Export Dynamics and Inequality: ARDL Analysis of the Effects of GDP, Unemployment, and HDI in Indonesia

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Abstract

Inequality in particular is still a major economic issue in every nation. This study uses data from the World Bank, covering the years 1990–2022, to investigate the relationship between exports and economic inequality. It does this by treating the GDP, unemployment rate, and human development index (HDI) as independent variables. This study examines the relationship between short- and long-term variables using the Autoregressive Distributed Lag (ARDL) analytic method as its model. The results of this research show that Indonesia's exports are not considerably impacted by the country's unemployment rate or Human Development Index (HDI). Furthermore, the export variable and the Indonesian GDP variable show a clear negative connection.

Introduction

Economic inequality is still the main issue and the most significant challenge most countries worldwide are experiencing especially Indonesia. This inequality is reflected in income distribution and access to economic opportunities, education, and health services (Anwar, 2022). In Indonesia, rapid economic growth has brought significant changes in the economic and social structure, but an equal distribution of wealth has only sometimes followed it. In this context, exports are the driving force that significantly impacts the national economy, shaping the dynamics of inequality (Widarni & Bawono, 2021). Amid increasingly unstoppable economic globalization, exports are a key indicator in measuring a country's economic performance. Indonesia has abundant natural resources. As a developing country, Indonesia has long relied on exports to drive its economic growth (Saleh et al., 2020).

The research by Andari (2020) also shows that economic liberalization, including exports, plays a vital role in influencing income disparity in Indonesia. Exports can contribute favorably to economic expansion, but without the right policies, exports can also widen the inequality gap. This happens because uneven exports can increase specific sectors' income while others are left behind.

Unemployment, as one of the socioeconomic problems and a key indicator of social inequality, can be affected by export dynamics in a country. Growing exports can create jobs and reduce unemployment, but on the one hand, dependence on certain exports can also cause structural unemployment if not balanced with economic diversification (Nae et al., 2024). Export dynamics also have an impact on the HDI, which measures the population's productivity and quality of life. Value-added exports have the potential to increase HDI by enhancing public health, education, and income (Gryshova et al., 2020).

Exports and GDP, a gauge of a nation's overall economic output, are logically linked, where the aggregate of the worth of products and goods generated within a nation naturally has a close relationship with export activity. Increased exports are often considered an indicator of

economic growth, given their role in infusing foreign exchange into the domestic economy. When a country exports more goods and services, this indicates higher international competitiveness and increases GDP due to capital and income inflows. However, such growth must be inclusive and sustainable to provide balanced benefits to all levels of society (Oulton, 2023).

In research, Jia, Huang, Xu, and Sun (2020) stated that the export relationship harms unemployment, but the impact is negligible. This is also reinforced by other variables, which, according to the research by Ginting, Hutasoit, and Peranginangin (2021), indicate that the unemployment variable can harms exports, which is notable. However, according to research, exports have a significant partial impact on GDP. Sumiyati (2020) opposed the research, It claimed that neither initially nor thereafter, Indonesia's Gross Domestic Product (GDP) was significantly affected by the export component. The export variable has a significant positive influence on unemployment, according to Zamzami, Hastuti, and Sunargo (2020), yet the export variables of Korea, Indonesia, and other Asian exports have a considerable negative impact, depending on the nation.

In the meanwhile, the exports of nations like China and Hong Kong have a substantial and adverse effect on the unemployment rate. In addition, other financial variables, namely HDI, based on research by Azzaki (2021), simultaneously HDI affect exports, and partially, exports significantly affect HDI in Indonesia. Meanwhile, research by Rahman, Andrasari, and Sirojuzilam (2023) shows that each HDI variable does not significantly impact exports in Sumatra Island Province.

This article will examine the relationship between exports and inequality in Indonesia, focusing on its effects on unemployment, HDI, and GDP. Through data analysis and literature review, this research aims to understand how exports can be a tool to reduce inequality or, conversely, deepen existing inequality.

