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Global Competitiveness of Trade in the West Coast of Sumatra from the Perspective of the Agglomeration of Economic Approach

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Abstract

The main aim of this study is to analysed the pattern of agglomeration of trade flows in the city of Padang and Teluk Bayur Port with the regencies and cities along the west coast of Sumatra, as well as the factors that influence them. How competitive is trade flow with the West coast region compared to the East coast of Sumatra. The analytical approach used is spatial econometrics, especially the spatial lag model and spatial error model. The data used is the volume of loading and unloading of inter-island and foreign ships at Teluk Bayur Port and other districts and cities in 133 areas on the West Coast and 155 districts and cities in the economic corridors of Sumatra. The results showed that the West Coast trade flow variable had no significant effect on the existence of Padang City as the centre of economic agglomeration in the economic corridor area of Sumatra. Our findings are that trade flows in the city of Padang have not been able to encourage economic agglomeration in regencies and cities on the West Coast of Sumatra, on the contrary there are connections with regencies and cities in the economic corridors of the East Coast of Sumatra. Therefore, to accelerate the process of economic agglomeration through trade flows, joint policies are needed with the agricultural sector in the Sumatran economic corridor in facing global market competition, as well as strengthening inter-regional internal markets in the Sumatra corridor, agricultural commodity transactions between regencies and cities in the Sumatran economic corridor which must be strengthened, so as to be able to compete in a competitive global market.

JEL Classification: F14, P25, C21

Keywords

Trade flow, economic agglomeration, spatial models.

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Introduction

The gravity model of inter-regional trade flows was first put forward by Tinbergen (1962) and Lineman (1966) by determining the interaction of trade in goods and people or in the form of exports or imports between one region and another (Dresdner and Zerom, 2021). The trade gravity model has become increasingly popular since Krugman (1991) argued that the problem of geographical vulnerability influences the flow of trade in goods and people within an area. Research on gravitational graph models has become increasingly popular in regional scientific circles since (Asselin and Griffith, 1988), with analysis of spatial effects and spatial dependencies (Krugman et al., 1999). This is also in line with research from trade theory itself, which since Leontief (1963) has developed multiregional independence research that emphasizes the four concepts of trade structure analysis namely dependence, interdependence and hierarchy, as well as the spatial hierarchy of trade flows and the spatial flow of trade (Fujita and Hamaguchi, 2001), the strong impetus of agglomeration of trade flows in driving regional trade competitiveness (Bolduc et al., 1992; Parr et al., 2002; Guillain and le Gallo, 2010; Bergeijk and Brakman, 2010).

The interrelationship between location theory and trade has long been analysed by using economic interactions at a level of geographic space such as: regional, multiregional, national and international (Polenske and Hewing, 2004). This view has been dominated by a spatial analysis often referred to as the “first law of geography”(Tobler, 1987;

Vaz, 2020), which states that a region is always related to another region, and areas that are closed together tend to have closer proximity intense than the others. A measure of the proximity and interaction of a region with other regions uses a weighting matrix that measures the degree of interaction between neighbouring areas. The weighting matrix can be specified in various ways, the most popular is the contiguity matrix, with the most frequently used measurement methods being the Moran Index and the local index spatial autocorrelation (LISA) (Porojan, 2001). This study aims to analysed trade flows between regencies and cities in Sumatra's economic corridor through the approach of spatial effects and spatial dependence on agglomeration patterns of trade flows formed in global trade competition. Using the Moran and LISA indices to measure the proximity of districts and cities to Sumatra's economic corridors, as well as analysed the factors that affect their global competitiveness.

Trade routes in the West Coast of Sumatra, especially the Coastal Area of the province of West Sumatra today, have become international trade routes since the sixteenth century ago, with trading commodities in the form of gold, pepper, rice, dried fish, silk cloth, resin, camphor, brown sugar, raw tobacco and so on. (Kathirithamby, 1969; Kato, 1978; Kato, 1980; Kuzmina, 2008; Xinru Liu, 2010; Dobbin, 2016). Pariaman City and Tiku Harbour are the most active trading ports in connecting land trade routes (silk route) which supply the main commodities of gold and spices from the Minangkabau hinterland areas such as Sicincin, Padangpanjang, Pagaruyung, Salimpaung, Rao-Rao, Saruaso with international trade routes by sea with traders from Aceh, Gujarat (India) and the Portuguese in the Straits of Melaka (Dobbin, 2016). Meanwhile, Teluk Bayur, Indropuro, and Salido ports in the south are trading ports that have intense trade with Air Bangis, Sibolga in North Sumatra province, Singkil and Barus in Aceh province. This is the international trade route that has been going on around the XVII century with Portuguese, Indian and Arab traders, better known as the Silk Road. The involvement and hegemony of the West Coast Harbour area of West Sumatra; starting from the South, Port of Indrapuro, Salido, Teluk Bayur, Pariaman, Tiku, to the northernmost coastal area, namely Air Bangis in playing an important role in international trade routes in the West Coast Region of Sumatra, with Aceh, Gujarat, the Malacca Strait, and even up to Sunda Kelapa Harbour in Banten.

However, at this time, its role as a trade centre for the West Coast region has begun to diminish with the lack of integration of trade in the interior of West Sumatra with other regencies and cities, and the lack of integration of trade in West Sumatra with other cities and towns the economic corridor of Sumatra and ASEAN, so that the trade competitiveness of the main commodities of the province of West Sumatra is low and its economic value added is captured by external regions and neighbouring countries (Ansofino et al., 2019; Ansonfino et al., 2021). The factor causing the uncompetitive trade of the main commodities of the province of West Sumatra in the economic corridor area is due to the low added value of the commodities produced, so that this added value is captured by external trading partners in the trading system. Therefore, to increase regional and global economic competitiveness, it is necessary to encourage the development of economic agglomeration (Ansofino, 2021). Economic agglomeration is an economic activity carried out by several industrial companies or several regions located in the same location, so that they provide mutual benefits to each other due to decreased transportation and production costs, and costs for trade and export activities between regions (Bikker, 1987; Frenken et al., 2007; Porojan, 2001).

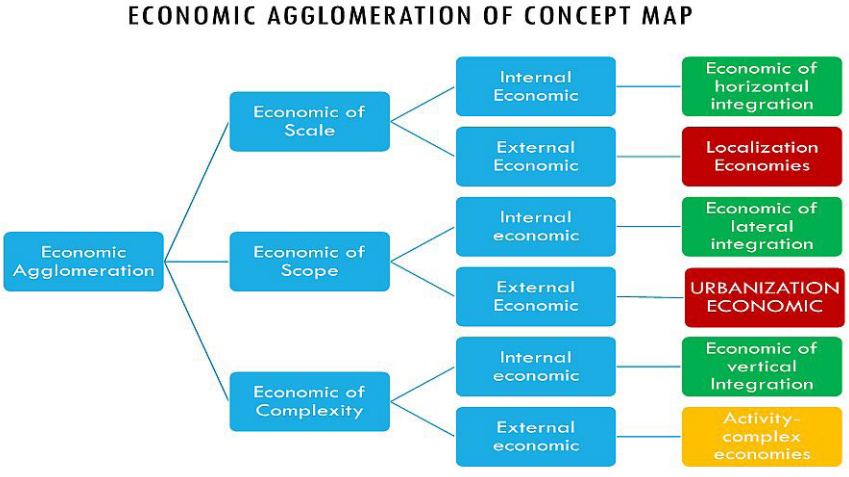
The integration of trade between the hinterland and the West coast of Sumatra as a gateway to the outside world, especially with other districts and cities along the West Coast of Sumatra, had been going on long before the arrival of the Dutch colonials (Dobbin, 1974; Kato, 1980). However, at this time, trade interactions with neighbouring areas in the West Coast Region of Sumatra, where there are 25 districts and cities among 155 districts and cities on the island of Sumatra, are still low.

