense, in the case of rejection of the null hypothesis, the RE method is pointed out as the most appropriate. The comparison between the RE and FE methods is based on the Hausman test, whose null hypothesis considers the non-correlation between the error and the regressors. If both are correlated, the FE method is more appropriate for the analysis. However, in the non-rejection condition of the null hypothesis, the RE method becomes the most effective (Gujarati & Porter, 2008). Ramsey (1969) proposed the Reset Test to detect specification errors. Considering that the null hypothesis is that the model does not present omitted variables, methods that do not reject this hypothesis are considered more adequate.

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.

Furthermore, Santo Silva and Tenreyro (2006) emphasize that, under heteroscedasticity, the estimated parameters of log-linearized models that use ordinary least squares contribute to biased estimations of elasticities. To address this issue, as well as, handling zero trade flows in the sample, they proposed the non-linear PPML estimator, which deviations are small due to its ease of implementation and reliability in a wide range of situations, making it relatively robust. In addition to being consistent in the presence of heteroscedasticity, it provides a natural way to deal with the dependent variable, when it presents values equal to zero (zero trade flows), being evaluated as the one with the best performance when compared to others.

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).

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:

$$\begin{aligned} LAC\_agri\_export_{ij} = \beta_0 + \beta_1 \ln(GDP_{reporter_i}) + \\ \beta_2 \ln(GDP_{partner_j}) + \beta_3 \ln(dist_{ij}) + \beta_4\, comlang\_off_{ij} + \beta_5\, contig_{ij} + \\ \beta_6\, colony_{ij} + \beta_7\, MERCOSUR_{ij} + \beta_8\, NAFTA_{ij} + \\ \beta_9\, Paris\_agreement_{ij} + \mu_{ij} \end{aligned} \tag{12}$$

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) see Table 5.

Table 5 Description of variables

Variables	Description	Data source
Dependent		
LAC_agri_export	bilateral aggregated agricultural exports of LAC countries to their destinations in millions of USD	World Bank (2021b)
Independent		
ln(GDP_reporter)	logarithm of LAC countries GDP in current USD	World Bank, (2021a)
ln(GDP_partner)	logarithm of GDP of agricultural importer countries from LAC in current USD	World Bank, (2021a)
ln(dist)	logarithm of geographic distance between the country's most populated cities in kilometres	CEPII (2021)
contig	1 if trading countries share common borders	CEPII (2021)
comlang_off	1 if trading countries have a common official primary language, 0 otherwise	CEPII (2021)
colony	1 for past common colonial relationship, 0 otherwise	CEPII (2021)
MERCOSUR	1 if trading countries are both the member of the MERCOSUR, 0 otherwise	Authors' composition
NAFTA	1 if trading countries are both the member of NAFTA, 0 otherwise	Authors' composition
Paris_Agreement	1 if trading countries are both signed the Paris Agreement, 0 otherwise	Authors' composition

Source: Own composition

The dependent variable of the model is derived from World Bank (2021b) World Integrated Trade Solutions (WITS) Commodity Trade Statistics Database (COMTRADE) Database. The LAC bilateral export data are downloaded for a total agricultural export under WTO Multilateral

Trade Negotiation aggregations at Harmonized System (HS) including raw, semi and processed agricultural products expressed in USD. The economic size of LAC countries and their partners ($GDP\_reporter_i$ and $GDP\_partner_j$) were collected from World Bank (2021a) World Development Indicators (WDI) database. The $dist_{ij}$ variable was retrieved from The Centre d'Études Prospectives et d'Informations Internationales (CEPII, 2021) database and considers the distance between the most populated city of each country in kilometres. Other bilateral dummy variables such as $comlang\_off_{ij}$, $contig_{ij}$, and $comcol_{ij}$ were also collected from the CEPII (2021) database, while the dummies for $MERCOSUR_{ij}$, $NAFTA_{ij}$ and $Paris\_agreement_{ij}$ were created by the authors.

4. ANALYSIS OF AGRICULTURAL TRADE DEVELOPMENT IN LAC COUNTRIES

One of the biggest global development challenges humanity faces in the 21st century is still related to agri-food sectors. In 2018, the Food and Agriculture Organization (FAO) estimated that about 820 million people were undernourished all over the world and around 2 billion suffered from micronutrient deficiencies, being low productivity and competitiveness in the agricultural sector the main reasons for food insecurity. Assuming current global trends in food consumption and population, the demand for agricultural products will grow by 15% over the coming decade and approximately 70% more food will be needed by 2050 (FAO, 2009; OECD/FAO, 2019).

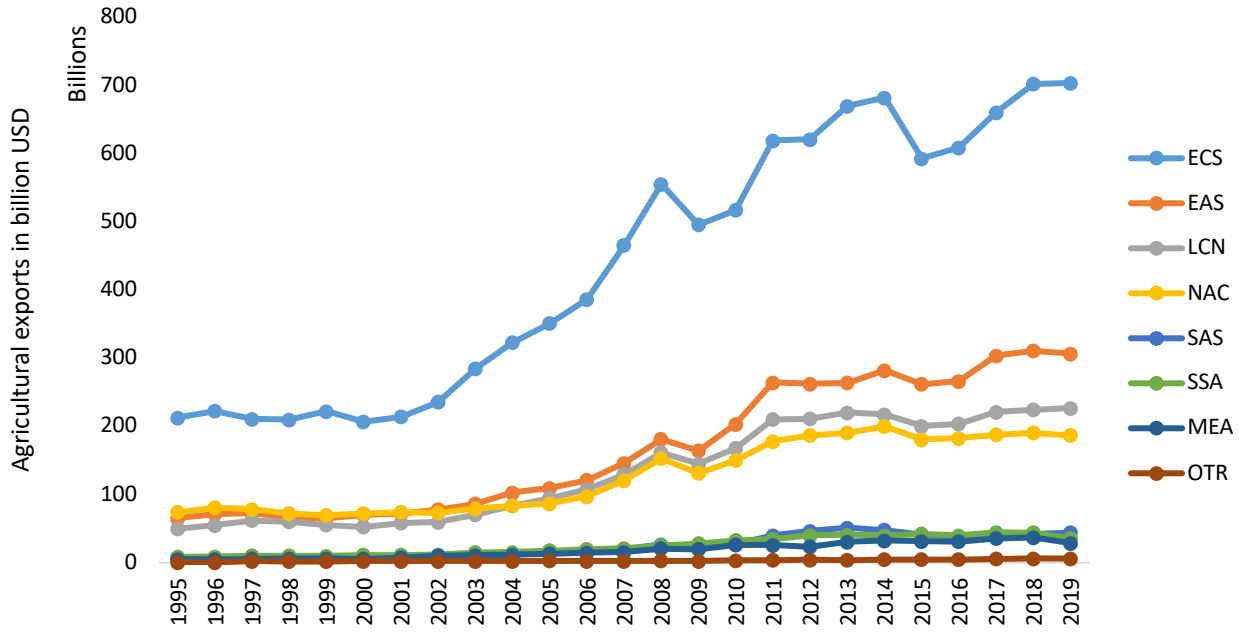
Latin America and the Caribbean (LAC), which covers more than 2 billion hectares and encompasses 39 countries, is one of the key regions affected by these challenges (World Bank, 2022). The region has become the world's leading net food exporting region, playing a key role in providing enough food for the growing global population, as well as in environmental sustainability, which, to be fulfilled, will need long-term strong investments and good related policies.

Agricultural trade has long been used by countries to increment their domestic production. Land, labour, and capital supply, as well as climatic conditions, are determinants that might affect production capacities and, as a result, trade flows. Following the liberalization of economic nations, the world witnessed outstanding growth in the volume of international trade and, in general, agri-food trade has grown steadily in recent years, supplementing solid global economic development and commerce (Jámbor and Babu, 2016).

4.1 Recent trends of agricultural trade in Latin America and the Caribbean

Reflecting on World Bank regional units and considering total trade, over the last ten years, Europe – Central Asia, East Asia – Pacific and North America have been the leading exporter regions worldwide. On the other hand, while pondering only agricultural trade, Latin America and the Caribbean became the third largest agricultural exporter in the world in 2004, accounting for an average of approximately 15% of all agricultural items shipped internationally between 1995 and 2019 (Figure 2).

Figure 2 Evolution of agricultural exports in the world, by region, in billion US dollars, 1995-2019



Note: East Asia - Pacific (EAS), Europe - Central Asia (ECS), Latin America - Caribbean (LAC), Middle East - North Africa (MEA), North America (NAC), Other Regions (OTR), South Asia (SAS), Sub-Saharan Africa (SSA).

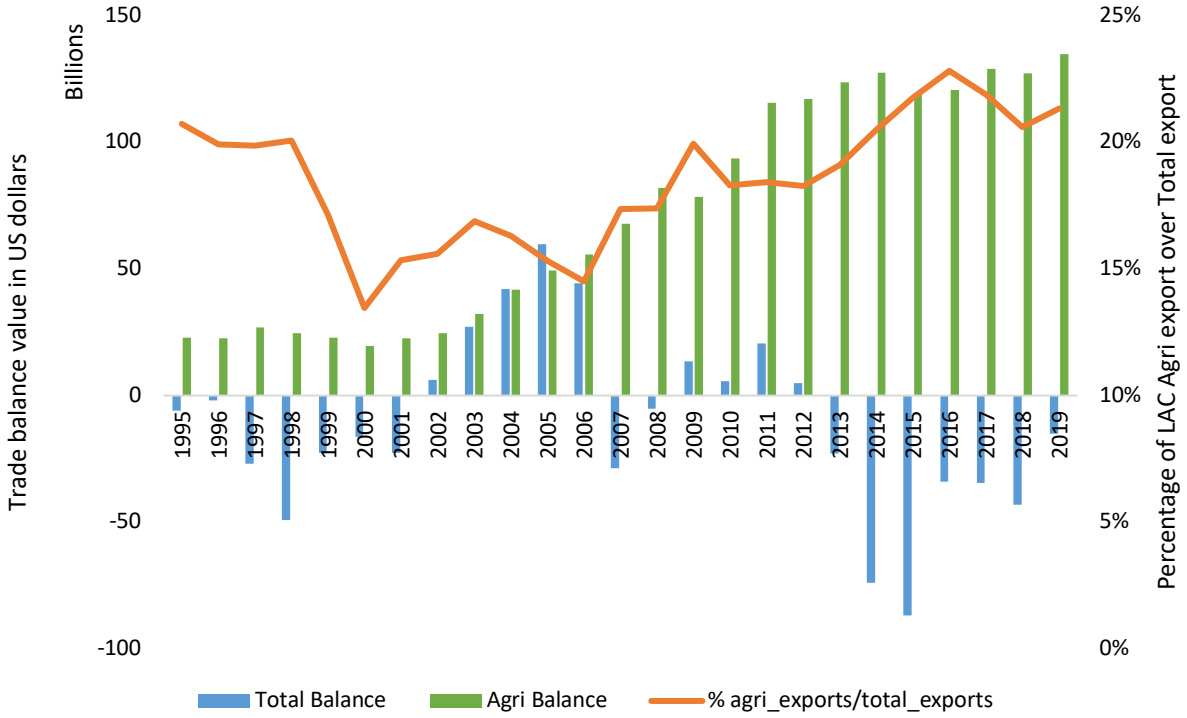
Source: Own composition based on World Bank (2021b) WITS database

Over the last decades, Latin America and the Caribbean countries have observed significant positive trends in the development of the agricultural sector, which has occurred particularly because of its agricultural trade growth, accompanied by adjustments in policy and production, as well as increasing global integration (OECD, 2019). The region has an abundance of land and water, from its available area, 38% is used for agriculture and 46% is covered with forests, thus accounting for 14% of global production and 23% of the world's exports of agricultural and fisheries commodities. Although it is presumed that the production will slow down over the years, the expectation is that by 2028 LAC will account for more than 25% of global exports in agricultural and fisheries products, emphasising to the region the positive impact of trade openness at the global level (OECD/FAO, 2019).

