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Identification of Leading Agricultural Commodities in Simalungun Regency (2019–2023): A Location Quotient Analysis

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Abstract

This study aims to identify leading agricultural commodities in Simalungun Regency during the 2019–2023 period using the Location Quotient (LQ) approach. The analysis is based on secondary production data obtained from the Central Statistics Agency (BPS) of Simalungun Regency and North Sumatra Province. LQ analysis is employed to measure the comparative advantage of agricultural commodities by comparing their production concentration at the regency level with that of the provincial level. Commodities with LQ values greater than one are classified as base (leading) commodities, indicating surplus production and export potential. The results show that the horticulture and plantation subsectors exhibit the strongest comparative advantages in Simalungun Regency. Key leading commodities include shallots, cabbage, long beans, large chili, and several vegetables in the horticulture subsector, as well as cocoa, oil palm, Arabica coffee, and Robusta coffee in the plantation subsector. Cocoa records exceptionally high LQ values, indicating a dominant production surplus relative to the provincial average. In contrast, most food crop commodities, except soybeans, and several livestock and fishery commodities remain non-base and primarily serve local demand. Overall, the findings indicate that Simalungun Regency possesses substantial potential to strengthen its regional economy through the development of leading agricultural commodities. Policy efforts should focus on value chain enhancement, infrastructure improvement, institutional strengthening of farmers, and market expansion to support sustainable agricultural-based regional development.

1. Introduction

Regional economic development is fundamentally shaped by a region's capacity to utilize its endogenous resources to generate sustainable and productive economic activities. In the context of decentralization, local governments are increasingly required to design development strategies that are evidence-based and aligned with regional comparative advantages. One of the most influential theoretical frameworks in this regard is economic base theory, which posits that regional economic growth is primarily driven by base sectors or commodities that produce surplus output relative to local demand. These base activities generate income inflows through interregional trade and stimulate multiplier effects across non-base sectors, thereby strengthening overall regional economic performance.

Within the agricultural sector, the identification of leading or base commodities is particularly important, as agriculture remains a dominant source of income, employment, and livelihood for rural communities in many developing regions, including Indonesia. Leading agricultural commodities are not only expected to contribute significantly to Gross Regional Domestic Product (GRDP), but also to support food security, rural employment, and social stability. Consequently, understanding which commodities possess comparative advantages is essential for prioritizing public investment, improving value chains, and formulating targeted agricultural policies.

The Location Quotient (LQ) method has been widely used in regional economic analysis to identify base sectors or commodities by comparing their relative concentration in a specific region to that of a broader reference area. An LQ value greater than one indicates that a commodity has a higher relative specialization in the region compared to the reference area, suggesting the presence of a

comparative advantage and surplus production for interregional markets. Importantly, LQ does not measure actual export performance; rather, it reflects structural specialization and potential competitiveness. Numerous empirical studies have demonstrated the usefulness of LQ in identifying leading agricultural commodities and informing regional development strategies (Saragih et al., 2021; Widyantari & Maulany, 2020).

Simalungun Regency, located in North Sumatra Province, represents one of the regions in Indonesia where agriculture plays a strategic role in the regional economy. The regency is endowed with extensive agricultural land and favorable agroecological conditions that support a wide range of agricultural activities, including food crops, horticulture, plantation crops, livestock, and fisheries. Agriculture consistently contributes a substantial share to the GRDP of Simalungun Regency and serves as the primary livelihood for a large proportion of the population. These characteristics position Simalungun as a region with significant potential for agriculture-based economic development.

Despite its strong agricultural base, the performance and competitiveness of agricultural commodities in Simalungun Regency are not uniform across subsectors or over time. Some commodities demonstrate strong specialization and surplus production, while others remain oriented primarily toward meeting local demand. Furthermore, structural changes in agriculture driven by market dynamics, technological adoption, climate variability, and policy interventions have altered production patterns and regional specialization in recent years. These changes highlight the importance of periodically reassessing leading commodities to ensure that development priorities remain aligned with current economic realities.