This study wants to reveal how the patterns of trade integration and agglomeration between regencies and cities in the West Coast of Sumatra have been so far? What are the factors that determine the spatial agglomeration activities of leading commodity trade between regencies and cities in the West Coast Region of Sumatra? What are the leading commodities that are the mainstay in regional trade between regencies and cities in the West Coast Region of Sumatra? How is clustering formed based on the trade of the leading commodities of each district and city in the West Coast of Sumatra? How is the strength of clustering competitiveness based on the superior commodities

in the West coast of Sumatra, able to compete in international trade? how this competitiveness and cooperation can improve the economic competitiveness of the West Coast region of Sumatra. It is hoped that by analysing all the problems raised, using spatial analysis and using the economic agglomeration approach through analysis of spatial concentration and spatial distribution of trade integration activities in the West Coast of Sumatra, policy proposals can be formulated in increasing the competitiveness of the West Coast region's economy in the trade constellation. regional and global.

Economic activity at a certain location tends to lead to stability in an area where the spatial configuration of economic activity can be traced through the two forces that make it up, namely the agglomeration force (centripetal), and the dispersion force (centrifugal) (Fujita and Thisse, 1996; Guillain, 2010). These two forces are believed to accelerate the renewal of regional economic development, and the structural transformation of the regional economy (Parr et al., 2002). In relation to regional trade, the root for the occurrence of economic agglomeration is that it begins with trade integration, either horizontally, laterally or vertically (Porojan, 2001; Parr et al., 2002; Bergeijk and Brakman, 2010; Peng et al., 2006). Vertical integration refers to the dimensions of the operational size of a company or economic business, which reflects the internal economy of scale or increasing returns, or more generally the unit cost of output is decreasing function of scale. Lateral integration refers to the multi-product of a company or economic enterprise and its expansion depends on the internal economic scope. This refers to the fact that the production of two or more products, is produced at a lower total cost among individual firms, then that product diversity results from the sharing of inputs among firms. While Vertical integration is the involvement of a company in relation to other companies in various processes and stages of production, in this case internal economic of complexity is a force that directs a company to produce stages of production of a product or goods that are produced or traded, meaning that several stages of production are carried out by a separate company (specialized firm) (Parr et al., 2002).

The study of patterns of trade integration patterns both horizontally, laterally and vertically is based more on the economic approach of the business scale of one company or several companies. At the time of increasing economic scale of business (increasing return) and increasing multi-output by several companies (economic of scope) at one location or several locations, it has become a geographical economic study, because it is related to the spatial proximity of activities. particular economy, which is an important feature in the concept of economic agglomeration. An internal economic (economic of scale) and external economic (economic of scope), is only seen as an economic agglomeration if there are co-location and concentration of production constraints are met (Parr, 2002). In the Figure 1, the study of regional trade in the West Coast of Sumatra is traced from the window or economic agglomeration approach by referring to the theory of economic localization, economic urbanization, and economic



Source: inferred from J. Parr et al. (2002)

Figure 1: The Concept of Economic Agglomeration in the Case of Regional Trade in the West Coast of Sumatra.

complexity in the regional context of the Sumatran economic corridor area. Regional trade referred to in this study is trade in the main commodities traded between regencies and cities that have carried out regional trade with agricultural commodities such as rice, horticulture, capture fishery products, including processed fish products such as dried fish and so on, as well as forestry products such as rubber, palm oil, Gambhir and so on. The selection of this trading commodity begins with analysing trade commodities which are currently the mainstay of regional trade and have long roots since the pre-colonial and colonial times and until now.

Materials and methods

In relation to mutual trade relations between different regions, it can be analysed through a gravity model approach. The amount of trade flow between districts and cities will be inversely proportional to the distance, the farther the distance, the lower the intensity of trade between regions, and vice versa, so that adjacent areas will group together in one trading activity.

The gravity model of the flow of trade between regions was first proposed by Tinbergen (1962) and Linnemann (1966) by determining the interaction of trade in goods and people or in the form of exports or imports between one region and another (Bikker, 1987; Porojan, 2001; Behar and Nelson, 2014). The gravity trade model has become increasingly popular since Krugman (1991) suggested that the problem of geographical proximity affects the flow of trade in goods and people within a region. Research on the gravity trade model has become increasingly popular among regional sciences since Anselin and Griffith (1988) included it as a very important location role model which has so far made standard econometric analysis techniques fail to overcome the autocorrelation problem, resulting in biased estimates, has been successfully overcome with the spatial auto regressive model and the spatial lag model (Anselin and Griffith, 1988; Cainelli et al., 2014; Griffith, Chun and Li, 2019b; Johansson and Quigley, 2003).

The initial contribution of the gravity model to the trade flow of two regions as suggested by Tinbergen (1962), Linnemann (1966), Bergeijk and Brakman (2010), the model itself can be applied to various phenomena, but the earliest application is to bilateral trade flows which take the form of the equation is as follows:

$$T_{ij} = \frac{GDP_i^{\alpha} GDP_j^{\beta}}{D_{ij}^{\theta}} \quad (1)$$

Where T_{ij} shows bilateral trade between region i and area j. The economic size index in region i, measured by GDP_i, D_{ij} is a measure for the bilateral distance between the two regions i, and j, while the parameters, and I are estimated through linear logs through model estimation. So that equation (1) above is able to explain bilateral trade using economic measures and distance. Where the larger the size of the economy between trades, the greater the trade flow. On the other hand, the farther the distance between the two regions, the lower the bilateral trade.

The gravity trade model describes the flow of goods or people from region i to region j, symbolized by (F_{ij}) as a function of the characteristics of the origin region (region i) by the symbol (O_i), the characteristics of the destination region symbolized by (D_j) and several measurements separation, in the symbol with (S_{ij}) (Porojan, 2001). The formula is as follows:

$$F_{ij} = g[O_i, D_j, S_{ij}] \quad (2)$$

This model was later developed by Zhang and Kristensen (1995), using the law of universal gravity, emphasizing that trade increases with increasing volume and the proximity of partner territories, so that the bilateral trade model takes the following form:

$$F_{ij} = X_{\beta} + \varepsilon, \qquad \varepsilon \sim N(0, \sigma^2) \quad (3)$$

$$F_{ij} = \rho W F_{ij} + X_{\beta} + \varepsilon \quad (4)$$

Where X is a vector of explanatory variables which can be in the form of an estimate of the size of two regional economic conditions in the form of GDP, GDP per capita, Exports, Imports and the distance between the two regions; can be in the form of transportation costs, and other forms of trade disruption. This study uses a trade flow model between regencies and cities in the Sumatran economic corridor, especially exports and imports of marine products between 155 regencies and cities in the Sumatran economic corridor.