Overall, LAC's agricultural trade surplus has steadily increased and has served as a kind of "buffer" against large economic contractions during periods of recession and times of economic

crisis (Arias et al., 2017). As seen in Figure 3, a cursory examination of LAC's trade balance in recent years reveals the significance of agricultural product exports (H1).

Figure 3 Trade balance of agricultural and total products in billion of US dollars, 1995-2019, and share of agricultural exports over total exports, %



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

Agriculture's proportion of total exports in the region fell from 20.71% to 14.51% in 2006, when it hit its lowest point. The percentage subsequently began to rise steadily, reaching a highest of 22.81%in 2016 and a relatively high of 21.32% in 2019. The large volume of exported agri-food results in large and growing surpluses, and agribusiness has shown to be of essential importance for the region's growth, playing an important part in its economic dynamics corroborating H_1 hypothesis.

Moreover, the LAC region is one of the few parts of the world with significant resources of unexploited agricultural land, suggesting that it will continue to play a pivotal role in global food production and exports in the future (Duff & Padilla, 2015). Many of the region´s countries have risen to 'middle-income' status and achieved high agricultural productivity growth in recent years, resulting in increased export competitiveness.

Latin America, in general, had an excellent economic performance during the years 2003 and 2010, thanks to the international commodity boom. The period became known as the Golden Era, a time of economic growth and reduction of poverty and inequality in the region. The commodity boom, predominantly due to the sharp increase in demand from emerging markets, especially from China, combined with low-interest rates in developed countries, brought prosperity to the region, with clear observed changes such as social inclusion, macroeconomic stability, and growth (Maghin & Renon, 2018).

The financial vigour gave governments throughout all Latin American regions unusual levels of features and the usage of the resources was translated into a serious engagement to equity, that, however, has not corresponded with compelling investments in the future. By 2010, as pointed out by Maghin and Renon (2018), a gradual inevitable and announced decline began to take place, and the normal pattern of falling commodity prices relative to manufactured products was recovered, reflecting crisis expectations for most economies dependent on commodity exports, due to a possible vulnerability to rising macroeconomic challenges. The authors claim that by the end of 2012 it was revealed that decisions made during the boom were not sustainable, "the gains of golden era had been temporary, and at worst illusory" (Maghin & Renon, 2018, p 138).

Following the period of fast economic growth associated with high commodity prices (Golden Era), LAC entered a phase of an almost lethargic performance, from 2010 to 2016. Despite some differences within the region, many countries have faced some recession, macroeconomic turbulence and/or a slowdown in growth, meantime a sharp drop in commodity prices took place. Finally, in 2017, the prices started to stabilize and, together with a depreciation in the exchange rate, which in its turn made their exports more competitive, a modest recovery begin to happen in the region's countries. And yet, with the exception of Mexico, which in 2019 reached the position of the largest exporter to the USA, "despite the somewhat better terms of trade and the greater competitiveness from real exchange depreciation, exports from the region have stagnated, or even declined". The region is still growing slower than other emerging markets and even richer advanced economies (World Bank, 2019, p.16).

According to the World Bank (2019) report, LAC's financial situation is especially affected by domestic conditions, as international conditions have recently become more favourable, and the inward-looking strategy played a crucial role in the region's small growth. Although LAC

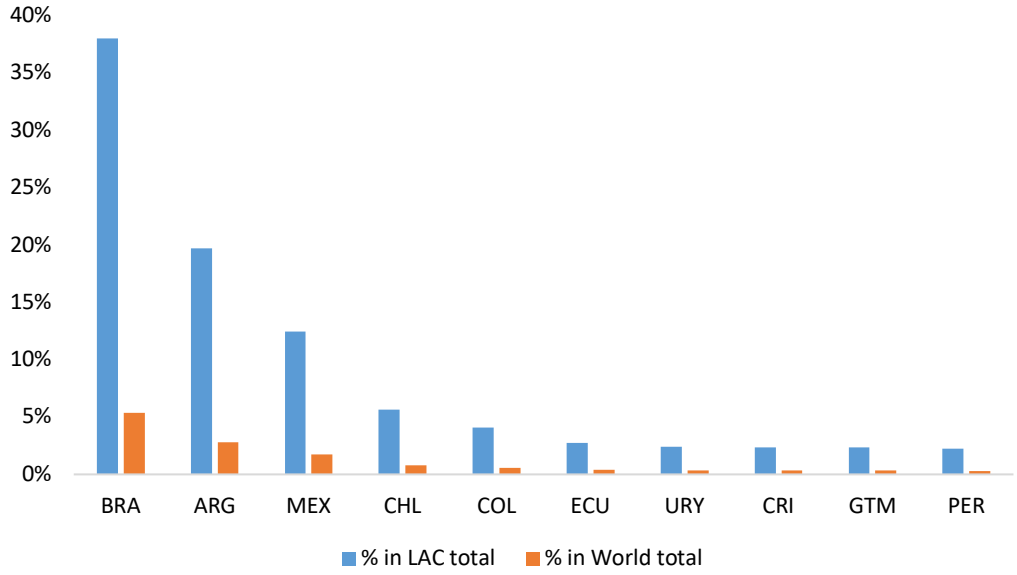
signed a large number of trade agreements, those, besides having demonstrated to be shallow, have shown to be mostly intra-regional, associations with small market partners of low degrees of economic complexity (World Bank, 2019).

Rodríguez (2004) argues in his studies that due to various political, social and economic conflicts, Latin America was unable to achieve higher levels of economic growth, which caused the region to experience a prolonged macroeconomic crisis. For the author, it is necessary to first understand Latin American distinctive politics, so that it becomes possible to comprehend the real reason for the poor institutions in the region.

Therefore, competitiveness in the agri-food sectors started to be considered a key issue for many governments in the region as they realised that the sector can contribute to general economic growth and sustainable development. Nevertheless, according to OECD-FAO (2019), the support provided to the farmers is low when compared to the OECD countries and the global average, which indicates that decisions related to aspects of production are mainly determined by market indicators.

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 4 suggests, contributing to an average of 70 % of LAC's agricultural exports.

Figure 4 Share of the leading agricultural exporters of the LAC region in LAC and world total agri-exports, 1995-2019, in per cent.



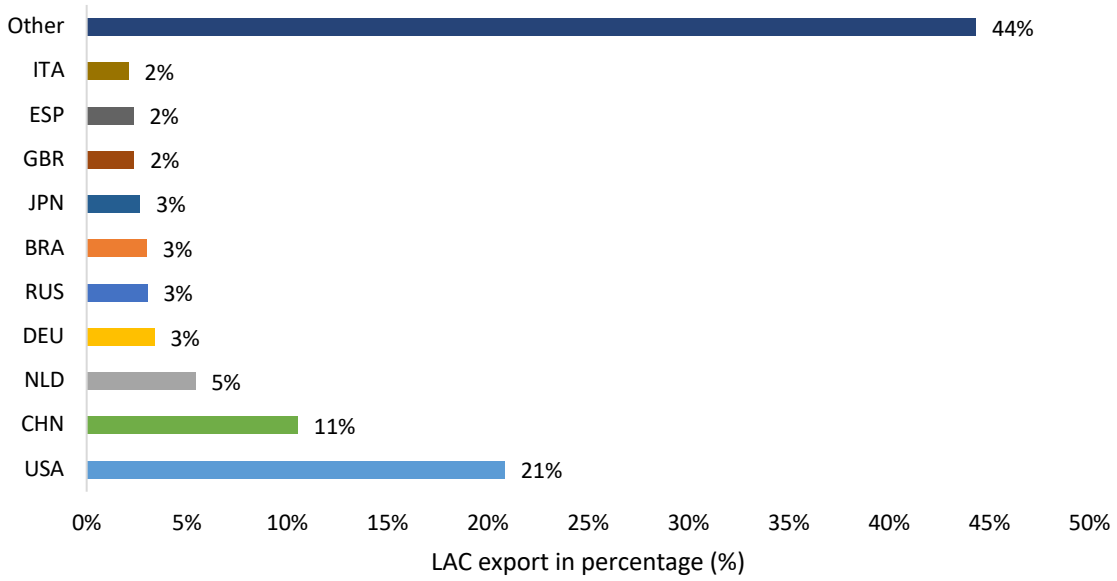
Note: Brazil (BRA), Argentina (ARG), Mexico (MEX), Chile (CHL), Ecuador (ECU), Uruguay (URY), Costa Rica (CRI), Guatemala (GTM), Peru (PER).

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 10 highest ranked LAC destination countries that imported the highest share of LAC agricultural products accounted for 56% of the total market share of agricultural products in the past 25 years. The United States of America (USA) is the biggest trading partner of LAC agricultural products, with a share of 21% in all destination markets in the same period, as seen in Figure 5.

Figure 5 LAC destination agricultural export share in total LAC agricultural export by destination in per cent, 1995-2019.



Note: United States of America (USA), China (CHN), Netherlands (NLD), Germany (DEU) Russian Federation (RUS), Brazil (BRA), Japan (JPN), United Kingdom (GBR), Spain (ESP), and Italy (ITA).

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

The United States is the world's largest economy in terms of GDP (in current USD) and the largest importer in the world (OEC, 2021). Since 2015, Mexico surpassed Canada and became the largest agricultural exporter to the United States (both countries share borders with the USA), boosting commerce with Latin America and the Caribbean as a whole. On average, from 1995 to 2019, Mexico has exported 13.4 billion US$ to the USA in agricultural products. In this same period, Brazil also exported 2.9 billion US$ of agri-food products to the North American country, being its fifth-largest agricultural trading partner.

Behind the USA, China is the second biggest importer of agricultural products from Latin America and the Caribbean. China is the world's number two economy in terms of GDP (current US dollars) and number two in total imports (OEC, 2021). The rise in agricultural imports in China reflects the country's demographics, as it is the world's most populous, as well as its unrelenting economic growth in relation to its lack of land resources. As a result, the import strategy was used to meet the rising domestic demand, which benefits LAC.

