Analysis Of The Concentration Of The Coffee Export Market

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ABSTRACT
The coffee crop is one of the main agricultural crops of Brazilian agribusiness, with Brazil being one of the main producers and exporters of the fruit. In this sense, this work aimed to analyze the concentration of the world coffee export market and the Brazilian competitiveness in the sector, from 1962 to 2017. Concentration ratio indexes (CRk), Herfindahl-Hirschman index (HHI), Entropy index de Theil (E), Gini The Coefficient (G) and the Revealed Comparative Advantage Index (RCA) were determined, whose data were collected based on the Economic Complexity Observatory (OEC) and analyzed using Excel® and SigmaPlot software ®. Brazilian competitiveness has a comparative advantage for coffee exports throughout the period, especially with regard to the export of coffee beans, which is mainly destined for Germany, which uses it to re-export processed coffee. In this sense, it can be concluded that, although the coffee export market is not considered concentrated, it is unequal, in which few countries concentrate large fractions of the exported value.

Key words: *Degree of concentration. Re-exportation. International Market. Agribusiness.*

I. INTRODUCTION

Agribusiness is considered one of the main sectors of the Brazilian economy, and it has shown continuous growth in recent years. In this sense, amid the economic downturn suffered by practically all sectors of the economy, agribusiness grew in the period between January and October 2020, 16.81% in relation to the same period of the previous year, equivalent to $ 48.32 billion dollars (Cepea, 2021).

The insertion of sustainability has been fundamental to drive the growth of agribusiness, especially in face of the challenges related to climate change and its influence on productivity and product quality. Directing the introduction of practices that integrate environmental, economic and social aspects, with soil conservation techniques, conscious and responsible management of water resources, besides the use of renewable energy (KHONDOKER et al., 2023; OROBIO et al., 2023).

This drives innovation and the development of technological solutions. Opening the way for the creation of new opportunities, reducing dependence on finite resources and minimizing environmental risks. In this way, continuous and sustainable growth is promoted in the agricultural sector (AKELLA, et al., 2023; ASIF, 2023).

In the last two consecutive years, Brazilian agribusiness reached record grain production in the 2018/19 and 2019/20 harvests, presenting values of 242.1 million and 257.8 million tons of goods, respectively. According to the survey carried out by the Brazilian National Supply Company (CONAB), a new record is expected in the 2020/21 harvest, with an estimated 268.9 million tons of goods (Conab, 2019; 2020a; 2020b).

Following the record growth in agricultural production, coffee production reached a record of 63.08 million bags produced in the last harvest in 2020, contributing to the continuous evolution of Brazilian agribusiness, making it one of the main food supply countries in the world, standing out both in the production and in the export of agricultural products (Conab, 2020c).

Currently, Brazil is considered the world's largest exporter of coffee beans. The country exported around 40.6 million bags of it in the 2018/19 harvest, almost a third of the total volume exported in the world, while Vietnam and Colombia exported 28.4 and 12.0 million bags respectively (Usda, 2019; Fao, 2020; Mapa, 2020). In the same harvest, coffee represented about 5.34% of total exports for Brazilian agribusiness, with a turnover of $ 5 billion dollars, occupying the 6th position in the agribusiness export basket (Mapa, 2020).

The coffee market is made up of a few producing countries in the world, notably Brazil, Vietnam, and Colombia, which concentrate 63.07% of world production, and more than 64.5% of exports (Ico, 2019b; 2019a).

Over the years, the composition of countries in the international fruit market ranking has changed, in view of the increased participation of non-producing countries with the practice of re-exporting the processed fruit, increasing the representativeness of countries such as Germany, Belgium, Italy and among others, in the world beverage export market (Nishijima et al., 2012; Brainer, 2019).

In this sense, market concentration indicators determine the degree of participation that a given country has in relation to others in a specific product, so that the more concentrated the market is, the smaller the competitive environment will be, expanding the market power (Possas, 1999; Possas, 2002).

Several studies deal with market concentration in agribusiness, for example the work of Junior, Rezende and Oliveira (2013), in which the authors analyzed the degree of concentration of world exports of agricultural products using the Concentration Ratio indicators (CRk), Herfindahl-Hirschman Index (HHI), Theil Entropy Index (E) and Gini Index (G). Their conclusion was that Brazil has a growing participation in the wood export market, seeking commercial strategies to retain the advantages acquired by the gain in scale.

