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Analysis of the export base in Parana's state mesoregions from 2001 and 2021

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Abstract

This study aims at identifying the pattern of exports by the Paraná mesoregions in the years 2001, 2011 and 2021. To do so, the method of regional Location Quotient analysis was applied. The results demonstrated that the extraction sectors, such as wood and pearls, have a higher concentration in some regions, given their intrinsic characteristics, whereas the export of goods, which requires less skilled labor and less intensive capital, is more dispersed among the mesoregions.

Keywords: regional economy; regional analysis; export; regional development; competitiveness.

Code JEL: P25, P33, R58.

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Análise da base de exportação das mesorregiões paranaenses entre 2001 e 2021

Resumo:

Este estudo tem como objetivo identificar a estrutura das exportações das mesorregiões do Paraná nos anos de 2001, 2011 e 2021. Para tal, foi utilizado o método de análise regional do Quociente Locacional (QL). Os resultados mostraram que os setores relativos à extração, como madeira e pérolas, possuem uma concentração maior em algumas regiões, dado suas características intrínsecas, enquanto a exportação de mercadorias, que necessitam menos de capital intensivo e mão-de-obra menos qualificada, estão mais dispersas no entre as mesorregiões.

Palavras-chave: *economia regional; análise regional; exportação; competitividade; desenvolvimento regional.*

Código JEL: P25, P33, R58.

Introduction

Exports are seen as promoters of economic growth and have had a positive impact on the countries' economic recovery since the 2008 economic crisis (OLIVEIRA; GALDINO, 2010) as well as the current health crisis caused by Covid-19 (OLIVEIRA *et al.,* 2021). When it comes to the economic recovery, a conceivable alternate pathway for Brazilian regions would be to either begin exporting or raise the exported volume by diversifying the export list and target markets (BASSO *et al*., 2021; BRAUN; LIMA; CARDOSO, 2007; CHRIST *et al*., 2021a).

Export-related activities have such a positive ripple effect that they are listed in the 2030 Agenda, also known as the 17 Sustainable Development Goals (SDGs), which was proposed by the United Nations in September 2015 (UN, 2015). This engine of economic growth not only contributes to eradicating poverty, but also specifically to sustainable development (CHRIST; ALVES; PIFFER, 2021; UNCTAD, 2016).

In this regard, Brazil has historically proven to be a significant contributor as a world food provider. According to previous research, Brazil is in a good position in terms of agro-industrial product demand, particularly for prepared meals, soy, and wheat (CHRIST *et al.*, 2021b; CHRIST; CUNICO, 2022; CHRIST; OLIVEIRA; CATTELAN, 2022; SANTOS *et al*., 2016).

In the case of the Paraná State, its initial economic base consisted of primary-export activities, from the exploitation of yerba mate and wood, until the first half of the 20th century. During this period, economic and population occupation took place, fundamentally, in the regions between Campos Gerais, Curitiba and Paranaguá, where the main transport infrastructures were also built, linking these regions with the rest of the South and Southwest of Brazil (MAGALHÃES FILHO, 1996). Also in this period, the coffee culture was also consolidated in the North of the State, initially as an extension of the São Paulo coffee economy, but which gained importance and made Paraná the largest Brazilian coffee producer in the 1940s. The coffee culture lost dynamism in the 1960s and entered a crisis in the 1970s. In that decade, still, the context of state and national policies to promote Agri-industrialization and road

integration in the State; together with the expansion of soybean and corn crops in the state, they contributed to change and diversify the economic base of Paraná (MAGALHÃES FILHO, 1993, 1994).

In Curitiba's capital region, the Curitiba Industrial City (CIC) had been implemented in 1973 (Decree nº 30/1973) (CURITIBA, 1973), favored by the Federal Government policy that sought the industrial deconcentration of São Paulo; factor that attracted several large industrial investments that, together with the consolidation of the agro-industrialization of Paraná's agriculture, gave a new industrial economic profile to Paraná, but in a concentrated way. In 1970, the State's Industrial Production Value was concentrated in more than 60% in the regions of Curitiba, followed by Londrina, Ponta Grossa and Maringá. The rest of the State was fundamentally agricultural, and was greatly influenced by the diversification and modernization of its agriculture and livestock and by the programs of the Federal Government, which managed to increase production and planted area, especially in the production of soy, wheat, sugar cane, cotton, corn and cattle, pigs and poultry, which supplied the domestic and foreign markets (NIEHUES, 2014; SCHNEIDER; STADUTO; FERRERA DE LIMA, 2011).

As a result, the integration of the economy of Paraná state with the Brazilian territory and the rest of the world effectively occurred in the 1970s, when Brazilian farming and cattle raising modernization, the diversification of industrial sectors, among other issues, resulted in the formation of a new geo-economic structure in the state of Paraná (PIFFER, 2009). According to the author, as the economic basic grows, so does the whole region's economy (PIFFER; AREND, 2009). However, it is worth mentioning that regional growth follows the demand from other regions for the goods produced by the companies based in their territory, which consequently rises.

Exports from Paraná state depend on several factors. According to Sereia, Nogueira and Camara (2011), the products exported by Paraná make the state very dependent on the economic policies adopted by Brazil and dependent on external shocks. The paper of Fraga and Campos (2021) showed that exports from Paraná are concentrated in the regions of Curitiba, Londrina and Maringá, especially those with high and medium technological intensity. This is due to more technology-intensive products depend more on human and physical capital more easily found in these regions. These regions also have infrastructure and logistics that allow these products to flow more quickly to the main ports.

Some situations also harmed exports from the Paraná agro-industrial complex. According to Paganini and Fraga (2014), droughts and phytosanitary problems contributed to the drop in the share of exports from Paraná in relation to Brazil.

Furthermore, it is important to enhance regional planning, not only to understand its dynamics, but also to provide a diagnostic of the area so that entrepreneurs, policy makers and even investors may make decisions (PIACENTI; LIMA, 2012; SIMÕES, 2005). By applying methods of regional analysis and incorporating the formal employment variable, Silva *et al.* (2020) analyzed several indicators between 2002 and 2018 and found that it is the primary sector located in the state of Paraná that concentrates the largest labor force.

Thus, this paper considers the following research question: was there export diversity portfolio of the mesoregions of Paraná in years 2001, 2011 and 2021 or not? In order to answer this research question, two specific goals have been set: The first one is to identify what the most important product section in the state export profile is. The second one is to identify what the most diversified mesoregion is.

