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GEO-ECONOMICS COMPLEXITY AND THE REGIONALS GEOGRAPHIC'S ANALYSIS

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Abstract

The goal of the paper is to unravel the geo-economic complexity of regional agglomeration economies. For this one, the spatial focus is on the western region of Santa Catarina. The main result of cross-referencing the literature with empirical research data was to break the stereotype that the region under analysis is specialized purely and simply in agro-industrial production. In fact, it is a complex, specialized and diversified geo-economic dynamic; given the overflow of agro-industrial capital into other productive sectors, such as machinery and equipment, mechanical metal, renewable energy, meat production technologies, real estate investments and others. This led to the identification of four agglomeration economies with differences and similarities from a production point of view: Chapecó and Xanxerê, Concórdia and Joaçaba, Videira and Caçador and, finally, São Miguel do Oeste. Methodologically, the research considers three steps: 1) bibliographic and data collection; 2) fieldwork and technical visits; 3) organization, cross-referencing and qualification of the data collected.

Keywords: Geo-Economics Complexity; Agglomeration of Economy; West of Santa Catarina.

Resumo / Resumen

COMPLEXIDADE GEOECONÔMICA E AS ANÁLISES GEOGRÁFICAS REGIONAIS

O objetivo do artigo é desvendar a complexidade geoeconômica em economias de aglomeração regionais. Para este artigo, o recorte espacial se dá sobre a região Oeste catarinense. O cruzamento do referencial bibliográfico com os dados empíricos da pesquisa teve como resultado principal a quebra do estereótipo de que a região em análise é especializada pura e simplesmente na produção agroindustrial. Na verdade, trata-se de uma dinâmica geoeconômica complexa, especializada e diversificada; diante da verificação do transbordamento de capital agroindustrial para outros setores produtivos, tais como: máquinas e equipamentos, metal mecânico, energia renovável, tecnologias de produção frigorífica, investimentos imobiliários e outros. Diante disso, chegou-se a identificação de quatro economias de aglomeração com diferenças e semelhanças do ponto de vista produtivo, quais sejam: Chapecó e Xanxerê, Concórdia e Joaçaba, Videira e Caçador e, por fim, São Miguel do Oeste. Metodologicamente a pesquisa considera três passos: 1) levantamento bibliográfico e de dados; 2) trabalhos de campo e visitas técnicas; 3) organização, cruzamento e qualificação dos dados levantados.

Palavras-chave: Complexidade Geoeconômica; Economias de Aglomeração; Oeste Catarinense.

COMPLEXIDAD GEOECONÓMICA Y LAS ANÁLISIS GEOGRÁFICAS REGIONALES

El objetivo del artículo es revelar la complexidad geoeconómica en economías de aglomeración regionales. Para el presente artículo, el recorte espacial es la región Oeste del estado de Santa Catalina. El cruzamiento del referencial bibliografico con los datos empíricos de la pesquisa tubo cómo resultado principal la quiebra del estereotipo de que la región en análisis es especializada solamente en la producción agroindustrial. En verdad, se trata de una dinámica geoeconómica complexa, especializada y diversificada; frente la verificación del desbordamiento del capital agroindustrial para otros sectores productivos, cómo: máquinas y equipamientos, metal mecánico, energía, tecnologías de producción frigorífica, investimentos inmobiliarios y otros. Frente al expuesto, se llegó a la identificación de cuatro economías de aglomeración con especificidades y semejanzas del punto de vista productivo, cual sea: Chapecó y Xanxerê, Concórdia y Joaçaba, Videira y Caçador y, en fin, São Miguel del Oeste. Metodológicamente la pesquisa consideró tres pasos: 1) levantamiento bibliográfico y de datos; 2) trabajos de campo y visitas técnicas; 3) organización, cruzamiento y cualificación de los datos levantados.

Palabras-clave: Complexidad Geoeconómica; Economías de Aglomeración; Oeste de Santa Catarina.

INTRODUCTION

Brazil's recent geoeconomic dynamics allow us to infer that, between 2003 and 2014, government intervention in direct investments and partnerships with the private sector enabled the country to several achievements, such as: “full employment”, a gradual increase in the purchasing power of the minimum wage, a decrease in the interest rate, the appreciation of the national currency (Real) in relation to the US dollar, an increase in the number and qualification of research, innovation, and technology centers; the expansion of the network of qualifications for technical professional education, improvements in the road and electrical systems, growth in agricultural and industrial production, growth in trade, expansion of public services (health, education, social security), among others.

This growth proved to be more dynamic in relation to the Brazilian economy in the 1990s (BIELSCHOWSKY, 2014). As a result of these dynamics, there was a spread of capital, to varying degrees, in the regional economies located in the countryside of Brazil (however, there are specific cases in which certain regions continued in a state of economic stagnation despite the aforementioned economic dynamism). In many cases, growth has been fostered by the installed production capacities, new technologies, and innovations in processes and products, new relationships between public and private initiatives, among others. In this sense, Diniz and Mendes (2021) analyzed the behavior of economic dynamics in Brazil and signaled, from 2003 onwards, an expansion of the polygon of the main industrial areas that were previously concentrated in the capitals of the Southeast and South regions of Brazil. Within the new polygon, new Relevant Industrial Areas (AIRs, for the Portuguese acronym, Áreas Industriais Relevantes) created between the years 2003-2014 have been implemented (surpassing the territorial division criteria previously used for macroregions and federated states, Diniz (1993) and Diniz and Crocco (1996) proposed an alternative regionalization criterion. They used the IBGE’s geographic microregions as a basis and designated those microregions with more than 10,000 industrial jobs as relevant industrial agglomerations (AIRs) (DINIZ and MENDES, 2021, p. 8)). These areas include, for example, the western region of Santa Catarina (the western mesoregion of Santa Catarina, defined by the IBGE (1990), covers 118 municipalities (VON DENTZ, 2022)) – Figure 1, which is the focus of this very work.