In turn, the study by Dilly et al., (2017) analyzed the competitiveness of Brazilian exports in the world corn market compared to the United States through the degree of concentration of exports from these countries, using the methodology of the Revealed Comparative Advantage (RCA) and Concentration Ratio (CRk), highlighting the short-term production and export instability not threatening American production.

II. OBJECTIVE

Thus, the objective of this work is to analyze the degree of concentration of the world coffee export market and the Brazilian competitiveness in the period between 1962 and 2017, and to verify if the presence of non-producing (re-exporting) countries in the international market affects the Brazilian competitiveness in the world of agribusiness.

III. METHOD OF ANALYSIS

Used database and software

The data used in the analysis of the concentration of coffee exports were obtained from the Economic Complexity Observatory (OEC), in the period between 1962 to 2017. The OEC is an online platform for visualization and data distribution focusing on the geography and dynamics of economic activities (Simões & Hidalgo, 2011). For such, the countries that export coffee beans and roasted, processed coffee were considered, regardless of the exported value. The values are measured in dollars (US $).

The code used to obtain the data was 0711 SITC code - green or roasted coffee. Excel® was used to tabulate and perform calculations. The elaboration of the graphs was done on SigmaPlot®.

Concentration and inequality measures

Concentration indexes are classified as partial or absolute. The partial indexes use only the part of the countries that operate in a certain industry, the most used measure being the Concentration Ratio (CRk). The absolute indexes, on the other hand, consider all the information of the sample population and not only the largest firms, with Herfindahl (HHI) and Theil Entropy Index (E) measures being the most used (Resende, 1994). For the analysis of the present study, the following indexes were used:

Concentration Ratio (CRk)

This partial index provides information on the market power of the k $(k = 1, 2, 3, ..., n)$ largest exporting coffee nations, typically using the participation of the four (CR4) and / or eight largest (CR8) countries in the sector. As proposed by Bain (1959), the calculation of the measure is given by:

$$CR(k) = \sum_{i=1}^{k} s_i \qquad (1)$$

The sum of the market shares of the k largest exporting countries defines the degree of concentration,

while si represents the market share of the ith country, so that the higher the value of the index, the greater the market power exercised by the k largest nations. Table 1 shows the different levels of concentration for CR4 and CR8.

Table 1. Classification of the degree of concentration of the largest exporting countries.

Degree of concentration	CR (4)	CR (8)
Very high	75% or more	90% or higher
High	65% - 75%	85% - 90%
Moderately high	50% - 65%	70% - 85%
Moderately low	35% - 50 %	45% - 70%
Low	35% or less	45% or less

Source: Bain (1959).

However, some criticism is attributed to the use of this index, referring to the possibility of countries having vastly different market shares (Dilly et al., 2017b).

In view of these assessment, the use of absolute measures is suggested as a means of complementing the analysis of the degree of concentration of exports (Resende, 1994).

Herfindahl-Hirschman Index (HHI)

The Herfindahl-Hirschman index is characterized by being an absolute index, that is, it measures the degree of concentration considering all coffee exporting countries. It is represented by the following equation (Eq. 2):

$$HHI = \sum_{i=1}^{n} s_i^2 \qquad (2)$$

Where n is the number of nations that export coffee and si is the Market share, in percentage of country i for the value of coffee exports.

When the effective participation of each country is raised to the square, greater weight is attributed to the countries that have greater participation in the coffee export market. Thus, the higher the HHI, the higher the concentration and, therefore, the less competition.

The HHI varies between 1/n and 1. The upper limit of the index indicates that there is a maximum concentration, as in the case of the monopoly. The minimum limit indicates the situation in which all countries are the same size.

When there is an analysis of the degree of concentration over time, there may be a variation in the number of exporting countries, in which case it is necessary to adjust the formula to perform the calculations, described below (Resende & Boff, 2013).

$$HHI' = \frac{1}{n-1}(n \times HHI - 1); \; n > 1 \qquad (3)$$

Table 2. Classification of concentration levels according to the Herfindahl-Hirschman Index of exporting countries.