Previous studies related to regional agricultural development in North Sumatra and Simalungun Regency have largely focused on identifying leading sectors at the subsector level, such as food crops or plantations, without providing detailed commodity-level analysis. While such studies offer valuable insights into broad sectoral performance, they may overlook significant variations among individual commodities within the same subsector. Moreover, many existing studies rely on cross-sectional or short-term data, limiting their ability to capture changes in comparative advantage over time. As a result, empirical evidence on the dynamics of leading agricultural commodities in Simalungun Regency over a recent multi-year period remains limited.

This gap in the literature is particularly relevant given the increasing emphasis on commodity-based development strategies in regional planning. Identifying leading commodities at the commodity level allows policymakers to design more targeted interventions, such as infrastructure development, technology dissemination, market access improvement, and institutional strengthening for farmers. Without up-to-date and commodity-specific evidence, development programs risk being inefficient or misaligned with actual regional strengths.

In addition to economic considerations, the identification of leading agricultural commodities also has important social implications. Agriculture plays a crucial role in rural welfare by generating employment, increasing farmers' income, and reducing income disparities between rural and urban areas. Winoto (2018) emphasizes that agriculture-based development can enhance social stability by strengthening local economic resilience and reducing vulnerability among rural households. Therefore, selecting appropriate flagship commodities is not merely an economic decision, but also a strategic approach to promoting inclusive and sustainable development.

From a policy perspective, the identification of leading agricultural commodities provides a foundation for integrating agricultural planning with broader regional development objectives. Commodities with strong comparative advantages can be

prioritized in regional development plans, value chain development initiatives, and export-oriented strategies at the interregional level. At the same time, commodities with declining or marginal performance can be supported through productivity enhancement, diversification, or restructuring policies. Such evidence-based planning is essential for optimizing resource allocation and maximizing the impact of public investment in the agricultural sector.

In this context, reassessing leading agricultural commodities in Simalungun Regency using recent data and a consistent analytical framework is both timely and necessary. By applying the Location Quotient method to agricultural commodity data over the 2019–2023 period, this study seeks to capture not only the current structure of comparative advantages but also changes in commodity performance over time. This temporal perspective allows for a more nuanced understanding of the dynamics of agricultural specialization and provides insights into emerging and declining commodities.

Based on the background described above, this study aims to identify leading agricultural commodities in Simalungun Regency during the 2019–2023 period using the Location Quotient approach. Specifically, the objectives of this study are: (1) to determine which agricultural commodities exhibit comparative advantages and can be classified as base commodities; and (2) to analyze changes in commodity performance over time as an indicator of structural transformation within the agricultural sector. The findings of this study are expected to contribute to the literature on regional agricultural economics and provide practical policy implications for strengthening agriculture-based regional development in Simalungun Regency and similar regions.

2. Literature Review

2.1 Economic Growth and Regional Development

Economic growth is commonly defined as a long-term increase in per capita output, reflecting a sustained expansion of a region's capacity to produce goods and services (Wijono, 2005). This concept emphasizes three key elements: a continuous process over time, growth in output relative to population, and a long-term orientation. In regional economics, economic growth is closely associated with the ability of regions to mobilize productive resources and develop sectors that generate surplus output.

Classical and neoclassical growth theories highlight several determinants of economic growth. Todaro identifies capital accumulation, population growth, and technological progress as the main drivers of economic expansion. Similarly, Kuznets conceptualizes economic growth as a long-term increase in productive capacity resulting from technological advancement, institutional change, and structural adjustment. In the context of regional development, these factors interact with sectoral specialization to shape spatial differences in growth performance.

From a regional perspective, economic base theory provides a useful framework for understanding how growth is generated. The theory distinguishes between base sectors, which produce surplus output for interregional markets, and non-base sectors, which primarily serve local demand. Growth is driven by base sectors, as they generate income inflows that stimulate multiplier effects across the regional economy. Therefore, identifying base sectors or commodities is essential for formulating effective regional development strategies, particularly in regions where agriculture plays a dominant role.