Furthermore, this study also looks at the influence of two types of spatial effects: spatial dependence and heterogeneity (Porojan, 2001; Anselin, 1988; Anselin and Rey, 2012; Anselin and Arribas, 2013). This exploration is problematic for regression models using the ordinary least square (OLS) method, which is related to heteroscedasticity

and spatial autocorrelation problems which can generally cause misspecifications in the model, due to the presence of spatial autocorrelation and heterogeneity in the residuals from OLS estimates. Therefore, facing spatial autocorrelation and spatial dependence, (Griffith et al, 2019a; Kelejian and Piras, 2017), the spatial econometric model can overcome this by adding a weight contiguity matrix to the error term multilateral trade flow equation in equation (4) above, so that it becomes as follows:

$$\varepsilon = \lambda W_{\varepsilon} + \mu, \qquad \mu \sim (0, \sigma_{\mu}^{2} I) \tag{5}$$

$$ln\left(T_{ij}/Y_i E_j\right) = (1 - \sigma)t_{ij} + \alpha_1^{i} D^{i} + \alpha_2^{j} D^{j} + \\ + 1\text{-}\lambda W)^{-1}\alpha_3 \varepsilon_{ij} \tag{6}$$

where the null hypothesis is = 0, if the parameter is statistically different from zero, it will have the implication that the size of the trade flow of a region will affect the size of the trade flow of its neighbouring region, only if the trade flow of the neighbouring region is above the normal average. So it is clear that, is the coefficient of autoregressive error term, when W, represents a weighting matrix, which measures the degree of potential interaction between neighbouring regions (Pons and Marsal, 1999; Anselin et al., 1996). Matrix W, can be estimated in various ways (see Anselin, 1988; Bolduc, et al., 1992). This study uses a more popular formulation, namely the Moran index, which is a matrix that measures spatial dependence between regions that are geographically close. Moran's index value is positive and significant, positive spatial autocorrelation which indicates that the area interacts spatially.

$$I_n = \frac{\sum_{i=1}^{m}\sum_{j=1}^{m} w_{ij}(x_i - \bar{\mu}_x)(x_j - \bar{\mu}_x)}{\sum_{i=1}^{m}(x_i - \bar{\mu}_x)^2}$$

$W_{ij}^{*} = \left(W_{ij}/\sum_j W_{ij}\right)$ where $W_{ij} = 1$ for countiguous countries,0,otherwise (7)

The data used by this study for the contiguous matrix (W_{ij}) is data on trade in marine products in the economic corridor of Sumatra. Therefore, this study uses several measurements of spatial autocorrelation by comparing two types of information, namely: the similarity between the attributes, and the similarity between the locations. This spatial effect occurs, if a number of neighbouring units from the trading area in the Sumatra economic corridor affect each other directly, or the trade flow value of a region is determined by several other variables which are spatially correlated (Granovetter, 1973).

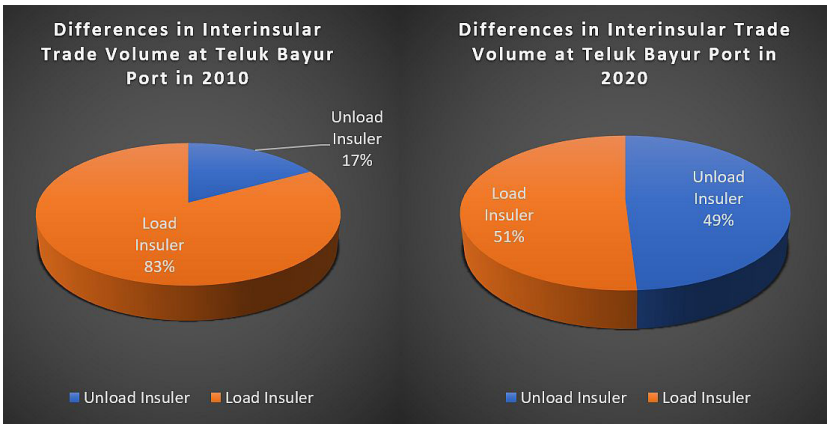
Furthermore, to measure the accuracy of the spatial model, both SLM and SEM, four indicators are used that can be considered when the ML approach is used, the four indicators are: (1). Pseudo R^2, (2) maximum likelihood (LIK), (3) Akaike information criterion (AIC) and Schwartz Criterion (SC). A good model (goodness of fit) is fulfilled if the Pseudo R^2 value, the LIK value is higher, while for AIC and SC, which have small values for a better model (Anselin, 2019; Putra, et al., 2020).

Result and discussion

Overview of Inter-Regional Trade in the West Coast of the Island Sumatra

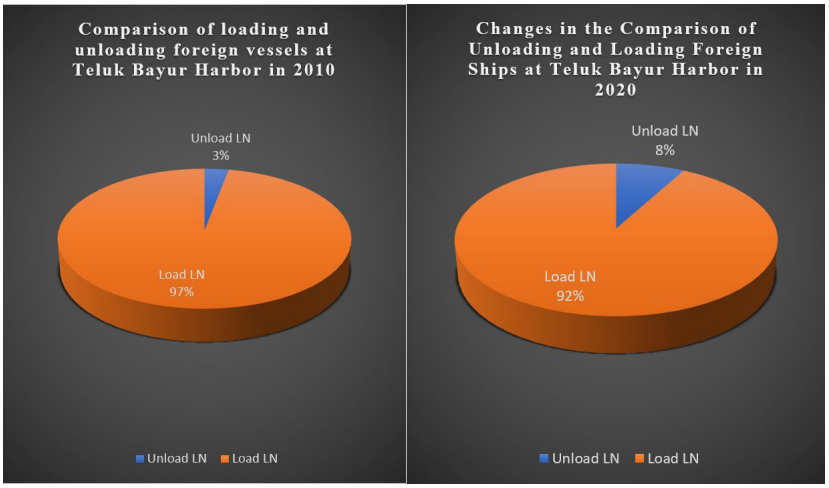
Trade between regions on the West Coast of Sumatra has long been going on, especially Teluk Bayur Port with ports along the West Coast of Sumatra, areas along the East Coast of Sumatra, even to the North Coast of Java. The main commodities that are the mainstay for this trade are rice, spices, rattan, dried fish and vegetables. Activities of Teluk Bayur Port as an important port on the West Coast of Sumatra, in the last ten years, loading and unloading activities at this port have shown an increasing trend, the activity of Teluk Bayur Port is more dominated by activities of loading goods on ships to be carried and traded at a number of ports. important on the East Coast of Sumatra and Java.

In 2010 until now, the busyness of Teluk Bayur Port has been dominated by loading and unloading activities for inter-insular vessels with a loading volume much larger than the loading and unloading activities. This means that the volume of goods transported outside the region (exports) is much greater than the volume of goods unloaded (imports), as shown in Figure 2 below, so that trade between regions has so far been a surplus. This indicates that the flow of trade between regions on the West Coast of Sumatra with other regions, namely the East Coast of Sumatra and the North Coast of Java is quite large and the trend is increasing from time to time. However, the trend of the volume of goods loaded (exported) during the last ten years has decreased. This means that the volume of trade in goods for the province of West Sumatra for inter-regional export activities tends to decrease and become increasingly in deficit after the COVID-19 pandemic, due to restrictions



Source: own calculation based on data the West Sumatra statistical centre bureau, 2022

Figure 2: Comparison of the volume of loading and unloading of inter-insular trade at Teluk Bayur Port during 2010 and 2020.



Source: own calculation based on data the West Sumatra statistical centre bureau, 2022

Figure 3: Comparison of the volume of loading and unloading of foreign vessels at Teluk Bayur Port during 2010 and 2020.