Degree of Concentration	Herfindahl-Hirschman 'Index
High concentration	Greater than 0.25
Moderate concentration	$0.15 < HHI' \leq 0.25$
Not concentrated	$0.1 < HHI' \leq 0.15$
High competitiveness	Less than or equal to 0.1

Source: Adapted from Coelho Júnior et al., (2013).

Theil Entropy Index (E)

The Theil Index is a measure used to analyze the degree of income distribution in a given country and can be used to analyze the concentration of exports in a given sector. Its calculation is performed by the mathematical equation defined as:

$$E = -\sum_{i=1}^{n} \ln(s_i) \qquad (4)$$

Where, n = number of coffee-exporting nations; si = Market share of country i for the value of world coffee exports; and ln = Napierian logarithm.

As the index approaches the lower limit, close to zero, the case of monopoly takes shape, with only one

exporting country in the sector. In turn, the upper limit equal to ln (n), indicates equal market shares between countries and minimum concentration.

If the analysis is carried out in a certain period of time, in which there may be a variation in the number of exporting countries, the formula is adjusted as follows:

$$E' = -\frac{1}{\ln(n)}\sum_{i=1}^{n} s_i \ln(s_i) \qquad (5)$$

In this case, Theil's Entropy starts to vary between 0 and 1, so that, 0 represents the maximum concentration of the market (monopoly) and 1 represents minimum concentration (perfect competition) (Coelho Junior et al., 2010).

Gini coefficient (G)

The Gini coefficient is a measure of income distribution inequality. However, as in the case of the Entropy Index, it can also be used to measure the degree of inequality in coffee exports between countries. The formula can be represented as follows:

$$G = 1 - \frac{\left[\sum_{i=1}^{n}\left(s_{ij} + s_i\right)\right]}{n} \qquad (6)$$

Where n = number of coffee-exporting countries; sij = cumulative share of world coffee exports in ascending order; and si = Market share, as a percentage of country i for the value of world coffee exports.

The index variation occurs between 0 and 1, and can be classified as follows (Table 3).

Table 3. Degree of concentration according to the Gini coefficient.

Degree of Concentration	Gini Coefficient
Null or weak inequality	0.101 – 0.250
Weak to average inequality	0.251 – 0.500
Mean to strong inequality	0.501 – 0.700
Strong to very strong inequality	0.701 – 0.900
Very strong to absolute inequality	0.901 – 1.000

Source: Coelho Júnior et al. (2013).

Theory of Comparative Advantages (RCA)

This theory was developed by David Ricardo (1987) in his work Principles of Political Economy and Taxation. According to the author, each nation should specialize in the manufacture of items that have greater advantages for production, so that the specialization promotes the increase of the productive capacity and, consequently, the increase of the production, making the country more competitive (DILL et al., 2013).

Based on the theory of David Ricardo, Balassa (1965) developed the Revealed Comparative Advantage index (RCA) which consists of the comparison analysis for export data for a given country (Cavalcanti & Guedes, 2015; Dilly et al., 2017b). It is a revealed measure because it uses the real data of the exports, after the commercial transactions are concluded (Hidalgo & Mata, 2004). The RCA is calculated using the following equation:

$$IVCR = \frac{\dfrac{x_{ij}}{x_i}}{\dfrac{x_{mj}}{x_m}} \qquad (7)$$

Where xij = total export value of product j from country i; xi = total value of exports from country i; xmj = total value of world exports of product j; and xm = total value of world exports.

When RCA > 1, the country has a comparative advantage revealed for exports of a certain product. On the other hand, when RCA < 1, the country has a comparative disadvantage revealed for exports of the product (Dorneles et al., 2013).

The index, therefore, can reveal the level of specialization of a country in relation to a product, allowing it to identify the competitiveness of that country vis-à-vis the other exporting countries (Dilly et al., 2017a). The RCA takes into account the performance in international trade without considering the existence of tax restrictions, subsidies, trade agreements and exchange misalignment (Dorneles et al., 2013; Dilly et al., 2017a).

IV.   RESULTS

The international coffee market

During the years of 1962 until 2017, there was an average participation of 143 countries in the coffee export market (green and roasted). A maximum of 182 countries participated in the international market in 2013, with the presence of Brazil and Colombia predominating over the period, occupying the first and second positions in the ranking, respectively.

