

## THE IMPORTANCE OF PRIMARY COMMODITIES IN THE FOREIGN TRADE OF BRAZIL IN THE 21ST CENTURY

DOMINIKA KOCÁNOVÁ<sup>1</sup>

***Abstract:** This paper aims to identify the importance of primary commodities in Brazil's foreign trade and define the commodity groups in whose exports Brazil has the highest comparative advantages. At the same time, we want to find out how these comparative advantages have changed and developed in the period from 2001 to 2020, i.e., in the period of high prices of primary commodities (2003 – 2012) and the period after until the outbreak of the global pandemic COVID-19. To achieve this goal, we used the Lafay index of international specialization using data at the four-digit level of the Harmonised System. The results of the Lafay index indicate that Brazil achieves comparative advantages, especially in exports of agricultural products, food, and some minerals. A significant comparative advantage is achieved in the soybean and iron ore commodity groups.*

***Keywords:** Brazil, comparative advantage, Lafay index, foreign trade*

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<sup>1</sup> Dominika Kocánová, University of Economics in Bratislava, Slovak Republic,  
e-mail: dkocanova2@student.euba.sk

## 1 Introduction

Primary commodities are a significant part of world trade. Despite their important role, dependence on their export is often perceived as a negative phenomenon, for reasons such as the deterioration of real exchange relations in the long term or the high volatility of primary commodity prices compared to industrial production prices (Jančovič, 2021). Primary commodities can mean primary and agricultural products, specifically mineral raw materials such as metallic and non-metallic minerals or fossil fuels, but also agricultural products such as coffee, cocoa or cotton, and many other commodities. Not all countries, even economically advanced ones, are self-sufficient in the production of essential commodities. The countries in question import commodities mainly from less developed economies, for which their export often constitutes a significant part of foreign trade income. Brazil, which is the largest economy in the Latin American region, is part of the developing BRICS economies and one of the world's largest economies, is among the countries in which primary commodities make up a significant share of exports. Primarily and above all, agricultural products form a significant part of the commodity structure of Brazil's exports. The presented work identifies the importance of comparative advantages in the country's foreign trade. Based on the historical analysis of foreign trade, we will try to find out the changes that have affected Brazil's exports and imports since independence. The main goal of the work is to identify the importance of primary commodities in Brazil's foreign trade with an emphasis on the commodity structure of exports. We aim to achieve this goal by analysing the international specialisation of Brazil's foreign trade by calculating the Lafay index, which takes into account the difference between the normalized trade balance of each commodity with the total normalized trade balance. The work is structured into three chapters: the theoretical basis of the work, the foreign trade of Brazil at present and the conclusion.

## 2 Theoretical background

The paper aims to identify the importance of primary commodities in Brazil's foreign trade with an emphasis on the commodity structure of exports. We attempt to achieve this through the analysis of Brazil's specialization in foreign trade by calculating the Lafay index. We obtained the data required for the calculation from the ITC Trade Map database for the monitored period from 2001 to 2020.

The Lafay Index (LFI) is a reliable tool for determining a country's comparative advantages and level of international specialization. Lafay's index, compared to Balassa's index of revealed comparative advantage (RCA), also takes into account a country's imports, which makes it possible to control a country's intra-industry trade and re-export flows. The Lafay index considers the difference between the normalized trade balance of each commodity with the total normalized trade balance (Zaghini, 2003).

The mathematical formulation of the Lafay index:

$$LFI_j^i = 100 \left( \frac{x_j^i - m_j^i}{x_j^i + m_j^i} - \frac{\sum_{j=1}^N (x_j^i - m_j^i)}{\sum_{j=1}^N (x_j^i + m_j^i)} \right) \frac{x_j^i + m_j^i}{\sum_{j=1}^N (x_j^i + m_j^i)} \quad (1)$$

Where:

$x_j^i$  = export of country  $i$  of commodity group  $j$

$m_j^i$  = import of country  $i$  of commodity group  $j$

$N$  = number of analysed commodity groups

The sum of all analysed items should equal zero. A country achieves a comparative advantage if the value of the Lafay index for a given commodity is higher than 0. At the same time, the higher the positive value of the LFI index, the higher the degree of international specialization of the country in trade with a given group of commodities. On the other hand, negative values of the calculated Lafay index indicate that the economy has a comparative disadvantage in exporting the studied commodity group (Platania, Rapisarda and Rizzo, 2015).

## 2.1 International trade

*"Foreign trade is part of the sphere of circulation of goods, which represents exchange with foreign countries. In a narrower sense, it includes the exchange of goods with foreign countries. In a broader sense, it includes, in addition to the movement of goods, the movement of services"* (Lipková et al., 2011). Foreign trade consists of the export of products produced in the country abroad, otherwise known as export. The second component of foreign trade is imports into the country from abroad.

Exchange trade relations arise as a result of the international division of labour. The specialization of the country is determined by the availability of factors of production. The international division of labour is influenced by natural, historical, technical, economic, and political conditions. The essence of the international division of labour is achieving economies of scale. The economies of scale are achieved when countries specialize in the production of products whose production is demanding on the country's abundant factors of production. Countries are not involved in the international division of labour equally. While selected countries are dependent on involvement in the international division of labour, some countries are almost independent and only minimally involved. We can describe them as autarkic economies (Lipková et al, 2011).

As already mentioned above, the conditions in individual countries influence the possibilities of countries' specialization and subsequent involvement in the international division of labour. The availability of factors of production and suitable conditions can be characterized as an advantage of a given country over another country. The advantages of individual countries were formulated into several theories of foreign trade.

### **2.1.1 Theories of foreign trade**

Representatives of classical economics, including Adam Smith, the author of the theory of absolute advantage, dealt with economic advantages (Brewer, 1985). Adam Smith argued in his theory that a country has an absolute advantage over another country if it can produce a product at a lower cost. A country should export goods whose production is more efficient than its trading partners, that is, it uses a smaller absolute amount of labour (Oustrata, 2000). In his theory, Smith assumed that a country can produce selected goods at a lower cost, i.e., with a smaller amount of work, and subsequently acquire other goods in which it does not have an absolute advantage by engaging in foreign trade (Lipková et al., 2011). According to Smith, the absolute advantage of a country arises as a result of different production conditions in countries.