The breakdown of LAC agricultural exports by country sheds more light on the trends discussed above. During the time studied, ten nations with different locations provided the majority of the region's agricultural export, with varying concentration ratios (Table 6). The concentration of the Top 10 agri-food exporters has been remarkably consistent — these nations accounted for more than 90% of all agri-exports in all periods. Brazil, Argentina, Mexico and Chile held the first four positions, respectively, throughout all the periods.

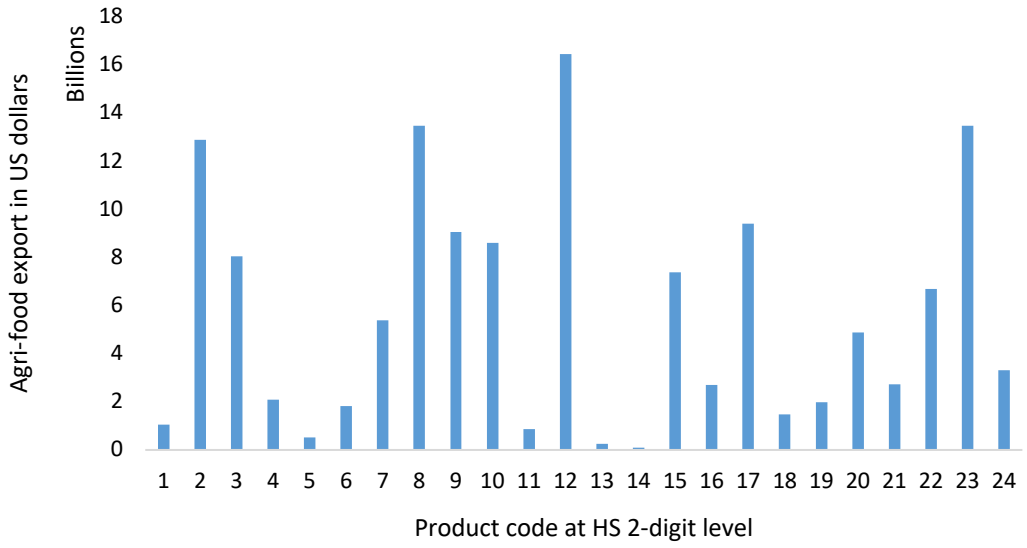
Table 6 Top 10 agri-food exporters in Latin America and the Caribbean in the percentage of region's agri-food total export for the period of 1995 to 2019.

1995-1999		**2000-2004**		**2005-2009**	
Brazil	26%	Brazil	29%	Brazil	35%
Argentina	22%	Argentina	21%	Argentina	21%
Mexico	12%	Mexico	14%	Mexico	11%
Chile	8%	Chile	9%	Chile	8%
Colombia	7%	Colombia	5%	Colombia	4%
Ecuador	5%	Ecuador	4%	Ecuador	3%
Costa Rica	4%	Costa Rica	3%	Peru	3%
Peru	3%	Peru	3%	Uruguay	2%
Guatemala	3%	Uruguay	2%	Costa Rica	2%
Uruguay	2%	Guatemala	2%	Guatemala	2%
LAC Top 10	91%	LAC Top 10	90%	LAC Top 10	92%
2010-2014		**2015-2019**		**1995-2019**	
Brazil	38%	Brazil	36%	Brazil	35%
Argentina	19%	Argentina	16%	Argentina	19%
Mexico	11%	Mexico	13%	Mexico	12%
Chile	7%	Chile	8%	Chile	8%
Ecuador	4%	Ecuador	5%	Ecuador	4%
Peru	4%	Peru	4%	Colombia	4%
Colombia	3%	Colombia	3%	Peru	4%
Uruguay	3%	Paraguay	3%	Uruguay	2%
Paraguay	2%	Guatemala	2%	Costa Rica	2%
Guatemala	2%	Uruguay	2%	Guatemala	2%
LAC Top 10	93%	LAC Top 10	93%	LAC Top 10	92%

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

As mentioned above, 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 6 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 4

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.

The region demands increases in technological innovation and product diversification. According to Ocampo (2017), the LAC has been a prominent sufferer of the macroeconomic vulnerabilities caused by commodity cycles and has been unable to fully capitalize on the benefits

of its natural resource specialisation, thus enduring some severe structural consequences, most notably deindustrialisation.

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.

4.2 The role of Brazil played in global agri-food competitiveness

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.

Brazilian agribusiness has shown to be of fundamental importance for the development of the country, with an important role in its economic dynamics. As Figure 7 suggests, a brief analysis of the Brazilian trade balance in recent years makes us acknowledge the importance of exports of agricultural products.

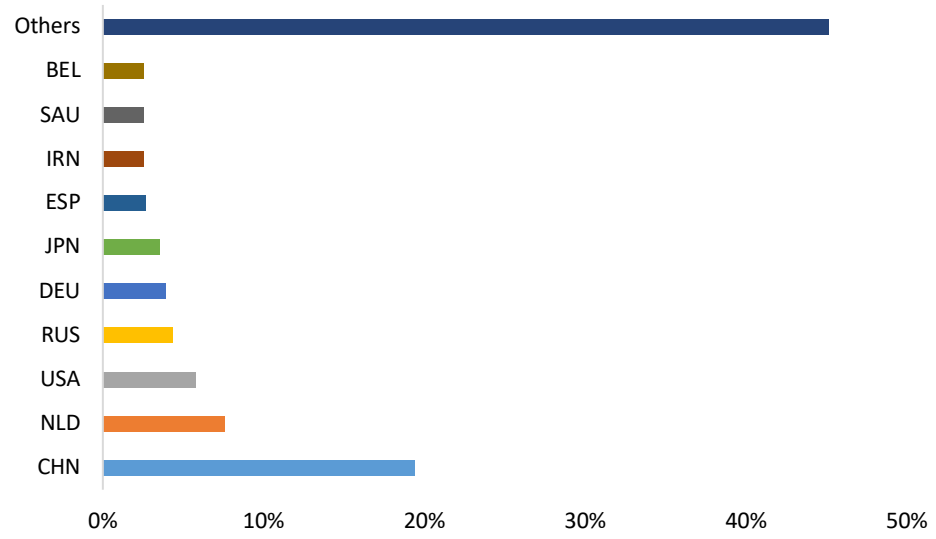
Figure 7 Brazilian trade balance in billions of dollars for the period of 1997 to 2019.

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

The high amount of exported agri-food results in significant trade surpluses, and the exclusion of agribusiness brings a predominant deficit to the trade balance (except for the years 2005 and 2006), also confirming hypothesis 1. Since 2012, more than 40% of total exports are exclusively from agricultural products, indicating that there is some certainty in the sector. The jump in productivity led the country to become a major food producer and exporter. Its main source was the growth of TFP, defined as the ratio between the aggregate product and the inputs used in its production, which happened mainly due to the investment in research, development of the private-public sector and sectoral incentive policies (Gasques et al., 2018).

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 8).

Figure 8 Brazil destination agricultural export share in total Brazil agricultural export by destination in per cent, 1995-2019.



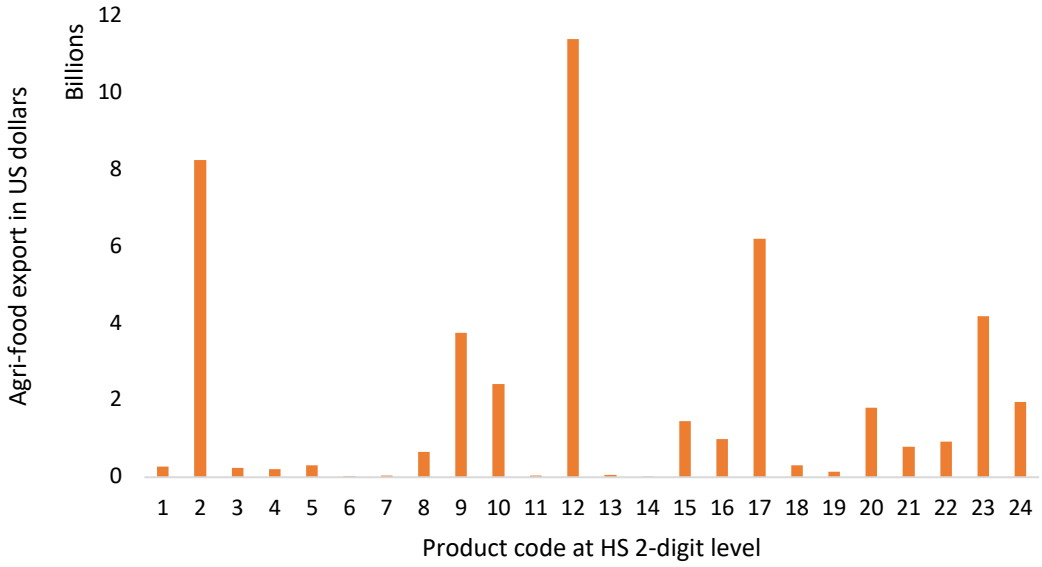
Note: China (CHN), Netherlands (NLD), United States of America (USA), Russian Federation (RUS), Germany (DEU), Japan (JPN)), Spain (ESP), Iran, Islamic Rep. (IRN), Saudi Arabia (SAU), and Belgium (BEL).

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. The Netherlands, in turn, showed a huge decline in its share as a Brazilian agri-food destination. The country used to be the biggest partner of the Brazilian agri-food sector but was surpassed by China in 2008 and by the USA in 2019, the latter also facing a steady decrease in the Brazilian agri-food market share throughout the 25-year-period analysis.

When analysing the Brazilian agricultural export by product groups at the HS 2-digit level in Figure 9, we can conclude that the category of the most traded chapter was HS12 (oil seeds and oleaginous fruits; miscellaneous grains, seeds and fruit, industrial or medicinal plants; straw and fodder), followed by HS02 (meat and edible meat offal) and HS17 (sugars and sugar confectionery).

Figure 9 Agricultural products at 2-digit level, exported by Brazil to the world market in US billion dollars, 1995-2019



Note: See in Table 4

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

It is interesting to observe that the percentual share changed within the periods. The export of coffee, tea, mate and spices (HS09) used to be the "flagship" of the Brazilian agri-food export sector but has lost ground over the years, being surpassed by other categories. At the end of the 20th century, Brazil began to diversify its exported agricultural products to reduce the risks of recurrent crises linked to falling international prices (Contini, 2014). Even so, the three most traded categories accounted for more than 55.60% of the total agri-food exported from 1995 to 2019.