However, in the mid-1990s, changes were noted in the ranking of major coffee exporters (both green and roasted), with the rise of new countries, producers, and non-producers of coffee to the highest ranks, such as Vietnam, Germany, Italy, Switzerland and Japan.

In this sense, Table 4 shows the rise of non-coffee producing countries in the world ranking for the export of the product.

Table 4. Evolution of the ranking of coffee exporting countries.

Country	1962	1972	1982	1992	2002	2012	2015	2016	2017
Brazil *	1	1	1	2	1	1	1	1	1
Colombia *	2	2	2	1	2	4	2	2	2
Germany	34	29	17	3	4	3	3	3	3
Switzerland	43	44	56	41	25	5	5	4	4
Italy	50	47	43	16	6	7	6	5	5
Honduras *	25	20	14	11	11	6	-	-	6
Indonesia *	12	11	5	4	7	8	7	6	7
France	55	34	33	23	23	20	11	10	8
Belgium	39	48	28	12	15	9	8	7	9
Peru *	15	17	23	20	10	11	13	9	10
Netherlands	28	25	29	30	24	18	15	-	11
United States	26	26	25	19	12	10	10	8	12
Vietnam *	74	95	86	22	3	2	4	-	-

* - Producing countries. Source: Developed by the author.

More and more, non-coffee producing countries are gaining prominence among the main exporters with the commercialization of processed coffee, after the process of roasting and grinding the beans, adding value to the final product, practicing the re-export of coffee to other countries in the world (Ico, 2014; Franck et al., 2016; Sindicafé, 2020).

Considering the analysis of the period, non-coffee producing countries had greater gains in position in the ranking of exports in relation to producing countries. Countries that were highlighted were: France, which went from 55th in 1962 to 8th in 2017; Italy, jumping from 50th to 5th in the 56 years analyzed; Switzerland, from 43rd to 4th, and Germany, leaving the 34th position in 1962 to occupy the 3rd in 2017.

In this sense, the rise of these countries in the world ranking is associated with the growth of the consumer market in recent decades, increasing imports by the European Union (EU) by 183.6%, between 2000 and 2019. Germany increased domestic consumption by 186.6%, while Italy grew 370.6% of the volume of coffee imports in the same period (Ico, 2020c).

This growth is mainly noticed by the increase in the consumption of innovative, premium and gourmet coffee drinks in this segment. Coffee is increasingly becoming a drink for appreciation of a high standard, distributed among the growing chains of coffee shops and franchises in expansion around today's world. That's why economists are calling this the 3rd Wave of Coffee (Rocha, 2019; Rouchou, 2019).
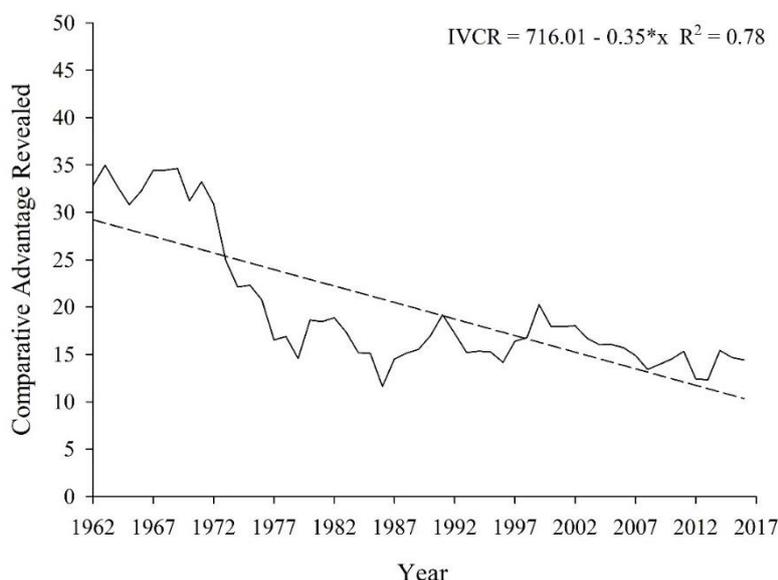
In this sense, billions of dollars are handled with the acquisition of coffee shops by large companies, such as Nestlé, buying 68% of Blue Bottle Coffee for $ 425 million dollars; Coca-Cola, acquiring the British chain Costa Cafés with about 4,000 coffee shops for $ 5.1 billion dollars; and to the deal closed between Starbucks, which has more than 22,000 stores in the world, and the Chinese Alibaba to deliver the products around the world (Rocha, 2019; Rouchou, 2019).