The AIRs encompass industrial activities with more advanced technology, involving a capacity for integration and multiplication of more comprehensive production processes, such as the metal-mechanical, electrical, chemical and real estate industrial segments. In the western region of Santa Catarina, on the other hand, industrial activities linked to meat processing, cereal processing, long-lasting machinery and equipment, agricultural inputs, paper and cellulose, textiles, energy generation (hydroelectric, solar, and bioenergy), irrigation systems, cooling systems and transportation of food products, among others, also emerged and expanded. This is a new composition of more complex economic activities, present in economic agglomerations that have been established in the region and, as a result of their own development, have begun to characterize the AIRs in countryside subregions, as is the case in the Western part of Santa Catarina.

Therefore, considering that the western region of Santa Catarina has become part of the so-called AIRs (DINIZ and MENDES, 2021), the goal of this paper is to unravel the geoeconomic complexity present in the agglomeration economies of the western mesoregion of Santa Catarina (Figure 1). Methodologically, three steps were taken into consideration: 1) bibliographic and data survey; 2) fieldwork and technical visits; 3) organization, processing and cross-referencing of data collected in the office and in the field.

In order to achieve the established objective, the article was divided, in addition to this introduction and the final considerations, into two structuring parts: first, a historical review of the bibliographic basis on the new regional economic geography and geoeconomic complexity is made; the second part presents an empirical approach to the region under study, with a view to unveiling the characteristics of the so-called geoeconomic complexity of the western region of Santa Catarina.

Figure 1 shows the geographic location of the western mesoregion of Santa Catarina.

Figure 1 - Geographical location of the western mesoregion of Santa Catarina and its main cities.
Source: IBGE cartographic base. Prepared by the authors.

NEW REGIONAL ECONOMIC GEOGRAPHY AND GEOECONOMIC COMPLEXITY: GENESIS AND BRIEF STATE OF THE ART

It can be said that there is no single approach to regional economy and economic complexity. Likewise, it is difficult in the field of geographical science to find texts that articulate the two aforementioned concepts. What exists is a diversity of perspectives, which attempt to capture the complexity of economic phenomena in the geography of the most diverse productive regions of Brazil and the world. However, according to Corrêa (2000), regional analysis constitutes an attempt to introduce the spatial dimension into economic studies. Physical distance, in this sense, is a fundamental variable, giving it enormous weight in the locational process of economic activities and cities, capable of generating some economic development, such as transfer costs, spatial interactions, land use, among others. On the other hand, it is clear that the technological evolution that has occurred in transport systems and communications systems has made physical distance a variable that is not always fundamental for business decisions.

In this context, given the importance of the different schools of thought in the literature on regional economic geography and regional economy, two major theoretical groups were identified that deserve to be highlighted: 1) the classical location theories that developed in a relatively continuous manner since the publication of Der isolierte Staat in Beziehung auf Landschaft und Nationalökonomie (VON TÜNEN, 1826) until the publication of Location and space economy (ISARD, 1956); 2) regional development theories with emphasis on agglomeration factors, inspired by Marshall and Keynes, born from 1950 onwards, whose main references that emphasized regional economic development in one way or another are: Note sur la notion de pôle de croissance (Perroux, 1955), Economic theory and underdeveloped regions (MYRDAL, 1957), The strategy of economic development (Hirchman, 1958) and Location theory and regional economic growth (NORTH, 1955).

According to Monasterio and Cavalcante (2011), between 1950 and 1980, studies on regional economic development lost strength and returned to being the target of numerous researchers after 1980. From then on, efforts began to address concepts such as agglomeration and transportation costs, through mathematical formulas that aimed to expand discussions on regional economic development. This occurred within the scope of the so-called "new economic geography", with the aim of incorporating aspects into the analyses carried out on the subject to date.

Consequently, we arrive at a period in which theoretical production on regional economics takes on a more interdisciplinary face, with the inclusion of an increasingly greater diversity of references. While this can be seen as positive, it should also be highlighted that the expansion of the use of references has made it difficult to establish a continuous flow in the construction of thinking about regional economics. As part of this contextualization, a scheme was created (Figure 2) that details the two main theoretical groups that deal with a set of themes that are in line with the discussion on what we are calling geoeconomic complexity. The authors and themes in Figure 2 are marked according to their countries of origin, or countries in which the main authors worked scientifically and professionally for most of their lives. Thus, figure 2 is presented.