The classical school of economics later came up with a new theory of foreign trade. The author of the theory of comparative advantages is David Ricardo, a representative of the classical school. As part of his theory, he pointed to the fact that foreign trade and exchange of goods work not only if countries have different absolute advantages, but also if they have relative comparative

advantages. It follows from this that even if the country has no absolute advantage, it will still be advantageous for it to participate in international exchange.

Relative comparative advantage is the country's ability to produce at lower opportunity costs, i.e., the value of the alternative. *"Relative comparative advantage exists when the relative labour intensity between two commodities is different in each country"* (Outrata, 2000). Different opportunity costs contribute to optimal country specialization. The premise of the theory is two countries A and B and two goods 1 and 2. L represents the amount of labour necessary for the production of the given product. A country has an absolute advantage if  $L(1, A) < L(1, B)$  and a comparative advantage if  $L(1, A) / L(2, A) < L(1, B) / L(2, B)$ . We can divide comparative advantages into traditional (static) and new (dynamic). While traditional comparative advantages only consider the geographical conditions of the country and its equipment with various factors of production, dynamic comparative advantages arise as a result of investment in human capital, modern technologies, or a suitable working environment. Dynamic comparative advantages are created purposefully (Melišek, 2012). A significant difference compared to traditional comparative advantages is that dynamic comparative advantages are not given and immutable, but can be acquired and transformed (Lesáková, 2008).

Ricardo's theory of comparative advantage points out that even countries that have an absolute disadvantage in the production of all products can still engage in foreign trade. In the theory of comparative advantage, only human resources are considered a resource; land and capital are not recognized. The only costs are labour costs for workers. In the theory, the development of the relative productivity of the labour force and the commodity structure of foreign trade were linked. The theory is explained in terms of perfect competition. David Ricardo's theory of comparative advantage has some limitations. In his theory, he does not address the sources of obtaining comparative advantages, and another possible limitation is the assumption of perfect competition (Outrata, 2000).

The Heckscher-Ohlin theorem is also based on the assumption of perfect competition. The Heckscher-Ohlin theorem also called the theory of the availability of factors of production, is an important part of foreign trade theories. Heckscher and Ohlin tried to explain the sources of obtaining comparative advantages by working with the relative endowment of the

country with the selected production factor and the relative demandingness of the production process for the given factor of production. The theorem formulates the assumption that each country will export a product whose production is relatively more demanding for the factor of production that the country has enough of. On the contrary, the country will import a product whose production process is relatively more demanding on the factor of production, which is in short supply in the country (Oustrata, 2000). It follows that capital-rich countries will focus on capital-intensive production and labour-abundant countries on labour-intensive production. The factor of production that is represented in the country in the largest quantity is also the cheapest, which affects the total production costs (Lipková et al., 2011). The theorem is based on several assumptions: two countries, two products, and two factors of production are examined. There are also other assumptions, such as the immobility of factors of production between countries, or the same preferences of consumers in both countries. It is also important that countries have the same level of technical equipment, which can be considered one of the limitations of the theorem (Keuschnigg, 2012).

The theorem was tested. We call the result of this test the Leontief paradox after its author Wassily Leontief. Leontief assessed the Heckscher-Ohlin theorem on data from 1947, using the example of the United States of America, which has a capital-abundant economy. According to the Heckscher-Ohlin theorem, the United States should export products that are capital-intensive to produce. However, an analysis of foreign trade data revealed that the United States exported goods whose production was labour-intensive (Keuschnigg, 2012). This test has several limitations. In his experiment, Leontief did not directly challenge the Heckscher-Ohlin theorem. On the contrary, he tried to prove that the United States achieves significantly higher labour productivity, which would mean that the factor they have in sufficient quantity is a labour force that achieves high productivity. Higher productivity is achieved by higher qualifications. Highly skilled labour is referred to as human capital, so it should be classified as capital rather than labour as a factor of production. The data may point to the fact that it may not be a paradox, but merely a misclassification of factors of production (Lipková et al., 2011).

## ***Primary commodities***

Primary commodities are defined as goods where all or almost all of the added value during production was created by the primary sectors of the economy, i.e., j. primary commodities are mostly unprocessed or unrefined (UNCTADSTAT, 2018).

According to Chovancová et al. (2012), primary commodities include:

1. Mineral raw materials and metals, which are divided into energy raw materials such as oil, natural gas, or coal, and metals, which include precious metals such as gold or silver, and industrial metals such as iron, steel, aluminium, or copper.

2. Agricultural products, which can be of plant origins such as wheat, cocoa, and coffee, and animal origins such as poultry or pigs.

Based on the standard international trade qualification (SITC), we can include among the primary commodities items that are in category 0 – food, 1 – beverages and tobacco, 2 – raw materials, 3 – mineral fuels, 4 – oils and fats and items 67 – iron and steel and 68 – non-ferrous metals (Radetzki and Wårell, 2016).

Primary commodities are characterised by high price volatility. The demand and supply of primary commodities are relatively inelastic and unstable, which can cause problems or hinder the economic growth of a country. Volatility and instability of prices also lead to instability of exports, especially if the country specializes only in the export of primary commodities and immediate products of primary commodities. Price fluctuations and instability are not characteristic features of only selected commodities such as oil but concern primary commodities in general (Reyes and Sawyer, 2015).

### **2.1.2 The Prebisch - Singer theorem and the Dutch disease**

An important theory that deals with primary commodities and their connection with global poverty are the Prebisch-Singer theorem. Prebisch and Singer divide the world into two parts: the centre, which includes industrialized countries, and the periphery, which consists of developing countries (Hönsch, 2006). In their publications, Prebisch and Singer stated that developing countries mainly export primary products. In countries that are developed,

i.e., advanced, exports are made up primarily of industrial products. Industrial products are sold both in the centre and in the periphery. The problem was the deterioration of real exchange relations. Developing countries in the periphery are unable to produce industrial products and are dependent on purchasing and importing these products from the centre at significantly higher prices compared to the products they export. For this reason, countries in the centre benefit from international trade more than countries in the periphery (Reyes and Sawyer, 2015).