Comparative Advantage Index Revealed (RCA)

Brazil is a major exporter of agricultural commodities in the world, standing out in the production and export of various crops that make up Brazilian agribusiness. Coffee is among the main crops, so the country's productive process proves to be competitive and profitable, allowing participation in the internal and external markets, in an efficient and sustained manner (Dilly et al., 2017).

In this sense, the RCA in relation to Brazilian coffee exports proves to be competitive vis-à-vis other markets during the entire analyzed period, between 1962 and 2017, as can be seen in Figure 1.

Figure 1. Brazil's Revealed Comparative Advantage index coffee export market.

Source: Developed by the authors (2023).

It is possible to observe a significant drop in Brazil's RCA in the mid-1970s, a period marked by the great transformation of Brazilian agriculture, favored by the increase in rural credit, enabling modernization in the countryside and increasing the production and yield of other crops cultivated in Brazil, expanding the diversity of agricultural production (Alves et al., 2008; Bacen, 2012; Silva & Winck, 2019).

An increase of 375.3% was observed in relation to the number of agricultural machines sold in the domestic market, accumulating a total of 108,314 machines sold in the 1960s, to 514,764 sales of machinery in the 1970s, improving the index of mechanization of the agriculture from 359 ha/tractor to 99 ha/tractor (Gonzales & Costa, 1998; Brito, 2021).

In this sense, with the advance of Brazilian agriculture, other crops gained prominence in the agribusiness scenario after the 1960s, increasing the indexes of agricultural production in the country. The soybean crop is highlighted, rising from 100 thousand tons, in the 1950s, to more than 1.06 million tons, in 1969, achieving the most significant growth and becoming the main crop in Brazilian agribusiness (Agnol et al., 2007).
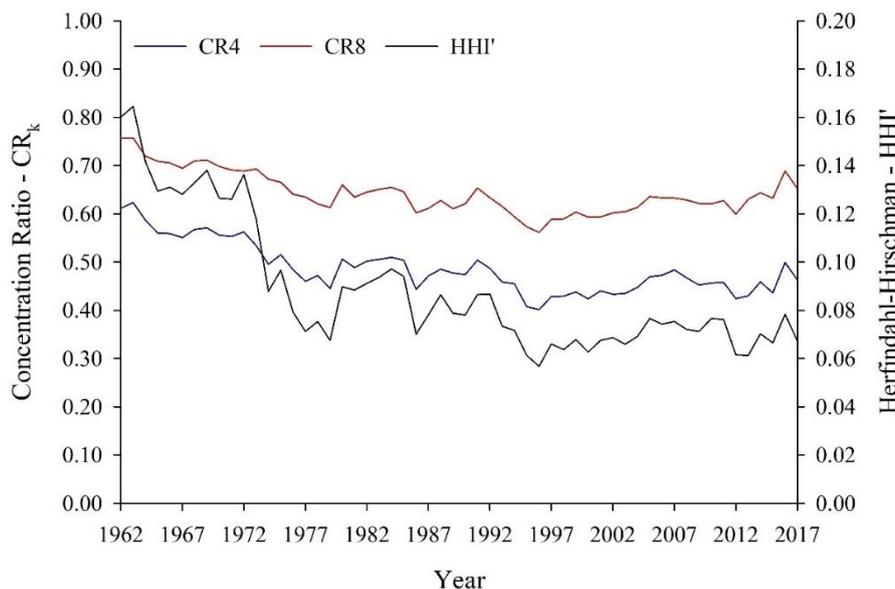
Although the scenario presents a drop in the RCA indexes, Brazil is a major competitor in the production and export of coffee, favored by the climate that is suitable for cultivation, fertile land, labor, in addition to having a technological contribution given by research and development institutions such as the Brazilian Coffee Research and Development Consortium (CBP&D) and Embrapa Café, which contribute to increasing the productivity of agricultural production.

