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Analysis Of The Influence Of Port Export And Import Volume On Economic Growth In North Sumatera And West Sumatera Provinces

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Abstract. *Using a quantitative approach, this study investigates the effect of port export and import volumes on economic growth in North Sumatra and West Sumatra Provinces. Time series data from the World Bank and the Central Statistics Agency (BPS) from 2006 to 2023 are used as secondary data. The analysis uses the ARDL Panel model, which allows for analysis of data dynamics across time and regions. The results show that the three main indicators that affect economic growth (GRDP) in both provinces, both in the short and long term, are export volume, inflation, and exchange rates. In North Sumatra, export volume has a positive impact on GRDP, while import volume has a negative impact, indicating a risk of dependence on imports. Controlled inflation also has a positive impact, while the exchange rate shows a diversion. Policy recommendations are expected to improve global competitiveness and exchange rate stability through coordination of fiscal and monetary policies, support for the Export Capacity Building Program and MSMEs through the Regional Comprehensive Economic Framework (RCEP), and export diversification to reduce dependence on certain commodities. This study emphasizes that policies that are responsive to changes in trade at the national to international levels are an important foundation for stabilizing sustainable economic growth.*

Keywords*: ARDL Panel, Export Volume, Import Volume, North Sumatra, West Sumatra*.

1. INTRODUCTION

Indonesia as an archipelagic country has sea transportation which plays an important role in connecting regions between islands (Farid et al., 2023; Jensen, 2024). Ports, as maritime transportation hubs, are the main means of distribution and trade between regions (Yang et al., 2023)). According to the Minister of Transportation Regulation No. 51 of 2015, the port functions as a place for government and economic activities that play a strategic role in supporting regional economic growth (Liu et al., 2024). The development of ports and transportation infrastructure directly contributes to the increase in industrial and trade activities, which in turn spurs national and regional economic growth. Studies show that ports play an important role in driving the growth of the fisheries and non-fisheries industries, as well as facilitating international trade connectivity, especially Indonesia with its strategic geographical location at the crossroads of two continents and two oceans (Diana & Zulfa, 2019; Juliansyah et al., 2018). North Sumatra, as one of the national economic centers outside Java, shows a significant contribution with Gross Regional Domestic Product (GRDP) reaching Rp 955.19 trillion and economic growth of 4.94 percent. Similar achievements are also seen in West Sumatra, where economic and social development continues to increase.

Strong and sustainable economic growth is the main focus of economic policy, with positive impacts such as increased incomes, reduced unemployment, and more equitable socio-

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economic development (Rangkuty et al., 2022; Rastra Dwitama et al., 2022). Gross Domestic Product or GDP As the main indicator of measuring economic growth in a country and based on regions through Gross Regional Domestic Product or GRDP reflects the increase in production capacity with a certain time period in a country, which is generally measured through Gross Domestic Product (GDP) (Niara & Zulfa, 2019; Novalina et al., 2023;Rusiadi; Ade Novalina, 2016; Valentine et al., 2024). Economic growth plays an important role because it has a direct impact on improving living standards, reducing poverty, and creating jobs (Azhari & Zulfa, 2020; Raza & Zulfa, 2020). Without sufficient economic growth, countries or regions will have difficulty meeting the needs of a growing population and maintaining economic stability.

Economic growth in North Sumatra and West Sumatra has fluctuated, especially in 2020 when the recession occurred (Bakhtiar Efendi et al., 2023; Rangkuty et al., 2023). The cause is through the impact of the Covid-19 pandemic which slows down economic activity in various sectors (Aprillia et al., 2024; Nasution et al., 2022; Rusiadi et al., 2021; Suhendi et al., 2022). In addition, the volume of exports and imports at the ports of the two provinces also showed a fluctuating pattern during the study period, with one of the main causal factors being the contraction in the logistics sector. The decline in export and import volumes directly affects economic growth, as evidenced by data showing a close relationship between changes in export and import volumes and economic growth. In the regions of North Sumatra and West Sumatra, economic growth plays a strategic role in infrastructure development, increasing regional competitiveness, and improving the quality of life of its residents (Djannah Rosadi & Rusiadi, 2024; Rusiadi et al., 2024). Both provinces have developed into centers of trade and industrial activity over the past decade, making their economic growth vital to maintaining economic stability, both regionally and nationally. The good infrastructure and export potential of both regions further strengthen the position of North Sumatra and West Sumatra as important pillars of the national economy.

Exports and imports are key factors in determining the direction of a region's economic growth (Taime & Djaelani, 2021; Zulfa et al., 2016). The increase in export volume, especially of superior goods such as palm oil, coffee, and rubber from North Sumatra and West Sumatra, has a significant impact on GRDP. Increased exports not only help local companies expand production and attract investment, but also create more jobs (Farid et al., 2023; Haas et al., 2023; Jensen, 2024). Although export volumes were affected by global factors such as trade wars and the pandemic, a recovery trend began to emerge in the 2020–2024 period (Liu et al., 2024). Meanwhile, imports also have an important role, especially in supporting the

manufacturing sector by providing raw materials and technology that are not available locally (Akbas & Sancar, 2021; Petchko, 2018). However, an imbalance between export and import volumes can lead to a trade deficit, which ultimately affects economic stability (Bhakti Nauli Siregar & Efendi, 2022; Yang et al., 2023). Therefore, maintaining a balance between exports and imports is crucial for North Sumatra and West Sumatra to maintain sustainable economic growth.

This study focuses on analyzing the influence of export and import volumes on economic growth in North Sumatra and West Sumatra, taking into account other variables such as inflation and exchange rates. The main objective is to analyze how these variables play a role in influencing the regional economy and are important to face global economic challenges. In addition, this study can also help local governments in identifying sectors that have great potential to be exported or imported efficiently. Thus, the steps taken can contribute to increasing regional competitiveness at the international level, as well as maintaining the balance of inflation and exchange rates that affect people's welfare.