The Prebisch-Singer hypothesis contained the basic fact that the difference between per capita incomes in developed countries compared to developing countries was increasing significantly. The formulation of the theorem took place in Latin America around the middle of the 20th century. In the theorem, was also considered whether specialization based on static comparative advantages does not cause the fact that developing countries are not able to participate in the process of technological progress to the same extent as countries producing industrial products.

The hypothesis contained three basic assumptions (Cuddington, Ludema and Jayasuriya, 2002):

1. Countries in the periphery specialize in the production of primary products.
2. Technological progress is located mainly in countries with industrial production.
3. Relative prices of primary products have been falling since the end of the 19th century.

Their theorem was one of the reasons for the introduction of protectionism in several developing countries in the middle of the 20th century. According to the authors, the number of primary products in demand is also lower precisely because of technological progress, which will reduce the necessary amount of required raw materials. Prebisch recommended that countries in the periphery should focus on increasing industrial production, which has a higher added value (Hönsch, 2006).

Even in the case of this theorem, there are several limitations. The first limitation is that the assumption that prices of primary products fell significantly may not be true, but that changes in the volume and value of trade were due to



reductions in transport costs. Of course, the most important limitation is the fact that developing countries do not only export primary commodities, but also industrial products, and developed countries also do not export only industrial products (Hadass and Williamson, 2001).

We refer to the conditions that are associated with a high increase in production and income from primary commodities and the impact of the export of primary commodities on other sectors of the country's economy as Dutch disease (Reyes and Sawyer, 2015). Increased income from primary commodities causes the currency to appreciate, and increase the exchange rate, thereby reducing the ability of industrial product exports to compete with other countries (Obadi, 2010). Lower competitiveness leads to a lower level of industrial production, i.e., to gradual de-industrialization. Direct de-industrialization occurs when employees move from the industrial sector to the primary sector). Indirect de-industrialization and the transfer of employees from the industry sector to the service sector occurs because of the spending effect, and the increase in demand from the service sector (Hlavová, 2014).

## **2.2 The development of Brazil's foreign trade from independence to the entry into the Common Market of the South (MERCOSUR)**

Brazil gained independence from Portugal in 1822 under relatively peaceful conditions compared to surrounding Latin American states. Gaining independence was not the only major event that had an impact on Brazil's economy and foreign trade in the 19th century. A significant event was the fall of the monarchy in 1889 and the subsequent establishment of the Republic of Brazil (Haber, 1997). The abolition of slavery in 1888 also had an impact on the economy, as until then the expansion of the export-oriented economy was dependent on the use of slaves as labour (Absell and Tena-Junguito, 2017).

Sugar production from sugarcane was a significant part of Brazil's economy even before independence when sugar was a dominant product. In the period after gaining independence (1820 – 1830), producers in selected provinces began to focus not only on the production of sugar but also coffee (Centeno and Ferraro, 2013). The decline in sugar production was primarily due to a shift to coffee production due to its higher prospects and increasing foreign demand, while sugar prices fell. The economic growth that Brazil achieved during this period was mainly due to an increase in the production and export of coffee and partly rubber. The growth of sugar and cotton production decreased year

on year between 1822 and 1913. The production and export of cotton briefly revived during the Civil War in the United States of America, when prices increased significantly (Absell and Tena-Junguito, 2017).

Shortly after independence, coffee accounted for about a quarter of the value of Brazilian exports, and sugar for almost a third. At the end of the century, coffee was already the dominant product, when it accounted for up to 60 per cent of the export value and sugar for less than 10 per cent (Luna and Klein, 2014). The coffee market was unstable, and prices fluctuated significantly. The significant dominance of coffee in Brazil's foreign trade at the end of the 19th century caused the Dutch disease to affect other sectors involved in exports. At the turn of the 19th and 20th centuries, the share of rubber in the total export value also increased significantly. The increase in rubber exports was primarily due to increasing demand for automobile production. A significant increase in rubber prices occurred at the beginning of the First World War (Absell and Tena-Junguito, 2017). The production of rubber was physically demanding and required a greater number of workers. Brazil was a major producer and exporter of rubber until 1910 when it was overtaken by Asian producers. Later, production and exports gradually decreased, and at the end of the 20th century, Brazil no longer exported rubber but instead imported it (Luna and Klein, 2014).

During the First World War, the value of Brazilian exports decreased, but the total volume of exported products increased. On the contrary, the volume of imported products decreased, but the value of total imports increased. During this period, Brazil became the second largest cocoa exporter. Sugar production, which had been declining before the war, rose again during this period, and so did its price. A reduction in sugar production due to severe frosts in Argentina caused a significant demand for Brazilian sugar in 1918. During the First World War, there was a rise in products that were not previously intended for export. A significant increase occurred in the export of chilled beef, the largest consumers of which were Italy, Great Britain, and France. After the end of the First World War, the commodity structure of exported goods was more diverse, even though the largest part of exports was still coffee. Brazil exported agricultural products such as sugar, coffee, rubber, cotton and cocoa, and iron ore from mineral resources (Carreras-Marín, Badia-Miró and Peres Cajías, 2013).

An important product that was imported in the past was textiles. From 1910, the volume of imported textiles decreased, as domestic industrial production of this product continued to grow. Between 1924 and 1929 there was a boom in coffee production. The significant increase in the production and export of coffee also helped other industries that were necessary for the production and transport of coffee. By the late 1920s, Brazil's production of coffee exceeded the world's demand. The supply significantly exceeded the demand and the coffee remained in the warehouses. Despite initial efforts to help coffee exporters, a decision was made in 1933 by the Brazilian government. The planting of new trees was prohibited, and a certain part of the excess coffee stock stored was ordered to be burned, as coffee prices were too low. During this period, Brazil lost approximately 10 per cent of the total world share of coffee production (Luna and Klein, 2014).