Literature Review

Several empirical studies describe the correlation between exports to HDI, unemployment, and GDP in Indonesia. From 2005 to 2021, exports have contributed significantly to economic progress in Indonesia (Purnama et al., 2024). Similarly, the Human Development Index (HDI) also indicated a significant positive impact during this period. Labor shows a significant adverse effect on the economy's expansion during this period. Exports, HDI, and labor simultaneously significantly impact the economy's expansion (Yumashev et al., 2020). As the worth of exports increases, it is predicted to further strengthen its influence on economic growth, indicating that the results are significant. The increasing HDI in Indonesia is also positively and significantly related to the acceleration of economic expansion. Conversely, however, labor makes a vital contribution but has a negative impact on economic development, indicating that labor is not the only factor determining economic growth (Jung & Lim, 2020).

Miranti and Mendez (2023) found that each HDI variable has no discernible impact on exports in the province of Sumatra Island. In addition, Stievany and Jalunggono (2022) confirmed that exports significantly influenced Indonesia's economic growth from 2018 to 2020. Similarly, investment proved to have a substantial contribution to economic progress during this time. The HDI (Human et al.) also showed a meaningful impact on economic expansion in the country between 2018 and 2020. The research also revealed that exports, economic openness, and imports, when analyzed together, significantly impact HDI in ASEAN countries. Individually, each of the import, export, and variables related to economic openness also have a significant influence on HDI.

Other literature also examines the export variable in Indonesia's GDP. The study of Saputera, Wijaya, and Muttaqin (2023) reveals that exports do not have a noteworthy impact on

Indonesia's short- and long-term GDP, and the unemployment rate variable has a negative correlation with economic expansion. This shows a correlation. Noman (2021) argues that exports have a negligible and adverse effect on unemployment, which means that exports, in this context, do not significantly impact the unemployment rate. A "negative effect" indicates that exports tend to be associated with decreased unemployment. However, since it is said to be "insignificant," the relationship or effect is not strong enough to be considered as having an actual or statistically significant impact. According to research by Pramesti (2023), the impact of the export variable is negative on the unemployment rate, suggesting that a rise in exports from Bali Province may help lower the jobless rate in the area. Drawing on the review of the literature, we propose the following hypothesis:

H1. Exports play a role in increasing Gross Domestic Product
H2. Exports play a role in increasing the Human Development Index
H3. Exports play a role in increasing unemployment

Research Methodology

This research compares Indonesia's exports to its GDP, Human Development Index (HDI), and unemployment percentages, all represented in percentages. The following equation, which represents the ARDL analysis used in this study, is used to express the data in quantitative form:

$$EXP_t = \beta_0 + \beta_1 GDP_t + \beta_2 IPM_t + \beta_3 UNM_t + e_t$$

Description:
EXP: Exports
GDP: Gross Domestic Product
IPM: Human Development Index
UNM: Unemployment

The World Bank provided the data for the years 1990–2021, with GDP, HDI, and unemployment in Indonesia acting as independent variables and Indonesian exports acting as the dependent variable. This study chose the quantitative method with ARDL analysis modeling as a test. The ARDL (Autoregressive et al.) method is an econometric dynamic model that combines two models, namely the AR (Auto Regressive) model and the DL (Distributed Lag) model.

Results And Discussion

This study uses annual export data, GDP, Human Development Index (HDI), and unemployment expressed in percent so that the four variables can be used in a linear model and are typically distributed. Thirteen observations covering the years 1990–2021 make up the data period.