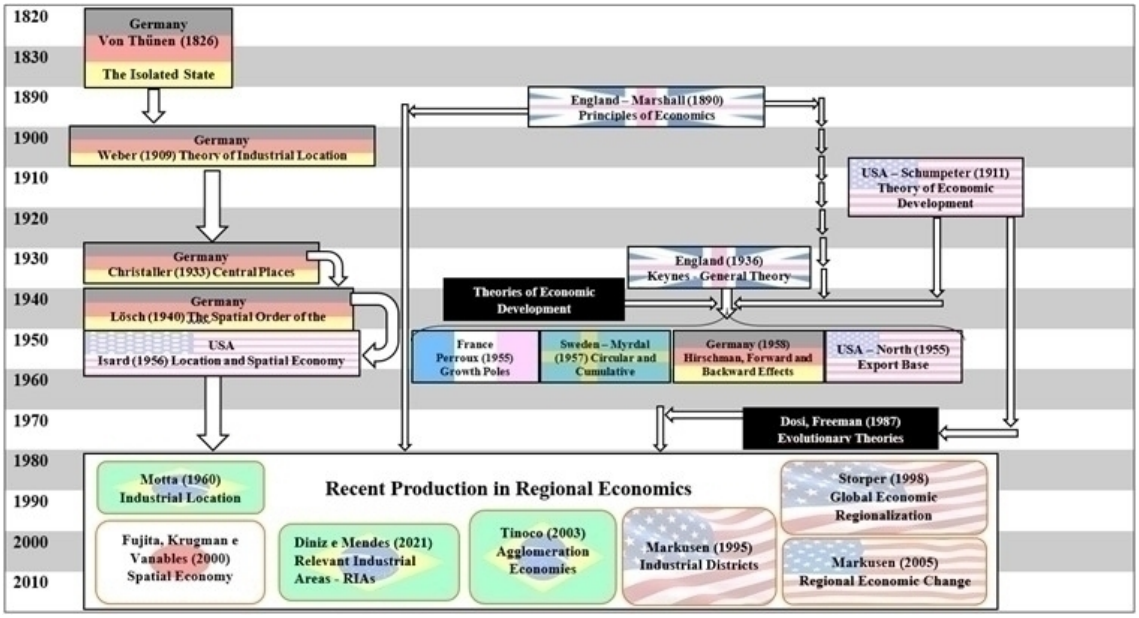

Figure 2 - Main theoretical currents on regional geoeconomic complexity (1820-2021). Source: Adapted from Monasterio and Cavalcante (2011). Own elaboration.

From figure 2, it is possible to observe, in the lower part, a wider block, where recent scientific production on regional economy has been accommodated. On the left margin is the chronological order of the authors, considering the year of publication of the main work. In this sense, in the first group of figure 2 (left part) are the authors and their research topics on classical location theories, which evolved in a more or less chained manner from Von Thünen (1826) to Isard (1956). Due to the predominance of German authors in this group, it is common to find the expression "German school" of classical localization theories in the literature. These authors emphasize the decisions of firms that, taking into account the role of transportation costs, seek to determine their best location.

For Von Thünen (1826), the closer the production was to the city, the greater the profit would be, as transportation costs would be low or non-existent. Producers located close to cities would have locational advantages with large profits. Weber's (1929) central idea was that the decision regarding the location of industrial activities was basically a result of three factors: transportation costs, labor costs and a local factor resulting from the forces of agglomeration and de-agglomeration of productive activities.

Christaller (1966), in turn, focused attention on the challenge of finding an explanation for the size, distribution and number of cities in a given spatial area. From this problem derived the work on central places in Southern Germany, which concluded that in order to arrive at the spatial distribution of central places, three basic principles were necessary: 1) the market (the smallest possible number of centers), 2) transport (the shortest possible distance between centers), 3) administration (the smallest possible number of higher-order centers that commanded the lower-order centers). With this, Christaller (1966) observed that the distribution of cities in Germany, in a certain way, followed the market principle. However, Christaller (1966) noted something brilliant: "as you go down the urban scale, the number of centers increases, that is, there are few large cities and many small cities" (MONASTERIO and CAVALCANTE, 2011, p. 59). Thus, the so-called Christaller rings were fundamental to explaining the size, distribution and number of cities in the southern German area.

Lösch's (1954) central idea, when seeking to understand the spatial order of the economy, proposed a hierarchy between market areas, which tend to be larger the lower the density of demand, price elasticity and transportation costs. Thus, productive activities would adapt to the urban structure present in a region. On the other hand, Isard (1956), the first outside Germany in the group of classical location theorists, identified that it was necessary to incorporate new disciplines into this analysis to increase its degree of adequacy to reality as it is. Isard's (1956) work points to industrial orientation (raw materials, market, labor, energy and others) as determining factors.

In the second theoretical group, located in the central and right part of figure 2, are the theorists of regional economy based on agglomeration factors. According to Monasterio and Cavalcante (2011), despite the difficulty of defining a time frame, discussions on the agglomeration of economic activities began with Marshall (1916), when he developed the idea that producers clustered in a given location bring advantages and that these advantages explain the movement of agglomeration. For Marshall (1916), three main benefits result from economic agglomerations: 1) the possibility offered by a broad local market to enable the existence of suppliers of inputs within its scale of operation; 2) the advantages of the abundant supply of labor; and 3) the exchange of information that occurs when companies in the same sector or nearby sectors are located close to each other.

Although Marshall (1916) was emphatic about these benefits at the end of the 19th century, from 1950 onwards the concept of agglomeration began to be used more to interpret movements of regional growth and development. At the same time, although the concept of agglomeration was of great valued by Perroux (1955), Myrdal (1957), Hirschman (1958) and North (1955); they are authors who were not directly influenced by Marshall, but the influences they had from Schumpeter and Keynes are easily identified. For this reason, in Figure 2, the arrows linking Schumpeter and Keynes to the aforementioned authors are continuous, indicating a direct influence; but the dotted arrows, linking Marshall to these authors, indicate an indirect influence.