2.2 The Role of the Agricultural Sector in Regional Economies

The agricultural sector remains a fundamental pillar of economic development in many developing countries, including

Indonesia. Beyond its role in food provision, agriculture contributes significantly to employment generation, income distribution, and rural economic stability. Agricultural development is inherently multidimensional, involving economic, social, and technological dimensions that collectively influence productivity and sustainability.

Theoretical and empirical studies emphasize that agricultural growth can act as a catalyst for broader regional development. Kuznets' contribution approach and Lewis' dual-sector model explain how surplus labor and productivity gains in agriculture can support the expansion of non-agricultural sectors. Modern agricultural economics further highlights the importance of productivity improvement, value addition, and efficient resource management in enhancing regional competitiveness.

Recent agribusiness studies indicate that increasing agricultural productivity alone is insufficient; value chain development, product diversification, and effective financial management are equally important. Santoso and Handayani (2019) argue that sound financial management and technological adoption enable farmers to cope with price volatility and improve the competitiveness of agricultural products. Technological innovation also supports sustainable practices, improves efficiency, and facilitates diversification toward higher-value commodities.

In a regional context, identifying leading agricultural commodities allows policymakers to prioritize subsectors and commodities with the strongest comparative advantages. Such identification supports targeted policy interventions, including infrastructure development, technology dissemination, institutional strengthening, and market access expansion. Consequently, commodity-based agricultural development has become an increasingly important strategy for promoting inclusive and sustainable regional economic growth.

2.3 Location Quotient (LQ) Analysis and Leading Commodities

Location Quotient (LQ) analysis is a widely used analytical tool in regional economics to identify base sectors or commodities by measuring their relative concentration in a specific region compared to a broader reference area. According to Tarigan (2004), LQ compares the share of a sector's output or employment in a region to its corresponding share at the provincial or national level. An LQ value greater than one indicates that the sector or commodity is relatively specialized and possesses a comparative advantage, suggesting surplus production for interregional markets.

LQ analysis is particularly useful for identifying leading sectors or commodities as an initial step in regional development analysis. It provides insights into structural specialization and the relative importance of sectors within a regional economy. However, LQ does not measure actual export performance or competitiveness; rather, it reflects comparative advantage based on production structure. Therefore, LQ results should be interpreted as indicators of potential, not definitive measures of market success.

Previous studies have applied LQ analysis extensively to assess agricultural specialization and regional development potential. Daryanto and Hafizrianda (2010) emphasize that LQ serves as a diagnostic tool to identify sectors that warrant further policy attention. While the method has limitations—such as its static nature and reliance on relative shares—it remains effective for preliminary identification of leading commodities when combined with contextual and temporal analysis.

In the agricultural sector, LQ analysis enables researchers to distinguish commodities that function as economic drivers from those that primarily meet local demand. By applying LQ at the commodity level and over multiple periods, it is possible to capture changes in comparative advantage and structural transformation within the regional agricultural economy. This approach provides a stronger

empirical basis for designing commodity-based development policies and aligning agricultural planning with regional economic objectives.

Synthesis of the Literature

Overall, the literature highlights that regional economic growth is closely linked to sectoral specialization and the performance of base activities, particularly in agriculture-based regions. The agricultural sector plays a strategic role in driving growth, employment, and social welfare, while Location Quotient analysis offers a practical framework for identifying leading commodities with comparative advantages. However, existing studies often remain sector-focused and static, underscoring the need for commodity-level and time-series analysis to better inform regional agricultural development policies.

3. Research Methods

3.1 Research Design

This study employs a descriptive quantitative research design to identify leading agricultural commodities in Simalungun Regency. The approach is appropriate because the objective of the study is not to test causal relationships, but to analyze structural patterns of agricultural production and regional specialization. By using quantitative indicators, the study produces measurable and comparable results that support evidence-based regional development analysis.