The present study also includes a literature review, which brings notes on Perroux's motivational principles and North's export base. Furthermore, it presents in its methodology the procedures for the development of such study, as well as its results and discussions and a conclusion.

Perroux's key principles of motivation and North's export base

Both Douglass North and François Perroux's theory mention economic-functional terms, engendered by the driving sector/export base on production and market demand of different regions.

François Perroux elaborated the growth poles theory (PERROUX, 1955). According to it, the growth polypole arises due to the emergence of a driving industry, recognizing as such that this industry, which previously carries out the separation of the sources of production, causes the concentration of capitals under the same power, and technically decomposes tasks and mechanization. As stated by the author: "the national economic growth no longer seems to be a mere politically and organized territory, in which the population lives, nor it is a combination of factors whose mobility is limited to borders" (PERROUX, 1955, p. 18). In other words, there is no symmetric growth in all regions, nor is it ubiquitous. Therefore, here lies a reason for studying regional development (PLEIN, 2015).

It is worth noting that amidst the economic-functional effects engendered by the motivational sector on the regional production and market demand, the following aspects should be considered (HADDAD, 1989; PERROUX, 1955; SCHUMPETER, 1961):

- The creation of new companies: back and forth productive threads (the appearance of one or a few industries diversifies a period of favorable atmosphere and provides a suitable environment that leads to growth and progress, such as the service companies that started in the SADIA area (city of Toledo located in the western region of Paraná state).
- Innovation: Innovation introduces different and supplemental variants in the economic horizon and in the agent and group plans of dynamic agents: thus, it has a stabilizing effect. When successfully carried out, by patenting the disparity between agents who apply and those who remain static, innovation motivates their drive for similar success and power.
- Human and social capital: skilled workers and entrepreneurship emerge and influence each other, build industrial framework, create their individual traditions, and eventually participate in a collective spirit.
- Financial capital: the complex, in geographical agglomeration industrial poles, modifies not only its immediate geographic environment, but once it is powerful enough, it modifies the entire economic structure of the country in which it operates. As a center of human resources accumulation and agglomeration and fixed capital, it gives rise to other centers of accumulation and agglomeration.
- Interventionist role of the State: collective needs: housing, transportation, education, and health, public services seem to be linked.

In this regard, the driving sector, which is the most essential link in the chain, is capable of generating and spreading development over time and the regional space

because it creates new forms of organizations (companies), generates innovations, qualifies people, spreads and multiplies income locally, attracts financial capital to the pole, and enables the State to take the rules of the game (NORTH, 1990). In other terms, it can promote development, which can be closely related to growth. The State function in this sense, is to reduce regional asymmetries, and to do so, it is necessary to create well-planned productive chains so that it leads to a territorially growth of the municipalities (MATOS, 2008).

As for the theory of the American economist Douglass North, it appears amidst the controversies in the theories of location and regional growth, and it aims at explaining the dynamics of the American economy. It represents the development of the economic base theory, through the understanding of regional growth sustained by capitalist structures (MADUREIRA, 2015).

North (1977) suggests five stages of development, which relate to both: location and regional growth theories, as it follows: first, the stage of subsistence economy, with little investment or trade, as the region improves the efficiency of its transportation systems. In doing so, it moves to the second stage, when the area will have trade and regional specialization. From that on, the region tends to link agricultural crop production (livestock, horticulture); afterwards, it reaches the phase of industrialization, which the author describes as "an introduction to the so-called secondary activities (mining and manufacturing) on a considerable scale" (NORTH, 1977, p.312). Finally, the last phase is deals with regional development, when the region specializes in exporting capital, skilled labor, and so forth.

In accordance with North (1977, p. 312-313),

> export base relevance is a result of its primary role in determining the level of absolute and per capita income in a region, and; therefore, in determining the amount of growth of the local, secondary, and tertiary activities. The export base has also significantly influenced the character of subsidiary industry, the distribution of population and the pattern of urbanization, the type of labor force, the social and political attitudes of the region, and its sensitivity to current fluctuations in income and employment [...].

Given the fact that the growth of a region is tied to the success of its export products that particularly belong to a region, and it is also called the "export base", the author suggests examining to a greater extent, the factors for the export base.

After 1970, new modes of productive organizations emerged. From this perspective, whereas some authors defined them as new territorial innovation models (DUARTE; SCHNEIDER, 2019; MAILLAT, 1998), others consider them as new forms of endogenous development (PIACENTI, 2016); yet, some have seen them as new local institutional dynamics (LIMA, 2020; SANTOS, 1994). From this decade on, it has been common to see an outsourcing of production processes in certain sectors, greater division of labor among small firms, greater specialization at different production stages interdependently, and geographical deconcentration of production.

Regarding the location of economic activities in certain territories and in the regional analysis itself, several regional and local factors have been taken into account for decisions about the location since 1970 as an instance: the regional labor force, scientific capital (universities and research institutes), infrastructure facilities (roads, energy, water), governance and business culture (public authorities and business environment), and agglomeration economies (urban concentration, costs of fixed infrastructure) (LIMA; ALVES, 2012; UNIOSTE, 2018).

The new location factors, such as the Innovative Environment, Industrial Districts (ID), Local Productive Arrangements/Localized Production Systems (APL), New Industrial Spaces, Innovation Clusters, Regional Innovation Systems (RIS), and the Learning Region, have also been responsible for the development of new production models (RA). Concerning the common features of the different types of models, it is possible to mention the following (MAILLAT, 1998):

- All concepts refer to territories that exhibit a particular degree of homogeneity and contain an often-specialized production system;
- Besides, the products and the technology used are based on specific, non-material production factors, such as technical knowledge, culture, and entrepreneurship, historically constituted and in accumulation of territory, which are "comparative advantages" that generate positive externalities and favorable proximity effects;
- The areas represented, the technology used and the manufactured goods are often suitable with small-scale production units. However, that does not mean that major businesses have no place;
- The close multidirectional and complex links of interdependence between local firms result in the formation of cooperation and exchange networks, concerning both production and innovation;
- The production systems, in turn, allow companies to benefit from local agglomeration, which is the result of intense relationships between local businesses.
- Such relations expand the division of labor, leading to a greater productive specialization in addition to the introduction and integration of new technology;
- The arrangements for collaborative work agreements and experience sharing give rise to learning dynamics, which enables businesses to adapt to external environment changes.
- Due to close economic relations between the companies, there are strong bonds and mutual trust between partners. Such aspects prevent or limit possible opportunistic behavior;
- The production volume of these systems is large enough to cover a significant portion of both: the national production and the national exports- an important characteristic that intensifies the involvement in competition and in international trade.