2. THEORETICAL BASIS

Gross Regional Domestic Product (GRDP), which shows the value of goods and services produced by production units in the area, can be used to measure the economic growth of a region. To calculate GRDP, there are three main approaches: production, income, and expenditure. The production approach divides the goods and services produced by companies into 17 business sectors, which cover various aspects of the economy. (1) Agriculture, Forestry, and Fisheries; (2) Mining and Quarrying; (3) Manufacturing; (4) Electricity and Gas Supply; (5) Water Supply, Waste Management, Waste, and Recycling; (6) Construction; (7) Wholesale and Retail Trade, Automobile and Motorcycle Repair; (8) Transportation and Warehousing; (9) Accommodation and Food Provision; (10) Information and Communication; (11) Financial Services and Insurance; (12) Real Estate; (13) Each of these sections contributes to the overall GRDP, which shows the economic performance of the region. Since each sector plays a role in producing goods and services needed by society and industry, these production units play an important role in driving economic growth. Regional GDP can increase as a result of increased output from these sectors. This indicates significant economic growth (Liu et al., 2024; Lou et al., 2024). Therefore, the sustainability and development of this production system, together with the support of economic actors, are very important to create stable and sustainable economic growth for a country or region.

Based on Article 53 of Law Number 17 of 2006 concerning Amendments to Law Number 10 of 1995 concerning Customs, any prohibition or restriction issued by a technical agency must be submitted through the Director General of Customs and Excise to the Minister of Finance. Furthermore, the Director General of Customs and Excise investigates and determines a list of prohibited or restricted goods for Regulation of the Minister of Finance Number 224/PMK.04/2015 regulates the import and export of goods included in the list of prohibitions and restrictions. This regulation is supported by several other regulations, such as Government Regulation of the Republic of Indonesia Number 55 of 2008 concerning the Imposition of Export Duty on Exported Goods, several regulations of the Minister of Finance (PMK No. 145/PMK.04/2007, PMK No. 214/PMK.04/2008, PMK No. 13/PMK.010/2017), and Regulation of the Director To ensure compliance with applicable documents and regulations, DJBC is responsible for conducting supervision (Directorate General of Customs and Excise, 2023). According to Law Number 10 of 1995, as amended by Law Number 17 of 2006, import procedures regulate the release of imported goods through red, green, yellow, and priority channels based on the risk and compliance of the importer. Imports are intended to meet domestic needs, obtain raw materials, and improve the balance of payments, with strict regulations to maintain economic stability through export duties, tariffs, and an effective customs supervision system.

These various regulations not only provide a strong legal basis for the import and export monitoring process, but also play an important role in maintaining trade balance and national economic stability (Juliansyah et al., 2018; Petchko, 2018; Rangkuty et al., 2022, 2023; Yang et al., 2023). Next, this literature review will describe in detail the theoretical basis of this study, the concept of grand theory plays an important role in understanding the basic framework underlying the phenomenon studied. Grand theory provides a broad conceptual guide to understanding various more specific aspects in this field of study. In the following section, we will further explain the relevant grand theories and their contributions to this research framework:

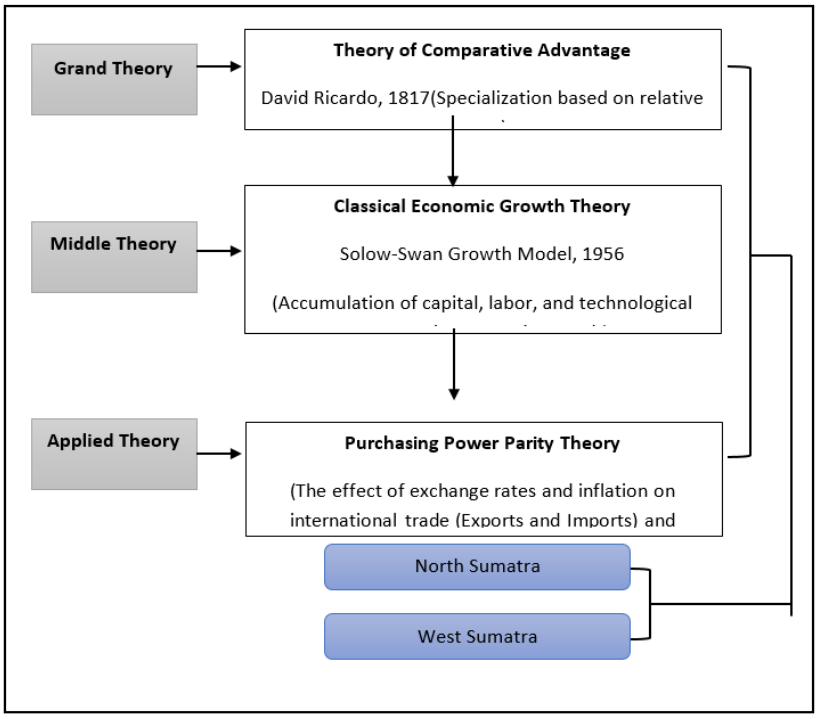

Figure 1. Framework *State Of The Art Research*
Source: Author's Plan, 2024

The figure above provides an overview of the theoretical mechanisms used in this study. Grand theory is a concept that explains phenomena broadly and produces evidence that can be tested even though it is difficult to do. In the context of this study, David Ricardo's theory of comparative advantage is used as a basis. This theory emphasizes that countries will benefit from international trade by focusing production on more efficient goods, in contrast to Adam Smith's theory of absolute advantage, which suggests that only countries with absolute advantages can engage in international trade (Ricardo, 1817) in (Petchko, 2018). The theory of comparative advantage emphasizes that countries can gain from specialization, even if they do not have an absolute advantage. In the context of international trade, increasing the volume of exports compared to imports can increase state revenues and contribute positively to economic growth. This theory emphasizes the importance of specialization and efficiency in trade, which ultimately has an impact on increasing gross domestic product (GDP).

Middle theories, such as the Solow-Swan Classical Theory of Economic Growth, explain more specifically how the accumulation of capital, labor, and technology affect economic growth. This theory links increases in the volume of exports and imports to capital accumulation and technological progress, which can increase the production capacity and productivity of the economy. Exchange rate fluctuations and inflation also play an important role in determining purchasing power and production costs, which have a direct impact on the volume of trade and economic output.