Table 1. Unit Root Test Results at Level and First Difference ADF Levels

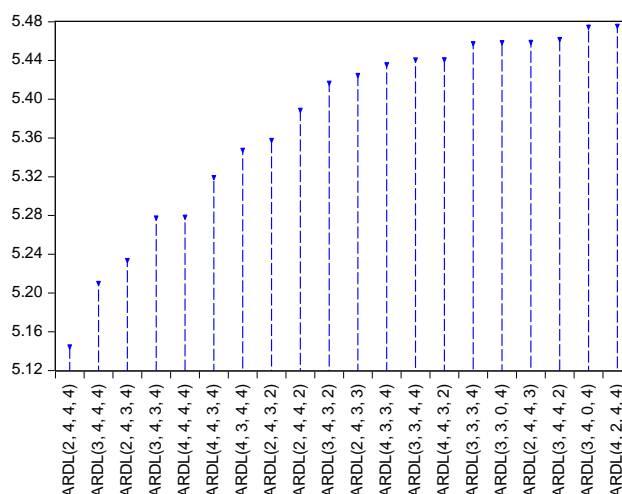| Variable	Unit Root	Prob.	Description
Ekspor	Level	0.1561	Stationary
	First Diff	**0.0000**	
GDP	Level	0.0035	Stationary
	First Diff	**0.0000**	
IPM	Level	0.0014	Stationary
	First Diff	**0.0001**	
Unemployment (UNM)	Level	0.5352	Stationary
	First Diff	**0.0005**	

Since not all variables are stable at the data level according to the findings of the stationarity analysis using the ADF Test, the study moves on to the first difference data. The stationarity test at the first difference data level is considered stationary because all variables meet the conditions of probability <0.0005.

Table 2. Cointegration Test Results with Johansen Test

Variable	Trace Statistic	Critical Value 5%	Prob.
Ekspor	85.66404	47.85613	0.0000
GDP	32.34347	29.79707	0.0249
IPM	13.47710	15.49471	0.0984
UNM	0.103249	3.841466	0.7480

Based on the results of the cointegration study on the Trace Test, the Johansen Test, and exports with a very low probability (0.0000), the hypothesis that there is no cointegration equation is rejected. Stated otherwise, there is a minimum of one cointegrating equation. Similarly, at the 0.05 significance level, the Maximum Eigenvalue test shows that GDP has a low probability (0.0249), indicating that there are two cointegrating equations, and exports have a very low probability (0.0000), implying that there is at least one cointegrating equation. Although GDP has a higher probability (0.1008), it is still more than the 0.05 criterion of significance. There are at least two cointegrating equations in this model. This suggests that there is a steady, long-term relationship between the variables.


Figure 1. Optimum Lag Test Results

The optimal model for the analysis, as determined by the lag optimum test findings, is ARDL(2, 4, 4, 4), which means that the model uses two lags for the dependent variable and four lags for each of the dynamic independent variables (D(GDP), D(HDI), D(UNM)). This was selected using the Akaike information criterion (AIC) method, one of the standard methods for selecting the best model in regression analysis.

Table 4. Bound Test Results

Test Statistic	Value	K
F-statistic	6.818729	3
Critical Value Bounds		
Significance	10 Bound	11 Bound
10%	2.37	3.2
5%	2.79	3.67
2,5%	3.15	4.08
1%	3.65	4.66

The F statistic value, based on the aforementioned test findings, is 6.818729, and the critical limit, at the 5% level, is 2.79. A link between the variables is shown by the F statistic value being bigger than the critical limit value (cointegration).
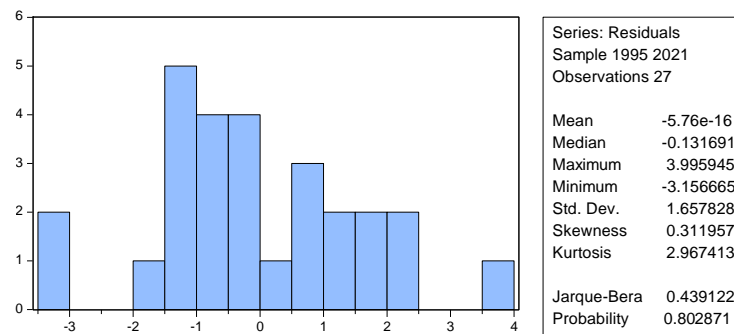
Figure 2. Normality Test Results

Given that the results of the normality test indicate that the Jarque-Bera Statistic probability is 0.802871>0.439122, the data is normally distributed. In light of the premise that the normalcy assumption is satisfied, the analysis employs the ARDL approach.