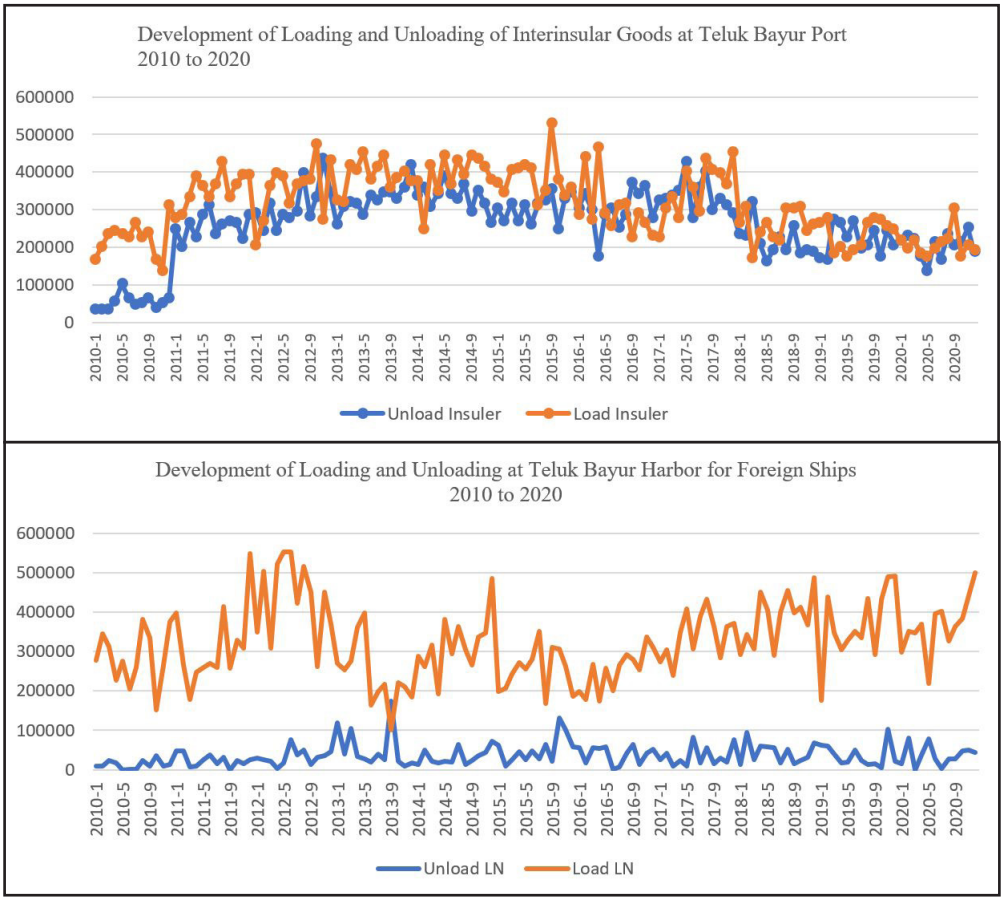
on large-scale community activities.

On the other hand, if we look at the developments over the last ten years, it turns out that the volume of cargo loading on inter insular vessels has changed drastically, as seen from the 2010 volume of goods loading on inter insular vessels, which decreased by 83% to 51% in 2020. This is presumably due to because of the lack of integration of inter-regional trade between the West Sumatra region and its neighbouring regions. Plus the impact of the implementation of large-scale social restrictions during the current COVID-19 pandemic.

In Figure 3 above it can also be seen that the loading and unloading activities of foreign ships at Teluk Bayur Port, actually looks less shaky, because the decrease in the percentage of shiploads on ships to overseas is not so significant the difference in the decrease, namely from 97% in 2010 it fell to 92% in 2020. Likewise for unloading activities, in 2010 by 3%, it will increase to 8% in 2020.

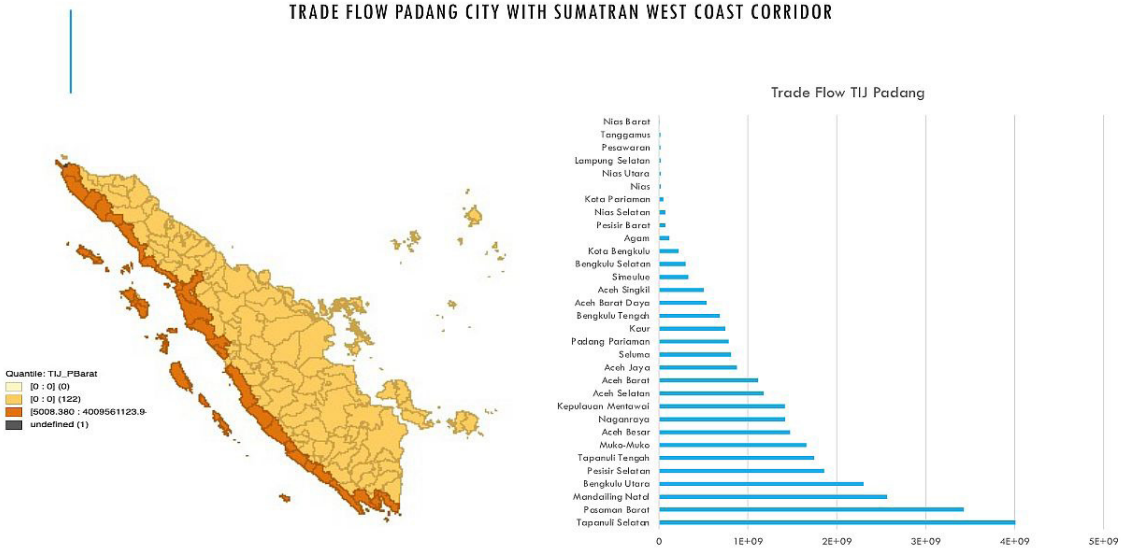
In Figure 4 below, it can be seen that there is a downward trend of loading and unloading of goods on inter-insular vessels at Teluk Bayur Harbour for the last ten years. On the other hand, unloading activities from inter insular vessels have shown an increasing trend over the last ten years. This means that the import or entry of goods from various ports in the archipelago has an increasing trend over the last ten years.

The flow of trade between the city of Padang and the area along the west coast of Sumatra with 33 regencies and cities along the west coast is dominated by the districts of South Tapanuli, West Pasaman, Mandailing Natal, to Aceh Besar and Nagan Raya (Figure 5). The city of Padang has Teluk Bayur Harbour, which has been built since



Source: own calculation based on data the West Sumatra statistical centre bureau, 2022

Figure 4: Trend of trading activities at Teluk Bayur Port for the last ten years.



Source: own calculations based on data from the Central Bureau of Statistics for each province on the island of Sumatra, 2022

Figure 5: Padang City trade flow hierarchy with regencies and cities along the West Coast of Sumatra.