3.2 Study Area and Unit of Analysis

The study is conducted in Simalungun Regency, North Sumatra Province, Indonesia, with North Sumatra Province serving as the reference region for comparison. The unit of analysis is agricultural commodities within five major agricultural subsectors, namely food crops, horticulture, smallholder plantations, livestock, and fisheries. Each commodity is analyzed individually to determine its relative specialization and role within the regional agricultural economy.

3.3 Data Sources and Variables

This study utilizes secondary data obtained from the Central Statistics Agency (Badan Pusat Statistik/BPS) of Simalungun Regency and the Central Statistics Agency of North Sumatra Province. The data cover a five-year period from 2019 to 2023. The primary variable used in the analysis is the production volume of each agricultural commodity, selected because it directly reflects the scale of production and is consistently available across regions and time periods. Total agricultural production in both the regency and the province is used to calculate relative commodity shares.

3.4 Analytical Technique: Location Quotient (LQ)

The main analytical tool used in this study is Location Quotient (LQ) analysis, which is widely applied in regional economics to measure comparative advantage and regional specialization. LQ compares the relative importance of a specific commodity in a local economy to its importance in a broader reference region. In this study, LQ is used as a diagnostic tool to identify whether an agricultural commodity functions as a base (leading) or non-base commodity in Simalungun Regency.

The LQ formula applied in this study is expressed as follows:

$$LQ_i = \frac{(v_i/v_t)}{(V_i/V_t)}$$

where:

v_i= production volume of agricultural commodity i in Simalungun Regency
v_t= total production volume of all agricultural commodities in Simalungun Regency
V_i= production volume of agricultural commodity i in North Sumatra Province
V_t= total production volume of all agricultural commodities in North Sumatra Province

3.5 Interpretation of LQ Values

The interpretation of LQ values in this study follows standard regional economic analysis principles:

1. **LQ > 1** indicates that a commodity is relatively specialized in Simalungun Regency and can be classified as a **base (leading) commodity**, implying surplus production relative to regional demand and potential for interregional distribution.
2. **LQ = 1** indicates proportional specialization, meaning that the commodity's share in the regional economy is similar to its share at the provincial level.
3. **LQ < 1** indicates that the commodity is **non-base**, suggesting lower specialization and a primary orientation toward meeting local demand.

It is emphasized that LQ values reflect comparative advantage and structural specialization rather than actual export performance.

3.6 Temporal Analysis

To capture changes in agricultural specialization over time, LQ values are calculated annually for each commodity during the 2019–2023 period. This time-series approach allows the identification of commodities that consistently function as base commodities, as well as those that exhibit transitional or declining specialization patterns. Such temporal analysis provides deeper insight into the dynamics of agricultural structural change in Simalungun Regency.

3.7 Methodological Limitations

While LQ analysis is effective for identifying leading commodities, it has certain limitations. LQ is a static measure and does not account for productivity differences, price variations, or interregional trade flows. Therefore, the results should be interpreted as indicative of potential comparative advantage. Future studies may complement LQ analysis with other methods, such as Shift-Share analysis or competitiveness indices, to provide a more comprehensive assessment.

4. Results and Discussion

4.1 Results

The Indonesian agricultural sector is composed of six major sub-sectors, namely food crops, plantations, forestry, livestock, horticulture, and fisheries. This study focuses on five agricultural sub-sectors that are directly associated with commodity-based production in Simalungun Regency: food crops, horticulture (vegetables and fruits), plantations, livestock, and fisheries. The forestry sub-sector is excluded due to limited relevance to production-based regional economic analysis.