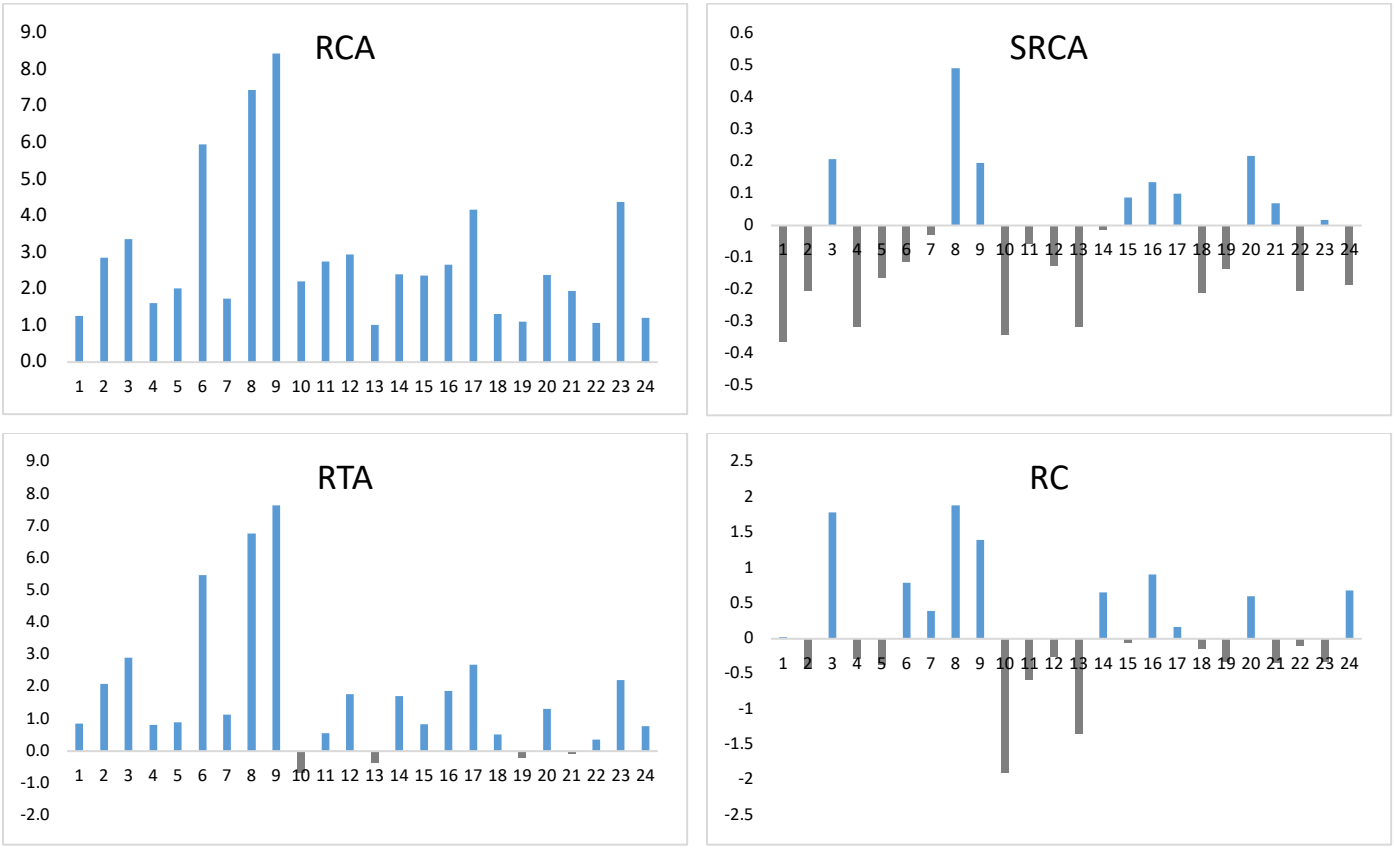
Since 1995, Brazil has made considerable advances in technical development. During the commodities boom, the country's technical growth accelerated, resulting in substantial progress. The move to increased technical capacity in the production base has allowed the country to face an evolution in product complexity distribution, increasing its diversification levels (UNCTAD, 2021).

5. ANALYSIS OF LAC'S AGRICULTURAL COMPETITIVENESS IN GLOBAL MARKETS

The trade competitiveness of the LAC agri-food sector was calculated by using Revealed Comparative Advantage Indices. The RCA defined by Balassa (1965), and its derivatives RMA and RC, proposed by Vollrath (1991), and SRCA, suggested by Dalum et al. (1998), were investigated further (Figure 5). It's worth noting that the period under consideration is 25 years, to properly examine long-term trends and construct a dataset of econometrically acceptable size. As a result, the findings were expressed as an arithmetic mean to offer a better understanding of the indices through time, in line with previous important studies such as Jámbor and Gibba (2017), Jámbor et al. (2018), Matkovski et al. (2019), and Mizik et al. (2020).

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 (Figure 10).

Figure 10 LAC's Revealed Comparative Advantage Indices by product code at HS 2 digit-level, 1995-2019.



Note: See in Table 4

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

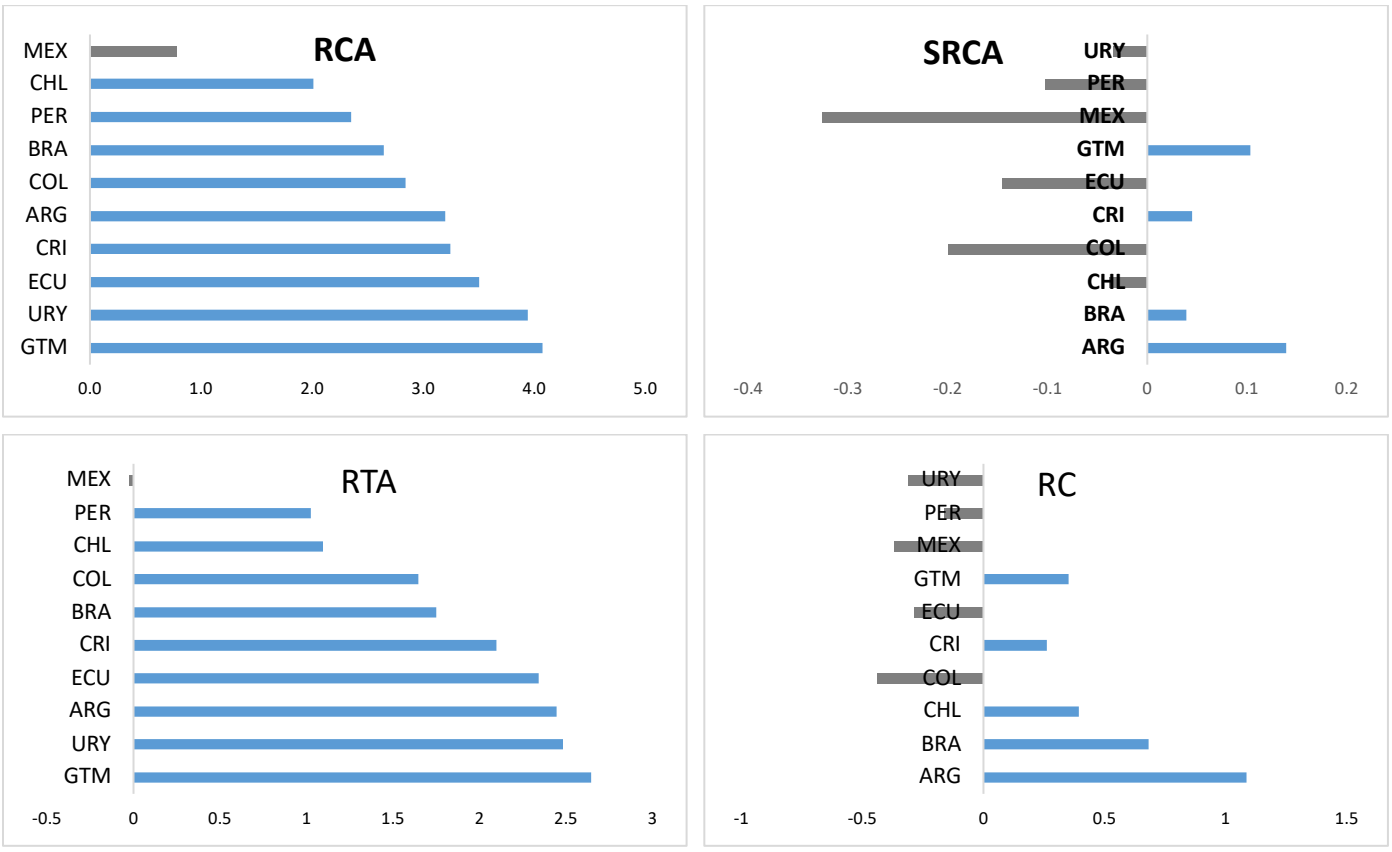
Following Vollrath's (1991) methodology, the revealed import advantage values were computed and the Relative Trade Advantage (RTA) index can be generated which produced similar results to the RCA index with product codes 09 (coffee, tea, mate and spices), 08 (fruit and nuts), and 06 (trees and other plants) proving to be the most competitive. However, with RTA less than zero, *cereals* (HS 10), *resins and other vegetable extracts*; (HS 13), *preparations of cereals, flour, starch or milk* (HS 19), and *miscellaneous edible preparations* (HS 21) were not competitive throughout the study period.

Considering Symmetric Revealed Comparative Advantage, 9 out of 24 product codes were competitive. *Fish and crustaceans, molluscs and others* (HS 03), *fruit and nuts* (HS08), and *coffee, tea, mate and spices* (HS 09) demonstrated the highest comparative export advantage, with values ranging from zero to one. The RC index was also examined, and less than half of the items had

Revealed Competitiveness (values greater than one) with *fruit and nuts, edible* (HS 08), *fish and crustaceans, molluscs and other* (HS 03), and *coffee, tea, mate and spices* (HS 09) having the highest rates.