Agricultural products still made up the majority of Brazil's exports between 1930 and 1945, and of these, despite the measures, coffee was still dominant. The second most important agricultural product was cotton. Within industrial products, textile products were the most important. The world economic crisis of the 1930s had an impact on imports. Imports had to be limited due to high prices and domestic production was encouraged. High tariffs and quotas were imposed on non-essential products that Brazil did not need for its production. The year 1930 is important above all because of the change in the dominant development strategy of the Brazilian economy. The importance of foreign trade decreased, and the importance of domestic production and consumption increased. By encouraging domestic production, Brazil gained self-sufficiency in selected industries and by the end of the 1940s was able to produce up to 50 per cent of the products it needed to import until then (Hilton, 1975). Brazil's exports in the period after 1930 consisted mainly of selected agricultural products, as industrial products were unable to compete in international markets. There was a revival in the coffee sector in 1945. While there was a surplus of coffee during the 1930s and prices were at low levels, in the mid-1940s there was a shortage of coffee on the world market, which led to a significant increase in prices. Prices remained at a high level until 1954, when there was a significant drop in prices and subsequently a repeated surplus of coffee (De Abreu and Bevilaqua, 2000).

During World War II, there was a high world demand for Brazil's primary commodities. At the same time, Brazil had a problem with the lack of fuel and finished products that were imported. Despite the high demand for Brazilian

products, its exports were not at a sufficient level due to the overall decline in world trade. Import prices were high, which supported the policy of import substitution by domestic industrial production. The policy of protecting the domestic economy lasted in Brazil until the 1980s. From the beginning, the system of the high level of protection of the domestic market through tariffs, quotas, and the necessity of licenses for imports worked, and Brazil achieved rapid growth of the gross domestic product. After a certain period, this fact no longer applied. After 1964, when there was a coup in Brazil, Brazil tried to return to an open economy for some time and abandoned several forms of protectionism. It tried to support exports and their diversification. The efforts to modernize agriculture were part of the diversification of exports. In this period, soybeans, and orange juice, as well as sugar cane, began to be exported in larger quantities.

As a result of the oil shocks, Brazil once again reverted to protectionism and import substitution policies to protect the economy from external shocks. During the promotion of domestic industrial production, there was also a change in the structure of exports. The share of industrial products in total exports recorded a significant increase. The oil shocks encouraged the use of sugar to produce ethanol as an alternative fuel in Brazil, as Brazil imported too much fuel from abroad.

The reintroduction of protectionist policies led to faster gross domestic product (GDP) growth again, but this trend ended in the 1980s. The deterioration of economic growth led Brazil to reconsider the liberalization of the economy, which was also happening in other Latin American countries. The process of liberalization occurred in the late 1980s and early 1990s. The debt crisis of the 1980s led to the adoption of a new development paradigm in Latin America based on the principles of neoliberalism. The principles of neoliberalism, promoted by international financial institutions, were conceptually summarized by Williamson, and are known as the Washington Consensus. It is a set of the following policies, or macroeconomic and structural reforms: 1. Fiscal discipline, 2. Reordering of public expenditure priorities, 3. Tax reform, 4. Interest rate liberalization, 5. Competitive exchange rate, 6. Trade liberalization, 7. Removal of barriers to the entry of foreign direct investments, 8. Privatization, 9. Deregulation, 10. Protection of property rights (Borghi and Sarti 2019). In Brazil, the protection of the industrial sector was reduced, and taxes and quantitative restrictions on exports, which were introduced in the previous period, were reduced. At the same time, import duties were

significantly reduced and non-customs import restrictions were gradually completely abolished. Liberalization was gradual and slower compared to other countries in the region (Helfand and Castro de Rezende, 2004).

### **3 Brazil's foreign trade in the 21st century**

#### **3.1 Brazil's foreign trade from the entry into MERCOSUR to the present**

Brazil's entry into MERCOSUR brought more competition to trade. Domestic producers were exposed to higher competition and modernization of several areas was required. Within MERCOSUR, a common customs tariff was introduced in 1995, which was adopted to introduce customs duties against non-member countries within the customs union as a stage of interregional economic integration. The introduction of the tariff was most important precisely for Brazil, whose intention was to protect its industrial sector. Liberalization of foreign trade in Brazil proceeded slowly. In Brazil, licenses were still required to import flour, wine, or chemicals. Protectionism in Brazil has forced Argentina to adopt certain protective measures against the products of Brazil, including the so-called anti-dumping duties (Grugel and Hout, 1999). Mutual market restraint did not only take place at the beginning of MERCOSUR in the 1990s but continued into the new millennium. Brazil and Argentina imposed restrictions on each other such as necessary import licenses or the aforementioned anti-dumping duties, especially for products such as sugar, flour, wine, and chemicals.

MERCOSUR represented an opportunity for Brazil to increase its exports, which were previously affected by protectionism. It enabled Brazil to expand foreign trade within Latin America. Argentina has become the second most important recipient of Brazilian exports after the United States of America. It is important to note that sugar and automobiles were excluded from the free trade agreement, as both Brazil and Argentina had significant domestic production in these industries.

The years 1996 and 1997 were characterized by measures to support the development of exports. Several national programs were introduced to help finance the export of small and medium-sized companies. Customs procedures were also simplified, and the privatization of selected ports reduced certain fees. During this period, there was a significant increase in the export of cars to

MERCOSUR member countries. Even though automobiles, like sugar, were left out of the original trade agreement, their import and export were regulated by a special agreement that established that the import of automobiles from member countries would be subject to only half the amount of the duty imposed on third countries (International Monetary Fund, 1998).

Despite the increase in the share of industrial products in total exports in the 20th century, at the beginning of the 21st century, there were still perceptions and concerns in Brazil that Brazil exports a large number of primary commodities, which include agricultural products and minerals, or low-value products, and, conversely, imports still a large number of finished products. Dissatisfaction with this structure of exports prevailed mainly because of a fundamental characteristic of primary commodities and their trade: low income and vulnerability to external shocks (OECD, 2001).