In this sense, there are two components that not only influence the whole process in the regional/local development, but also exert 'power' to dictate the pace of regional development, they are: (I) the endogenous (or differential/geographic) components and (II) the exogenous (or structural) components (HADDAD, 2010; MOULAERT; SEKIA, 2003; PIACENTI, 2016). That being the case,

> Thus, regional development is characterized as a stage or a process. It is a stage because it reflects the extent of growth, progress, and improvement in living conditions, concerning the productive aspects as well as social welfare. Regional development is also a process because, in order to achieve certain stages of development, a set of actions, policies, and movements are put into action. Such processes may occur spontaneously or may be induced by endogenous (internal) or exogenous (external) elements from the regional space (LIMA, 2016, p. 16).

Endogenous components (PIACENTI, 2016) are related to geographical factors, such as: natural and human resources, entrepreneurial experiences, industrial structures, technical education among others. On the other hand, exogenous components are related to structural factors. This way, they depend mainly (but not exclusively) on the outline of macroeconomic policies as well as the criteria that guide the allocation of resources between regions and external demand (PIACENTI; LIMA; EBERHARDT, 2016).

Method

This is a quantitative approach research, framing itself as to its objectives as a descriptive case study, that is, it seeks to describe the characteristics of a population, a phenomenon, or an experience. Regarding procedures, the present research is bibliographic and documental (CRESWELL, 2009). As for the time perspective, we present longitudinal research. To visualize the regional changes, the years 2001, 2011 and 2021 will be used as temporal delimitation, being 2001 (before the crisis), 2011 (post 2008 crisis) and 2021 (during the pandemic caused by Covid-19).

The present study was divided into four main stages: first, a theoretical and conceptual nature, based on a literature review on the theme, founded the subsequent analyses regarding the theories of François Perroux (motive sector) and Douglass North (export base) for regional development. The second stage was aimed at collecting secondary data, collected from official sources, namely: the database made available by the Ministry of Economy, Comex Stat, a portal for free access to foreign trade statistics in Brazil (COMEX STAT, [2022]).

Although employment is the most used variable in the literature and in regional analysis methods (ALVES, 2012; CHRIST; ARAÚJO, 2022), it is possible to highlight some studies that used other variables, such as harvested area in hectares (ha) (GALAFASSI; ALVES, 2021; GALAFASSI; BEBBER; SHIKIDA, 2021). The alternative indicated for this study was the variable export values (US$), considering the twenty-two (22) sections of the goods' tax classification (Table 1).

The tax classification of products in Brazil is applicable to operations in the domestic market and in the foreign market. International trade relations need to be recognized in the same way by different actors, given their global aspect. A harmonized and uniform tax classification is essential to facilitate international trade, sign tariffs and agreements, enable analysis and statistical data, common "customs" language, reduction of costs and charges, etc. (ASSIS JÚNIOR, 2014).

In this sense, tax standardization facilitates agreement between seller, buyer and others involved in international trade processes. In Brazil, products are classified based on Section (22 sections), Chapter (first 2 digits of the Harmonized System), Position (first 4 digits of the Harmonized System), Sub position (first 6 digits of the Harmonized System), Item (7th digit of the Mercosur Common Nomenclature – NCM), Subitem (8th digit of the NCM). Thus, the aggregation of data for this research was carried out based on the classification of the 22 sections of the products.

The chosen period is due to 2021 being the last available year of data and 2001 to comprehend a 20-year range. In other words, the sectorial division used are the 22 sections established for classifying goods which are applied by Brazil and are based on the Mercosul Common Nomenclature (NCM), drawing on the Harmonized System (HS). For the descriptive analysis of the data, those sectors that were most prominent in the proposed period were prioritized.

Table 1 – Classification of Goods by Section (SH/NCM)