At the country level (Figure 11), 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 11 LAC's Revealed Comparative Advantage Indices by country, from 1995-2019



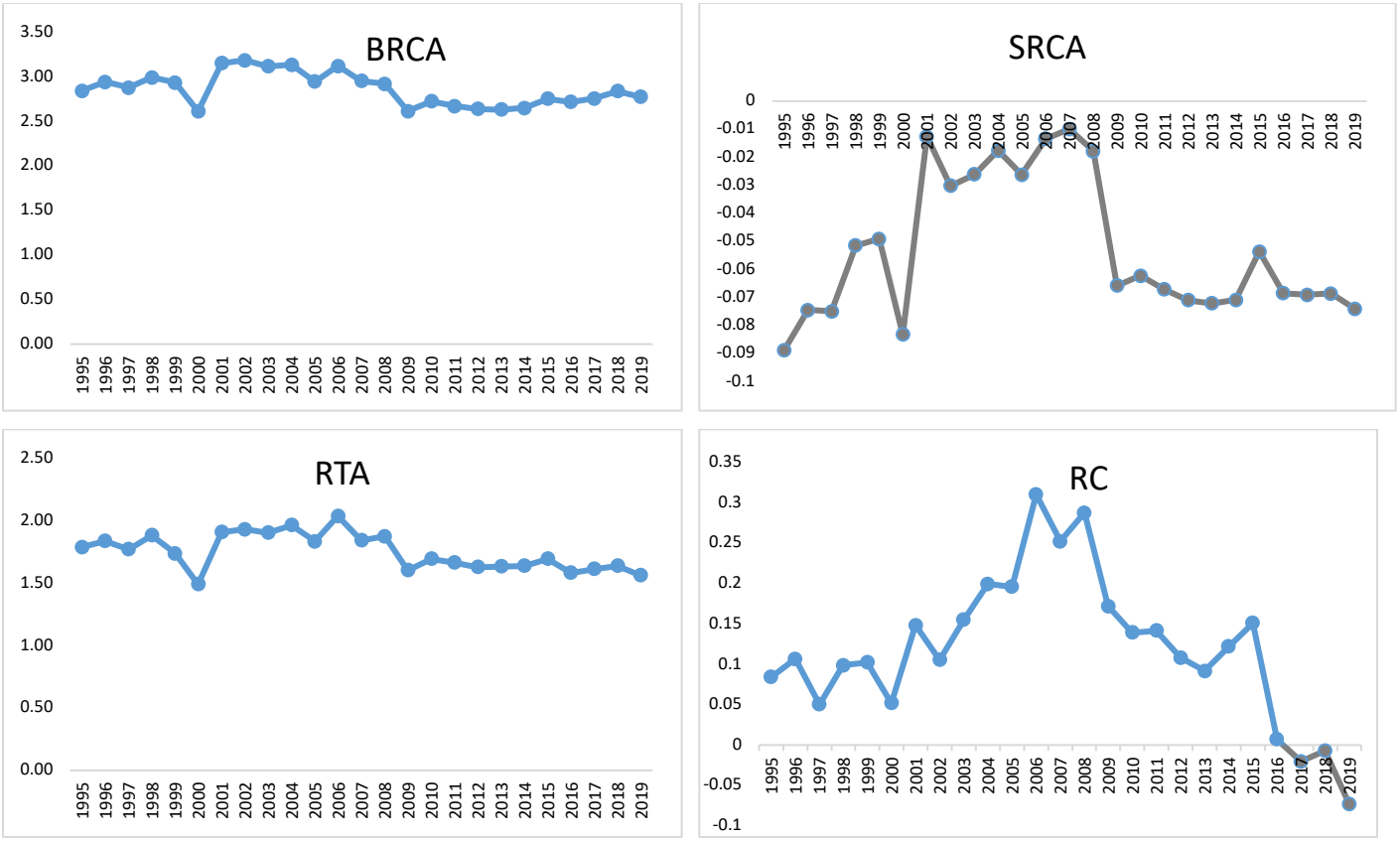
Source: Own composition based on World Bank (2021b) WITS database

Except for Mexico, the RTA index evaluation showed a relative trade advantage for every country, with Guatemala, Uruguay, and Argentina ranking the highest. Argentina is the most competitive country shown by SRCA, followed by Guatemala, Costa Rica, and Brazil, with all other nations having a comparative export disadvantage. Argentina, Brazil, Chile, Costa Rica, and

Guatemala had the highest revealed competitiveness results when considering the RC index, whereas the other five countries were not competitive.

Figure 12 presents the competitiveness interpretation throughout time from 1995 to 2019. For all of the years investigated, there was a clear comparative advantage, with the greatest RCA values occurring between 2001 and 2006. When looking at the SRCA, the scenario is radically different, with all values being negative, resulting in a long-term export comparative disadvantage.

Figure 12 LAC'S Revealed Comparative Advantage indices over time 1995 to 2019



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

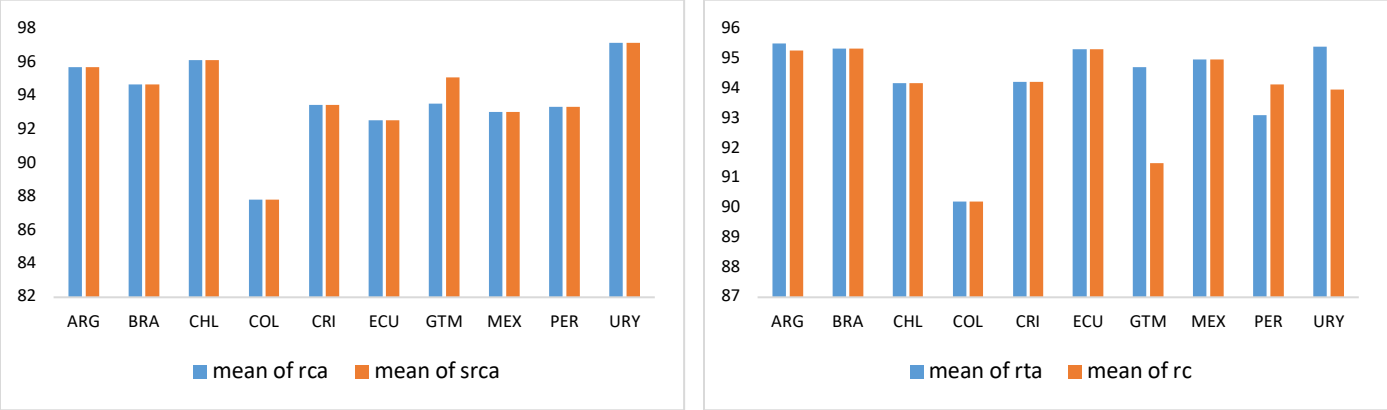
The Relative Trade Advantage index also disclosed competitiveness over time, whereas the Revealed Competitiveness index only indicated a lack of competitiveness in the years 2017, 2018, and 2019.

5.1 Markov transition probability and the Kaplan–Meier survival rate of RCA indices in LAC

In this part, 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 Markov process is a stochastic model that describes a series of potential occurrences where the probability of each event is solely determined by the state obtained in the preceding event (Gagniuc, 2017). In this study, Markov transition probability matrices were calculated and then summarized using the mobility test, allowing the evaluation of mobility across nations and periods. The degree of transition mobility of all indices is depicted in Figure 13 using the Markov transition probabilities.

Figure 13 The mobility of BRCA, SRCA, RTA and RC indices, by country, in percentage, 1995-2019

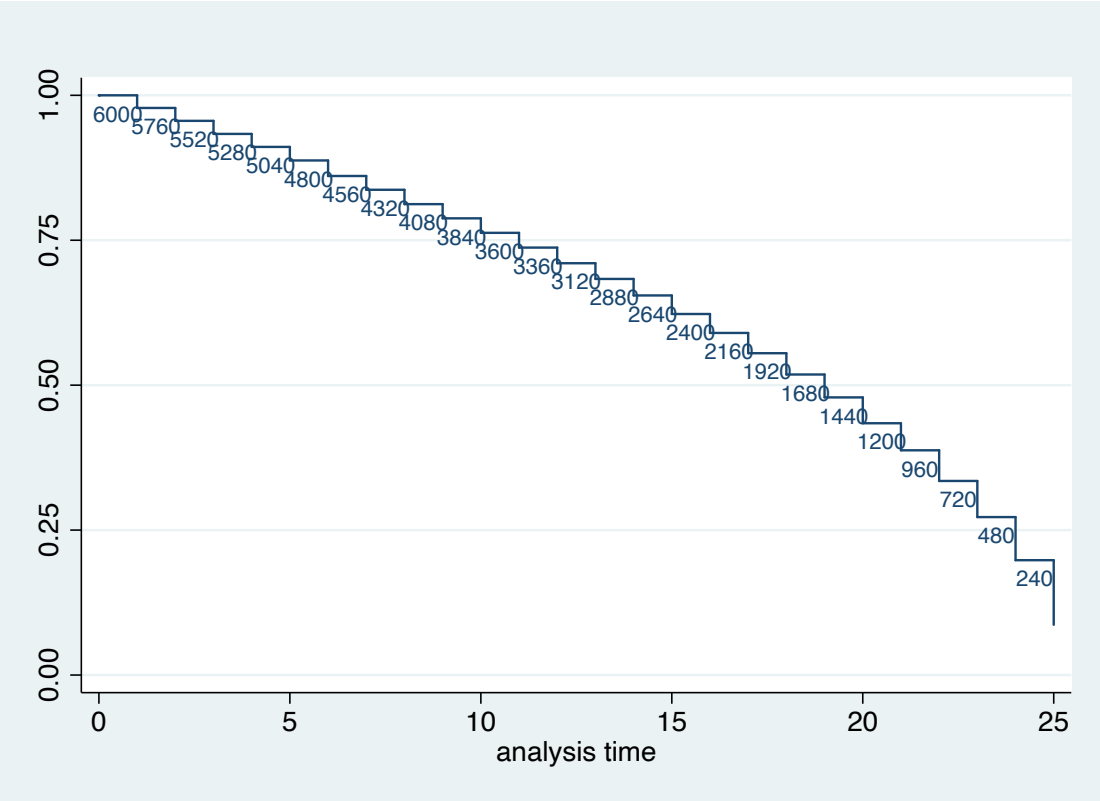


Source: Own composition based on World Bank (2021b) WITS database

The higher the index value, the less dynamism there is, implying that the index indicators are more likely to remain persistent. Results indicated low mobility of RCA, SRCA, RTA, and RC indices in LAC agri-food trade for the studied period, suggesting stable competitive potentials. 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 14).

Figure 14 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, predicting the hypothesis 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 & Fertő (2018). The findings varied by item category, revealing that HS-04 (Dairy produce; birds' eggs; natural honey; edible products of animal origin, not elsewhere specified or included) had the shortest survival duration, while HS-08 (Fruit and nuts, edible; peel of citrus fruit or melons) had the highest survival times, giving the vast majority of LAC agri-trade (Appendix 2).