Applied theory, such as the Purchasing Power Parity (PPP) Theory, is used to analyze empirical phenomena. PPP explains how currency exchange rates adjust to differences in prices and inflation across countries. In the context of international trade, changes in exchange rates caused by inflation affect purchasing power and the prices of goods in international markets. This theory helps understand how exchange rates and inflation affect trade volume and economic growth.

3. RESEARCH METHOD(S)

The approach used in this study is a quantitative approach, which aims to measure and analyze phenomena or problems based on numerical data. This approach involves collecting, processing, analyzing, and interpreting numerical data with the aim of obtaining objective understanding and conclusions that can be tested mathematically. Common methods applied in this approach include surveys, experiments, statistical analysis, and mathematical models to produce reliable results. This study uses secondary quantitative data taken from the Central Statistics Agency (BPS) of North Sumatra and West Sumatra Provinces, as well as from the World Bank. The data taken is in the form of a time series with a period of 18 years, namely from 2006 to 2023. This type of data is very important for analyzing the dynamics that occur in the two provinces in the context of international economics and trade, as well as for testing research hypotheses. Data collection was carried out through documentation studies, where data was taken from existing sources, such as official reports from the World Bank, BPS, and related articles. For data analysis, the ARDL Panel model was used, which allows analysis of data across time and between regions, and provides accurate estimates of the individual characteristics of each region. This approach helps in understanding the relationship between the variables analyzed. Next, an explanation of the conceptual framework will outline the relationship between these variables and their roles in this research, as follows:

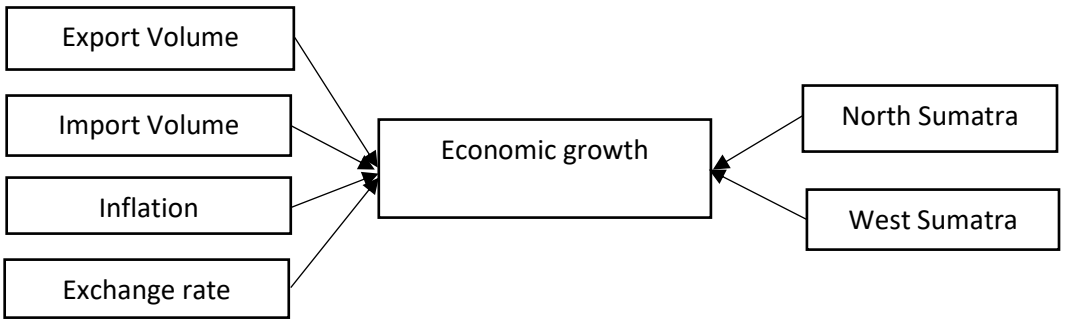

Figure 2. Framework ARDL Panel Model Research

Source: Author's Plan, 2024

Panel Regression Testing with the formula:

INFSit North Sumatra = α+β1PEit+β2INFSit+β3KURSit+β4VEKSit+β5VIMPit+e

INFSatWest Sumatra = α+β1PEit+β2INFSit+β3KURSit+β4VEKSit+β5VIMPit+e

Where:

PE : Economic growth (%)

VEKS : Export Volume (Thousand Tons)

VIMP : Import Volume (Thousand Tons)

INF : Inflation (%)

Kurs : Exchange Rate (Rupiah)

e is Error Term

β is Regression Coefficient

α is Constant

i is Number of observations of 2 Provinces in Indonesia

t is Lots of Time 17 Years

The ARDL model has the advantage of handling time series data, both stationary at level (I(0)) and stationary after the first differentiation (I(1)). This approach also allows the analysis of short-term and long-term relationships simultaneously, resulting in a more comprehensive understanding. There are several criteria that must be met so that the ARDL Panel model estimation can be considered valid and reliable (Rusiadi; Ade Novalina, 2016). First, having a cointegrated lag to ensure the long-term relationship between variables. Second, showing the overall significance of the model through the F test, and third using the optimal lag selected based on information criteria so that the model remains stable and accurate. After explaining the research methods applied in this analysis, the next step is to formulate the hypothesis to be tested (Novalina & Rusiadi, 2018). The research hypothesis is formulated to test the effect of economic variables on economic growth in two different provinces, namely North Sumatra and West Sumatra. This study assumes that export volume, import volume, inflation, and exchange rates have a significant impact on economic growth in both regions. In this context, the first hypothesis highlights the influence of these variables on economic growth in North Sumatra, while the second hypothesis focuses on the same influence on economic growth in West Sumatra.

An important aspect in the estimation of the ECM model is that the Error Correction Term (ECT) must have a negative value, where the negative value of the ECT indicates the validity of the estimated model. After explaining the research method applied in this analysis, the next step is to formulate the hypothesis to be tested (Novalina & Rusiadi, 2018). The

research hypothesis is formulated to test the influence of economic variables on economic growth in two different provinces, namely North Sumatra and West Sumatra. This study assumes that export volume, import volume, inflation, and exchange rates have a significant impact on economic growth in both regions. In this context, the first hypothesis highlights the influence of these variables on economic growth in North Sumatra, while the second hypothesis focuses on the same influence on economic growth in West Sumatra.