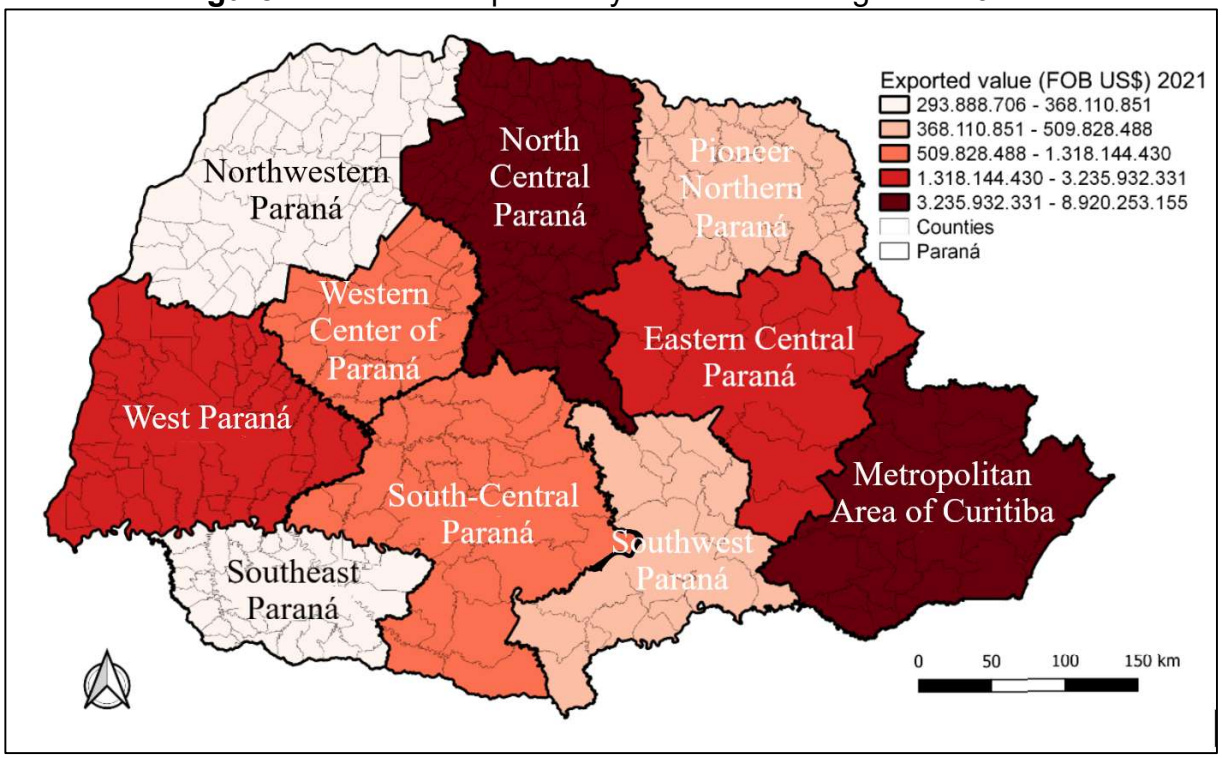
Section Code	Description Section
I	Alive animals and products from the animal kingdom
II	Products from the vegetable kingdom
III	Animal or vegetable fats and oils;Products of their dissociation; Prepared edible fats; Animal or vegetable waxes
IV	Food industry products; Beverages, alcoholic liquids and vinegar; Tobacco and its manufactured substitutes
IX	Wood, charcoal and articles of wood;Cork and its works; Works of straw or basketry
V	Mineral products
VI	Products from the chemical industries or related industries
VII	Plastics and articles thereof; Rubber and articles thereof
VIII	Skins, hides, furskins and articles thereof; courier or saddlery; travel goods, handbags and similar articles; gut works
X	Pulp of wood or other fibrous cellulosic material; paper or cardboard for recycling (waste and scrap); Paper and paper products
XI	Textiles and articles thereof
XII	Footwear, headgear, umbrellas, sun umbrellas, walking sticks, whips, riding crops and parts thereof; prepared feathers and articles made therewith; artificial flowers; hair works
XIII	Articles of stone, plaster, cement, asbestos, mica or similar materials; Ceramic products; Glass and its works
XIV	Natural or cultured pearls, precious or semi-precious stones, precious metals, metals clad with precious metal, and articles thereof; Bijou; Coins
XIX	Weapons and ammunition; its parts and accessories
XV	Common metals and their articles
XVI	Machinery and mechanical appliances; electrical equipment and parts thereof; Apparatus for recording or reproducing sound, apparatus for recording or reproducing images and sound on television, parts/accessories thereof
XVII	Transport material
XVIII	Optical, photographic or cinematographic, measuring, checking or precision instruments and apparatus; Medical-surgical instruments and apparatus; Clocks and similar apparatus; Musical instruments; Its parts and accessories
XX	Miscellaneous goods and products
XXI	Objects of art, collectibles and antiques
XXII	Special transactions

Source: Prepared by the authors. Based on (COMEX STAT, ([2022]).

The state of Paraná represents 2.3% of the national territory and occupies a total area of 199,298.982 km². According to the Brazilian Institute of Geography and Statistics (IBGE, 2020), the state has 399 municipalities. These, in turn, are divided into homogeneous mesoregions which, as the homogeneous microregions – aim to establish a regional system that allows the development of regional studies at different levels of aggregation. It is important to highlight that the microregions were established in 1977 and were the result of a Regional Division work started in the mid-1960s – the studies mentioned above make it possible to use information that was not always representative for the current observational units.

For a better understanding of the spatial dynamics, the territorial scope of this study will be the 10 mesoregions of the Parana State (Figure 1). The results will be better explored in the next section.

Figure 1 – Amount exported by Paraná mesoregion in 2021.



Source: Prepared by the authors. Based on (COMEX STAT, [2022]).

Based on the regional specialization, it was decided to employ the Locational Quotient (LQ) to identify the most specialized mesoregions and the most important sections for such result. Initially developed to quantify labor market indices, the LQ gained notoriety in other segments, including agriculture, because it provides a more comprehensive analysis of its results (ALVES, 2012).

The papers by Souza, Alves and Piffer (2013, 2014) and Souza, Gomes and Lírio (2007), used mesoregions as geographic units and the locational quotient as methodology. The research by Souza, Feistel and Coronel (2021), Freitas and Vinhólis (2020) and Lima *et al.* (2013) used the locational quotient to analyze exports.

The LQ compares each of the mesoregions of Paraná, and highlights those with the highest export value in a given section compared to the reference region, which will be the state of Paraná itself. Thus, it is a useful indicator to analyze the productive potential of the mesoregion individually. Therefore, when LQ≥1, it indicates that the region is specialized in that section (ALVES, 2012; HADDAD, 1989).

Equation (1) for calculating the LQ is represented as follows:

$$QL = \frac{X_{ij}/X_{it}}{X_{tj}/X_{tt}}$$

In which:
Xij = export value (US$) in sector i of mesoregion j;
Xit = export value (US$) in sector i in Paraná;
Xtj = export value (US$) in mesoregion j;
Xtt = value exported (US$) in Paraná.

Besides the careful choice of the reference region, in order not to bias the data, it is necessary to analyze the results, considering the local demand pattern, in case there is a more labor-intensive technology (example: textile industry). The LQ is very sensitive to regional aggregation and to the degree of sectorial detail (number of branches of activity).