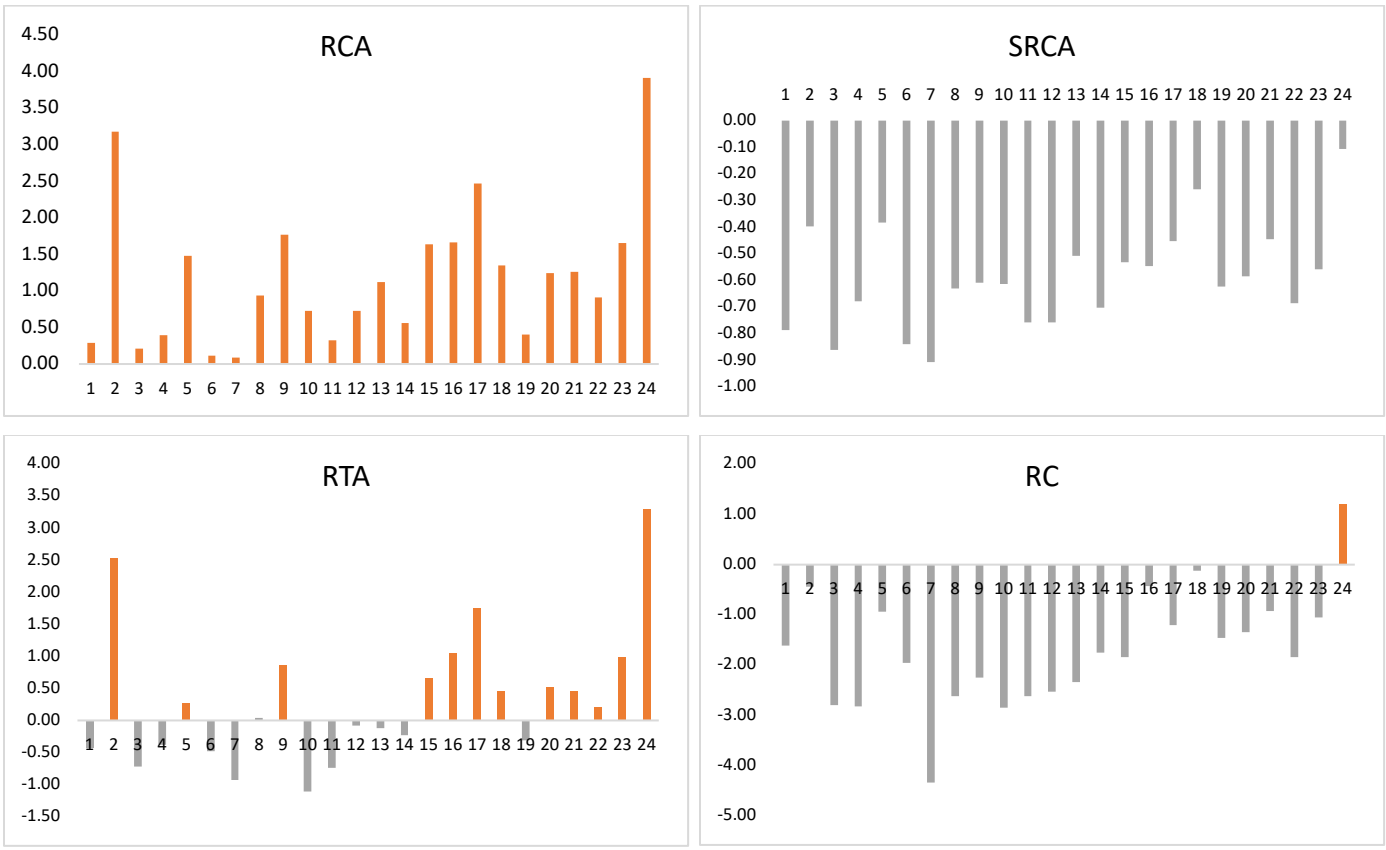
While these findings are reliable and consistent with the empirical literature and previous forecasts, their analysis can provide some policy lessons. If a product has a comparative advantage and is therefore competitive in the global market for a certain nation, it should be an indication for its government to concentrate and accentuate the exports of such items.

As previously indicated, international agriculture trade is incredibly fierce and there is not a specific component or a single combination of elements that can boost a country's agricultural competitiveness. Likewise, there is not a single activity or collection of actions that will ensure future success in international agricultural commerce. Nevertheless, Jámbor and Babu (2016) analysed the WEF competitiveness 12 pillar framework, which associates competitiveness with productivity signalling that a more competitive economy would develop more quickly over time, and adjusted it to the agriculture sector. According to the authors, creating efficient institutions, a favourable environment, and well-functioning land markets, while also investing in physical infrastructure, health and education, along with improving market access, agricultural risk management, innovation and technology adoption, as well as ensuring food security, are all prerequisites for improving agricultural competitiveness.

5.2 Analysis of Brazilian agricultural competitiveness

The Brazilian agricultural export performance can be evaluated by the calculation of the Revealed Comparative Advantage (RCA) indices. At the product level (Figure 15), we can conclude that, considering the original Balassa index, all agricultural products are competitive in the world market, 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 15 Brazilian Revealed Comparative Advantage Indices by product code at HS 2 digit-level, 1995-2019



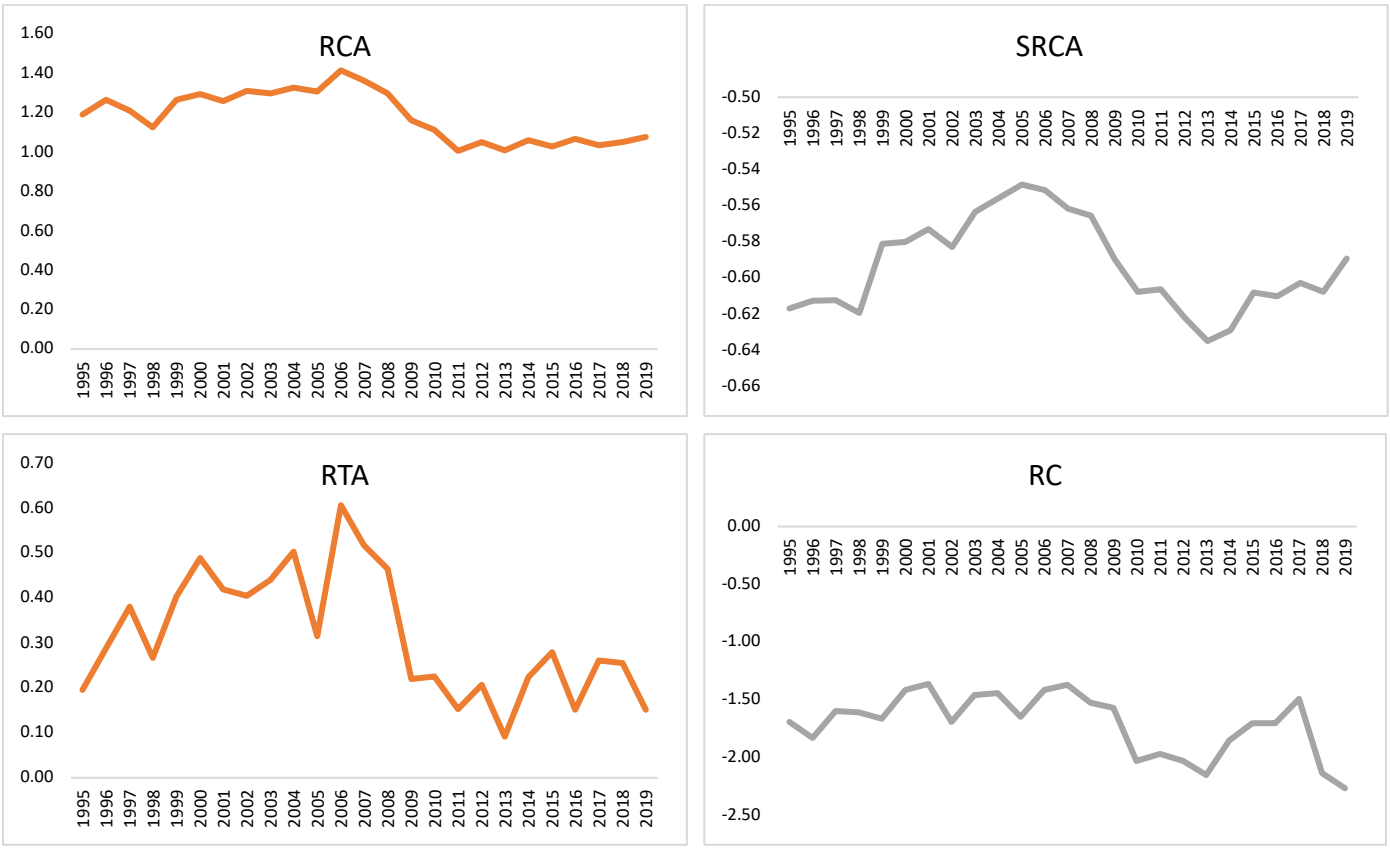
Note: See in Table 4

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

If we take into consideration the other indices, the situation can be very different. *Tobacco and manufactured tobacco substitutes* (HS 24) was the most competitive product group on the Index of Relative Trade Advantage (RTA) and Revealed Competitiveness (RC). The former revealed a comparative advantage for 13 of the 24 product groups, while the latter presented only HS24 as competitive. Conversely, the Symmetric Revealed Comparative Advantage (SRCA) index indicated that none of the group products was competitive.

By examining those indices over time, we can observe that Brazil's agriculture sector exports remained competitive throughout the whole period of 1995 to 2019 (H2), with positive RCA and RTA indices (Figure 16).

Figure 16 Brazilian Revealed Comparative Advantage indices over time 1995 to 2019



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

However, SRCA and RC remained negative for the entire period, which could indicate the opposite, that Brazil's agri-food exports 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 and Jámbor, 2016).

6. 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 analyse the determinants of LAC agricultural bilateral trade flows for the period 1995-2019, primarily, the gravity estimation was made using Ordinary Least Squares (model 1), Random Effects (model 2) and simple pseudo-maximum-likelihood (model 3), which drops regressors that may cause convergence problems, providing results in Table 7. Regarding the first hypothesis, the general gravity model applies to LAC agri-food trade with positive values for GDP and negative ones for geographical distance. All models corroborated the basic premise that trade flows are directly proportional to the size of economies and inversely proportionate to the geographical distance between them.

Table 7 Primary Gravity estimation results for Latin America and the Caribbean region, 1995-2019

	(1)	(2)	(3)
VARIABLES	ln(Agri_export)	ln(Agri_export)	Agri_export
ln(GDP_reporter)	1.0012***	0.8088***	0.7976***
	(0.0067)	(0.0211)	(0.0151)
ln(GDP_partner)	0.7328***	0.6054***	0.7343***
	(0.0053)	(0.0194)	(0.0163)
ln(dist)	-1.3736***	-1.1247***	-0.2091***
	(0.0187)	(0.0649)	(0.0625)
contig	0.6361***	1.7766***	0.8551***
	(0.0548)	(0.2398)	(0.0718)
colony	1.7640***	2.4517***	-0.2747*
	(0.0830)	(0.3644)	(0.1153)
MERCOSUR	0.7964***	1.4767**	0.5111***
	(0.1114)	(0.5118)	(0.1106)
NAFTA	0.4792***	2.0595***	0.2590**
	(0.1191)	(0.2685)	(0.0831)
Paris_Agreement	-0.1845***	-0.0619*	0.0274
	(0.0356)	(0.0289)	(0.0684)
Constant	-17.2244***	-12.4297***	-27.3473***
	(0.2228)	(0.7724)	(1.2667)
Observations	53245	53245	54118
R-squared	0.4217	0.4490	0.6149

*Legend: * p<0.05; ** p<0.01; *** p<0.001. Robust standard errors in parenthesis.*

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

However, as we are dealing with observations from 35 Latin America and the Caribbean nations, it is necessary to carry out appropriate treatment for observations of zero trade flows, since, due to the economic implications of zero trade values, estimating a shortened data sample might result in biased conclusions. In this context, multilateral resistance terms such as temporal and geographic dummies were added to the dataset.

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. 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 (4) while model (5) 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.

Table 8 Final Gravity estimation results for Latin America and the Caribbean region, 1995-2019

	(4)	(5)
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 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 5 indicates that contiguity has a positive effect, model 4, 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 4 indicating that the former colonial relationship (colony) has a positive significant effect on agricultural export between LAC and its trading partners, model 5 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 4, which made hypothesis 7 to be rejected, contrary to the

previous empirical literature. Although the variable was negative in model 5, 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).