4. FINDINGS AND DUSCUSSION

Economic growth data for North Sumatra and West Sumatra from 2006 to 2023 shows the dynamics of fluctuations influenced by various domestic and global factors, further in the following graph:

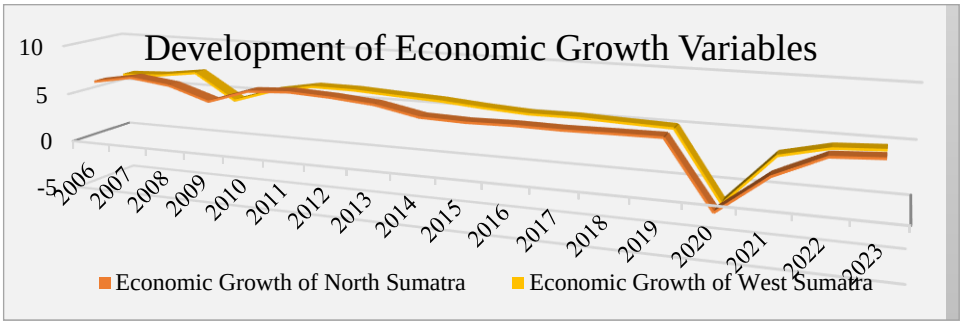

Figure 3. Development of Economic Growth Variables in North Sumatra and West Sumatra (2006-2023)

Source: Central Bureau of Statistics of Indonesia, 2024

Economic growth data for North Sumatra and West Sumatra from 2006 to 2023 shows the dynamics of fluctuations influenced by various domestic and global factors. At the beginning of the period, in 2006, North Sumatra recorded economic growth of 6.2%. The peak of growth occurred in 2007 with a rate of 6.9%, before declining in 2009 to 5.07% as a result of the 2008 global financial crisis, this result is in accordance with Kusuma's research (2010) which found that regional economic growth is very vulnerable to the global crisis, especially in areas whose economies depend on commodity exports. Growth recovered in 2010 with a figure of 6.42% and was relatively stable until 2013. However, since 2014, North Sumatra's economic growth has tended to slow down, only recording a figure of 5.23% that year. This decline continued until 2015-2017, with an average growth rate in the range of 5%. Growth increased slightly again in 2019 with a figure of 5.22%. The COVID-19 pandemic has had a significant impact, with the North Sumatra economy contracting by -1.07%. In 2021, the North

Sumatra economy began to recover with positive growth of 2.61%, and continued to rise in 2022 to reach 5.01% in 2023, although it has not fully returned to pre-pandemic growth levels.

Meanwhile, West Sumatra's economic growth in 2006 reached 6.14% and continued to increase until it peaked in 2008 with a growth of 6.88%. However, due to the global economic crisis, West Sumatra's economic growth contracted to 4.28% in 2009. After 2009, West Sumatra's economy gradually recovered, recording a growth of 5.6% in 2010 and returning to stability at around 6% until 2012. However, starting in 2013, economic growth began to slow down until 2015-2017, where the average economic growth of West Sumatra was around 5.3%. The COVID-19 pandemic in 2020 caused a significant contraction in the West Sumatra economy, with economic growth falling to -1.61%. In 2021, West Sumatra's economy began to recover with a growth of 3.29% and reaching 4.62% in 2023.

The 2008 global financial crisis caused economic growth in both provinces to decline sharply in 2009, as seen from the significant decline in North Sumatra (5.07%) and West Sumatra (4.28%). In addition, the COVID-19 pandemic in 2020 resulted in a drastic decline in economic growth. North Sumatra contracted by -1.07%, while West Sumatra contracted more, at -1.61%. This decline occurred due to social restrictions, disruption of business activities, and declining global demand. This study is in accordance with research (Novalina & Rusiadi, 2018; Rangkuty et al., 2023) highlighted that the COVID-19 pandemic had an unexpected impact, especially on the tourism and MSME industry sectors, which are important pillars of the West Sumatra economy. The study also shows that post-crisis economic recovery depends on appropriate fiscal and monetary policies, as well as efforts to revitalize key sectors of the regional economy. After the impact of the pandemic subsided, the economies of both provinces began to show signs of recovery in 2021 and 2022. Economic recovery policies and increased domestic and global trade activities helped boost growth.

Export and import activities at the port are very important because they reflect the high mobility of supply and demand, both domestic and international. The port functions as an entry and exit point for the flow of goods, including export/import and inter-island goods. The following is the development of export and import activities at the Ports of North Sumatra and West Sumatra.

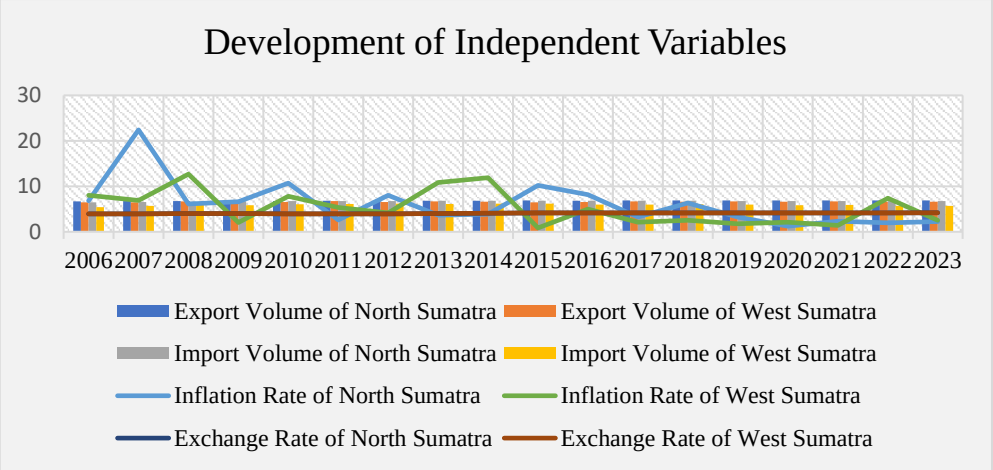

Figure 4. Development of Independent Variables in North Sumatra and West Sumatra (2006-2023)

Source: Central Bureau of Statistics of Indonesia, 2024

Based on data on the development of export volume, import, inflation rate, and exchange rate (KURS) in North Sumatra and West Sumatra from 2006 to 2023, several significant fluctuating patterns are seen in various economic variables. Export volume in North Sumatra shows a stable trend with a slight increase during the period 2020 to 2023. One of the main factors driving the increase in exports in North Sumatra is the increase in the price of leading commodities such as crude palm oil (CPO) in the global market, as well as improving demand from major trading partner countries such as India, China, and the United States (Raza & Zulfa, 2020; Zulfa et al., 2016). This increase was greatly influenced by the global economic recovery after the Covid-19 pandemic. This is in line with Cynthia's research (2024) which shows that the increase in CPO prices is the main factor in driving North Sumatra's exports. In addition, Sari's research (2022) also stated that the recovery in global demand contributed significantly to the growth of North Sumatra's plantation exports, especially palm oil and rubber.