Concentration Measures

Until the early 1990s, the four main coffee exporting countries came from South America, North America, and Africa, with Brazil and Colombia occupying the first and second positions in the ranking, respectively, during almost the entire period, standing out as exporters of coffee beans (greens).

The behavior of the concentration measures of the main coffee exporting countries, namely the concentration ratio of the 4 and 8 largest exporters (CRk) and the adjusted Herfindahl-Hirschman index (HHI'), are shown in Figure 2.

Figure 2. Measures of concentration, CR*k* and HHI', of the coffee exporting countries in the period between 1962 and 2017.

Source: Developed by the authors (2023).

At the beginning of the period, the degree of concentration of exports was considered moderately high, with CR4 representing around 56.9% and CR8 representing 76.5% of coffee exports in the early 1960s. However, over the years it has been perceived a more competitive market, with the participation of new countries entering the coffee export market, presenting an average for the CR4 of 47.5% and for the CR8 of 65.5%, classified as moderately low.

In this sense, there is an increase in coffee imports by European countries, mainly in the practice of re-exporting processed coffee, carrying out the process of roasting and grinding the beans, adding value to the product and selling at higher prices, reaching an average of 74% in relation to the purchase price of imported green coffee (Moreira, 2013).

This trend of new countries entering the international coffee export market, mainly in relation to the product re-export activity, is also verified in the behavior of the Herfindahl-Hirschman index. The HHI obtained values for classification of moderate concentration at the beginning of the period higher than 0.15 and, over the years, there was an increase in market competitiveness, measuring indexes with values lower than 0.15, characterizing it as a non-concentrated market.
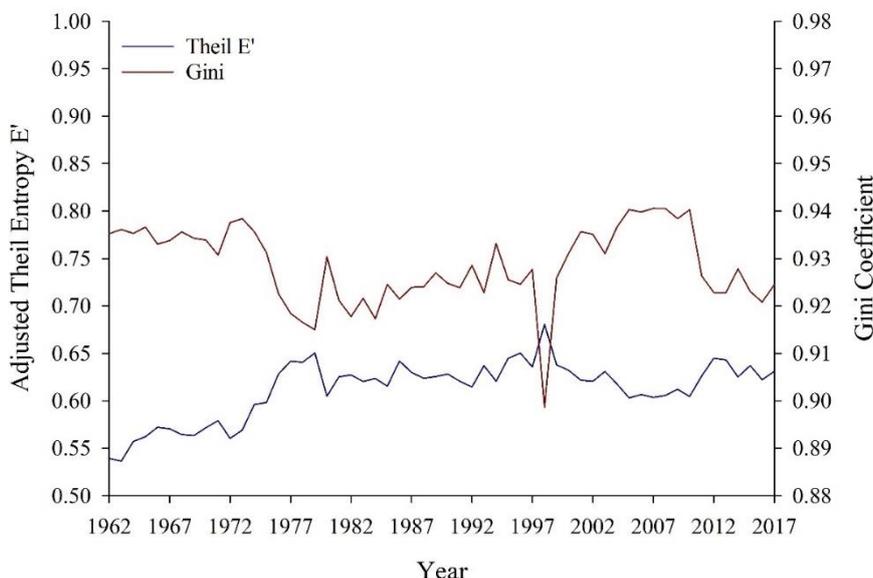
In addition to the potential growing European coffee market, as evidenced by the growing number of franchises and coffee shop chains spread across Europe in recent years, it is estimated that the sector will grow by 30% in the coming years, with a turnover of around $ 28 billion dollars in countries from Asia and the Middle East, increasing market competitiveness (Silva, 2017). In turn, the United States, one of the main importing countries of Brazilian coffee, increased the amount of coffee imported in the period between 1961 and 2017 by 30.20%, representing a gain of about 407 thousand tons (Fao, 2021).

Inequality Indexes

Inequality indexes complement the analysis of the market concentration study, revealing the discrepancy between coffee exporting countries.

Figure 3 shows the behavior of the values of the inequality indexes, adjusted Theil Entropy Index (E') and Gini Coefficient for the coffee export market.