In the central and right part of figure 2, we find Perroux (1955), whose central idea was that of growth poles, widely used in the formulation of regional development policies, which was influenced by Schumpeter (1911) regarding the role of technical progress and innovations in capitalist dynamics. For Perroux (1955), economic growth does not occur homogeneously in space, but manifests itself in different growth poles, with varying intensities, expanding through different channels and with varying final effects throughout the economy. This means that a complex industrial hub would be able to modify its immediate geographic environment, whose determining factor for spatial economic change would come from a driving industry. The incentives that driving companies receive from the State, such as those that were part of the local development policies implemented in developed and underdeveloped countries from 1950 onwards (Italy, USA, France, Russia and Brazil itself) are part of Perroux's (1955) ideas for economic growth plans. Markusen (1996) called Perroux's central idea a "central-radial district", that is, a productive arrangement that develops around a kind of driving company that plays the anchor role. However, Perroux's ideas began to be heavily criticized from 1970 onwards, mainly because in some regions their implementation did not produce the expected results. This led to the failure of regional economic planning based on Perroux's growth of poles theory.

Consequently, the idea of circular and cumulative causation, from the Swede Myrdal (1957), appears. For the author, economic development mechanisms are mutually reinforced by market forces and lead regions along different paths. Myrdal (1957) argued that there would be a kind of causal and circular interrelation in the factors linked to the issue of development. His hypothesis of circular and

cumulative causation would be valid in the field of social relations, since "the game of market forces operates in the direction of inequality" (Myrdal, 1957, p. 39). Thus, even the State's actions, through public policies aimed at reducing social inequalities, would only accentuate them, as such policies would have a more efficient effect in developed regions than in underdeveloped ones. Only after a certain time, with the economic rise of the central regions, would centrifugal mechanisms begin to act in a way that improved the social indicators of poorer regions. However, this would be insufficient to lead to an abrupt drop in social inequalities.

Contrary to Myrdal (1957), who sees inequalities as a problem, Hirschman (1958) considered inequality a necessity or even a requirement of the development process. The author highlighted that economic development, rather than being marked by a trajectory of continuous growth, has leaps and setbacks that are characterized by imbalances of importance to the process. These imbalances would be a way for the region to be economically strengthened. In his words, "[...] international and interregional inequalities in growth are an inevitable and concomitant condition of the growth process itself" (HIRSCHMAN, 1958, p. 36). In this context, the regional issue is discussed based on the concepts of forward and backward effects. The backward effects express the externalities resulting from the implementation of industries, which, by increasing the demand for inputs in upstream sectors, would make their production scales viable in a given region. The forward effects would be the result of the supply of inputs, which would make numerous sectors positioned downstream of industries viable, that is, ahead of industries (MONASTERIO and CAVALCANTE, 2011).

Finally, closing the group of authors who deal with regional economic development and geoeconomic complexity, we point to North (1955), who presented the thesis that regional economic development would be linked to an export base. He disputed the idea that development would occur in successive stages, but admitted that perhaps this occurred in some regions of Europe, which would not apply to other experiences, such as in the countries of the Americas. For North (1955), export activity induces the emergence of distribution hubs and cities, in which industrial processing activities and other services associated with the export product emerge and develop. North (1955) highlighted that sectoral diversification is the result of what worked in the basic activities, and not the result of the exhaustion of the primary sector, for example. Furthermore, industrialization would be incapable of ensuring that regional development continues in the long term, since it would be tied to the success of the export base (Tiebout (1956) presented several criticisms of North's central idea, including the intellectual limitation of believing that the export base is responsible for all regional economic dynamism). Despite the criticism received, North's (1955) ideas can be seen in regional development plans to this day.

In fact, although the theories presented emphasize decisions from the firm's point of view, from the 1980s onwards, with advances in productive modernization processes and the advent of globalization, other authors stood out. Storper (1998), for example, highlighted that globalization is the expansion of direct flows of goods (technology, equipment, products) and capital (real and financial assets) beyond the border lines that divide countries. Furthermore, productive monopolies and oligopolies impose barriers on regional economies that often prevent certain regions from reaching levels of development beyond those that already exist (STORPER, 1998). Given this, in the turbulent environment of corporate capitalism, new strategies require regional companies to consider the needs of consumers in different parts of the world, that is, with variations from region to region.

Therefore, the two major theoretical blocks that appear in figure 2 summarize the lines of thought on regional economic complexity and economic agglomerations from the 19th century onwards. This matrix of thought, whether one agrees with it or not, must be taken into account to identify new concepts consistent with current regional production dynamics. The new economic geography and geoeconomic complexity that will be addressed in the next item cannot come from nothing. It is necessary to consider the theoretical composition that brought the debate to the current reality. In view of this, other authors would be appropriate for this brief state of the art, but we sought to include those who are most familiar with the theme of regional economic complexity, whose writings serve as a basis for the debate on the new economic geography. In this context, the western region of Santa Catarina is part of the large inland portion of Brazil that developed rapidly with the intensive use of technologies in production processes (VON DENTZ, 2022). Thus, a new regional economic geography is confirmed, in which regional agglomeration forces and geoeconomic complexity from a technological point of view begin to play new roles. In this regard, the western region of Santa Catarina will be discussed in the next topic.

GEOECONOMIC COMPLEXITY AND AGGLOMERATION ECONOMIES: APPROACHES TO THE WESTERN REGION OF SANTA CATARINA

According to the writings of Espíndola (1999), Goularti Filho (2016) and von Dentz (2022), the West of Santa Catarina has a relatively recent economic trajectory, since the first meat processing units appeared around 1960. The fact that it is a "young" region does not mean that it has fallen behind in terms of the productive structures that have developed. On the contrary, it is a regional cut in which the development of the productive sectors happened à la Schumpeter (the term "a la Schumpeter" refers to the understanding that technical progress has a nature characterized by both continuity and discontinuity, a rhythm associated with its dynamism, and a direction related to improvements, adaptations, and disruptions. Thus, economic dynamism, science, and social structures result in technical progress. Of particular note are historically accumulated competencies, the environment, and selection, which tend to validate or reject an innovation through its application and/or diffusion), that is, incorporating increasingly greater technological intensity, adapted to regional productive characteristics, in order to promote the successive increase in the productivity of human labor and mechanical labor in the productive units (based on the idea of entrepreneurial work).