On the other hand, West Sumatra showed a relatively stable export volume but experienced a slight decline in certain years, especially during 2020 to 2021. This was influenced by the decline in global demand due to economic disruption during the Covid-19 pandemic, which resulted in a decline in exports of leading commodities such as rubber and agricultural products (Rangkuty et al., 2023; Taime & Djaelani, 2021). Rismayeti's research (2022) in (Bakhtiar Efendi et al., 2023) supports this finding by highlighting that West Sumatra's exports are highly dependent on fluctuations in global commodity prices, which are heavily influenced by international market demand. Despite a recovery in 2022 and 2023, West Sumatra's exports have not fully recovered to pre-pandemic levels. However, this study is

inconsistent with other studies that state that the global economic recovery should have been able to boost West Sumatra's export volume more quickly, especially with increased demand from major countries (Akbas & Sancar, 2021; Petchko, 2018).

Import volumes in both provinces, North Sumatra and West Sumatra, showed a sharp downward trend in 2020 and 2021. The impact was dominated by global economic problems due to the Covid-19 pandemic, which caused a drastic decline in international trade volume. This is supported by Widya's research (2020) in (Rangkuty et al., 2023; Taime & Djaelani, 2021), which found that the decline in import activity in North Sumatra and West Sumatra was closely related to the contraction of the global and domestic economy during the pandemic. In addition, the research results showed that fluctuations in import commodity prices and restrictions on the movement of goods due to lockdown policies in various countries contributed to the decline in import volumes in the two provinces (Bakhtiar Efendi et al., 2023; Bhakti Nauli Siregar & Efendi, 2022). However, starting in 2022, there are signs of import recovery, especially in North Sumatra, along with the reopening of international trade routes and the recovery of global supply chains. This is in line with findings showing that the post-pandemic global economic recovery has driven increased demand for imported goods in several sectors (Farid et al., 2023).

Inflation rates in North Sumatra and West Sumatra also showed a fluctuating pattern. Inflation in North Sumatra experienced a drastic decline in 2020 and 2021, largely due to the economic contraction caused by the pandemic. The decline in domestic consumption and slowing economic activity during the pandemic were the main factors that reduced inflationary pressures. This study is in line with the findings of Rismayeti (2021) in (Jensen, 2024), which shows that the decline in domestic demand due to the pandemic has contributed to low inflation in both provinces. However, this study is not entirely in line with Romi (2021) in (Liu et al., 2024), which states that inflation should remain high due to rising domestic production costs due to supply chain disruptions, which are not fully reflected in inflation data during the pandemic.

The impact of changes in export volume, import, inflation, and exchange rates on economic growth in North Sumatra and West Sumatra is quite significant. The increase in export volume, especially driven by the increase in the price of leading commodities such as CPO, has contributed positively to the economic growth of the two provinces through increasing foreign exchange and regional income. This is in accordance with research which states that export growth directly contributes to increasing state income and economic growth (Liu et al., 2024). However, the decline in import volume, especially capital and consumer

goods, has the potential to hold back economic growth due to the reduced supply of goods needed to support domestic production activities.(Lou et al., 2024). Other studies have also revealed that a decline in imports could slow down post-pandemic economic recovery due to difficulties in meeting the needs of capital goods and industrial raw materials (Jensen, 2024).

In the next section, an ARDL (Autoregressive Distributed Lag) panel test is conducted, which will provide a clearer picture of the short-term and long-term relationships between the independent variables and the dependent variable. The following are the results of the ARDL Panel test.

Table 1. Results of Data Processing of Long-Term ARDL Panel Model Research

Dependent variable	: Economic Growth (GRDP)
Location	: North Sumatra and West Sumatra
Sample	: 2006-2023
Software	: Eviews, 12
Source	: Data processed by the author in 2024

Variables	Long-term			
	Coefficient	Std.Error	t-statistic	Prob.
VEKS	-13.55783	1.719237	-7.885953	0.0000
VIMP	2.297925	0.140666	16.33604	0.0000
INFLATION	-0.511651	0.025970	-19.70188	0.0000
EXCHANGE RATE	-13.62005	0.458107	-29.73112	0.0000

This study examines the effect of export volume, import volume, inflation, and exchange rate on economic growth (GRDP) in North Sumatra and West Sumatra, both in the long term and short term. The long-term estimation results show that export volume (VEKS) has a significant negative effect on GRDP, with a coefficient of -13.56 and a probability of 0.0000. This indicates that every 1 percent increase in export volume will reduce GRDP by 13.56 percent. This finding leads to the conclusion that exports may not contribute enough to strengthening the local economy, or there is a strong dependence on imports. In contrast, import volume (VIMP) shows a significant positive effect on GRDP, with a coefficient of 2.30 and a probability of 0.0000, meaning that a 1 percent increase in imports will increase GRDP by 2.30 percent. Inflation is also found to have a significant negative effect on economic growth, with a coefficient of -0.51 and a probability of 0.0000, indicating that every 1 percent increase in inflation will reduce GRDP by 0.51 percent. The exchange rate has a significant negative effect

with a coefficient of -13.62 and a probability of 0.0000, indicating that currency depreciation (exchange rate increase) tends to worsen economic growth.