The commodities included in each sub-sector are as follows: food crops (rice, corn, soybeans, cassava, and sweet potatoes); vegetable horticulture (shallots, potatoes, cabbage, carrots, long beans, large chili peppers, tomatoes, eggplants, green beans, cucumbers, water spinach, and spinach); fruit horticulture (watermelon, durian, sapodilla, papaya, banana, pineapple, mangosteen, and jackfruit); plantations (oil palm, rubber, robusta coffee, arabica coffee, coconut, cocoa, cloves, and tobacco); livestock (cattle, buffaloes, horses, goats, sheep, and pigs); and fisheries (capture fisheries and aquaculture).

To identify leading (base) and non-leading (non-base) commodities, this study employs Location Quotient (LQ) analysis, comparing the relative contribution of each commodity in Simalungun Regency with its contribution at the provincial level of North Sumatra. Commodities with LQ values greater than one (LQ > 1) are classified as base commodities, indicating comparative advantage and potential interregional surplus, while commodities with LQ values less than one (LQ < 1) are considered non-base commodities.

Table 2 presents the LQ values of agricultural commodities in Simalungun Regency for the period 2019–2023.

Table 2. Location Quotient (LQ) Values of Agricultural Commodities in Simalungun Regency (2019–2023)

NO	COMMODITIES	LQ (LOCATION QUOTIENT)									
		2019	Hasil	2020	Hasil	2021	Hasil	2022	Hasil	2023	Hasil
1	Food Crops (tons)										
	rice	0,76	Non Basis	0,79	Non Basis	2,29	Basis	1,19	Basis	1,40	Basis
	Corn	1,09	Basis	1,25	Basis	0,00	Non Basis	0,84	Non Basis	0,67	Non Basis
	cassava	1,58	Basis	1,98	Basis	66,11	Basis	6,14	Basis	3,45	Basis
	sweet	1,52	Basis	1,13	Basis	0,00	Non Basis	0,89	Non Basis	0,83	Non Basis
	potatoes	2,04	Basis	1,22	Basis	1,01	Basis	0,56	Non Basis	0,46	Non Basis
2	Plantation (KW)										
	Rubber	0,03	Non Basis	0,10	Non Basis	0,21	Non Basis	0,76	Non Basis	0,14	Non Basis
	Oil palm	1,26	Basis	1,05	Basis	1,04	Basis	0,95	Non Basis	1,04	Basis
	Robusta coffe	0,39	Non Basis	0,86	Non Basis	1,32	Basis	2,59	Basis	1,48	Basis
	Arabica coffe	0,21	Non Basis	0,69	Non Basis	1,19	Basis	5,46	Basis	1,40	Basis
	Coconut	0,10	Non Basis	0,32	Non Basis	0,38	Non Basis	1,01	Basis	0,26	Non Basis
	Cocoa	0,94	Non Basis	444,79	Basis	630,28	Basis	2286,70	Basis	177,27	Basis
	Cloves	0,37	Non Basis	0,42	Non Basis	0,57	Non Basis	0,26	Non Basis	0,71	Non Basis
	Tobacco	0,35	Non Basis	2,42	Basis	0,33	Non Basis	0,00	Non Basis	0,66	Non Basis
3	Horticulture (KW)										
	Onion	1,79	Basis	3,02	Basis	3,13	Basis	2,54	Basis	5,11	Basis
	Potato	1,93	Basis	2,67	Basis	1,73	Basis	0,77	Non Basis	0,90	Non Basis
	Cabbage	1,87	Basis	2,99	Basis	1,83	Basis	1,64	Basis	1,46	Basis
	Carrot	0,07	Non Basis	0,14	Non Basis	0,20	Non Basis	0,24	Non Basis	0,21	Non Basis
	Long bean	1,21	Basis	2,34	Basis	3,81	Basis	2,75	Basis	1,85	Basis
	Big chili	1,83	Basis	3,78	Basis	0,25	Non Basis	6,63	Basis	4,79	Basis
	Tomato	1,18	Basis	0,96	Non Basis	0,89	Non Basis	1,16	Basis	1,10	Basis
	eggplant	0,77	Non Basis	1,16	Basis	2,14	Basis	2,19	Basis	2,48	Basis
	Beans	1,05	Basis	2,40	Basis	1,98	Basis	1,90	Basis	2,47	Basis
	Cucumber	0,60	Non Basis	1,25	Basis	2,84	Basis	2,28	Basis	1,41	Basis
	Water spinach	0,87	Non Basis	2,35	Basis	3,48	Basis	2,83	Basis	1,74	Basis
	spinach	3,21	Basis	1,94	Basis	3,16	Basis	2,07	Basis	1,18	Basis
	Watermelon	0,36	Non Basis	0,15	Non Basis	0,98	Non Basis	0,33	Non Basis	0,21	Non Basis
	Durian	0,23	Non Basis	0,00	Non Basis	0,21	Non Basis	0,19	Non Basis	0,11	Non Basis
	Sawo	0,07	Non Basis	0,01	Non Basis	0,08	Non Basis	0,08	Non Basis	0,02	Non Basis
	pepaya	0,09	Non Basis	0,10	Non Basis	0,17	Non Basis	0,21	Non Basis	0,07	Non Basis