In this sense, it is a region recognized locally, nationally and internationally for its productive potential linked to the chicken, swine, milk, and cattle production chains. From these productive segments, with successive stages of overflow of accumulated capital, a regional geoeconomic complexity was formed, comprised of the set of economic activities found in the agglomeration economies present in the aforementioned region. This complexity involves public and private institutions dedicated to the production of research, innovation and new technologies aimed at the development of the regional economy.

From this point of view, the observation of the expansion of AIRs is corroborated (DINIZ and MENDES, 2021). However, the definition of agglomeration economies is added (TINOCO, 2003). For Tinoco (2003, p. 49-50), it is understood as

> Agglomeration economies are any gain in productivity of the agent arising from its co-location with other agents. [...] It is no longer the study of industrial location that is of interest. But rather the study of the growth of cities and the industries located there. Agglomeration economies are no longer responsible solely for attracting companies to locate in a city. Much more than that, they are responsible (not the only ones, obviously) for the dynamism and growth capacity of the companies that have set up there.

In these terms, one of the results of national, state and regional economic complexity was the emergence of new businesses. In the western region of Santa Catarina, the new businesses that have emerged impose a web of highly integrated and competitive productive sectors on the regional geoeconomic dynamics. Businesses such as the production of dog houses have emerged as a viable option, as, prior to their emergence, there was a thriving timber and furniture sector. Thus, with the introduction of adaptations, the new segment becomes part of the regional production dynamics, as it is a segment that incorporates new processes and products.

On the other hand, businesses involving more sophisticated production lines, such as the home and apartment lighting segment, were a regional necessity, since it cost more to bring detailed lighting fixtures from the coast of Santa Catarina, São Paulo, Paraná or Rio Grande do Sul. These new businesses, however insignificant they may seem, play an essential role in oxygenating and improving regional economic complexity. Possibilities are opened up for maintaining and expanding sources of income, while at the same time these are businesses designed, initially, to meet regional demand and, later, to expand into new consumer markets in Brazil and abroad.

In this sense, to show in concrete data the businesses that grew the most and those that lost strength in the western region of Santa Catarina, we use the records from the IBGE Central Business Registry. In a historical series, without considering the size of the companies (small, medium or large), in nineteen different economic segments it is possible to note the difference in behavior in the creation and closing of new businesses, depending on the economic sector addressed. Thus, in table 1 it is

possible to see this behavior between the years 2006 and 2019, considering the data from the 118 municipalities of the western mesoregion of Santa Catarina.

Year Number of companies by sector	2006	2008	2010	2012	2014	2016	2018	2019	(%) variation 2006-2019
Electricity and gas	22	45	52	60	60	68	89	201	813%
Real estate activities	187	228	338	449	620	691	847	1,364	629%
Financial, insurance and related services activities	318	330	351	346	455	513	624	1,130	255%
Civil construction	903	1,116	1,711	1,994	2,490	2,522	2,588	3,129	246%
Professional, scientific and technical activities	1,115	1,277	1,612	1,689	1,953	2,246	2,612	3,167	184%
Human health and social services	969	1,147	1,234	1,337	1,467	1,637	2,008	2,420	149%
Education	743	735	798	617	700	1,263	1,334	1,417	90%
Administrative activities and complementary services	1,609	1,725	1,828	1,863	2,152	2,225	2,465	2,794	73%
Information and communication	548	500	608	657	737	736	756	872	59%
Public administration, defense and social security	243	250	293	316	346	357	388	371	52%
Water, sewage, waste and decontamination activities	95	109	120	118	120	104	131	145	52%
Transport, storage and mail	4,831	4,839	5,389	5,727	6,720	6,322	6,154	6,513	34%
Agriculture, livestock, forestry, fishing and aquaculture	490	501	516	510	538	495	473	598	22%
Manufacturing industry	5,061	5,196	5,671	5,479	5,681	5,507	5,577	5,972	18%
Extractive industries	42	40	50	49	59	53	47	47	12%
Trade, repair of vehicles and motorcycles	18,763	19,471	20,194	19,380	19,437	18,052	17,648	18,410	-0.2%
Arts, culture, sports and recreation	1,339	1,447	1,388	1,326	1,225	1,141	1,127	1,118	-19%
Accommodation and food	2,899	2,979	3,124	2,637	2,583	2,341	2,259	2,280	-27%
Other service activities	5,745	5,676	5,831	5,748	5,094	3,449	2,846	2,692	-113%
Total	**45,922**	**47,611**	**51,108**	**50,303**	**52,473**	**49,722**	**49,973**	**54,640**	**19%**

Table 1 - Evolution of the number of companies by sector of the economy in the western mesoregion of Santa Catarina (2006-2019). Source: IBGE, Central Business Register, 2019.

As shown in table 1, the western region of Santa Catarina went from 45.9 thousand companies in 2006 to 54.6 thousand companies in 2019, a growth of 19% in the period. The significant growth that occurred between 2018 and 2019 stands out, when almost 5 thousand companies were created in the

region. This occurs immediately after the approval of the labor reform in the national congress in November 2017, which established flexibilities in labor relations while simultaneously encouraging the creation of individual companies. However, the distinct behavior that occurred between the economic sectors in table 1 is noteworthy.