Table 2. Results of Short-Term ARDL Panel Model Research Data Processing

Dependent variable	: Economic Growth (GRDP)			
Location	: North Sumatra and West Sumatra			
Sample	: 2006-2023			
Software	: Eviews, 12			
Source	: Data processed by the author in 2024			
Variables	Short-term			
	Coefficient	Std.Error	t-statistic	Prob.
Cointegration	-1.353740	0.664472	-2.037318	0.0190
GRDP (-1)	1.025343	0.513819	1.995535	0.0739
VEKS	44.89051	21.63876	2.074542	0.0648
VEX (-1)	6.135013	1.842964	3.328884	0.0076
VIMP	1.252312	11.45616	0.109313	0.9151
VIMP(-1)	4.629178	3.466888	1.335255	0.2114
INFLATION	0.458391	0.225315	2.034442	0.0693
INFLATION(-1)	0.304720	0.097115	3.137727	0.0106
EXCHANGE RATE	-2.372486	27.50434	-0.086259	0.9330
COURSE(-1)	65.87914	18.46835	3.567136	0.0051
C	187.9309	91.63000	2.050976	0.0674
Statistics			**Mark**	
The average of the dependent variable			-0.1128	
Standard deviation of the dependent variable			1.5625	
SE of Standard Error of Regression			0.2375	
Sum of squares of residuals			0.5643	
Log likelihood value			22.7564	
Akaike Information Criterion			0.1802	
Black Criterion			1.3239	
Hannan-Quinn Criterion			0.5794	

The results of the data processing above show that in the short term, there is a significant cointegration relationship between these variables with a probability of 0.0190, approaching a

significance level of 10 percent. This indicates a stable long-term relationship between exports, imports, inflation, exchange rates, and GRDP. The previous period's GRDP (GRDP (-1)) shows a positive influence on the current GRDP, with a coefficient of 1.03 and a probability of 0.0739, which is almost significant at the 10 percent level, indicating that past economic conditions have a positive impact on current economic conditions. Export volume (VEKS) in the short term also shows an influence that is close to significant, with a coefficient of 44.89 and a probability of 0.0648, indicating that an increase in current export volume can drive economic growth. In addition, the lag of exports (VEKS (-1)) has a significant influence on GRDP with a coefficient of 6.13 and a probability of 0.0076, indicating that past exports make an important contribution to current economic growth. Meanwhile, the import volume (VIMP) in the short term does not give a significant effect, with a probability of 0.9151, although the lag of imports shows some effect but is still not significant. Inflation in the short term has a positive effect that is almost significant on economic growth with a probability of 0.0693, while the lag of inflation (INFLATION (-1)) shows a significant effect, with a coefficient of 0.3047 and a probability of 0.0106, indicating that inflation in the past has a significant contribution to economic growth. The exchange rate in the short term does not show a significant effect, but the lag of the exchange rate (EXCHANGE (-1)) shows a significant effect with a coefficient of 65.88 and a probability of 0.0051, indicating that changes in the exchange rate in the past have a large impact on current GRDP.

The summary statistics result shows that the mean of the dependent variable (GRDP) is -0.1128, with a standard deviation of 1.5625, indicating a significant variation in GRDP during the study period. The SE of the regression of 0.2375 indicates a relatively low prediction error, while the residual sum of squares of 0.5643 indicates the total prediction error of the model. The log likelihood value of 22.7564 indicates a relatively good model fit. This model was evaluated using the Akaike Information Criterion (AIC) of 0.1802, the Schwarz Criterion (SC) of 1.3239, and the Hannan-Quinn Criterion (HQC) of 0.5794. These values indicate that the model used has good quality, with a balance between model fit and complexity.

After understanding the long-term and short-term relationships between exports, imports, and exchange rates on economic growth in general, a more in-depth analysis is needed to see how these variables affect economic growth in each region, namely North Sumatra and West Sumatra. In this context, the ARDL panel test per region is applied to further explore the differences and similarities in economic dynamics in the two provinces. In the next section, the results of the ARDL panel data processing will be presented for each region separately, in order to clarify the pattern of relationships between economic variables in the context of economic

growth in North Sumatra and West Sumatra. By dividing the analysis into two regions, we can see more clearly how the role of each economic variable, such as exports, imports, inflation, and exchange rates, interact in influencing GRDP growth in North Sumatra and West Sumatra. In the next section, the results of the ARDL panel data processing will be presented for each region separately, in order to clarify the pattern of relationships between economic variables in the context of economic growth in North Sumatra and West Sumatra.

Table 3. Results of ARDL Panel Model Research Data Processing Based on Region

Dependent Variable	: Economic Growth (GRDP)
Sample	: 2006-2023
Software	: Eviews, 12
Source	: Data processed by the author in 2024

Variables	North Sumatra Region				West Sumatra Region			
	Coefficient	Std.Error	t-statistic	Prob.	Coefficient	Std.Error	t-statistic	Prob.
COINTEQ01	-0.689269	0.001486	-463.7248	0.0000	-2.018212	0.001683	-1199.335	0.0000
D(GRDP(-1))	0.511524	0.002037	251.1034	0.0000	1.539162	0.004083	376.9268	0.0000
D(VEKS)	66.52927	10.69372	6.221338	0.0084	23.25175	1.369387	16.97968	0.0004
D(VEKS(-1))	4.292049	4.218009	1.017553	0.3838	7.977977	0.183204	43.54694	0.0000
D(VIMP)	-10.20385	3.824984	-2.667685	0.0758	12.70847	0.144117	88.18193	0.0000
D(VIMP(-1))	8.096065	3.802820	2.128963	0.1231	1.162290	0.302612	3.840857	0.0311
D(INFLATION)	0.233076	0.000299	780.1352	0.0000	0.683707	0.002485	275.1612	0.0000

D(INFLATION(-1))	0.207605	0.000164	1266.634	0.0000	0.401835	0.001712	234.7233	0.0000
D(CURRENCIES)	-29.87682	4.886189	-6.114546	0.0088	25.13185	3.785010	6.639838	0.0070
D(RATE(-1))	47.41078	9.404298	5.041395	0.0150	84.34749	8.755963	9.633149	0.0024
C	96.30090	76.61052	1.257019	0.2977	279.5609	450.2059	0.620962	0.5786