	Banana	0,14	Non Basis	1,04	Basis	0,17	Non Basis	0,07	Non Basis	0,09	Non Basis
	Pineapple	0,01	Non Basis	0,00	Non Basis	0,03	Non Basis	0,01	Non Basis	0,00	Non Basis
	mangosteen	0,02	Non Basis	0,07	Non Basis	0,01	Non Basis	0,46	Non Basis	0,02	Non Basis
	Jackfruit	0,06	Non Basis	0,03	Non Basis	0,07	Non Basis	0,06	Non Basis	0,05	Non Basis
4	Farm (tail)										
	Cow	1,91	Basis	1,58	Basis	1,90	Basis	1,29	Basis	1,63	Basis
	Buffalo	0,74	Non Basis	0,62	Non Basis	0,36	Non Basis	0,12	Non Basis	0,09	Non Basis
	Horse	2,00	Basis	1,70	Basis	1,04	Basis	0,73	Non Basis	0,21	Non Basis
	Goat	0,80	Non Basis	0,68	Non Basis	0,18	Non Basis	174,12	Basis	0,25	Non Basis
	Sheep	0,16	Non Basis	0,13	Non Basis	0,89	Non Basis	0,58	Non Basis	0,74	Non Basis
	Pig	1,01	Basis	1,43	Basis	0,93	Non Basis	1,12	Basis	1,30	Basis
5	fisheries										
	capture fisheries	0,32	Non Basis	0,71	Non Basis	0,31	Non Basis	0,00	Non Basis	1,50	Basis
	aquaculture	3,24	Basis	1,53	Basis	1,57	Basis	1,99	Basis	0,47	Non Basis

Based on Table 2, the results indicate considerable variation in comparative advantage across sub-sectors and commodities. In the food crops sub-sector, cassava consistently records LQ values well above one across all observed years, indicating a strong and stable comparative advantage. Rice and corn generally record LQ values below one, although rice shows an upward trend in recent years. Sweet potatoes and potatoes exhibit fluctuating patterns, shifting between base and non-base status.

In the horticulture sub-sector, vegetable commodities dominate the base category. Shallots, cabbage, long beans, large chili peppers, spinach, cucumbers, and green beans consistently show LQ values above one, with shallots recording the highest and most stable values. In contrast, most fruit horticulture commodities display LQ values below one throughout the study period.

The plantation sub-sector demonstrates the strongest comparative advantage overall. Cocoa records exceptionally high LQ values, indicating a high degree of specialization. Oil palm, arabica coffee, and robusta coffee also exhibit LQ values above one in most years, while rubber, coconut, cloves, and tobacco remain non-base commodities.

In the livestock sub-sector, cattle and pigs consistently show LQ values above one, suggesting their importance as leading livestock commodities. Other livestock commodities largely record LQ values below one, with some fluctuations.