The improvement of the overall situation in the Brazilian economy occurred with the arrival of a new government in 2003, which, with the help of new measures, stabilized the situation in the foreign exchange markets, reduced credit risk, and tried to stabilize inflation in the country. The country's exports increased and prospered. The penetration of the Chinese market and the increased price of primary commodities contributed to the positive trend in exports. In 2003, primary commodities accounted for 30 per cent of Brazil's total exports; the share has increased by 5 per cent since 1999 (OECD, 2005). Brazil mainly exported soybeans, orange juice, sugar, coffee, and beef.

Imports were still mainly made up of industrial products. Despite the liberalization of the market and the gradual removal of barriers, the level of protection and the level of customs duties vis-à-vis third countries (outside MERCOSUR) were still higher compared to other countries. Protection was also counterproductive, as more technologically advanced products and products imported from abroad were too expensive for domestic producers, affecting subsequent production and the ability to be competitive exporters.

In the period from 2000 until the global financial crisis in 2008/2009, Brazil's exports grew at a rapid pace, and so did the share of exports in GDP. The most important part of exports continued to be primary commodities, i.e., mineral raw materials and agricultural products, whose exports recorded year-on-year growth. Despite increasing exports and share of GDP, the openness of the economy was and still is below the world average. The openness of the

economy is expressed as the share of exports and imports in the total GDP. In the table, we can see that the total volume of exports and imports increased approximately twice between 2001 and 2020.

**Table 1:** The degree of economic openness

Area	Figures from 2001 in billions (constant prices USD 2015)				Figures from 2020 in billions (constant prices USD 2015)			
	Export	Import	GDP	% Openness	Export	Import	GDP	% Openness
Brazil	122.35	118.98	1,200	20.11	244.82	238.54	1,750	27.62
World	11,650	11,320	49,180	46.71	20,220	21,570	81,900	51.03

**Source:** Author's elaboration based on the World Bank (2022).

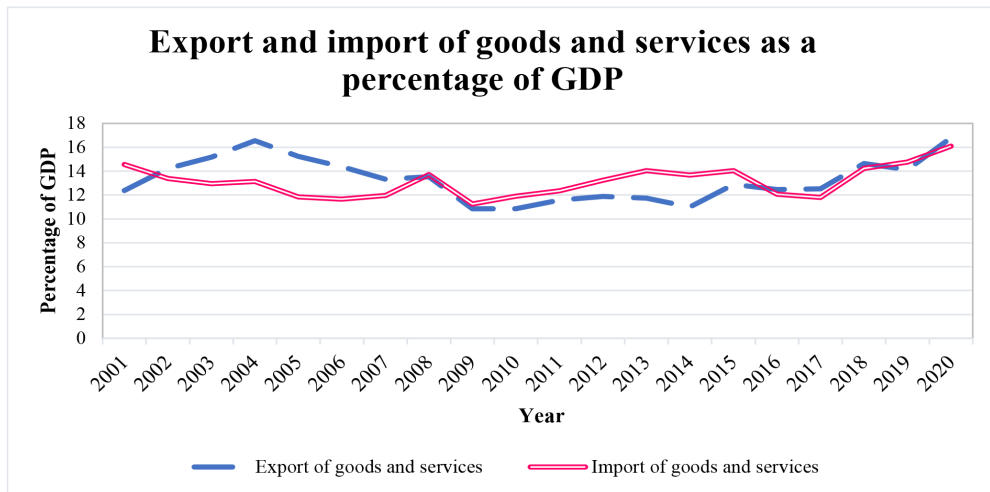
Looking at the commodity structure of Brazilian exports in the period under study, we can conclude that primary commodities gained importance and their share in total exports gradually increased from the beginning of the 21st century, while the share of industrial products, which made up most exports in the 1990s, began to decrease. The share of industrial products in total exports began to decline even before the outbreak of the global financial crisis. One of the reasons may be the impossibility of competing with China in this area (Jenkins, 2014). Another reason may be low labour productivity or lower investments in research compared to competitors. Another important factor is the high world prices of primary commodities in the period 2003 – 2013, which led to the so-called "reprivatisation" of the economy (Ocampo, 2017). The long-term maintenance of a larger export volume of agricultural products and raw materials was achieved mainly by demand from China and other Asian countries. Within primary commodities, soybeans, and their products, such as oil, gradually gained dominance. At the same time, iron ore also made up a significant part of commodity exports. The increasing demand caused an increase in the prices of primary commodities (Castilho, Torracca and de Freitas, 2019). The increase in prices caused the appreciation of the Brazilian real currency, which in turn caused a decrease in the share of industrial production.

Brazil's foreign trade recovered relatively quickly from the global financial crisis. Between 2009 and 2011, exports increased significantly, and in 2011, the value of exports reached an overall record, representing the highest value



compared in all years. Subsequently, from 2011, the year-on-year increase in Brazil's exports slowed down significantly, so much so that in 2013, which is characterized by the end of the "boom" in the prices of primary commodities, and in 2014, the balance of the trade balance was negative, which means that the value of imports was higher than the value of exports (International Trade Centre, 2021). Between 2011 and 2016, the value of exports decreased year on year. In 2017 and 2018, there was a renewed increase in exports, which did not last long, when, according to available data, in 2019 and 2020, Brazil's exports again decreased year-on-year. The total value of Brazilian exports has not reached the level that was reached in 2011. The value of imports decreased significantly after 2014. After this period, Brazil's trade balance was active. In the period between 2017 and 2018, when the value of exports increased, imports also increased again. Despite the renewed increase in the value of imports, Brazil's trade balance was active, as the total value of exports was higher than the total value of imports. In the graph below, we can see the development of Brazil's exports and imports as a percentage of GDP in the period from 2001 to 2020.