Table 5. Autocorrelation Test Results

F-statistic	0.398055	Prob. F(2,7)	0.6859
Obs*R-squared	2.757143	Prob. Chi-Square(2)	0.2519

Based on the results of the autocorrelation test, the Breusch-Godfrey Serial Correlation LM approach is used to compute the probability > 0.05, or 0.6859. Thus, it is possible to conclude that there is no autocorrelation.

Table 6 Heteroscedasticity Test Results

F-statistic	2.135185	Prob. F(17,9)	0.1238
Obs*R-squared	21.63554	Prob. Chi-Square(17)	0.1991
Scaled explained SS	2.364780	Prob. Chi-Square(17)	1.0000

As per the findings of the heteroscedasticity test conducted by the Breusch Pagan Godfrey method, the probability that the value is> 0.05 is 0.1238. Thus, the heteroscedasticity issue is resolved.

Table 7. ARDL Model Test Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
D(EXSPOR(-1))	-0.530314	0.251194	-2.111177	0.0639
D(EXSPOR(-2))	-0.819789	0.337016	-2.432495	0.0378
D(GDP)	-0.873371	0.203785	-4.285744	0.0020
D(GDP(-1))	-0.409972	0.346475	-1.183264	0.2670
D(GDP(-2))	-1.614116	0.467783	-3.450569	0.0073
D(GDP(-3))	-0.360898	0.219555	-1.643771	0.1346
D(GDP(-4))	-0.487024	0.213668	-2.279348	0.0486
D(IPM)	0.410433	0.638710	0.642597	0.5365
D(IPM(-1))	0.506799	0.656654	0.771790	0.4600
D(IPM(-2))	-1.211967	0.565450	-2.143367	0.0607
D(IPM(-3))	-0.499609	0.307330	-1.625643	0.1385
D(IPM(-4))	0.544592	0.430858	1.263972	0.2380
D(UNM)	1.363734	1.335575	1.021083	0.3339

D(UNM(-1))	0.938781	1.453785	0.645750	0.5346
D(UNM(-2))	1.119899	2.215919	0.505388	0.6254
D(UNM(-3))	-1.338711	2.069977	-0.646728	0.5340
D(UNM(-4))	2.810815	1.359843	2.067015	0.0687
C	-1.173522	0.788643	-1.488026	0.1709
R-squared	0.935721	Mean dependent var		-0.189011
Adjusted R-squared	0.814304	SD dependent var		6.538890
SE of regression	2.817765	Akaike info criterion		5.144486
Sum squared resid	71.45821	Schwarz criterion		6.008378
Log-likelihood	-51.45057	Hannan-Quinn criteria.		5.401367
F-statistic	7.706713	Durbin-Watson stat		2.141030
Prob(F-statistic)	0.001887			

The ARDL model (2, 4, 4, 4) is the most appropriate ARDL model for this investigation, according to the estimate findings of the ARDL model utilizing the aforementioned Akaike info criterion (AIC). There is at least one significant independent variable in forecasting changes in exports, as shown by the F-statistic likelihood of 0.001887. The GDP variable is the crucial one. Each independent or dependent variable may explain the variance in the dependent variable exports, according to the modified R-squared value of 0.81.

**Table 8.** Long Run Equation Results

Variabel	Koefisien	Std. Error	t Statistik	Probabilitas
C	-0.499349	0.338840	-1.473703	0.1747
D(GDP)	-1.593709	0.241884	-6.588735	0.0001
D(IPM)	-0.106273	0.735133	-0.144562	0.8882
D(UNM)	2.082682	1.355143	1.536872	0.1587