7. CONCLUSIONS

Latin American and Caribbean nations have seen substantial positive trends in agricultural development over the past few decades, notably in the rise of agricultural commerce, which has been accompanied by policy and production modifications, as well as more global connectivity. The agricultural trade surplus in LAC has gradually risen, serving as a barrier against major economic contractions during recessions and crises (Arias et al., 2017).

The agricultural trade development in LAC was examined in Chapter 4. To better understand the agri-export contribution to the region's economy, a descriptive analysis of the nation's agri-export data was conducted. 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. Agriculture's share of overall exports in the region declined from 20.71% to 14.51% per cent in 2006, the lowest point on record. Following that, the proportion proceeded to progressively grow, hitting a peak of 22.81 per cent in 2016 and a high of 21.32 per cent in 2019. 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 H_1 hypothesis.

A special emphasis was given to Brazil nation in chapters 4 and 5, 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, exporting an average of $46.524 billion in agricultural products throughout 1995 and 2019. A glance at the Brazilian trade balance over the last several years reveals the importance of agricultural product exports, the high volume of exported agri-food results in considerable trade surpluses, while the exclusion of agribusiness results in a significant trade deficit, also confirming hypothesis 1.

Chapters 6 and 7 analysed the competitiveness of Brazil's and Latin America and the Caribbean's agri-food sectors, respectively. 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. It's also 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.

The performance of Brazilian agricultural exports, particularly discussed in Chapter 5, demonstrated that, when taking into consideration the RCA, all agricultural product groups are competitive in the global market, verifying hypothesis 2. *Tobacco and manufactured tobacco substitutes* (HS 24) had the highest Balassa indices in the period studied. The RTA index revealed a comparative advantage for 13 of the 24 product groups, while RC only presented HS 24 as competitive. Contrary to these findings, SRCA revealed a comparative disadvantage for all Brazilian agri-products. Observing these indices over time reveals that Brazil's agricultural sector exports remained competitive from 1995 to 2019 (H_2), with positive RCA and RTA indices.

The competitiveness of the top ten agri-food exporting nations in Latin America and the Caribbean over 25 years (1995-2019) was investigated in Chapter 6. Multiple findings are explored in the study. First, 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.

Second, our study revealed that oil seeds and oleaginous fruits, 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. By analysing competitiveness at the product level, Revealed Comparative Advantage was found in every product group (H_2). RCA and RTA indices results showed that *coffee, tea, mate and spices* (HS 09) were the most competitive crops in the international market, followed by *fruit and nuts* (HS 08) and trees and other plants (HS 06). In the meantime, the SRCA and RC calculations endorsed that *fruit and nuts, edible; peel of citrus fruit or melons* (HS 08) had the highest competitiveness in the global market.

Third, 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, while Guatemala, Argentina, and Brazil had the largest comparative export advantages (SRCA). The countries with the highest relative trade advantage (RTA) indices

were Guatemala, Uruguay, and Argentina, whereas Argentina, Brazil, and Chile had the highest revealed competitiveness indices (RC).

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 (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.

The agri-food trade has increased significantly in recent years, complementing strong demand, economic growth and expanding trade worldwide. The Latin America and the Caribbean region have cemented their position as the world's third-largest agricultural exporting region. From 1995 to 2019, the Top 10 nations in the LAC area accounted for more than 90% of total agri-exports, with Brazil in the first place, followed by Argentina and Mexico. The LAC trade statistics showed a strong concentration also on the import side, more specifically, the United States and China accounted for 31% of all agri-food products in total as LAC export destination markets.

This work employed the gravity model approach in chapter 7 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.

8. POLICY IMPLICATIONS

The results of this study are consistent and trustworthy enough to have policy implications. Brazil is one of the world's largest economies, in terms of gross domestic product, and is very active in the agricultural-export sector. As already mentioned, the country is the third largest exporter of agricultural and fisheries products and has been working towards greater technological capacity, increasing its diversification levels, so in this sense, it can be considered a country to be followed by its peers.

Nonetheless, the region of Latin America and the Caribbean as a whole still requires more technological innovation and export diversification so that the region may see significant growth, which can be based on natural resources and commodity exports. The future demands a highly active policy plan for the sector and its approach must combine an aggressive pursuit of production diversification with a re-industrialization strategy. Keeping in mind that, as previously mentioned, several actions and recommendations must be implemented simultaneously, to promote the agricultural sector growth and development in the area.

Following this work's main results, LAC's export-oriented agricultural strategy should focus on improving and maximizing the export competitiveness of agri-food product categories, especially the ones with revealed comparative advantage, and also seek market diversification, as there is a high concentration on the exported products and market destinations.

Results imply that MERCOSUR appears to be favourable to LAC nations' agricultural trade. Moreover, LAC should expand market opportunities for regional trade integration, to make commerce more beneficial mutually, as well as strengthen commercial ties with its country peers, taking advantage that culturally similar nations might benefit from lower trade costs. Past colonial relationships with trading partners and the ratification of the Paris Agreement did not have a significant effect on LAC agricultural export.

In conclusion, LAC countries have promising prospects to boost their agricultural production when combined with expanding global demand, which may help to stimulate the region's economic development.

9. LIMITATIONS AND FURTHER RESEARCH DIRECTIONS

There are certain limitations to this research, and so to the dissertation as a whole. It is worth highlighting that one of the most significant complications that this research faced is the complexity of the world food trading system.

Trade nowadays takes place at all levels (individuals, companies, multinationals, and countries) and, as agricultural goods are indispensable for the survival of humanity, their trade is even further intensified, making it extremely difficult to summarize and consolidate the true amount of agricultural trade. To address this problem, this research employed agricultural trade data measured at the macro level (country).

The imperfection of the trade data and the lack of some have also determined the number of countries (Top 10 LAC exporters) and years analysed (1995-2019). In addition, as already mentioned in chapter 3, the trade indices that were used to measure comparative advantage can be distorted by agricultural and trade policies.

Trade data can be portrayed in different ways, by different institutions' reports, and the sum of sub-products, in the end, may not be equal to the main product group, because the disaggregation can be conducted distinctively. In this sense, there is also the problem of data inconsistency, as the reported export from a country may not be the same as the reported import from its trading partner, due to the difference in the measurement method, and at the same time that the lack of data for certain countries/years does not necessarily mean that there was no trade there. Those problems were solved by the usage of the World Bank's World Integrated Trade System (WITS), based on the UN's COMTRADE database, which is reliable, up-to-date, and ensures the elimination of data variation.

Future research directions can be proposed based on the results and limitations of this study. First, this research dataset could be exploited for more in-depth analyses of agricultural trade and competitiveness trends by country (if all LAC countries are specifically chosen, providing then a better understanding of national issues) and product level (if the data is collected at the HS-6 dig level, which is the highest level of data disaggregation), allowing a more detailed analysis of specific commodities. Second, this study might be expanded in the future to include additional major drivers of competitiveness and trade flow. Third, comparisons with other industries might provide interesting outcomes. Finally, an alternative direction is the expansion of

the examined region to other regions, as well as the comparison of fresh research findings to the ones here portrayed.

REFERENCES

Anderson, J. E. (1979). A Theoretical Foundation for the Gravity Equation. *The American Economic Review*, *69*(1), 106–116. http://www.jstor.org/stable/1802501

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

Arevalo, J. L. S., Andrade, Á. M. F. de, & Silva, G. A. B. e. (2016). Uma Nota Sobre Modelos Gravitacionais Aplicados à Exportação de Café de Brasil, Colômbia e Peru. *Revista Brasileira de Economia*, *70*(3), 271–280. https://doi.org/10.5935/0034-7140.20160013

Arias, D., Vieira, P. A., Contini, E., Farinelli, B., & Morris, M. (2017). Agriculture Productivity Growth in Brazil: Recent trends and future prospects. In *Agriculture Productivity Growth in Brazil*. https://doi.org/10.1596/32202

Atkinson, R. D. (2013). Competitiveness, Innovation and Productivity: Clearing up the Confusion. *The Information Technology & Innovation Foundation*, *August*, 1–7.

Azevedo, A. F. Z. de. (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

Balassa, B., & Noland, M. (1989). 'Revealed' Comparative Advantage in Japan and the United States. *Journal of International Economic Integration*, *4*(2), 8–22.

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

Bergstrand, J. H. (1985). The Gravity Equation in International Trade: Some Microeconomic Foundations and Empirical Evidence. *The Review of Economics and Statistics*, *67*(3), 481. https://doi.org/10.2307/1925976

Bhawsar, P., & Chattopadhyay, U. (2015). Competitiveness: Review, Reflections and Directions. *Global Business Review*, *16*(4), 665–679. https://doi.org/10.1177/0972150915581115

Bobato, A. M., Coronel, D. A., & Feistel, P. R. (2020). Os determinantes do comércio intraindústria entre o Brasil, a União Europeia e a China, no período de 2006 a 2017: uma aplicação do modelo gravitacional. *Geosul*, *35*(77), 695–731. https://doi.org/10.5007/2177-5230.2020V35N77P695

Bobirca, A., & Miclaus, P.-G. (2007). A multilevel comparative assessment approach to international services trade competitiveness: The case of Romania and Bulgaria. *International Journal of Economics and Management Engineering*, *1*(6), 122–127.

Bojnec, S., & Fertő, I. (2018). Drivers of the duration of comparative advantage in the European Union's agri-food exports. *Agric. Econ. – Czech*, *64*(2), 51–60. https://doi.org/10.17221/173/2016-AGRICECON

Bojnec, Š., & Fertő, I. (2008). European enlargement and agro-food trade. *Canadian Journal of Agricultural Economics*, *56*(4), 563–579. https://doi.org/10.1111/j.1744-7976.2008.00148.x

Bojnec, Š., & Fertő, I. (2009). Agro-food trade competitiveness of Central European and Balkan countries. *Food Policy*, *34*(5), 417–425. https://doi.org/10.1016/j.foodpol.2009.01.003

Bojnec, Š., & Fertő, I. (2019a). Agri-food comparative advantages in the European Union Countries by value chains before and after enlargement towards the east. *Agraarteadus*, *30*(2), 69–77. https://doi.org/10.15159/jas.19.10

Bojnec, Š., & Fertő, I. (2019b). 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

Breusch, T. S., & Pagan, A. R. (1980). The Lagrange Multiplier Test and its Applications to Model Specification in Econometrics. *The Review of Economic Studies*, *47*(1), 239. https://doi.org/10.2307/2297111

Cantore, N., & Cheng, C. F. C. (2018). International trade of environmental goods in gravity models. *Journal of Environmental Management*, *223*(May), 1047–1060. https://doi.org/10.1016/j.jenvman.2018.05.036

Charlier, C. (2001). A competitividade dos territórios rurais à escala global Conceber uma estratégia de desenvolvimento A competitividade dos territórios rurais à escala global Conceber uma estratégia de desenvolvimento. *Observatório Europeu LEADER*. Bruxelles, Belgium.