Based on the results of the ARDL Panel analysis per region, it was found that in North Sumatra, the long-term adjustment variable (COINTEQ01) showed a coefficient of -0.689 with a very high level of significance (probability 0.0000), indicating rapid adjustment towards long-term equilibrium. The GRDP variable in the previous period (D(GRDP(-1))) has a significant positive effect on the current GRDP with a coefficient of 0.511 and a probability of 0.0000. Export volume (D(VEKS)) also has a significant positive effect on GRDP with a coefficient of 66.529 and a probability of 0.0084, but the export volume in the previous period (D(VEKS(-1))) does not show a significant effect on GRDP. Conversely, the import volume (D(VIMP)) shows a significant negative effect with a coefficient of -10.203 and a probability of 0.0758, while the import lag is not significant. Inflation (D(INFLATION)) shows a significant positive effect on GRDP with a coefficient of 0.233 and a probability of 0.0000, as well as inflation in the previous period (D(INFLATION(-1))) which has a coefficient of 0.207. The exchange rate (D(CURS)) has a significant negative effect on GRDP with a coefficient of -29.876 and a probability of 0.0088, but the exchange rate in the previous period (D(CURS(-1))) shows a significant positive effect with a coefficient of 47.410 and a probability of 0.0150.

Meanwhile, the results for West Sumatra show that COINTEQ01 has a coefficient of -2.018 with a probability of 0.0000, indicating rapid long-term adjustment. The previous period's GRDP (D(GRDP(-1))) has a significant positive effect with a coefficient of 1.539 and a probability of 0.0000. Export volume (D(VEKS)) shows a significant positive effect on GRDP with a coefficient of 23.251 and a probability of 0.0004, as well as exports in the previous period (D(VEKS(-1))) which shows a coefficient of 7.977 and a probability of 0.0000. Import volume (D(VIMP)) also shows a significant positive effect on GRDP with a coefficient of 12.708 and a probability of 0.0000, while import lag (D(VIMP(-1))) has a positive effect with a coefficient of 1.162 and a probability of 0.0311. Inflation (D(INFLATION)) in West

Sumatra shows a significant positive effect with a coefficient of 0.683 and a probability of 0.0000, and inflation in the previous period (D(INFLATION(-1))) also shows a significant effect with a coefficient of 0.401. The exchange rate (D(CURS)) has a significant positive effect on GRDP with a coefficient of 25.131 and a probability of 0.0070, and the exchange rate in the previous period (D(CURS(-1))) also has a significant positive effect with a coefficient of 84.347 and a probability of 0.0024.

These results show that in both regions, economic variables such as exports, imports, inflation, and exchange rates have varying effects on GRDP, both in the short and long term, with important differences related to the direction and magnitude of the impact of each variable.

Discussion

Based on the estimation results using the ARDL Panel model, it was found that there is a significant relationship between several independent variables and GRDP in both regions, both in the short and long term.

In North Sumatra, the results of the study show that export volume (VEKS) has a significant positive effect on economic growth in the short term. This is in line with research that found that increasing export volume drives economic activity, especially in sectors based on export commodities (J.-A. Li et al., 2023; Liu et al., 2024; Lou et al., 2024). However, when the import volume (VIMP) increases, it is found that it has a negative effect on GRDP, meaning that dependence on imports can burden the local economy, especially in sectors that depend on imported raw materials. Other studies also support this finding, where increased imports can eventually disrupt the trade balance if not offset by increased local production (J.-A. Li et al., 2023). However, this study is not entirely in line with Romi's (2021) research in (Yang et al., 2023), which states that the overall import volume should have a positive impact because it supports the manufacturing sector and expands local production capacity. Romi argues that with imports, especially capital goods, it can increase domestic production capacity which will have a positive impact on economic growth (Bhakti Nauli Siregar & Efendi, 2022; Yang et al., 2023).

In West Sumatra, export volume shows a significant positive impact in both the short and long term. This finding is consistent with research stating that regions that rely on the agricultural sector and export commodities will experience faster economic growth when export volume increases (Yang et al., 2023). Other studies also support this result by emphasizing that exchange rate stability that supports exports will strengthen the competitiveness of local products in the international market, encouraging an increase in GRDP in the region (Farid et al., 2023; Haas et al., 2023).

On the other hand, there are several studies that are not entirely in line with these results, namely that in several regions in Indonesia, the exchange rate does not have a significant effect on economic growth (Gao et al., 2024; Xu & Li, 2024). In contrast to the results of this study which show that exchange rate changes have a significant impact on GRDP in West Sumatra, both in the short and long term (Song & Hua, 2024). Maulana argues that exchange rate stability is not the main determining factor in several economic sectors that focus more on the domestic market. In addition, inflation was also found to have a significant positive effect on economic growth in both regions. Increasing inflation, although often seen as a negative phenomenon, can increase economic growth if it is balanced by an increase in people's income. Research by Andini (2023) in (Gaies et al., 2024; Qiu & Yu, 2024; Wang et al., 2024)supports this result by stating that moderate inflation can provide incentives for producers to increase production, especially in conditions of high domestic demand. However, if inflation is not controlled, the impact can be negative, which states that high inflation that continues to erode people's purchasing power and hamper economic growth (Hu et al., 2024; Jiang et al., 2024). The following section describes the summary of the ARDL Panel test results.

Variable	North Sumatera	West Sumatera	*Short Run*	*Long Run*
Export Volume	1	1	1	1
Import Volume	0	1	0	1
Inflation	1	1	1	1
Exchange Rate	1	1	1	1

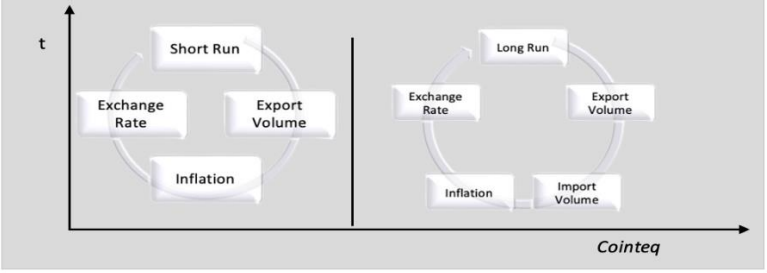

Figure 5. Summary of ARDL Panel Test Results for Controlling Economic Growth in North Sumatra and West Sumatra in the Short and Long Term

Source: Summary of Author's Analysis Results, 2024

From this analysis, it is known that the leading indicators that significantly influence economic growth in North Sumatra and West Sumatra are export volume, inflation, and exchange rates. Export volume is the main factor driving economic growth in both regions, especially in export-oriented sectors. Meanwhile, inflation, although often considered an economic risk, can provide a positive boost to the economy if it is within controlled limits. The exchange rate is also an important indicator in maintaining the stability of international trade,

where exchange rate fluctuations can have a direct impact on the competitiveness of export products.