**Graph 1:** Export and imports of Brazil as % of GDP



**Source:** Author's elaboration based on the World Bank (2022).

Brazil's foreign trade is currently made up of exports, which are mainly made up of primary products, whose added value and market price are low compared to industrial products, which make up the largest part of imports. The largest part of primary commodities is exported to China, while processed



and industrial products go mainly to MERCOSUR countries (Schönerwald, Brigoni Maciel and Michelon Zardo, 2019). The increase in exports to MERCOSUR countries has been systematic since 2002, reaching a peak in 2011 after a significant drop in 2009. Since 2011, the total volume of Brazilian exports to MERCOSUR countries has been decreasing. While the total volume is decreasing, the percentage of total foreign trade remains relatively constant (Viola and Lima, 2017).

Even though Brazil mainly exports primarily, it is one of the largest economies in the world. The highest share in the value of exports, expressed in US dollars, was achieved in 2020 by primary products. In 2020, it exported the most soybeans. Brazil's main import item is petroleum oils and oils obtained from bituminous minerals other than crude. At the same time, petroleum oils and oils obtained from bituminous minerals are the commodities with the third highest value in Brazil's exports. This is probably due to the insufficient amount and capacity of the refinery in Brazil. Of course, the reason is also the lack of technology that is necessary to process crude oil, which is why Brazil must engage in the exchange of "heavier" crude oil for "lighter" processed oil (The Energy Year, 2014).

### **3.2 Comparative advantages and international specialization of Brazil**

Brazil's comparative advantages and international specialization have been largely stable over the past 20 years. By analysing Brazil's foreign trade and calculating the Lafay index, we confirmed the theoretical knowledge about the commodity structure of foreign trade presented in the previous chapters. We calculated the Lafay index for 1259 items at the fourth level of the harmonized customs classification system (HS4) based on data obtained from the ITC Trade Map database. Using the calculation, we confirmed that Brazil has a comparative advantage in the export of several primary products. In the period we examined from 2001 to 2020, Brazil achieved a comparative advantage mainly in the same items, with possible changes in the order and entry of other commodities into the top 10. Brazil had a comparative advantage in 2020 in the export of 319 commodities. Thirty-eight commodities had a more pronounced comparative advantage, with an LFI value of more than 0.10. Only eleven commodities achieved an LFI value higher than one. The majority of comparative advantages are achieved precisely in the export of primary products.

In 2020, the commodities with the highest value of the Lafay index and therefore with the highest level of international specialization are: item 1201 - soya beans, whether or not broken; 2601 – iron ores and concentrates, incl. roasted iron pyrites; 2709 – petroleum oils and oils obtained from bituminous minerals, crude; 1701 - cane or beet sugar and chemically pure sucrose, in a solid form, 0202 – the meat of bovine animals, frozen, 2304 oilcake and other solid residues, whether or not ground or in the form of pellets; 1005 – corn or maize, 0207 - meat and edible offal of fowls of the species *Gallus domesticus*, ducks, geese, turkeys; 4703 - chemical wood pulp, soda or sulphate, 0901 - coffee, whether or not roasted or decaffeinated;

By calculation, we found that the commodity with the highest value of the Lafay index - soybeans, crushed or not crushed; reached positive LFI values, i.e., a comparative advantage during the entire period we monitored, and even its values increased. The results can be seen below in the table showing the 10 highest LFI values in 2001, 2010, and 2020. A notable change is visible for the commodity - "*2709 - petroleum oils and oils obtained from bituminous minerals, crude*", whose Lafay index up to 2009 reached negative values, meaning the comparative disadvantage of Brazil in this commodity. After 2009, except for 2013, there was a change and Brazil gained a comparative advantage in this commodity. The change also occurred in the values of the goods group – 8802 powered aircraft "*e.g., helicopters and aeroplanes*"; spacecraft, incl. satellites, and suborbital which in 2001 achieved the highest value of the Lafay index among all groups. Brazil continues to achieve a comparative advantage in this commodity group, although it is gradually decreasing. From a value of 2.80 reached in 2001, it decreased to a value of 0.16 in 2020. Brazil gained a comparative advantage thanks to Embraer, a company that ranks among the largest manufacturers of commercial aircraft in the world after Airbus and Boeing. This company is the industry leader in Brazil.

Brazil still achieves comparative advantage in all groups whose values were among the ten highest in 2001. Within minerals, it consistently achieves the highest level of international specialization and comparative advantage in the iron ore commodity group and concentrates, including pyrite powders. This commodity is an important part of Brazil's exports. The highest value of the Lafay index was reached in 2011, up to 8.23. This is the highest achieved level among all commodity groups for the entire period under review. Among metals, gold (including platinum-plated gold), raw or in the form of a semi-finished product or dust, achieves the highest comparative advantage. The

Lafay index of this commodity gradually increases every year, meaning a higher level of international specialization. In 2020, the LFI value was 1.14. Among industrial products, Brazil achieves a comparative advantage in the commodity group footwear with outer soles of rubber, plastics, leather, or composition leather. It also achieves a comparative advantage in the group - monumental or building stone, natural (excluding slate), worked, and articles; mosaic cubes and worked slate and articles of slate or of agglomerated slate. In these groups, the value of the Lafay index is only slightly above zero