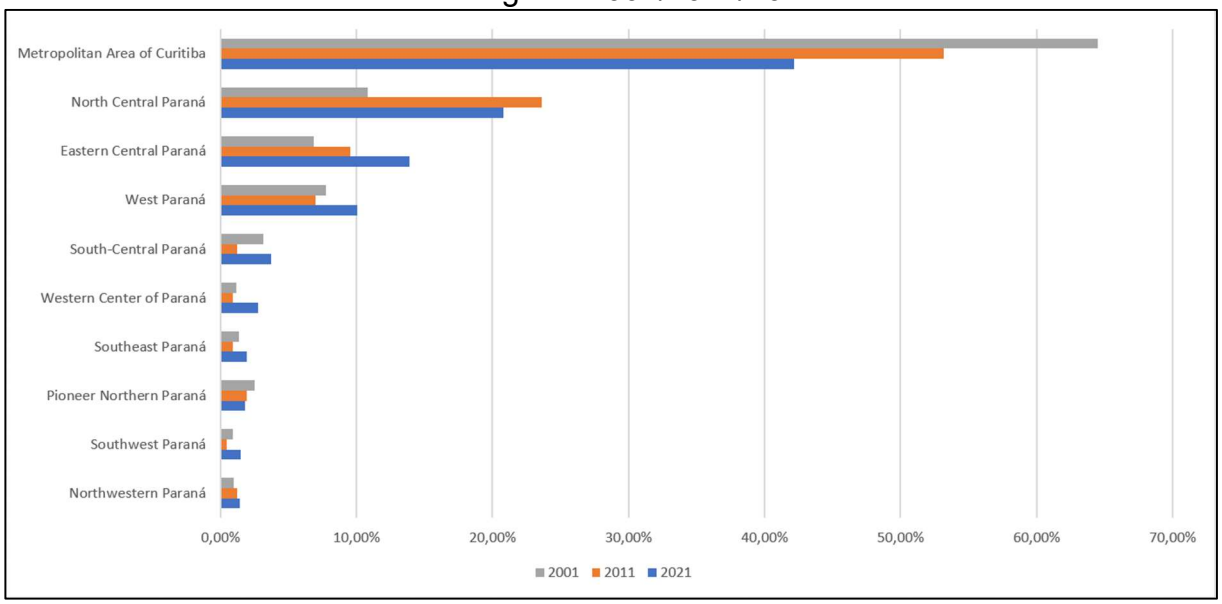
Results and discussion

This section aims to show the Paraná export data from the various sectors and for the three time periods chosen for the present analysis, as well as the LQ.

The aim of the LQ is to demonstrate the dispersion pattern of exports from the mesoregions of Paraná.

In 2021, the state of Paraná had record exports of US$ 21 billion, the largest volume exported in the 21st century. Compared to 2011, the year 2021 represented a growth of 8.33% (COMEX STAT, [2022]). In order to bear in mind how the evolution occurred among the mesoregions, Figure 2 presents the relative comparison of the exported value per mesoregion of Paraná in 2001, 2011 and 2021.

Figure 2 – Percentage share in the total value exported from the Paraná mesoregions 2001/2011/2021



Source: Prepared by the authors. Based on (COMEX STAT, [2022]).

Even though Curitiba, the capital of Paraná, concentrates most of the state exports, with 42.19% of the total exported in 2021, this percentage has been decreasing over the years. In 2001 the Metropolitan region of Curitiba concentrated 64.48% of the state exports. The North Central region of Paraná, exported US$ 4.40 billion in 2021, that is, 20.82% of the state exports originated in the North Central region of Paraná. This way, the North Central region is placed in second position. It is important to note that this relation decreased along the years and in 2011, the region concentrated 23.59% of the total exports (US$) of Paraná. The Eastern Central Paraná region occupies the third position, with 13.92%. Table 2 presents the information regarding the export value of Paraná state, emphasizing the three sections that exported the most along the referred elapsed time.

Table 2 – Total value (US$ FOB) exported from Paraná by section – 2001/2011/2021

Section		Paraná							Brazil	Market-share PR on BR
		2001	% 2001	2011	% 2011	2021	% 2021	Δ var. 2011/2021	2021	2021
I	Alive animals and products from the animal kingdom	565.852.779	10,90%	**3.496.666.018**	17,91%	**3.470.681.241**	16,41%	-0,74%	19.734.499.041	**17,59%**
II	Products from the vegetable kingdom	**847.757.234**	16,33%	**4.523.326.333**	23,17%	**6.152.885.119**	29,10%	36,03%	**52.035.664.407**	11,82%
III	Animal or vegetable fats and oils	138.139.463	2,66%	634.630.413	3,25%	648.742.047	3,07%	2,22%	2.753.131.381	**23,56%**
IV	Food industry products	**1.058.838.361**	20,39%	**4.137.085.180**	21,19%	**3.385.570.728**	16,01%	-18,17%	**25.357.399.186**	13,35%
V	Mineral products	23.338.792	0,45%	332.142.368	1,70%	366.234.474	1,73%	10,26%	**87.589.600.082**	0,42%
VI	Products from the chemical industries	106.346.287	2,05%	565.428.807	2,90%	620.824.201	2,94%	9,80%	11.415.311.222	5,44%
VII	Plastics and articles	27.444.736	0,53%	107.925.208	0,55%	180.680.712	0,85%	67,41%	5.234.229.022	3,45%
VIII	Skins	88.388.117	1,70%	282.774.168	1,45%	208.940.071	0,99%	-26,11%	1.496.761.195	13,96%
IX	Wood	500.093.783	9,63%	698.753.867	3,58%	1.833.466.134	8,67%	**162,39%**	4.501.194.362	**40,73%**
X	Paper and paper products	163.600.432	3,15%	471.118.661	2,41%	1.209.917.061	5,72%	**156,82%**	8.698.492.467	13,91%
XI	Textiles and articles	49.591.724	0,96%	222.957.135	1,14%	100.401.622	0,47%	-54,97%	4.477.556.021	2,24%
XII	Footwear	8.497.815	0,16%	11.389.285	0,06%	15.280.693	0,07%	34,17%	1.053.876.028	1,45%
XIII	Articles of stone	42.186.555	0,81%	65.222.072	0,33%	94.014.935	0,44%	44,15%	2.170.299.072	4,33%
XIV	Pearls	265.297	0,01%	2.631.791	0,01%	6.357.807	0,03%	141,58%	6.265.057.813	0,10%
XV	Common metals and their articles	69.437.489	1,34%	214.849.922	1,10%	171.110.655	0,81%	-20,36%	19.000.090.382	0,90%
XVI	Machinery and mechanical appliances	439.364.036	8,46%	1.251.789.315	6,41%	978.873.617	4,63%	-21,80%	14.439.212.200	6,78%
XVII	Transport material	**937.179.418**	18,05%	1.918.144.363	9,83%	1.426.526.068	6,75%	-25,63%	11.672.199.465	12,22%
XVIII	Optical instruments and apparatus	19.983.999	0,38%	39.236.269	0,20%	67.039.236	0,32%	70,86%	862.738.807	7,77%
XIX	Weapons and ammunition	0	0,00%	7.280.648	0,04%	5.470.700	0,03%	-24,86%	376.984.507	1,45%
XX	Miscellaneous goods and products	48.877.387	0,94%	140.260.107	0,72%	197.459.904	0,93%	40,78%	1.323.716.697	14,92%
XXI	Objects of art	0	0,00%	77.882	0,00%	4.907.937	0,02%	**6201,76%**	174.520.206	2,81%
XXII	Special transactions	56.600.985	1,09%	396.097.857	2,03%	0	0,00%	-100,00%	0	
	Σ Total	**5.191.784.689**	**100,00%**	**19.519.787.669**	**100,00%**	**21.145.384.962**	**100,00%**	**8,33%**	**280.632.533.563**	**7,53%**

Source: Prepared by the authors. Based on (COMEX STAT, [2022]).