Export volume plays a major role as a driver of economic growth, especially in regions with strong export-oriented sectors, such as agriculture, plantations, and manufacturing industries. Inflation, although often considered a threat to economic stability, turns out that in a controlled context, it can provide a positive boost for producers and increase consumer purchasing power. Meanwhile, the exchange rate is an important indicator in maintaining the stability of international trade, because exchange rate fluctuations directly affect the competitiveness of local products in the global market. These results are in line with various other studies that emphasize the importance of export volume and macroeconomic stability to economic growth. For example, several studies have found that increasing export volume in regions with a strong production base is directly correlated with sustainable economic growth (Ninglis & Prasetyo, 2024; Rusdianto et al., 2024), this finding is also supported by stating that regions with high dependence on exports have better economic resilience in the face of global shocks (De Pascale & Romagno, 2024; A. Yadav et al., 2024). Inflation is also an important variable in this study. In line with Agus's research (2022) in (Hunjra et al., 2024), controlled inflation has been shown to provide stimulus to the production sector, increase output capacity and support economic growth. Yadav (2024) highlights that moderate inflation, especially when balanced with increased income, actually drives household consumption and increases GRDP (S. Yadav et al., 2024). The exchange rate as one of the leading indicators also receives special attention in several studies Qadri (2024) stated that exchange rate stability is key for regions that rely on exports to maintain the competitiveness of their products in the global market (Qadri et al., 2024; Song et al., 2024). This finding is reinforced by Sari (2021) who stated that exchange rate fluctuations can reduce export competitiveness, especially in areas that do not have sufficient product diversification, such as West Sumatra.

In this context, the government needs to focus on fiscal and monetary policies that are able to maintain inflation and exchange rate stability, as well as encourage increased export volume. This study is in line with the findings of Nugroho (2020) in (Rusdianto et al., 2024)which emphasizes the importance of the government's role in creating a conducive trade climate to encourage exports. Arief (2021) in (Surjaningsih et al., 2012)also shows that government support for macroeconomic stability, such as inflation control and exchange rate stability, is a key factor in maintaining economic growth. However, not all studies support this finding. Some find that inflation actually has a negative impact on economic growth in regions with high import dependence, especially when inflation reaches uncontrolled levels (Hu et al.,

2024; C. Li & Zhou, 2024). Furthermore, it highlights that exchange rate fluctuations that often occur in developing countries actually create uncertainty for business actors, thus having a negative impact on economic growth (Valentine et al., 2024). Susanto (2020) in (Maslahatul & Sutrisno, 2024)also found that inflation and exchange rate stability are not the only factors that determine economic growth, because some regions in Indonesia, such as North Sumatra, are still very dependent on foreign direct investment (FDI). Furthermore, although export volume is important, its influence on GRDP can be weakened if there is no diversification of export products (Andani et al., 2024; Maslahatul & Sutrisno, 2024).

Overall, the results of this study emphasize the importance of appropriate fiscal and monetary policies in maintaining the stability of inflation, exchange rates, and trade volume as the main leading indicators in supporting sustainable economic growth in North Sumatra and West Sumatra. Local and central governments need to pay attention to these variables in determining effective economic policies to encourage economic growth in the future. However, these findings need to be seen in a broader context, where comprehensive economic policies must also consider other variables, such as investment and economic diversification, to create more sustainable and resilient growth against global economic changes.

5. CONCLUSION AND RECOMMENDATION

Based on the results of the ARDL Panel model estimation, export volume, inflation, and exchange rate emerge as the main leading indicators that influence economic growth (GRDP) in North Sumatra and West Sumatra, both in the short and long term, although the impact varies in each region.

In North Sumatra, export volume has a significant positive impact on GRDP, confirming that increased exports drive economic growth. Conversely, import volume has a negative impact, indicating that import dependence can weaken the local economy. Controlled inflation has a positive impact, while the exchange rate has a negative impact in the short term but a positive impact in the long term, highlighting the importance of exchange rate stability for export competitiveness.

In West Sumatra, export volume also showed a significant positive impact in the short and long term, strengthening the role of exports as the main driver of economic growth. In addition, import volume, inflation, and exchange rates had a significant positive impact, indicating that the combination of inflation and exchange rate stability supports production and export activities. The results of this study underline that macroeconomic stability, especially in terms of inflation and exchange rates, as well as increasing export volumes, are key factors

supporting economic growth in both provinces. However, the high dependence on imports in North Sumatra indicates a risk to the local economy, which requires special attention from the policy side. The right policy recommendation for North Sumatra and West Sumatra is to encourage export diversification to reduce dependence on certain commodities and strengthen economic resilience to external shocks. In addition, it is important to strengthen local industries to reduce dependence on imports, especially in North Sumatra, by supporting import substitution through local raw material production. In addition, maintaining inflation and exchange rate stability is an important priority, because controlled inflation can support economic growth and exchange rate stability will maintain the competitiveness of export products. To improve global competitiveness, the government also needs to encourage innovation and technology in the export sector, and adopt green economic policies that focus on sustainability, especially in West Sumatra which has a large agricultural sector. The most appropriate policies to implement are a combination of coordinated fiscal and monetary policies to maintain inflation and exchange rate stability, as well as industrial policies that encourage import substitution and export diversification. The Export Capacity Enhancement Program and support for MSMEs through the Regional Comprehensive Economic Partnership (RCEP) Framework can help penetrate the global market, with a focus on improving local industry competitiveness and macroeconomic stability.

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