Contini, E. (2014). Exportações na dinâmica do agronegócio brasileiro: Oportunidades econômicas e responsabilidade mundial. In A. M. Buainain, E. Alves, J. M. da Silveira, & Z. Navarro (Eds.), *O mundo rural no Brasil do século 21: A formação de um novo padrão agrário e agrícola.* (pp. 147–173). Embrapa.

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

Domazet, T. (2012). Regional Cooperation Striving For Competitiveness And Finance. *Serbian Association of Economists Journal*, *5–6*, 290–300.

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

Duarte, R., Pinilla, V., & Serrano, A. (2019). Long Term Drivers of Global Virtual Water Trade: A Trade Gravity Approach for 1965–2010. *Ecological Economics*, *156*, 318–326. https://doi.org/10.1016/J.ECOLECON.2018.10.012

Duff, A., & Padilla, A. (2015). *Latin America: agricultural perspectives - RaboResearch* (A. Dumitru, J. Kalf, & H. Loman (eds.)). Latin America after the Commodity Boom; Rabobank. https://economics.rabobank.com/publications/2015/september/latin-america-agricultural-perspectives/

Eaton, J., & Kortum, S. (2002). Technology, Geography, and Trade on JSTOR. *Econometrica*, *70*(5), 1741–1779. https://www.jstor.org/stable/3082019?seq=1#metadata_info_tab_contents

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

FAO. (2009). *How to Feed the World in 2050*. Food and Agriculture Organization. Rome, Italy.

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. Rome, Italy.

Ferraz, J. C., Kupfer, D., & Haguenauer, L. (1996). *Made in Brazil: Desafios competitivos para a indústria.* Editora Campus.

Figueiredo, E., Lima, L. R., & Loures, A. (2014). *Uma Análise para o Efeito-Fronteira no*. 481–496.

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/

Flanagan, R., Jewell, C., Ericsson, S., & Henricsson, P. (2005). *Measuring Construction Competitiveness in Selected Countries*. http://www.reading.ac.uk/web/files/innovativeconstructionresearchcentre/icrc-25-d-final_report.pdf

Gagniuc, P. A. (2017). *Markov chains : from theory to implementation and experimentation*. John Wiley & Sons. https://www.wiley.com/en-us/Markov+Chains%3A+From+Theory+to+Implementation+and+Experimentation-p-9781119387558

Galle, V., Rachor, E., Arruda Coronel, D., Machado Pinto, N. G., & Costa, N. L. (2020). Vantagem comparativa revelada da indústria da carne de frango brasileira e dos principais players (2009-2016). *Revista Eletrônica Científica Da UERGS*, *6*(1), 42–53. https://doi.org/10.21674/2448-0479.61.42-53

Garelli, S. (2012). *The fundamentals and history of competitiveness*.

Gasques, J. G., Bacchi, M. R. P., & Bastos, E. T. (2018). Crescimento e Produtividade da Agricultura Brasileira. *Carta de Conjuntura*, *38*(1º trimestre), 1–9. http://www.ipea.gov.br/cartadeconjuntura/index.php/2018/03/02/crescimento-e-produtividade-da-agricultura-brasileira-de-1975-a-2016/

Gorton, M., Hubbard, C., & Fertő, I. (2013). *Theoretical background and conceptual framework International comparison of product supply chains in the agri-food sector: determinants of their competitiveness and performance on EU and international markets*. www.compete-

project.eu

Greene, W. H. (2012). *Econometric Analysis* (7th ed.). Pearson Education Limited.

Grubel, H. G., & Lloyd, P. J. (1971). The Empirical Measurement of Intra-Industry Trade. *Economic Record*, *47*(4), 494–517. https://doi.org/10.1111/j.1475-4932.1971.tb00772.x

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.

Heckscher, E. F. (1919). The effect of foreign trade on the distribution of income. *Ekonomisk Tidskrift*, *21*(21), 497–512.

Heckscher, E. F., & Ohlin, B. (1991). *Heckscher-Ohlin Trade Theory* (H. Flam & M. J. Flanders (eds.)). MIT Press.

Hoen, A. R., & Oosterhaven, J. (2006). On the measurement of comparative advantage. *Annals of Regional Science*, *40*(3), 677–691. https://doi.org/10.1007/s00168-006-0076-4

IMD. (2020). *IMD World Competitiveness Online*. https://worldcompetitiveness.imd.org/

Jámbor, 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

Jámbor, A., & Gibba, A. (2017). Competitiveness in global agri-food trade: The case of peanuts. *Bulgarian Journal of Agricultural Science*, *23*(2), 177–182. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85018415992&partnerID=40&md5=2e8045a89942ad19d0554d0c2ae8f550

Jámbor, , A., Tóth, T. T., & Kőröshegyi, D. (2018). Competitiveness in the trade of spices: A global evidence. Bulgarian Journal of Agricultural Science, 24(5), 729–736.

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*.

Krugman, P. (1994). Competitiveness: A Dangerous Obsession. *Foreign Affairs*, *73*(2), 28–44.

Krugman, P. R., & Obstfeld, M. (2003). *International Economics: Theory and Policy* (6th ed.). Addison Wesley.

Lafay, G. (1992). The Measurement of Revealed Comparative Advantages. In M. G. Dagenais & P.-A. Muet (Eds.), *International Trade Modelling*. Chapman & Hill.

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

Latruffe, L. (2010). Competitiveness, Productivity and Efficiency in the Agricultural and Agri-Food Sectors. *OECD Food, Agriculture and Fisheries Papers*, *30*(30), 1–63. https://doi.org/10.1787/5km91nkdt6d6-en

Linder, S. (1961). *An Essay on Trade and Transformation*. John Wiley.

Lobzhanidze, N. (2021). The impact assessment of competitiveness on export growth in Georgian mineral water sector (based on econometric model). *Economics. Ecology. Socium*, *5*(1), 1–12. https://doi.org/10.31520/2616-7107/2021.5.1-1

Maghin, H., & Renon, E. (2018). Latin America's Golden Era? In *The political economy of Latin America: reflections on neoliberalism and development after the commodity boom* (pp. 138–168). Routledge.

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

Maranhão, R. A., & Vieira Filho, J. E. (2017). *Inserção internacional do agronegócio brasileiro*. https://www.researchgate.net/publication/319290176_Insercao_internacional_do_agronegocio_brasileiro

Matkovski, B., Kalaš, B., Zekić, S., & Jeremić, M. (2019). Agri-food competitiveness in South East Europe. *Outlook on Agriculture*, *48*(4), 326–335. https://doi.org/10.1177/0030727019854770

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

Mizik, T., Szerletics, Á., & Jámbor, A. (2020). Agri-Food Export Competitiveness of the ASEAN Countries. *Sustainability*, *12*(23), 1–15. https://doi.org/10.3390/su12239860

Ocampo, J. A. (2017). Commodity-led Development in Latin America. In G. Carbonnier, H. Campodónico, & S. T. Vázquez (Eds.), *Alternative pathways to sustainable development: Lessons from Latin America* (Vol. 9, pp. 51–76). Brill. https://doi.org/10.1163/9789004351677

OEC, & The Observatory of Economic Complexity. (2021). *United States (USA) Exports, Imports, and Trade Partners*. https://oec.world/en/profile/country/usa

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. (2001). *Glossary of Statistical Terms*. https://stats.oecd.org/glossary/

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

Ohlin, B. (1933). *Interregional and International Trade*. Harvard University Press.

Paula, J. S. De, & Miranda, M. I. C. (2017). Análise do padrão de comércio entre os países do BRICS. *Ensaios FEE*, *37*(4), 1005–1032.

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

Porter, M. E. (1985). *Competitive Advantage of Nations : Creating and Sustaining Superior Performance.* Free Press.

Porter, M. E. (1998). *The Competitive Advantage of Nations*. Free Press.

Porter, M. E. (1999). Michael Porter on Competition. *Antitrust Bull*, *44*(4), 841–880.

Proudman, J., & Redding, S. J. (1997). Persistence and Mobility in International Trade. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.79473

Ramsey, J. B. (1969). Tests for Specification Errors in Classical Linear Least-Squares Regression Analysis. *Journal of the Royal Statistical Society.*, *31*(2), 350–371.

Reiljan, J., Hinrikus, M., Ivanov, A., Reiljan, J., Hinrikus, M., & Ivanov, A. (2000). *Key issues in defining and analysing the competitiveness of a country* (No. 1; Faculty of Economics and Business Administration). Faculty of Economics and Business Administration, University of Tartu (Estonia).

Ricardo, D. (1817). *On The Principles of Political Economy and Taxation* (3rd ed.). Batoche Books.

Rodríguez, F. (2004). *The Political Economy of Latin American Economic Growth*. World Bank Global Development Network Research Project: 1-65. Available from http://web.worldbank.org/archive/website00894A/WEB/PDF/F_RODRIG.PDF

Sanfey, P., & Zeh, S. (2012). *Making sense of competitiveness indicators in south-eastern Europe* (No. 145). http://www.ebrd.com/downloads/research/REP/regional-economic-prospects1205.pdf.

Santos Silva, J. M. C., & Tenreyro, S. (2006). The Log of Gravity. *The Review of Economics and Statistics*, *88*(4), 641–658.

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

Smith, A. (1776). *An Inquiry into the Nature and Causes of the Wealth of Nations*. Methuen & Co. https://www.libertyfund.org/books/an-inquiry-into-the-nature-and-causes-of-the-wealth-of-nations-set

Tinbergen, J. (1962). *Shaping the World Economy; Suggestions for an International Economic Policy*. Twentieth Century Fund. http://hdl.handle.net/1765/16826

Tyszynski, H. (1951). World Trade in Manufactured Commodities, 1899-1950. *The Manchester School*, *19*(3), 272–304. https://doi.org/10.1111/j.1467-9957.1951.tb00012.x

UNCTAD. (2021). The Commodities and Development Report 2021: Escaping from the Commodity Dependence Trap through Technology and Innovation. In *Unctad*. United Nations Publications.

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

Williamson, J. (1983). *Open Economy and the World Economy: A Textbook in International Economics*. Basic Books.

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/

World Bank. (2022, March). *Countries in Latin America & Caribbean*. https://wits.worldbank.org/chatbot/SearchItem.aspx?RegionId=LCN

World Economic Forum. (2016). *The Global Competitiveness Report 2016–2017*. https://www.weforum.org/reports/the-global-competitiveness-report-2016-2017-1

World Economic Forum. (2019). *The Global Competitiveness Report 2019*. http://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport2019.pdf

Yap, J. T. (2004). A Note on the Competitiveness Debate. *Philippine Journal of Development*, *XXXI*(1), 1–23.

Young, J. P. (1951). *The International Economy*. The Ronald and Press Company.

Yu, R., Cai, J., & Leung, P. S. (2009). The normalized revealed comparative advantage index. *Annals of Regional Science*, *43*(1), 267–282. https://doi.org/10.1007/s00168-008-0213-3