**Table 2:** Values of Lafay index

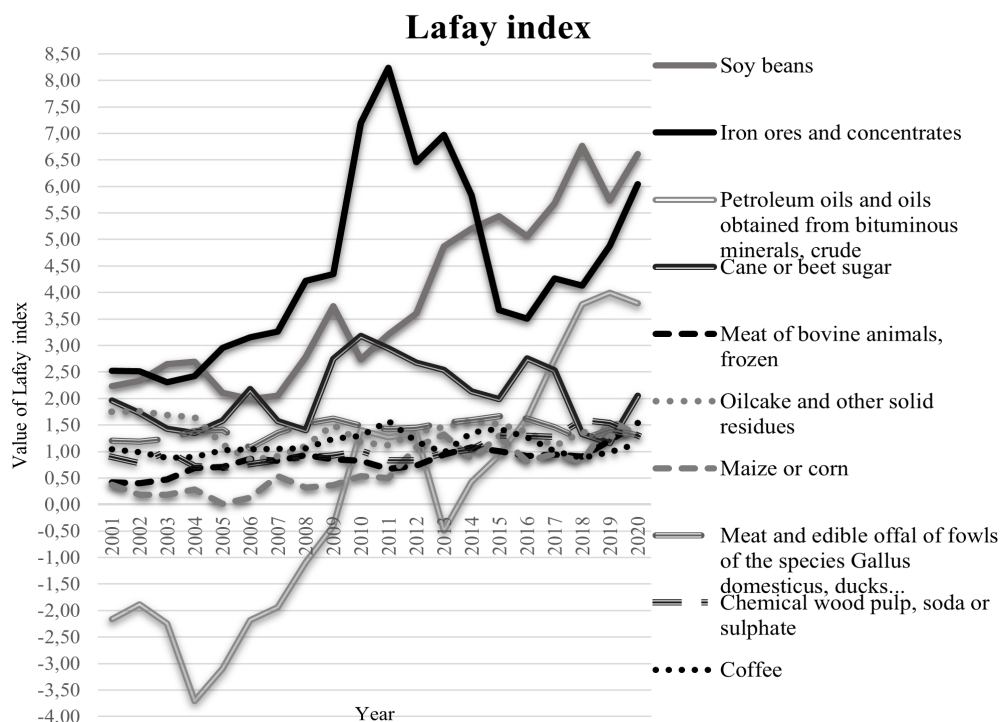
Nb	Year		
	2001	2010	2020
1.	Powered aircraft "e.g., helicopters and aeroplanes"; spacecraft, incl. satellites, and suborbital  <i>LFI = 2.80</i>	Iron ores and concentrates, incl. roasted iron pyrites  <i>LFI = 7.19</i>	Soya beans, whether or not broken  <i>LFI = 6.62</i>
2.	Iron ores and concentrates, incl. roasted iron pyrites  <i>LFI = 2.53</i>	Cane or beet sugar and chemically pure sucrose, in solid form  <i>LFI = 3.18</i>	Iron ores and concentrates, incl. roasted iron pyrites  <i>LFI = 6.04</i>
3.	Soya beans, whether or not broken  <i>LFI = 2.23</i>	Soya beans, whether or not broken  <i>LFI = 2.74</i>	Petroleum oils and oils obtained from bituminous minerals, crude  <i>LFI = 3.79</i>
4.	Cane or beet sugar and chemically pure sucrose, in solid form  <i>LFI = 1.96</i>	Meat and edible offal of fowls of the species <i>Gallus domesticus</i> , ducks, geese, turkeys  <i>LFI = 1.48</i>	Cane or beet sugar and chemically pure sucrose, in solid form  <i>LFI = 2.05</i>

5.	Oilcake and other solid residues, whether or not ground or in the form of pellets, <i>LFI = 1.75</i>	Petroleum oils and oils obtained from bituminous minerals, crude <i>LFI = 1.40</i>	The meat of bovine animals, frozen <i>LFI = 1.54</i>
6.	Meat and edible offal of fowls of the species <i>Gallus domesticus</i> , ducks, geese, turkeys <i>LFI = 1.20</i>	Coffee, whether or not roasted or decaffeinated <i>LFI = 1.29</i>	Oilcake and other solid residues, whether or not ground or in the form of pellets, <i>LFI = 1.39</i>
7.	Footwear with outer soles of rubber, plastics, leather or composition leather <i>LFI = 1.18</i>	Oilcake and other solid residues, whether or not ground or in the form of pellets, <i>LFI = 1.17</i>	Corn or Maize <i>LFI = 1.31</i>
8.	Coffee, whether or not roasted or decaffeinated <i>LFI = 1.04</i>	Chemical wood pulp, soda or sulphate <i>LFI = 1.02</i>	Meat and edible offal of fowls of the species <i>Gallus domesticus</i> , ducks, geese, turkeys <i>LFI = 1.30</i>
9.	Chemical wood pulp, soda or sulphate <i>LFI = 0.90</i>	Commodities not elsewhere specified <i>LFI = 0.94</i>	Chemical wood pulp, soda, or sulphate <i>LFI = 1.30</i>
10.	Unmanufactured tobacco; tobacco refuse <i>LFI = 0.78</i>	The meat of bovine animals, frozen <i>LFI = 0.82</i>	Coffee, whether or not roasted or decaffeinated <i>LFI = 1.15</i>

**Source:** Author's elaboration based on the ITC Trade Map.

Our results and the importance of primary commodities in Brazil's foreign trade are also confirmed by other authors. Similar findings were also made by Jančovič (2021), who, by calculating the LFI, identified the commodity groups in whose exports the countries of the MERCOSUR integration association achieved the highest comparative advantages in the period 1995-2019. Zdráhal et al. (2021) in their paper identified by calculating LFI and RCA the comparative advantage of Brazil in the export of forty-six agricultural products between 1995 and 2017. Maryam, Bandy and Mittal (2018) showed by calculating the RCA for 2015 that Brazil achieved a comparative advantage in the export of commodities such as meat, fish, and nuts.

**Graph 2:** The evolution of the Lafay Index of the highest value groups in 2020



**Source:** Author's elaboration based on the ITC Trade Map

In the above graph, we can observe several facts regarding the 10 commodities with the highest level of international specialization in 2020. In general, we can say that Brazil increased its comparative advantage in selected commodities, and in others, the level of comparative advantage remained relatively constant

in the period under our observation. Several significant changes are visible by displaying the development of LFI values on the graph. The first commodity we can observe is petroleum oils (crude). We already mentioned significant changes in the value of LFI earlier in the text. While until 2004 (within the period we examined) the value of LFI fell every year, after 2004 until 2010 it started to rise significantly. The highest increase occurred between 2009 and 2010. In 2010, Brazil had a comparative advantage in this commodity for the first time. The above is related to regulations, and investments, especially the finding of oil in several coastal deposits such as Tupi and Libra, in deep, so-called, pre-salt layers (Magalhães and Domingues, 2014). It maintained its comparative advantage from 2010 to 2012. We can see that in 2013, the LFI value was negative again, which means a comparative disadvantage. Subsequently, this short-term negative trend was reversed, and a comparative advantage was acquired again the following year. A slight indication of a decrease in the LFI value was recorded in 2020. According to the available information on oil exports in 2021, the negative trend is unlikely to be confirmed and Brazil will increase its comparative advantage in this commodity. Today, Brazil is among the top 20 most important exporters and has the ambition to be among the top 5 exporters of petroleum oils (The Rio Times, 2021). Of course, as with other commodities, the export of crude oil goes primarily to China. In 2019, it was up to 63 per cent (OEC, 2022).