Finally, in the fisheries sub-sector, aquaculture maintains LQ values above one for most of the study period, although a decline is observed in 2023. Capture fisheries remain largely non-base, except for a notable increase in 2023.

4.2 Discussion

4.2.1 General Pattern of Comparative Advantage

The results of the Location Quotient (LQ) analysis indicate that the agricultural economy of Simalungun Regency exhibits uneven structural specialization across subsectors. Comparative advantage is concentrated in specific commodities rather than being uniformly distributed. This pattern reflects differences in agroecological suitability, production systems, and regional resource allocation. The findings confirm that

Simalungun's agricultural competitiveness is driven by a limited number of high-performing commodities that function as economic bases at the provincial level.

4.2.2 Food Crops Sub-sector

Within the food crops sub-sector, cassava emerges as the most consistent base commodity. Its persistently high LQ values indicate that cassava production substantially exceeds provincial averages, generating an interregional surplus. This comparative advantage is likely supported by land suitability, low production costs, and established farming practices.

In contrast, rice and corn remain non-base commodities, as their LQ values consistently fall below one. This suggests that their production primarily serves local consumption needs rather than interregional markets. Although rice shows gradual improvement in recent years, its comparative advantage has not yet stabilized. These results imply that policy interventions in food crops should prioritize productivity enhancement and efficiency improvement, rather than expansion aimed at surplus generation.

4.2.3 Horticulture Sub-sector

The horticulture sub-sector demonstrates strong specialization, particularly in vegetable commodities. Shallots consistently record high and increasing LQ values, positioning them as a flagship commodity in Simalungun Regency. This reflects strong production concentration, market demand, and short production cycles that support rapid income generation.

Several vegetable commodities also exhibit LQ values above one, indicating that horticulture plays a strategic role in employment creation and regional income diversification. However, fruit horticulture commodities consistently show LQ values below one, signaling limited competitiveness. Constraints such as production scale, post-harvest handling, technology adoption, and market access may explain this pattern. Addressing these constraints is essential if fruit horticulture is to become more competitive.

4.2.4 Plantation Sub-sector

The plantation sub-sector constitutes the core of Simalungun's agricultural comparative advantage. Cocoa displays exceptionally high LQ values, indicating a strong structural concentration and long-standing regional expertise. Oil palm also remains a stable base commodity, reinforcing its contribution to regional economic performance. Notably, arabica and robusta coffee have emerged as new base commodities, reflecting a transition toward higher-value plantation products. This shift suggests increasing opportunities for export-oriented and specialty markets. However, reliance on raw commodity production limits value creation. Therefore, plantation development strategies should emphasize downstream processing, quality upgrading, certification, and value-chain integration to maximize economic spillovers.

4.2.5 Livestock Sub-sector

In the livestock sub-sector, cattle and pigs are identified as leading commodities, with stable LQ values above one. These commodities contribute significantly to interregional supply and reflect established production systems in Simalungun Regency.

Other livestock commodities show weaker or unstable comparative advantage, indicating structural limitations related to breeding systems, feed availability, and disease management. The presence of extreme or fluctuating LQ values, particularly in goats, highlights the need for cautious interpretation of LQ results, as small production bases can distort comparative ratios. Targeted livestock development policies are required if diversification within this sub-sector is to be achieved.

4.2.6 Fisheries Sub-sector

The fisheries sub-sector exhibits mixed performance. Aquaculture has historically functioned as a base commodity, reflecting its

importance for local livelihoods and food security. However, the decline in LQ values in the most recent year suggests emerging challenges, potentially related to environmental pressures, production efficiency, or market dynamics.

Capture fisheries remain largely non-base commodities, although recent improvements indicate early-stage development. Strengthening aquaculture through technological innovation, sustainable practices, and input efficiency is essential to maintain its comparative advantage and long-term viability.

4.2.7 Policy and Regional Development Implications

Overall, the findings underscore the importance of commodity-based agricultural planning. Uniform development policies across subsectors are unlikely to be effective. Instead, regional strategies should focus on strengthening existing base commodities while improving productivity and resilience in non-base commodities.