Between 2006 and 2019, the electricity and gas sector grew from 22 companies to 201 companies (813% growth). The real estate sector grew from 187 to 1,364 companies (an increase of 629%). Both the electricity and gas sector and the real estate sector showed uninterrupted growth over the period. There was also growth in the following sectors: financial activities, insurance and related services (255%); construction (246%); professional, scientific and technical activities (184%); human health and social services sector (149%); education (90%); public administration, defense and social security (52%); administrative activities and complementary services (73%); information and communication (59%); transportation, storage and mail (34%); water, sewage, waste and decontamination activities (52%); agriculture, livestock, forestry production, fishing and aquaculture (22%).

In addition, table 1 shows that the number of companies fell in four sectors, most notably the other activities and services sector, which lost more than 3,000 companies (-113%); the accommodation and food sector saw a 27% drop and the arts, culture, sport and recreation sector saw a 19% drop in the number of companies.

According to the data in Table 2, despite the fact that there is a significant presence of companies in the agri-food sector, we can go further, as long as we take into account the fact that large companies, by investing in process and product innovation, in conquering new markets (national and international), in productivity gains and in expanding processing capacity, have allowed different chains of new businesses to emerge and develop in the region.

Companies in the machinery and equipment sector (e.g. Torfresma, in São Miguel do Oeste), innovation in the energy sector (e.g. Renovigi, in Chapecó), among others; are examples of the spillover of regional capital to other productive sectors, in other words, to make up a process of constituting regional geo-economic complexity.

Table 2 shows a certain balance in the resident population (around 250,000 inhabitants), GDP (around BRL 10 billion) and bank branches (around 30) of the agglomeration economies of Concórdia and Joaçaba, São Miguel do Oeste and Caçador and Videira. Unlike the agglomeration economy of Chapecó and Xanxerê, which has more than 500,000 inhabitants, a GDP of BRL 20 billion and 57 bank branches. In this way, the first three economies of agglomeration mentioned converge towards economic complementation in relation to Chapecó, when it comes to access to more specialized services and activities, such as: the airport, bank branches of specific banks, medical specialties, among others.

For these reasons, the city of Chapecó attracts investment, especially in the real estate sector, since it has the largest supply of specialized services in the region for projects, construction work and the finishing and refinement of construction products. As a result, the economic agglomeration of Chapecó and Xanxerê stands out due to regional growth that converges on its urban centrality.

The economic sectors shown in table 1, beyond the variations signaled by the increase or decrease in the number of companies, are interdependent and together constitute the driving force behind regional geo-economic agglomerations. In this sense, it is corroborated by Lins (2017), as the central structure of capital origin linked to agribusinesses was preserved, but there were gains in productive diversification, since other sectors showed growth after 2005, such as the dairy, electric energy, construction, furniture, and real estate sectors. This diversity of sectors, which together present the content of regional geo-economic complexity, can be better understood when presented (Table 2) within the four agglomeration economies identified in the Western Santa Catarina mesoregion, as shown in Table 2 (the identification of the four agglomeration economies in the western mesoregion of Santa Catarina is not closed, rigid, or preclusive of repositioning one municipality or another to one agglomeration economy or another. Instead, it is the result of the interpretation of a set of geo-economic data, which intertwined the degree of dependence and hierarchy of municipalities concerning the role of centrality that companies in the region exert over one another in various economic activities and services. The presence of bank branches serving the population was considered in the case of services (von Dentz, 2022). Regarding economic activities, the largest companies in the region (Grupo Amanhã, 2019) and the number of companies in each municipality (IBGE, 2020) were considered).

Agglomeration economies	Resident population (2019)	GDP (x thousand, 2018)	Bank branches (2020)	Total number of companies (2019)	Main sectors in which companies operate
Caçador and Videira (Caçador, Videira, Fraiburgo, Treze Tílias, Lebon Régis, Tangará, Água Doce, Arroio Trinta, Salto Veloso, Rio das Antas, Ibicaré, Pinheiro Preto, Calmon, Matos Costa, Iomerê, Ibiam, Macieira). 17 municipalities	237,644	9,294,314	27	20,211	Timber and forestry, leather and footwear, paper and cellulose, plastics and rubber, machinery and equipment, energy, water and sewage services.
Concórdia and Joaçaba (Concórdia, Joaçaba, Capinzal, Piratuba, Herval d'Oeste, Catanduvas, Vargem Bonita, Ipumirim, Itá, Irani, Ponte Serrada, Xavantina, Luzerna, Ouro, Erval Velho, Passos Maia, Arabutã, Jaborá, Lindóia do Sul, Lacerdópolis, Peritiba, Ipira, Alto Bela Vista, Presidente Castello Branco). 24 municipalities	256,416	10,632,791	31	25,486	Food and drink, transport and logistics, health, construction and real estate, timber and forestry, animal nutrition, energy, tourism and hotels.
Chapecó and Xanxerê (Chapecó, Xanxerê, São Lourenço do Oeste, Pinhalzinho, Xaxim, Seara, Abelardo Luz, Faxinal dos Guedes, São Carlos, Quilombo, Coronel Freitas, São Domingos, Saudades, Nova Erechim, Guatambu, Cordilheira Alta, Modelo, Águas de Chapecó, Nova Itaberaba, Ipuaçu, Galvão, Águas Frias, Vargeão, Planalto Alegre, Caxambu do Sul, Bom Jesus, Serra Alta, Saltinho, União do Oeste, Formosa do Sul, Arvoredo, Jupiá, São Bernardino, Marema, Santiago do Sul, Sul Brasil, Jardinópolis, Novo Horizonte, Irati, Cunhataí, Coronel Martins, Entre Rios, Ouro Verde, Lajeado Grande, Paial). 45 municipalities	538,963	20,912,287	57	59,770	Production cooperative, food and beverages, wholesale and retail trade, paper and cellulose, leather and footwear, finance, automotive, energy.
São Miguel do Oeste (São Miguel do Oeste, Maravilha, Dionísio Cerqueira, Itapiranga, Palmitos, Cunha Porã, São José do Cedro, Campo Erê, Iporã do Oeste, Mondaí, Guaraciaba, Descanso, Palma Sola, São J. do Oeste, Guarujá do Sul, Caibi, Anchieta, Riqueza, Tunápolis, Iraceminha, Romelândia, Paraíso, Belmonte, Santa Helena, Bom Jesus do Oeste, Santa Terezinha do Progresso, Bandeirante, Princesa, Tigrinhos, Flor do Sertão, Barra Bonita, São M. da Boa Vista). 32 municipalities	261,205	9,289,543	30	26,541	Cooperative for production, furniture, timber and forestry, energy, machinery and equipment.
Total	1,294,228	50,128,935	145	132,008	-