Despite the excessive concentration in the metropolitan region of Curitiba, it was observed a decreasing movement between the years analyzed (2001, 2011 and 2021) in this region. The second mesoregion in the ranking, the North Central of Parana, has a different pattern compared to the other mesoregions analyzed. The mesoregion performed best in 2011, when it concentrated 23.59% of the Paraná exports, and in 2021, this value meant 20.82%, a fact that can be justified by the closure of the North of Parana dry harbor, located in the city of Maringá, which had its request for customs clearance formally submitted in 2018 because of economic unviable conditions.

To continue providing information to answer the research question that guides this study, Table 3 (a and b) shows the LQ for the various sectors researched for the three periods (2001, 2011 and 2021). In the Metropolitan Region of Curitiba, there were seven sectors with LQ above one in 2001, which became eleven in 2011 and thirteen in 2021.

Table 3a – Locational Quotient of the Exported Value (FOB US$) of Paraná 2001/2011/2021

Section		Metropolitan Area of Curitiba			North Central Paraná			Eastern Central Paraná			West Paraná			South-Central Paraná		
		2001	2011	2021	2001	2011	2021	2001	2011	2021	2001	2011	2021	2001	2011	2021
I	Alive animals and products from the animal kingdom	**1,06**	**1,01**	0,71	0,76	0,39	0,59	0,86	**1,12**	0,11	**1,78**	**2,97**	**3,80**	0,05	0,16	0,38
II	Products from the vegetable kingdom	0,91	0,85	**1,24**	**1,61**	**1,88**	**1,69**	0,50	0,26	0,17	**1,65**	0,66	0,36	0,49	0,29	0,24
III	Animal or vegetable fats and oils	0,92	0,59	0,65	**1,09**	0,80	0,64	0,19	**4,67**	**3,12**	**2,11**	0,43	**1,04**	0,07	0,61	0,24
IV	Food industry products	0,82	0,61	0,42	**1,92**	**1,74**	**1,73**	0,75	**1,17**	**1,79**	0,84	0,37	0,49	0,06	0,13	0,76
V	Mineral products	**1,48**	**1,82**	**2,18**	0,00	0,02	0,02	0,07	0,16	0,03	0,48	0,15	0,66	0,00	0,00	0,03
VI	Products from the chemical industries	0,58	**1,05**	**1,12**	**1,70**	0,39	0,69	**4,16**	0,78	0,65	**1,18**	**2,23**	**1,24**	0,28	**2,67**	**1,58**
VII	Plastics and articles	0,64	**1,07**	**1,41**	**1,59**	**1,07**	0,77	0,52	0,42	0,55	**4,77**	**1,68**	**1,28**	0,00	0,01	0,01
VIII	Skins	0,17	0,36	0,40	**6,77**	**3,25**	**3,76**	0,00	0,00	0,02	0,14	0,01	0,01	0,00	0,00	0,00
IX	Wood	0,63	0,57	0,62	0,06	0,01	0,00	**2,26**	**3,29**	**1,90**	0,31	0,12	0,16	**8,72**	**20,8**	**7,25**
X	Paper and paper products	0,22	0,45	0,23	0,15	0,03	0,02	**10,2**	**7,50**	**6,07**	0,74	0,13	0,05	**1,70**	**1,17**	**1,02**
XI	Textiles and articles	0,45	**1,45**	**1,27**	**1,21**	0,68	**1,51**	**1,53**	0,11	0,06	**2,34**	0,75	**1,30**	0,00	0,08	0,00
XII	Footwear	0,03	0,03	0,12	**1,86**	**1,35**	0,54	0,00	0,00	0,00	**10,0**	**9,09**	**6,90**	0,00	0,00	0,03
XIII	Articles of stone	**1,05**	0,98	**1,21**	0,02	0,00	0,01	0,02	0,04	0,03	**4,06**	**6,50**	**3,20**	0,00	0,00	0,01
XIV	Pearls	0,22	0,03	**1,54**	**7,28**	**1,74**	0,23	0,00	0,00	0,00	0,87	**1,40**	0,07	0,00	0,00	0,29
XV	Common metals and their articles	0,92	**1,44**	**1,64**	0,49	0,40	0,32	0,45	0,22	0,12	**3,49**	**1,11**	**1,10**	0,02	0,07	0,22
XVI	Machinery and mechanical appliances	**1,43**	**1,70**	**1,90**	0,25	0,11	0,27	0,09	0,09	0,19	0,54	0,79	0,72	0,00	0,05	0,02
XVII	Transport material	**1,54**	**1,84**	**2,32**	0,03	0,01	0,02	0,00	0,01	0,01	0,04	0,22	0,15	0,00	0,00	0,00
XVIII	Optical instruments and apparatus	**1,53**	**1,74**	**2,05**	0,03	0,19	0,29	0,00	0,00	0,10	0,13	0,39	0,21	0,00	0,00	0,01
XIX	Weapons and ammunition	0,00	**1,88**	**2,37**	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
XX	Miscellaneous goods and products	0,59	0,67	0,54	**1,89**	**1,63**	**2,50**	0,85	0,35	0,09	**2,46**	**1,74**	0,70	0,01	0,20	0,12
XXI	Objects of art	0,00	0,92	**2,34**	0,00	0,45	0,04	0,00	0,00	0,00	0,00	**5,83**	0,04	0,00	0,00	0,00
XXII	Special transactions	**1,49**	**1,84**	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,47	0,27	0,27	0,00	0,00	0,00
QLs > 1 number		**7**	**11**	**13**	**10**	**7**	**5**	**4**	**5**	**4**	**10**	**9**	**8**	**2**	**3**	**3**
QLs standard deviation		**0,52**	**0,60**	**0,77**	**1,99**	**0,87**	**0,97**	**2,29**	**1,88**	**1,45**	**2,30**	**2,41**	**1,63**	**1,87**	**4,43**	**1,55**
Average QLs		**0,76**	**1,04**	**1,19**	**1,30**	**0,73**	**0,71**	**1,02**	**0,92**	**0,68**	**1,75**	**1,67**	**1,08**	**0,52**	**1,20**	**0,55**

Source: Prepared by the authors. Based on (COMEX STAT, [2022]).