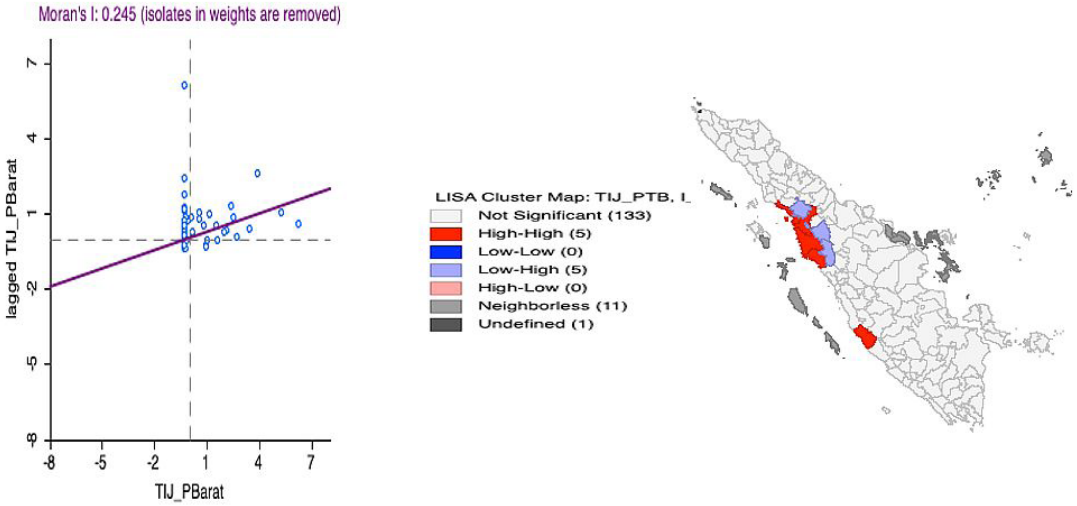
the Dutch colonial era, namely in 1893 under the name Emma haven. The main commodities transported at this port for loading and unloading activities are coal, cement, clinker, palm oil, cinnamon, tea, moulding, furniture and rubber, all of which are leading export commodities to the Americas, Europe, Asia, Australia and Africa.

Teluk Bayur Port is included in the working area of PT Pelindo II along with twelve other sea ports on the North Coast of Java Island and West Kalimantan. The interaction of this port with ports along the West Coast and East Coast of Sumatra is mainly with Sibolga Port, in Sibolga City, Panjang Port in Lampung, and Tanjung Periok Port in Jakarta. The West Coast of northern Sumatra is under PT Pelindo 1, which consists of sixteen main ports, especially the Malahayati Port, in Aceh Besar, Lhokseumawe Port, Lhokseumawe City, Gunung Sitoli Port, and Sibolga Port.

The flow of trade from Padang City, especially the flow of goods to the West Coast Region, turned out to be a spatial variable, as indicated by the statistical Moran Index value of 0.245, which is much larger than the standard size of 0.02, which indicates that an increase in the flow of trade in Padang City will have an impact in the surrounding area. The trade flow of the city of Padang has an effect on the surrounding area, especially the agglomeration effect. This reinforces the view of Parr and Hewing (2002) that economic agglomeration occurs because of the integration and externalities of economic activities in an area, so that districts and cities that form agglomerations with the Port of Padang City are areas that have a relationship with the flow of trade in agricultural products and processed agricultural goods. such as Mandailing Natal, South Tapanuli, Central Tapanuli and Muko-muko Regencies, as shown in Figure 6.

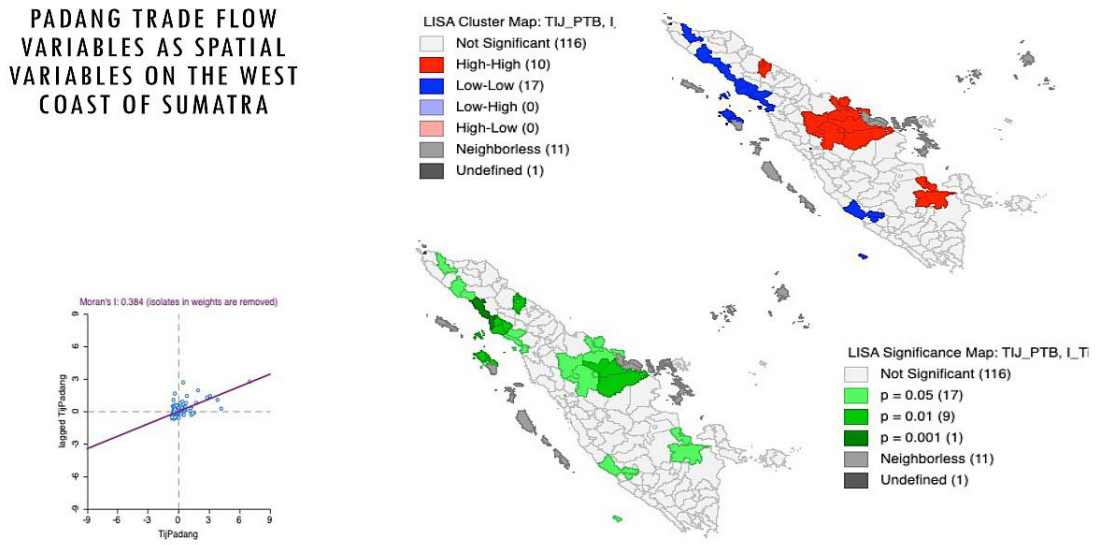
The local indicator spatial association map (LISA) in Figure 7 shows that there are 5 regencies and cities that have agglomeration links with Padang City in the HH category, namely West Pasaman, Mandailing Natal, South Tapanuli, Central Tapanuli, and regional Muko-Muko. There are 3 regencies that have environmental linkages, namely: Pasaman, Padang Lawas, and North Tapanuli. Apart from that, there are 11 areas on the West Coast of Sumatra which have absolutely nothing to do with Padang (less neighbours). This is in line with the study by (Guillain and le Gallo, 2010) which identified agglomeration patterns of economic activity around the City of Paris, areas that have a Lisa index in the HH and HL categories are clusters of economic activity.

Based on this LISA analysis, it can be stated that the Trade flow City of Padang is less related to the districts and cities on the West Coast, which amount to 33 districts and cities, the LISA indicator shows that the spatial dependencies between the districts of this city in regional trade are less related to each other. However, the results of the LISA trade flow analysis of Padang City with the Sumatra Economic Corridor area, there are 10 categories of HH, and 17 categories of LL. That is, the flow of trade in the city of Padang in the Sumatran economic corridor, not only



Source: own calculation based on data Trade Flow of Padang city

Figure 6: Matrix I Moran and Lisa Cluster Map West Coast of Sumatra.



Source: own calculation based on data from Padang trade flow variabel as spatial variable

Figure 7: Matrix I Moran and LISA Cluster trade flow of Padang City with Sumatra economic corridor Area.

with the West Coast area of the Sumatran economic corridor, but more dominantly with the Sumatran Economic Corridor, on the East Coast of Sumatra.

The spatial relationship of the Padang City trade flow is much greater with the East Coast Region of the Sumatran economic corridor area compared to the West Coast of Sumatra, this is indicated by the much higher Moran Index value of 0.384 which has a very significant spatial impact and the development of economic agglomeration between the regions. The city of Padang which has the Teluk Bayur Inter insular Port has a spatial concentration and spatial distribution with the surrounding area, the spatial concentration with the districts and cities along the West Coast is less concentrated and less related to the districts along the districts and cities on the West Coast of Sumatra, compared to the districts and cities along the East Coast of Sumatra.

Figure 7 above shows that the concentration and spatial linkages of the City of Padang as a trading centre in the Sumatra region on the West Coast are much higher with the regencies and cities in the economic corridors of Sumatra on the east coast compared to the spatial relationships with regencies and cities along the west coast of Sumatra. Therefore, to increase economic agglomeration in the West Coast region, the flow of trade between regencies and cities in the West Coast region must be intensified by developing its economic agglomeration, through strengthening and tightening trade in regional superior commodities between regencies and cities in the West Coast region of Sumatra. This is in line with the findings and recommendations of (Cainelli et al., 2014) who studied spatial agglomeration in Italy, where spatial agglomeration can be carried out through strengthening the specialization of local production systems while maintaining their respective comparative advantages.