Table 2 - summary of geo-economic data on agglomeration economies in the western region of Santa Catarina. Source: IBGE (2019); IBGE (2018); Febraban (2020).

Figure 3 shows the spatial outline of the four agglomeration economies shown in Table 2, the importance of the municipalities in each agglomeration economy based on the number of companies and their productive sectors. Figure 3 also allows the quality of life to be identified by the coloring of the municipalities (UNDP, 2010). Figure 3 is shown below.

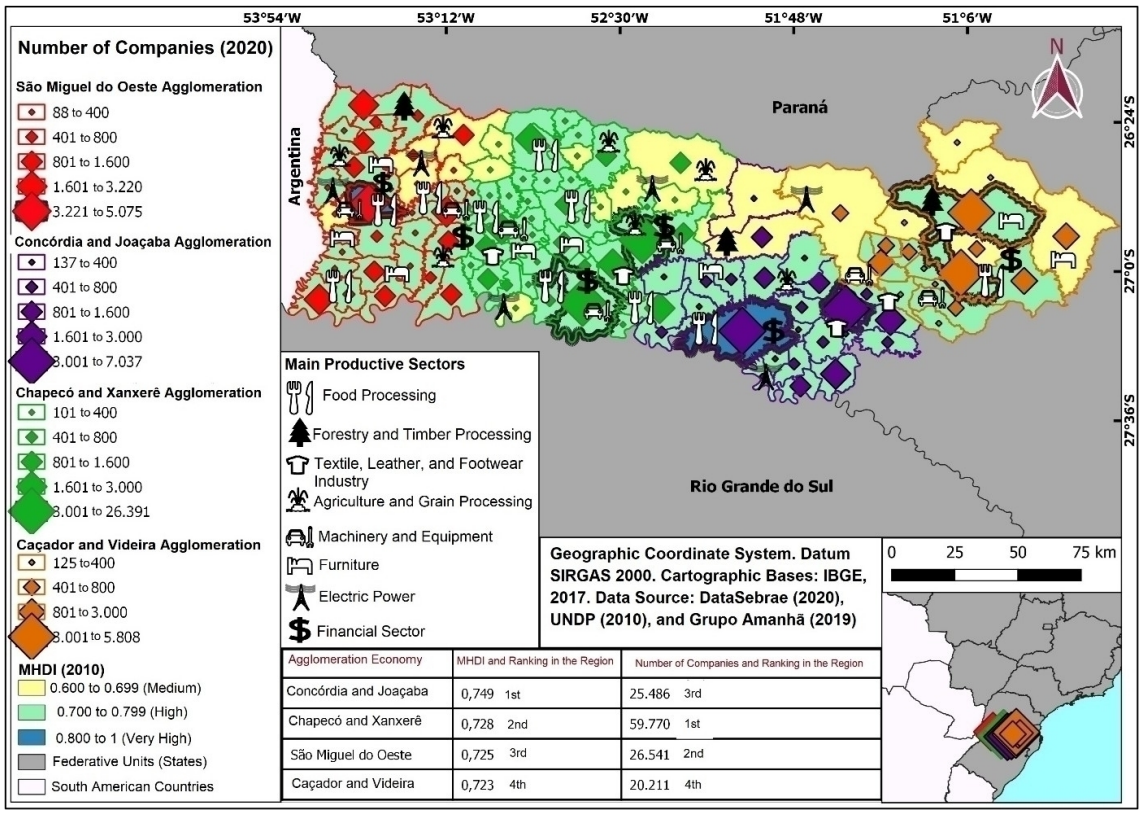

Figure 3 - Spatiality of agglomeration economies in western Santa Catarina: number of companies (2020), MHDI (2010) and main productive sectors (2019). Source: DataSebrae (2020), UNDP (2010) and Grupo Amanhã (2019). Adapted from von Dentz (2022).

According to figure 3, the quality of life in the four agglomeration economies (UNDP, 2010) points to a certain similarity in the figures, so that all of them have an MHDI between 0.700 and 0.799 - considered high human development by the UN-UNDP. However, the agglomeration economies of Concórdia and Joaçaba had the best quality of life in the region (average of 0.749). Caçador and Videira were the agglomeration economies with the lowest MHDI (average of 0.723).