In the graph 2 is possible to observe the fluctuations of the LFI for commodities: iron ores and concentrates, which first rose sharply and then experienced a significant fall due to the decline in Chinese demand and have been increasing again since 2018. Brazil has long been the 2nd largest exporter of iron ore in the world after Australia (Iron Ore OEC, 2022). We can also see on the graph the fluctuations of the LFI for commodities: iron ores and concentrates, which first rose sharply and then experienced a significant fall due to the decline in Chinese demand and have been increasing again since 2018. Brazil has long been the second largest exporter of iron ore in the world after Australia

A positive trend with only slight fluctuations was recorded by the commodity with the highest LFI value – soybeans. Brazil has been the world leader in soybean production for two years now, with Brazil producing more soybeans than the United States in 2019/2020. In the 2020/2021 period, it confirmed its leadership in the production of soybeans, and the difference between the production of Brazil and the United States of America increased (Shahbandeh, 2022). The increasing production is a response to the high demand for

Brazilian soybeans. Soybeans are considered an important commodity along with products from this commodity such as soybean meal and soybean oil. The expansion of production is primarily due to increasing demand. The commodity is in demand not only for consumption, but its industrial use has also expanded. Brazil began to gain a greater share of global exports in the 1990s (OEC, 2014). Brazil has maintained the lead in global soybean exports since 2017. Brazil was mainly helped by logistics investments and production expansion into previously untapped territory. The expansion is linked to clearing the Amazon Forest, destroying biological diversity, soil erosion, and water contamination.

Brazil is the world's largest exporter of beef and the second largest producer. As with other commodities, China is the most important trading partner. It is the demand from China that is driving the growth of beef production, and only the recent ban on the import of Brazilian meat for several months in 2021 may be a signal that too much dependence on this country may cause significant problems in the future. Brazil is the world's long-term exporter of cane sugar and also the largest producer of sugar. The country is responsible for supplying approximately 40% of the total global sugar volume (Samora and Teixeira, 2021). Production is threatened by drought for the second year.

### **3.3 The Future of Primary Commodities in Brazil's Foreign Trade**

The development of LFI values can help us formulate forecasts about the possible development of foreign trade and the commodity structure of Brazil's foreign trade. Likely, the commodity structure of Brazil's foreign trade will not change much in the absence of an unexpected event, and Brazil will continue to be strongly oriented towards primary product exports and achieve high comparative advantages in selected products. Brazil is likely to achieve a significant comparative advantage in the soybean commodity in the coming years. Production of soybeans and the yield in Brazil will increase in the future despite climate change, which will be a source of increased fertility. This was confirmed by the article of da Silva et al. (2021), who demonstrated that an increase in CO<sub>2</sub> will lead to higher yields and lower water consumption. It is possible that specialization, in this case, will increase even more. This is due to the increasing demand for soybeans. Demand will increase due to the projected growth of the world population to 9.8 billion inhabitants by 2050 (United Nations, 2017). Soybeans are among the basic sources of protein and



are essential for ensuring food safety. The performance of Brazil's foreign trade is significantly affected by demand from China, and a possible drop in demand would negatively affect the prices of primary products and, consequently, the total value of exports. Soon, Brazilian exports may be affected by the war in Ukraine. Brazil may benefit from the situation due to the rising prices of primary commodities.

## 4 Conclusion

This work aimed to identify the importance of primary commodities in Brazil's foreign trade with an emphasis on the commodity structure of exports. In the work, we identified commodity groups in the export of which Brazil achieves the highest comparative advantages and analysed whether significant changes occurred in the period from 2001 to 2020, that is, in the period of soaring prices of primary commodities (from 2003 to 2012) and the following period until the outbreak of the global pandemic of the COVID-19. To calculate comparative advantages, we used Lafay's index of international specialization, based on data on the commodity structure of foreign trade at the four-digit level of the HS nomenclature. The Lafay index has several advantages over other indices in detecting comparative advantage and country specialization. The values we found by calculation confirm the relatively high importance of primary commodities in Brazil's foreign trade. Brazil achieves the highest comparative advantages in the export of agricultural products, food, and some mineral raw materials and metals such as iron ore or gold.

Brazil achieves the highest values of the Lafay index in the commodity groups soybeans, crushed or uncrushed, and iron ores and concentrates, including pyrite powder. When exporting these commodity groups, Brazil has traditional (static) comparative advantages, which are achieved due to the availability of factors of production, namely natural resources. Brazil achieves traditional comparative advantages in the export of, for example, soybeans, crushed or uncrushed, iron ore and concentrates, beef, corn, or coffee.

In Brazil, specialization in primary products exceeds industrial production. Within the industrial area, Brazil achieves comparative advantages in the commodity group Powered aircraft "*e.g., helicopters and aeroplanes*", spacecraft, incl. satellites, and suborbital. In 2001, this product group achieved the highest comparative advantage, but the LFI values gradually decreased in



the period under study. Brazil has a comparative advantage thanks to Embraer, a company that ranks among the world's largest producers of commercial aircraft after Airbus and Boeing. This company is the industry leader in Brazil. Currently, it still achieves a comparative advantage, i.e., LFI values are higher than 0. In this case, it is the acquired dynamic comparative advantages. Currently, Brazil achieves a high degree of international specialization in the export of petroleum oils.

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