Factors affecting Teluk Bayur Port trade flow with West Coast Region

The improvement of inter-economic linkages and integration between districts and cities in the West Coast of Sumatra trade area that needs to be done will of course be caused by a number of factors that condition it, as indicated in Tinbergen (1966), Zang and Kirstensen (1985) and Porojan (2001) namely GRDP, the distance between regions, the volume of trade, and other economic characteristics of the region.

The trade flow model for the West Coast Region can be analysed using the spatial regression method, because this model has a Moran Index value of 0.1594 which is much greater than 0.02, so this model can be estimated using the spatial regression method. The variables used in the estimation have a spatial value. So that applies Tobler's law (1977), adjacent areas will have a greater advantage, when compared to areas that are far apart. Supposedly, districts and cities located on the West coast of Sumatra, interact more and integrate with each other, but the City of Padang actually integrates and has greater connectivity with districts and cities located on the East coast of Sumatra. It is

certainly interesting to explore the factors causing it. Moreover, since the colonial period, the trade relations and interaction of this region in producing trading commodities, especially spices and marine products, have become the prima donna in regional trade.

The results of the analysis using regression using the OLS method indicate that the factors that affect the trade flow of Padang City with the surrounding area are the economic growth of the districts and cities in the West Coast Region of Sumatra with a coefficient value of 6.3985, significant at the 10% level. This model has a Moran Index value of 0.1594, the probability is significant. The LM Lag and LM error values also have a significant probability, so this model is better analysed using the spatial regression method using the spatial lag and spatial error methods.

Spatial regression analysis provides the advantage of being able to analyse the occurrence of autocorrelation and heteroscedasticity in the OLS model, as indicated by Anselin et al. (1988), by using spatial data, so that the occurrence of spatial autocorrelation provides our understanding, that there is an interaction between the sample data or the area that becomes the unit of analysis that has been carried out. So with data on trade flows between districts and cities in the West Coast Region of Sumatra, it can be determined patterns of concentration and distribution of trade flows between Padang City; which has Teluk Bayur Port, as a port that carries out loading and unloading of goods to the archipelago, called inter insular ships and ships that carry and carry goods abroad.

The flow of trade between the City of Padang with the regencies and cities along the West Coast of Sumatra is the first model to be modelled with a weighting matrix for the volume of goods transported through Teluk Bayur Port, Padang City to sea ports along the West coast such as Sibolga Port, Lhokseumawe, and Gunung Sitoli Harbour, Panjang Harbour. While in model 2, the spatial interaction between the trade flow of Padang City and its Teluk Bayur Harbour with regencies and cities in the Sumatran economic corridor area. The results can be seen in Table 2 below.

In the Table 2, in both models, the weighting matrix variable for the Padang City trade flow with the districts and cities in the West Coast

Trade flow model of Padang City with West Coast Region				
Variable	Coefficient	Standar Erorr	T Statistic	Probability
Constant	44.93	18.982	2.3667	0.0193
Trade	-3.3714	1.65167	-0.2041	0.8386
Induso	-5.8485	2.70964	-0.02158	0.9828
Agris	6.7055	4.0571	1.6527	0.10059
PDRB_HB	4.3724	1.7648	0.2477	0.8046
Aksess	0.1080	0.1375	0.7855	0.4335
Expen_Tot	1.2137	1.01907	0.1191	0.9054
Export	-1.1046	1.8765	-0.5886	0.5570
ECGrowth	6.3985	3.3909	1.8869	0.0612
Tij_PBarat	3.3298	6.1033	0.5455	0.58621
Moran I	0.1594 (0.00285)			
LM Lag	(0.01800)			
Robust LM	(0.89021)			
LM Error	(0.00753)			
Robust LM Error	(0.21092)			
LM (Sarma)	(0.02785)			
Breusch-Pagan Test	7.2910 (0.60685)			
R^2	0.06696			

Source: own calculation, 2022

Table 1: Regression results with OLS model.

The trade flow model of Padang City with the West Coast Region					Trade flow model of Padang City with Sumatra Economic Corridor			
Variable	Coefficient	Std Error	Z Value	Probability	Coefficient	Std Error	Z Value	Probability
W_TijPdg	0.1956	0.0896	2.1823	0.02908	0.1945	0.0897	2.1671	0.0302
Constant	42.005	18.6737	2.2494	0.02448	43.2239	18.6115	2.3224	0.0202
Trade	8.4992	1.5694	0.5416	0.58812	8.5208	1.5711	0.5423	0.5875
Induso	-1.8164	2.5714	-0.7063	0.4799	-1.8373	2.5741	-0.7137	0.4754
Agris	7.5304	3.8450	1.9585	0.05017	7.4603	3.8483	1.9386	0.0525
PDRB_HB	1.1378	1.6707	0.6811	0.4958	1.1473	1.6727	0.6858	0.4927
Aksess	0.0776	0.1303	0.5954	0.5515	0.0696	0.1298	0.5362	0.5918
Expen_Tot	-4.8521	9.6467	-0.0502	0.9599	-1.2185	9.5841	-0.1271	0.8988
Export	-5.9751	1.8026	-0.3314	0.7403	-6.1352	1.8051	-0.3398	0.7339
ECGrowth	4.1149	3.2237	1.2765	0.2018	4.1963	3.2249	1.3012	0.1932
Tij_PBarat	3.5735	5.7769	0.6186	0.5362	-			
Spatial Lag Dependence	4.9956 (0.0254)							
Breusch-Pagan Test	7.4918 (0.5861)							
R^2	0.1052				0.1029			

Note: Dependent variable trade flow of Padang
Source: own calculation, 2022

Table 2: Spatial regression results factors affecting the trade flow of Padang City with neighbouring areas.

Region has a coefficient value of 0.1956, with a Z value of 2.1823, this is significant because the probability value is small from the error generated tolerable 5%. Likewise in model 2, the coefficient value is 0.145 with a Z value of 2.1671 which is also significant. This means that the variable that is weighted for this spatial regression model has an impact that is spatial dependence.

In the model using the OLS method in the Table 1, the factors that influence changes in the trade flow variable of Padang City to the districts and cities along the West Coast are economic growth with a coefficient value of 6.3985 and a t-count value of 1.8869 and a probability of 0.0612, significant at 10%. If the economic growth of regencies and cities along the west coast of Sumatra increases by 1%, it will have an impact on increasing the trade flow of Padang City with this regency and city area of 6.3985 tons.

The West Coast trade flow variable does not significantly affect the existence of Padang City as the centre of economic agglomeration in the Sumatran economic corridor area. This means that the flow of trade in Padang City has not been able to encourage the occurrence of economic agglomeration in the districts and cities in the West coast of Sumatra, on the contrary, connectivity occurs with districts and cities in the East Coast Region of Sumatra's economic corridor.

Therefore, to accelerate the process of economic agglomeration through trade flows, joint policies are needed with the agricultural sector in the economic corridor of Sumatra in facing global market competition, as well as strengthening the internal market among regions in the corridor of Sumatra, such as agricultural integration in European countries in facing current global trends (Svatoš, 2008; Svatoš et al., 2018). This is also in line with the trade transactions of agricultural commodities between districts and cities in the Sumatran economic corridor that must be strengthened (Ansofino, 2021), so that they are able to compete in the competitive global market, including transactions between existing economic sectors, such as agricultural products used to support culinary tourism.