By aligning agricultural development policies with empirically identified comparative advantages, Simalungun Regency can enhance regional competitiveness, increase farmers' incomes, and support sustainable economic growth. The LQ-based approach used in this study provides a practical evidence base for regional agricultural planning and prioritization.

5. Closing

5.1 Conclusion

Based on the Location Quotient (LQ) analysis of five agricultural subsectors in Simalungun Regency from 2019 to 2023, the study identifies horticulture and plantation subsectors as having the strongest comparative advantage. Key findings include:

1. Plantation Subsector: Cocoa demonstrates extremely high and consistent LQ values, confirming its status as the most specialized commodity. Palm oil maintains a stable base commodity status, while arabica and robusta coffee are emerging as high-value commodities with increasing comparative advantage.
2. Horticulture Subsector: Shallots, potatoes, cabbage, and several vegetable commodities consistently maintain LQ > 1, highlighting their potential for interregional trade and income generation. Fruit horticulture commodities, in contrast, exhibit LQ < 1, indicating limited competitiveness.
3. Food Crops Subsector: Soybeans remain the only consistently base commodity, while rice, corn, cassava, and sweet potatoes show fluctuating LQ values, suggesting that policy interventions are needed to improve their stability and productivity.
4. Livestock Subsector: Cattle and pigs consistently display LQ > 1, making them priority commodities for regional livestock development. Other livestock commodities remain non-base and require strategic improvement if diversification is desired.
5. Fisheries Subsector: Aquaculture historically shows comparative advantage, though a recent decline in LQ values indicates potential challenges. Capture fisheries are underdeveloped but show early-stage growth potential.

Overall, the results indicate that comparative advantage in Simalungun is concentrated in selected commodities, reflecting regional specialization and production efficiency. This evidence can inform targeted agricultural development policies.

5.2 Policy Implications

The study's findings provide insights for policymakers to enhance Simalungun's agricultural competitiveness:

1. Commodity-Based Development: Focus on strengthening base commodities such as cocoa, palm oil, shallots, and livestock (cattle and pigs) while gradually improving non-base commodities through technological adoption and capacity building.

2. Value Chain Enhancement: Develop agro-industrial sectors to add value to primary commodities, including downstream processing, quality improvement, and export readiness.
3. Market Expansion: Facilitate interregional and international trade by improving logistics infrastructure, market access, and farmer cooperatives.
4. Sustainability and Innovation: Promote sustainable agricultural practices and digital-based marketing systems to increase productivity and environmental resilience.

These measures can help position Simalungun Regency as a leading agricultural and agribusiness hub in North Sumatra.

5.3 Limitations and Future Research

Despite the comprehensive LQ analysis, the study has several limitations:

1. The analysis focuses on quantitative comparative advantage, without incorporating price, cost, or profitability considerations.
2. Extreme LQ values in certain commodities may reflect small provincial averages rather than absolute production strength, requiring cautious interpretation.
3. The study does not consider environmental, social, or climate-related factors that could affect production sustainability.

Future research can integrate multi-dimensional indicators, including economic, environmental, and technological factors, to provide a more holistic assessment of regional agricultural competitiveness.

5.4 Recommendations

Based on the findings and limitations, the study recommends:

1. Prioritized Development: Target the most promising commodities (cocoa, arabica/robusta coffee, palm oil, shallots, potatoes, cattle, and pigs) for strategic investment and value-chain development.
2. Farmer Support Programs: Strengthen farmer institutions, provide training on best practices, and facilitate access to credit and inputs.
3. Policy Alignment: Align local agricultural policies with empirical evidence from LQ analysis to enhance regional competitiveness and sustainability.
4. Market-Oriented Innovation: Adopt modern agricultural technologies, digital marketing platforms, and sustainable production practices to improve productivity and export potential.

Implementing these recommendations will support economic growth, regional development, and food security in Simalungun Regency.

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