Furthermore, the location of the companies in the different agglomeration economies shows a productive characterization of the western region of Santa Catarina that goes beyond the usual food production (Figure 3). The following sectors stand out: electricity, furniture, machinery and equipment, forestry and wood processing, textiles, leather and footwear, and the financial sector. This shows capitalism's ability to spread companies across the region, but with a disproportionate amount of land in the regional space, i.e. there is an unequal character impregnated in the space when we start from the variable "number of companies" and their location. Smith (1998, p. 188) points out that "location theory begins with the assumption of a given differentiated landscape, and then examines the local decisions of individual companies. To the extent that the localization structure - the geography of capitalism - is seen as historically changeable, this change is treated as the arithmetic sum of these decisions." Hence the relevance of studies on business decisions, which are different depending on the sector in which they operate and their location, since sector dynamics differ and are in a constant process of transformation.

The agglomeration economy of Concórdia and Joaçaba includes the food sector, but also transportation and logistics, health, real estate construction, timber and forestry, tourism and hotels, animal nutrition and energy. In the agglomeration economy of Caçador and Videira, companies in the timber and forestry, paper and cellulose, leather and footwear, plastics and rubber, machinery and equipment, energy and water and sewage services sectors stand out. In the agglomeration economy of Chapecó and Xanxerê, the most powerful from an economic point of view, companies in the food sector, production cooperatives and wholesale and retail trade stand out; however, the energy, paper and cellulose, leather and footwear, financial and automotive sectors also stand out. Finally, in the

agglomeration economy of São Miguel do Oeste, companies in the furniture, machinery and equipment, production cooperative, energy and timber and forestry sectors stand out (Figure 3).

In view of this, empirical analyses, in line with the theoretical discussion of central-radial industrial districts (Markusen, 1995), require a certain number of companies or industrial units of greater economic importance that act as key firms. These firms act as hubs for the regional economy, attracting numerous suppliers and other related activities to their surroundings. Hence the idea that, in the new regional economic geography, it is necessary to study the role of these firms in order to understand regional geo-economic dynamics, which are no longer simplified, but have an interesting degree of productive complexity. Consequently,

> If these enterprises develop to the point of creating a critical mass of services and skilled jobs, we can expect a process of diversification in which the new firms would benefit more from the economies of urbanization and agglomeration that now exist than from greater proximity to the district's core activities. Center-Radial Districts can thus exhibit both a firmer web of connections - in which small firms are highly dependent on the demand or supply of the most important ones - and a more nuclear character, when those firms fundamentally take advantage of the agglomeration economies provided by the district's hub firms, without necessarily having them as buyers or suppliers (MARKUSEN, 1995, p. 22).

Therefore, large companies with headquarters or branches in western Santa Catarina, such as Aurora Alimentos, BRF Brasil Foods, Cooperativa Alfa, Guararapes Papéis, Dass confecções, Torfresma, Renovigi, among others, fulfill the functions explained by Markusen (1995), in that they attract new companies linked to their sectors of activity or in new sectors. Depending on the variety of companies present in the regional geo-economic complexity, they can be dominated by many large, vertically integrated firms in one or more sectors. In the western Santa Catarina, it was possible to see that there are a variety of economic sectors in which the main companies operate, which means that the region is dominated by several companies, including in the agri-food sector itself, which is the strongest. In view of this, the inclusion of actors and their behavior under constraints in regional analyses becomes indispensable if economic geographers and regional economists want to go beyond the mere description of the regional scenario. The idea is that, under certain limitations, the article developed here on geo-economic complexity may have contributed to this perspective.

CONCLUSIONS

In light of the above, we would like to highlight four final considerations, which are not closed, but are in motion, as is the economic and social reality of a given geographical space:

1) There is a geo-economic complexity in the different productive sectors of the western region of Santa Catarina, which is reflected in the diversification and, at the same time, the specialization of regional production.

2) The agglomeration economies of the western region of Santa Catarina were formed on the basis of a production matrix based on agribusiness, but today it goes beyond this as the use of technology in production processes intensifies and provides for the transfer of capital to other sectors. This is why regional agglomeration economies serve as forces for expansion, both contiguous (close) and non-contiguous (distant), based on the spread of different businesses across the region's cities, as a result of the strategic thinking of companies to materialize their activities. Thus, a given company may be based in Chapecó, but have branches throughout the region and even beyond the regional scope analyzed here.

3) The emergence of new businesses has deepened the degree of regional complexity, yet there is still room to increase productive development. This is one of the factors that companies are hoping for in the future, namely to increase the sophistication of their products and to reach new national and international markets. However, there are challenges to this, such as product certification, adapting to the standards of the new consumer demands, sanitary adjustments (especially in the agri-food segments), among others. The demand for new private investment is a challenge that stands out, as it involves innovations for new processes and products.

4) The geo-economic complexity of western Santa Catarina is characteristic of a region that has developed in a country on the periphery of the capitalist system. Therefore, it is a complexity that has not yet developed the most advanced technology to produce microchips, semiconductors and even the machines that are used inside the production units.

From this point of view, grasping the geo-economic complexity of regional economic dynamics, as we have tried to do in the west of Santa Catarina, involves an effort to revisit the history of attempts to understand regional economic dynamics. However, recent dynamics have greatly changed the production complexes, which prevents the old readings from being considered the most appropriate for understanding the geo-economic complexity of today. There needs to be a constant effort to improve analytical skills, otherwise economic geography will be stuck with what has already happened to explain what is now happening, i.e. the advances incorporated by the production complexes, whether technical, scientific or informational.

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Von Dentz, E. - The author contributed to the elaboration, realization and manipulation of data and writing
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