The processing industry and wholesale trade have not been able to create connectivity and the formation of economic agglomeration between regencies and cities in the West coast of Sumatra, this is apparently due to the fact that industrial products, especially from the agricultural sector, are still limited to plantation agricultural products, while processed products are sub-sectors fisheries and food crops have not been able to penetrate the markets of neighbouring areas along the west coast, because goods transported

through Teluk Bayur Port as a trading node for goods are dominated by cement, clinker and palm oil products. Meanwhile, the volume of processed food crops and processed marine products is still small.

However, agriculture broadly is able to encourage connectivity and agglomeration between districts and cities along the West coast of Sumatra, especially perennial plantation products such as oil palm and rubber, as well as horticultural agricultural products such as mangosteen, durian and others. Trade products originating from food crops such as rice, rice flour, corn, which have always been the mainstay of the commodity from the West Sumatra region, are no longer able to trigger trade interactions with areas along the West Coast.

Conclusion

Based on the problems and discussions that have been carried out previously, some conclusions can be drawn as follows:

1. Patterns of trade integration and agglomeration between regencies and cities in the West Coast of Sumatra in inter-regional trade activities have decreased drastically over the last ten years. This can be seen from the decrease in the volume of loading and unloading of goods at Teluk Bayur Port from inter-insular vessels, from 83% in 2010 to 51% in 2020. This is due to the lack of integration of inter-regional trade between the West Sumatra region and its neighbouring regions. Plus the impact of the implementation of large-scale social restrictions during the current COVID-19 pandemic.
2. The economic agglomeration formed between regencies and cities along the West coast is weaker than the regencies and cities on the East coast, because trade flows come from commodities from old plantation crops such as oil palm and rubber, where the processing industry is centred in the area. the east coast of Sumatra such as the ports of North Sumatra, Riau and Riau Islands, as well as ports in South Sumatra and Jambi. Meanwhile, trade commodities with regencies and cities along the West Coast are more dominant in processed products from the agricultural sector in a broad sense.
3. The activity of exporting goods (ships loading) between regions has decreased during the last ten years, while import activities (ships unloading) over the past ten years have shown an increasing trend. So that the trade balance of the West Sumatra region becomes a deficit.
4. The flow of trade between the city of Padang and the area along the west coast of Sumatra with 33 regencies and cities along the west coast is dominated by the districts of South Tapanuli, West Pasaman, Mandailing Natal, to Aceh Besar and Nagan Raya. especially Malahayati Port, in Aceh Besar, Lhokseumawe Port, in Lhokseumawe City, Gunung Sitoli Port, and Sibolga Port.
5. The flow of trade from the city of Padang to the West Coast Region is a spatial variable, as indicated by its statistically significant Moran Index value of 0.245, but this is smaller than the same Moran index value in the East coast of Sumatra. So that the spatial relationship between the trade flow of the city of Padang and the East Coast is greater than that of the districts and cities on the West coast. This is reinforced by the LISA analysis which shows that the relationship between the flow of trade in Padang City and the districts and cities on the West Coast in the HH category is 5, and HL is 5. 17 and all are significant at the 5% level.
6. Factors that influence changes in the trade flow variable of Padang City to the districts and cities along the West Coast are economic growth with a coefficient value of 6.3985 and a t-count value of 1.8869 and a probability of 0.0612, significant at 10% .
7. The competitiveness of the processing industry and wholesale trade has not been able to create connectivity and the formation of economic agglomeration between regencies and cities in the West coast of Sumatra, this is apparently due to the fact that processing industry products, especially agricultural sector products, are still limited to plantation agricultural products, while processed products of the fishery and food crops sub-sector have not been able to penetrate the neighbouring markets along the west coast, because the goods transported through Teluk Bayur Port as the goods trading node are dominated by cement, clinker and palm oil products.

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References

[1] Anselin, L. and Griffith D. A. (1988) "Do spatial effects really matter in regression analysis", *Papers in Regional Science*, Vol. 65, No. 1, pp. 11-34. ISSN 1056-8190. DOI 10.1111/j.1435-5597.1988.tb01155.x.

[2] Anselin, L. (1988) "Spatial Econometrics: Methods and Models", In: "*Studies in Operational Regional Science,* 4". ISBN 978-94-015-7799-1. DOI 10.1007/978-94-015-7799-1.

[3] Anselin, L. (2019) "A Local Indicator of Multivariate Spatial Association: Extending Geary´s c", *Geographical Analysis*, Vol. 51, No. 2, pp. 1-18. ISSN 00167363. DOI 10.1111/gean.12164.

[4] Anselin, L. and Arribas-Bel, D. (2013) "Spatial fixed effects and spatial dependence in a single cross-section", *Papers in Regional Science*, Vol. 92, No. 1, pp. 3-17. ISSN 1056-8190. DOI 10.1111/j.1435-5957.2012.00480.x.

[5] Anselin, L. and Rey, S. J. (2012) "Spatial Econometrics in an Age of CyberGIScience", *International Journal of Geographical Information Science*, Vol. 26, No. 12, pp. 2211-2226. E-ISSN 1362-3087, ISSN 1365-8816. DOI 10.1080/13658816.2012.664276.

[6] Ansofino, A. (2021) "Building Regional Innovation Network: Evidence from Koridor Economic of Sumatra", *CoMBInES - Conference on Management, Business, Innovation, Education and Social Sciences*, Vol. 1, No. 1, p. 101-116, March 2021. ISSN 2776-5644.

[7] Ansofino, A., Zusmelia, Z., Yolamalinda, Y. and Dahen, L. D. (2019) "The Spatial Integration of Crumb Rubber Market within ASEAN Countries', *Academic of Strategic Management Journal*, Vol. 18, No. 4, pp. 1-13. ISSN 1544-1458, E-ISSN 1939-6104.

[8] Ansonfino, A., Zusmelia, Z., Dahen, L. D. and Puteri, Y. E. (2021) "Diamond Model and Competition of Rubber Export Markets: Evidence from Sumatra Economic Growth Center", *AGRIS on-line Papers in Economics and Informatics*, Vol. 13, No. 1, pp. 15-27. ISSN 1804-1930. DOI 10.7160/aol.2021.130102.

[9] Behar, A. and Nelson, B. D. (2014) "Trade Flows, Multilateral Resistance, and Firm Heterogeneity", *The Review Economic and Statistics*, Vol. 96, No. 3, pp. 538-549. ISSN 0034-6535, E-ISSN 1530-9142. DOI 10.1162/REST_a_00380.

[10] van Bergeijk, P. A.G. and Brakman, S. (2010) "*The Gravity Model in International Trade: Advance and Application*", Cambridge University Press. E-ISBN 9780511762109. DOI 10.1017/CBO9780511762109.

[11] Bikker, J. A. (1987) "An International Trade Flow Model with Substitution: An Extension of the Gravity Model", *Kyklos*, Vol. 40, No. 3, pp. 315-337. E-ISSN ISSN 1467-6435. DOI 10.1111/j.1467-6435.1987.tb00683.x.

[12] Cainelli, G., Montresor, S. and Vittucci Marzetti, G. (2014) "Spatial Agglomeration and Firm Exit: A Spatial Dynamic Analysis for Italian Provinces", *Small Business Economics*, Vol. 43, No. 1, pp. 213-228. ISSN 0921898X. DOI 10.1007/s11187-013-9532-6.