Table 3b – Locational Quotient of the Exported Value (FOB US$) of Paraná 2001/2011/2021

Section		Western Center of Paraná			Pioneer Northern Paraná			Southeast Paraná			Southwest Paraná			Northwestern Paraná		
		2001	2011	2021	2001	2011	2021	2001	2011	2021	2001	2011	2021	2001	2011	2021
I	Alive animals and products from the animal kingdom	0,00	0,00	**1,57**	0,43	**1,61**	0,95	0,46	0,28	0,17	0,17	**1,97**	**4,61**	**1,88**	**1,13**	**2,61**
II	Products from the vegetable kingdom	**1,35**	**1,65**	**1,14**	0,29	0,18	0,16	0,18	0,27	0,64	**3,55**	**1,75**	0,21	0,09	0,04	0,42
III	Animal or vegetable fats and oils	0,32	0,15	**1,61**	**4,10**	0,47	0,03	0,00	0,01	0,00	0,13	0,14	0,00	0,54	0,24	0,01
IV	Food industry products	**3,51**	**2,69**	**2,00**	**3,23**	**2,18**	**2,70**	0,01	**2,29**	0,02	0,13	0,19	0,13	**2,29**	**3,29**	**2,14**
V	Mineral products	0,00	0,00	0,00	0,00	0,00	0,04	0,03	0,27	0,09	0,00	0,00	0,00	0,00	0,10	0,20
VI	Products from the chemical industries	0,00	0,05	0,00	**1,67**	**3,74**	**5,02**	0,93	0,73	0,38	0,26	0,00	0,09	0,04	0,67	0,94
VII	Plastics and articles	0,30	**1,28**	0,65	0,00	0,24	0,17	0,03	0,25	0,74	0,44	0,16	0,14	0,00	0,04	0,31
VIII	Skins	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,15	0,00	**15,51**	**3,30**	**3,30**
IX	Wood	0,00	0,00	0,00	0,02	**1,45**	**2,06**	**8,43**	**8,92**	**7,47**	**1,88**	**1,03**	0,38	0,00	0,03	0,05
X	Paper and paper products	0,15	0,99	0,24	0,00	0,00	0,00	**1,35**	0,65	0,21	0,41	0,01	0,03	0,00	0,00	0,00
XI	Textiles and articles	**4,86**	0,00	0,00	**8,86**	0,07	0,01	0,00	0,00	0,12	0,72	0,00	0,11	0,65	0,28	0,41
XII	Footwear	0,00	0,00	0,00	0,00	**1,50**	**4,42**	0,00	0,00	**3,13**	0,62	0,00	0,05	0,00	0,02	0,04
XIII	Articles of stone	0,01	0,00	0,01	0,00	0,00	0,00	0,00	**1,96**	**8,33**	0,26	0,09	0,04	0,00	0,08	0,02
XIV	Pearls	0,00	0,00	0,00	0,00	**11,9**	**2,19**	0,00	0,00	0,00	0,00	0,00	0,83	0,00	**20,42**	**16,81**
XV	Common metals and their articles	0,00	0,01	0,00	0,00	0,01	0,06	0,09	0,02	0,06	**5,76**	**7,97**	**6,91**	0,02	0,07	0,03
XVI	Machinery and mechanical appliances	0,01	0,13	0,45	0,00	0,12	0,32	0,35	0,33	0,97	0,05	0,04	0,18	0,01	0,07	0,31
XVII	Transport material	0,00	0,00	0,00	0,00	0,03	0,06	0,00	0,00	0,00	0,00	0,10	0,00	0,01	0,00	0,00
XVIII	Optical instruments and apparatus	0,00	0,01	0,01	0,00	0,04	0,07	0,00	0,00	0,00	0,00	0,58	**2,69**	0,01	0,04	0,09
XIX	Weapons and ammunition	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
XX	Miscellaneous goods and products	0,09	0,02	0,18	**1,76**	**2,27**	**1,27**	**1,49**	**1,76**	**1,92**	**8,56**	**7,57**	**5,40**	**2,60**	0,28	**1,46**
XXI	Objects of art	0,00	0,00	0,00	0,00	0,00	0,09	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
XXII	Special transactions	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
QLs > 1 number		**3**	**3**	**4**	**5**	**7**	**6**	**3**	**4**	**4**	**4**	**5**	**4**	**4**	**4**	**5**
QLs standard deviation		**1,25**	**0,71**	**0,63**	**2,10**	**2,62**	**1,48**	**1,80**	**1,94**	**2,33**	**2,18**	**2,27**	**2,01**	**3,32**	**4,36**	**3,58**
Average QLs		**0,48**	**0,32**	**0,36**	**0,93**	**1,18**	**0,89**	**0,61**	**0,81**	**1,10**	**1,04**	**0,99**	**0,99**	**1,08**	**1,37**	**1,32**
QLs Coefficient of variation		**2,59**	**2,22**	**1,75**	**2,27**	**2,23**	**1,66**	**2,97**	**2,40**	**2,11**	**2,10**	**2,29**	**2,03**	**3,09**	**3,19**	**2,71**

Source: Prepared by the authors. Based on (COMEX STAT, [2022]).

The mineral products sector obtained, in all three periods, LQ above one, as did machines and equipment, transport material, and optical instruments and devices. It is important to notice that these sectors had LQ>1 only in this mesoregion (with the exception of optical instruments and appliances in the Southwest in 2021). It is also important to point out that the variable of analysis is exports, so the interpretation of the LQ values is different if compared to papers that use production or employment in the LQ calculation. In other words, the LQ reveals that the product was exported from that region but not, necessarily, produced in that region. This explains the results in the metropolitan region of Curitiba, in which the products can be transported there to

aggregate value and then be exported, since it is in this mesoregion that one of the most important ports in Brazil, the port of Paranaguá, is located.

The second mesoregion with the highest number of LQs above one was West Paraná (10, 9 and 8 LQ>1, respectively, in the three periods). The sectors that had their exports concentrated in the West were those related to agriculture and light industry, such as livestock, animal or vegetable fats and oils, and the textile industry.

It is important to highlight some characteristics about some export sectors in Paraná. The pearl sector obtained relatively high LQ values, a sector that represented only 0.03% of the total exports from Paraná in 2021, and it is concentrated in very few mesoregions. Such fact is coherent, given that its deposits are not uniformly found throughout the territory. One of the regions that obtained LQ>1 was the Northwest, which has a municipality named Pearl. This mesoregion concentrated 23.36% of all state exports in 2021 and the Metropolitan Region of Curitiba, 64.93%.