Figure 3. Inequality indexes, adjusted Theil Entropy (E') and Gini Coefficient of coffee exporting countries in the period between 1962 and 2017.
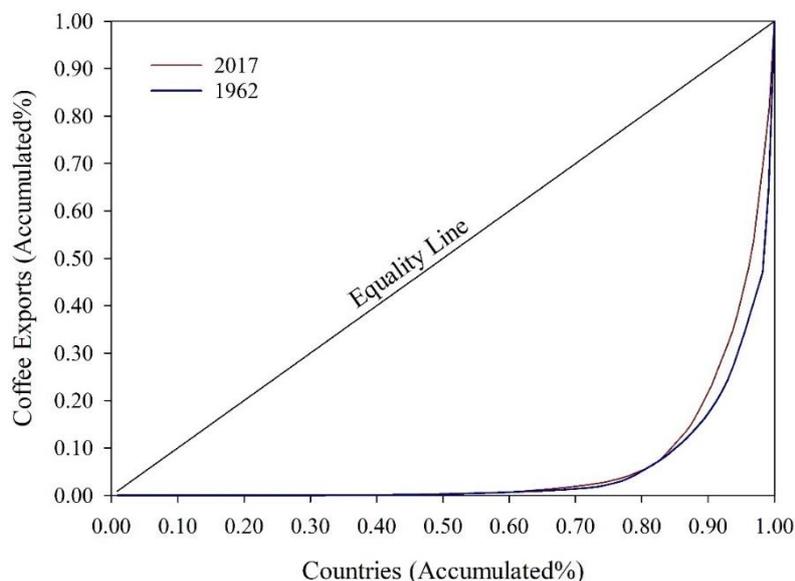

Source: Developed by the authors (2023).

The inequality indexes, adjusted Theil Entropy (E') and Gini Coefficient (G) complement the analysis of market concentration, in order to assess the differences in the participation of coffee exporting countries.

The behavior of the adjusted Theil Entropy (E') Index is increasing over the years, varying between 0.54 and 0.68 in the period, due to the fact that, the closer to one, the lower the inequality found in the market. This fact heeds increased competitiveness in the sector with new countries entering the coffee export trade, but with inequality prevailing among exporters.

The same behavior of the market can be verified based on the values presented by the Gini Coefficient, assuming indexes above 0.90, which indicates a very strong inequality between countries, with 75% of exports being concentrated in only 10% of coffee exporting countries.

In 2017, a total of 127 countries participated in the world coffee export market, in which the 12 largest exporters concentrate around 76.69% of the financial value traded in the international market. This reflects the high concentration of the coffee export market, with great inequality between the countries participating in that market. This scenario can be represented with the analysis of the Lorenz curve, shown in Figure 4, bellow.

Figure 4. Lorenz curve of the coffee export market between the years of 1962 and 2017.

Source: Developed by the authors (2023).

The great inequality in the coffee export market is identified by the inequality indexes, as well as by the analysis of the Lorenz curve, since the curves of the years 1962 and 2017, are far from the equality line, observed by the extension of the curve of those years.

The inequality becomes greater as there is a high number of countries participating in the coffee export market, in which the concentration of exports occurs in a few countries, either by exporting the commodity, or by re-exporting the processed coffee. The last one has grown over the period, evidencing the increased participation of a number of European countries, which are non-coffee producers now present in the world export scenario of the product.

V.   CONCLUSION

The preservation of natural resources is a central concern in agribusiness, and in coffee production, it is essential that producers are engaged in constantly improving their practices and techniques. Promoting environmental responsibility and ensuring economic viability, seeking a balance between efficiency in production, protection, and reduction of impacts, in order to have promising results in production and stimulus in the sector.

During the analyzed period, the degree of concentration of both indexes, CR4 and CR8, was considered moderately low, directly influenced by the participation of non-coffee producing countries in the coffee export market. Likewise, according to the HHI index, the coffee export market can be considered as non-concentrated, influenced by the practice of re-exporting the product by countries, which are mostly European.

Although there is a drop in the RCA line in Brazil, the country has a comparative advantage revealed for coffee exports over the entire period, mainly in terms of the export of coffee beans, destined primarily to the USA, the main coffee-consuming country, and Germany, the main importer of the fruit, a country which uses it to re-export the processed coffee.

In this sense, even though the coffee export market is not considered concentrated, it is uneven, in which few countries concentrate large fractions of the exported value, in other words, about 10% of the exporting countries hold about 75% of the marketed value in the international market.

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