[13] Dobbin, C. (1974) "Islamic Revivalism in Minangkabau at the Turn of the Nineteenth Century", *Modern Asian Studies*, Vol. 8, No. 3, pp. 319-345. ISSN 0026-749X. DOI 10.1017/S0026749X00014669.

[14] Dobbin, C. (2016) "*Islamic Revivalism in a Changing Peasant Economy*", 1st ed., pp. 1784-1847. ISBN 9781138226074. DOI 10.4324/9781315398181.

[15] Drezner, T., Drezner, Z. and Zerom, D. (2021) "An extension of the gravity model", *Journal of the Operational Research Society*, Vol. 40, pp. 315-337. ISSN 0160-5682. DOI 10.1080/01605682.2021.2015256.

[16] Frenken, K., van Oort, F. and Verburg, T. (2007) "Related variety, unrelated variety and regional economic growth", *Regional Studies*, Vol. 41, No. 5, pp. 685-697. E-ISSN 1360-0591, ISSN 0034-3404. DOI 10.1080/00343400601120296.

[17] Fujita, M., Krugman, P. and Venables, A. J. (1999) "The Spatial Economy: Cities, Regions, and International Trade", The MIT Press. E-ISSN 9780262273329. DOI 10.7551/mitpress/6389.001.0001.

[18] Fujita, M. and Thisse, J. F. (1996) "Economics of agglomeration", *Journal of the Japanese and International Economies*, Vol. 10, No. 4, pp. 339-378. ISSN 08891583. DOI 10.1006/jjie.1996.0021.

[19] Granovetter, M. S. (1973) "The strength of weak ties", *American Journal of Sociology*, Vol. 78, No. 6, pp. 1360-1380. E-ISSN 1537-5390, ISSN 0002-9602. DOI 10.1086/225469.

[20] Griffith, D. A., Chun, Y. and Li, B. (2019a) "Spatial autocorrelation", In: "Spatial Regression Analysis Using Eigenvector Spatial Filtering", pp. 1-27. DOI 10.1016/b978-0-12-815043-6.00001-x.

[21] Griffith, D. A., Chun, Y. and Li, B. (2019b) 'Spatial interaction modeling', Spatial Regression Analysis Using Eigenvector Spatial Filtering. Elsevier Inc., pp. 141–166. doi: 10.1016/b978-0-12-815043-6.00007-0.

[22] Guillain, R. (2010) "Agglomeration and dispersion of economic activities in and around Paris: an exploratory spatial data analysis", *Environment and Planning B: Planning and Design*, Vol. 37, No. 6, pp. 961-982. ISSN 0265-8135. DOI 10.1068/b35038.

[23] Guillain, R. and le Gallo, J. (2010) "Agglomeration and dispersion of economic activities in and around Paris: An exploratory spatial data analysis", *Environment and Planning B: Planning and Design*, Vol. 37, No. 6, pp. 961-981. ISSN 0265-8135. DOI 10.1068/b35038.

[24] Johansson, B. and Quigley, J. M. (2003) "Agglomeration and networks in spatial economies", *Papers in Regional Science*, Vol. 83, No. 1, pp. 165-176. ISSN 1056-8190. DOI 10.1007/978-3-662-07223-3_7.

[25] Kathirithamby-Wells, J. (1969) "Achehnese Control over West Sumatra up to the Treaty of Painan, 1663", *Journal of Southeast Asian History*, Vol. 10, No. 3, pp. 453-479. ISSN 0022-4634. DOI 10.1017/S0217781100005020.

[26] Kato, T. (1978) "Change and Continuity in the Minangkabau Matrilineal system", Indonesia, Vol. 25, pp. 1-16. DOI 10.2307/3350964.

[27] Kato, T. (1980) "Rantau Pariaman: The World of Minangkabau Coastal Merchants in the Nineteenth Century", *The Journal of Asian Studies*, Vol. 39, No. 4, pp. 729-752. E-ISSN 1752-0401, ISSN 0021-9118. DOI 10.2307/2055180 .

[28] Kelejian, H. and Piras, G. (2017) "Spatial Models: Basic Issues", In: "*Spatial Econometrics*", pp. 1–10. Academic Press, Elsevier Inc. ISBN 978-0-12-813387-3. DOI 10.1016/b978-0-12-813387-3.00001-9.

[29] Krugman, P. (1991) "Increasing returns and economic geography", *Journal of Political Economy*. Vol. 99, No. 3, pp. 483-499. E-ISSN 1537-534X, ISSN 0022-3808. DOI 10.3386/w3275.

[30] Kuzmina, E. E. (2008) "*The Prehistory of the Silk Road*", University of Pennsylvania Press, Philadelphia, US., 264 p. ISBN 0812240413. DOI 10.9783/9780812292336.

[31] Liu, X. (2010) "*Silk Road in World History*", New York, USA: Oxford University Press, Inc., 168 p. ISBN 0195338103.

[32] Parr, J. B. (2002) "Agglomeration economies: Ambiguities and confusions", *Environment and Planning A: Economy and Space*, Vol. 34, No. 4, pp. 717-731. ISSN 0308518X. DOI 10.1068/a34106.

[33] Parr, J. B., Hewings, G. J. D., Sohn, J. and Nazara, S. (2002) "Agglomeration and Trade: Some Additional Perspectives', *Regional Studies*, Vol. 36, No. 6, pp. 675-684. E-ISSN 1360-0591, ISSN 0034-3404. DOI 10.1080/00343400220146803.

[34] Peng, S. K., Thisse, J. F. and Wang, P. (2006) "Economic integration and agglomeration in a middle product economy", *Journal of Economic Theory*, Vol. 131, No. 1, pp. 1-25. ISSN 0022-0531. DOI 10.1016/j.jet.2005.06.005.

[35] Porojan, A. (2001) "Trade Flows and Spatial Effects", *Open Economic Review*, Vol. 12, No. 3, pp. 265-280. ISSN 0923-7992. DOI 10.1023/a:1011129422190.

[36] Putra, A. S., Tong, G. and Pribadi, D. O. (2020) "Spatial Analysis of Socio-Economic Driving Factors of Food Expenditure Variation between Provinces in Indonesia", *Sustainability (Switzerland)*, Vol. 12, No. 4, pp. 1-18. DOI 10.3390/su12041638.

[37] Svatoš, M. (2008) "Selected trends forming European agriculture", *Agricultural Economics*, Vol. 54, No. 3, pp. 93-101. ISSN 0139-570X, ISSN 1805-9295. DOI 10.17221/238-agricecon.

[38] Svatos, M., Smutka, L. and Miffek, O. (2018) "Competitiveness of agrarian trade of EU-15 countries in comparison with new EU member states", *Agricultural Economics*, Vol. 56, No. 12, pp. 569-582. ISSN 0139-570X, ISSN 1805-9295. DOI 10.17221/129/2010-agricecon.

[39] Tinbergen, J. (1962) "*Shaping the World Economy: Suggestions for an International Economic Policy*", New York.

[40] Zhang, J. and Kristensen, G. (1995) "A Gravity Model with Variable Coefficients: The EEC Trade with Third Countries', *Geographical Analysis*, Vol. 27, No. 4, pp. 307-320 ISSN 0016-7363. DOI 10.1111/j.1538-4632.1995.tb00913.x.