The wood export sector shares the same characteristics as the pearl sector in terms of uneven and concentrated spatial distribution. It is a sector that accounted for 8.67% of the total state exports in 2021. However, the forests with exporting wood are not equally distributed in the territory, a fact that explains the concentration of wood exports in some mesoregions. In the case of Paraná, these mesoregions are Center-South (concentrating 26.78% of exports in 2021), Center-East (26.49%), Metropolitan region of Curitiba (26.36%), Southeast and Southeast (14.37 %). Together, these four mesoregions accounted for 94.00% of Paraná's total exports in 2021.

Wood exports remain important for the state of Paraná since at least 1856. Foreign capital companies and their subsidiaries that owned land in the state managed the land and logistics until the export of wood (MAGALHÃES FILHO, 2011). In addition to wood and pearls, other important products for exports from the state of Paraná are soybeans and meat. The participation of these products in the export basket of Paraná were, respectively, 31% and 13% in 2011 (PAGANINI; FRAGA, 2014).

On the one hand, the mesoregions with the highest export values are the richest in the state, evidencing the positive correlation between GDP and exports found in previous research (CARMO; RAIHER; STEGE, 2017). On the other hand, it is worth pointing that, as shown in Table 2, the products exported by the mesoregions of Paraná have, in general, low added value. Therefore, Paraná municipalities still need to fulfill some stages proposed by North (1977), which are the same conclusions of the more recently developed theory of economic complexity. They are adding value to exported products, incorporating more technology, that uses more physical capital and producing and exporting more complex goods (HIDALGO; HAUSMANN, 2009).

From the export data shown in Figure 1, there are islands or export hubs in the state of Paraná. As export products need infrastructure to reach their destination, it had to be created, fostering the migration from smaller regions to the poles. These had an increment in their population and production. In this sense, public policies aimed at improving infrastructure can contribute to increasing comparative advantages/reduction in costs. The result will be more competitiveness for the export products of Paraná (MACHOSKI; RAIHER, 2016).

Export is the business card in an economy, that is, how the country is seen abroad. The more technology, innovation and added value the production, the more development it will promote to the region. Economies of scale and scope are encompassed by innovative industries and modern machines which reflect in higher productivity; in other words, the more you produce, the lower the unit cost of production and the higher can be the profits and wages involved in the production process.

Although it is not the objective of this paper, there are several ways to reduce the asymmetries in the regions found in this study. For instance, one possible solution might be implementing an Export Qualification Program Operational Nucleus (henceforth PEIEX) in a region with low attitudinal response for international trade. PEIEX is offered by the Brazilian Trade and Investment Promotion Agency (ApexBrasil) so that Brazilian companies may start the export process in a planned and safe way (APEXBRASIL, 2020). Throughout 2021, PEIEX assisted and qualified 4,894 companies, through the execution of 36 agreements, in the 5 regions of the country. Of this total number of companies: 74.44% are in the category of micro and small companies (MSEs); 677 exported in 2021, with a total value of BRL 661.3 million (an increase of 9.8% in the value exported by this same group of companies, compared to 2020) (APEXBRASIL, 2022).

Even if in foreign trade there are no short-term results, with planning and action one can achieve the desired position, that is, more regional development.

Conclusions

Acknowledging the region and, especially, its regional analysis is fundamental for planning and creating policies for development purposes, for reducing regional asymmetries, and for creating a regional identity. Regional analysis, especially for a country with continental dimensions - such as Brazil - is essential for the deliberation of proposals and actions (whether top-down or bottom-up). Methods of regional analysis (including the Locational Quotient), contribute to a better understanding of how regions function, and thus can be used to reach their full potential.

The objective of this study was seeking to understand how the process of spatial dispersion of exports from the mesoregions of Paraná took place in: 2001, 2011 and 2021. Likewise, the present study aimed to answer the following research question: was there or not diversification in the export agenda of the Paraná mesoregions between 2001, 2011 and 2021? In order to answer this research question, two specific objectives were defined.

The first was to identify the section of the most important products in the state's export agenda. Thus, it was observed that the most representative section in terms of export value (FOB US$) was section II, products from the plant kingdom that meant 29.0% of the total exported by the state in 2021. Considering the measure of analysis (LQ), three mesoregions had a bigger contribution to this result and showed more dynamism: the Metropolitan area of Curitiba, North Central Paraná and Western Center Paraná.

The second specific objective was to identify which mesoregion is the most specialized; here, the Metropolitan area of Curitiba presented a high concentration value, representing 42.19% of the total exported (FOB US$) and it was also the most specialized (13 sections with LQ>1). It's important to mention that in the analysis of the LQ the West of Paraná, even appearing in fourth place in the ranking of exported value (FOB US$), was the second mesoregion with the highest number of specializations (LQ) in 2021.

The results point to the concentration of exports in some regions, as was the case in the pearl and wood sectors. In other sectors, greater territorial deconcentration was observed, such as merchandise exports. Public policies which aim at improving the competitiveness of exports from Paraná can focus on implementing infrastructure,

especially if taking into consideration the cost reduction of transports and the reduction of losses between the place of production and destination.

This study raised a provocation in the title: analysis of the export base of Paraná mesoregions between 2001 and 2021: diversification or concentration?

In summary, a concentration of the respective aptitudes in the sections of the mesoregions was observed. There were no significant changes in the export patterns of the analyzed mesoregions. Mainly with the concentration of the metropolitan mesoregion of Curitiba, which has benefited since before the 1970s, with industrial attraction policies, as well as in the North Central mesoregions (where Maringá and Londrina are located), with the proximity to São Paulo and the effects of the coffee cycle and subsequent specialization in temporary agriculture.

A limitation found by the researchers refers to the interpretation of the analysis variable. It was observed that it concerns different measurements proposed by the employment or production variables, since this measurement (US$ exported value) indicates that the product was exported in that region and that it was not necessarily produced in the same region where the export started.

Exports can be important sources of income growth and decrease of regional inequalities. To do that, the regions need to allocate their resources to activities that will foster the greatest return and that can best exploit the advantages acquired through exports.

To conclude, it is important to mention that the variable related to exporting companies by mesoregion was not explored in the present analysis. Nevertheless, it constitutes an important aspect to be covered in future research since it identifies the productive activity and, therefore, assists in deepening the results found in this study.

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