The GDP variable is the sole independent variable that has an impact on Indonesian exports, according to the ARDL model's long-term analysis. Exports are negatively and significantly impacted by the GDP variable, indicating that a decline in Indonesian exports is correlated with a rise in GDP. There appears to be no relationship between Indonesia's export volume and its rates of unemployment and the Human Development Index (HDI), since both variables have little long-term effects on exports.
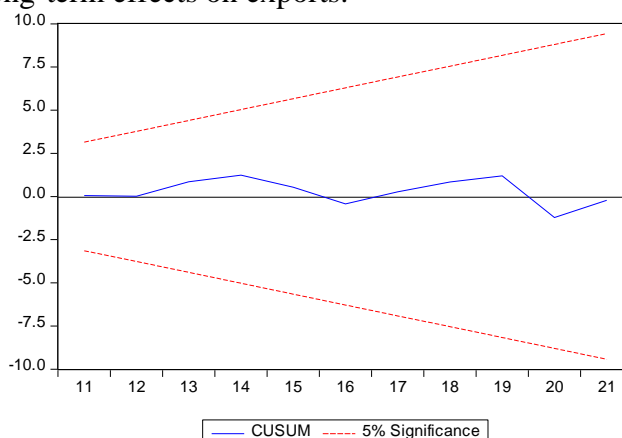
Figure 3. Cusum Test Results

Based on the diagram above, the blue line shows that the CUSUM value fluctuates between the red line and the upper and lower limits of the 5% error degree. This indicates that the forecasting model is stable.
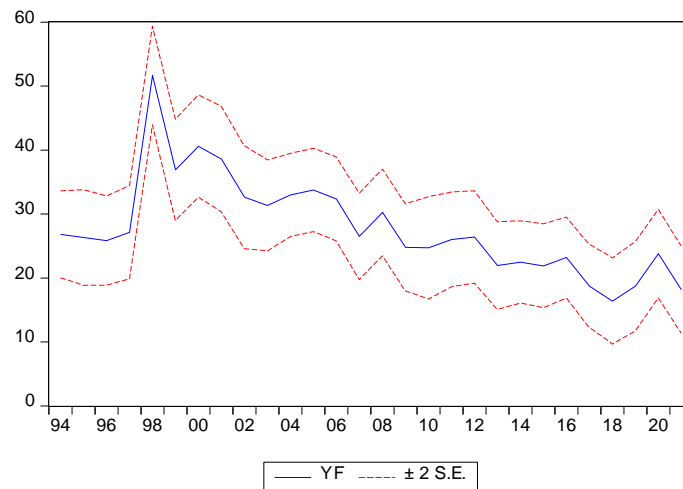
Figure 4. EViews Forecast Results

The diagram indicates that the maximum and lower bounds of the 5% error degree are represented by the red and blue lines, respectively. This indicates that the forecasting model is stable. The forecasting results are formed from the forecast results with the name YF.

Conclusion And Suggestion
Conclusion

Based on the analysis results using the ARDL model and its stages, we find that the unemployment variable and the Human Development Index (HDI) do not have a long-term influence on the export variable. However, the GDP variable has a substantial negative influence on exports. Specifically, as GDP increases, Indonesia's exports tend to decrease. These findings have important implications for Indonesia's macroeconomic variables and export trends.

Firstly, we observe a negative relationship regarding the effect of GDP on exports. An increase in GDP negatively affects exports, suggesting that domestic economic growth may be driven more by internal consumption and investment than exports. Additionally, import substitution becomes relevant as GDP rises, increasing domestic demand for goods and services. Consequently, reliance on exports decreases, and net imports may rise.

Secondly, the lack of a long-term effect of unemployment and HDI on exports implies that other factors play a more dominant role in determining export performance. These factors could include exchange rates, infrastructure quality, trade policies, and global economic conditions.

Suggestions

Economic diversification is essential for sustaining growth. Focusing on non-export sectors can help achieve this goal. Additionally, investment in productivity improvement and innovation can enhance export competitiveness. While the Human Development Index (HDI) does not directly impact exports, improving labor education and training can contribute to long-term export potential. As for recommendations for further research, conducting sector-specific analyses would help understand how these variables affect specific sectors contributing to exports. Comparative studies comparing these results with other countries that share similar economic structures may provide additional insights.

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