

Short-Run and Long-Run Relationship Between Indonesia's Export Value and Real Gross Domestic Product: Quarterly Data Analysis 2010Q1–2026Q1

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ABSTRACT

Purpose: This study examines the short-run and long-run relationship between export value and Indonesia's real gross domestic product (GDP) to evaluate the validity of the export-led growth hypothesis.

Research Method: The study uses 65 quarterly observations from 2010 to 2026, consisting of real GDP at constant 2010 prices and export value. The Autoregressive Distributed Lag (ARDL) approach, bounds test for cointegration, unit root test, and diagnostic and stability tests were employed to examine the relationship between the variables.

Results and Discussion: The unit root results indicate that both variables are integrated of order one, $I(1)$. Based on the Bayesian Information Criterion, the ARDL (1,1) model was selected as the optimal specification. The bounds test produced an F-statistic of 0.874, which is below the 5% lower critical bound, indicating no long-run cointegrating relationship between export value and real GDP. Although changes in export value have a positive and statistically significant short-run effect, the model exhibits heteroskedasticity, non-normal residuals, and parameter instability, particularly during the economic shock in the second quarter of 2020. These findings suggest that higher export values alone do not guarantee sustained economic growth because their impact depends on export composition, domestic value added, import content, and broader macroeconomic conditions.

Implications: Policies should emphasize export diversification and higher domestic value-added production rather than focusing solely on increasing export value.

Originality: This study provides updated evidence on Indonesia's export-led growth hypothesis using quarterly data through 2026 and demonstrates the absence of a stable long-run relationship despite significant short-run effects.

Keywords: ARDL; exports; Indonesia; cointegration; real GDP.

1. Introduction

Real gross domestic product (GDP), measured at constant prices, is the primary indicator of a country's economic performance because it reflects changes in the volume of goods and services produced rather than price fluctuations. In an open economy, economic growth is closely linked to international trade, particularly exports, which serve as an important source of foreign exchange earnings, employment creation, and industrial expansion (Yusoff & Febrina, 2014; Bank, 2025). The export-led growth (ELG) hypothesis argues that expanding exports stimulates economic growth by increasing foreign exchange earnings, promoting economies of scale, encouraging technological progress, attracting investment,



and improving productivity through greater integration into international markets (Adebayo *et al.*, 2022; Orhan *et al.*, 2022). Conversely, the growth-led exports (GLE) hypothesis suggests that economic growth itself enhances export capacity through higher production efficiency, infrastructure development, industrial competitiveness, and greater production capabilities. Under this perspective, improvements in domestic economic performance enable firms to become more competitive in international markets, thereby expanding export activities (Suripto *et al.*, 2025; Goh *et al.*, 2017).

Consequently, the relationship between exports and economic growth is theoretically ambiguous and may differ across countries depending on economic structure, trade composition, institutional quality, and stages of development (Adebayo *et al.*, 2022; Orhan *et al.*, 2022). Empirical evidence from Indonesia also reveals mixed findings. While several studies support the export-led growth hypothesis by documenting a positive long-run relationship between exports and economic growth (Lee & Fernando, 2021; Kurniawan & A'yun, 2022; Fitriyanto, 2023), other studies suggest that the direction of causality may be bidirectional or influenced by foreign direct investment, investment, and other macroeconomic factors (Febiyansah, 2017; Juliansyah *et al.*, 2022; Suripto *et al.*, 2025). These findings indicate that the export-growth nexus remains an empirical issue that requires continuous re-examination using updated data and appropriate time-series methodologies.

Indonesia provides an interesting context for re-examining this relationship. As one of the largest emerging economies in Southeast Asia, Indonesia has experienced substantial growth in both real GDP and export value over the past decade, with international trade playing an increasingly important role in supporting economic expansion and structural transformation (Bank, 2025; Putra *et al.*, 2025). Between the first quarter of 2010 and the first quarter of 2026, real GDP increased by approximately 109.9%, while export value rose by 88.1%. Nevertheless, these long-term trends conceal considerable short-run fluctuations. During the second quarter of 2020, real GDP contracted by 4.19% while export value declined by 17.0% following the COVID-19 pandemic. In contrast, export value reached a post-pandemic peak in the third quarter of 2022, whereas real GDP continued to fluctuate and did not immediately exhibit a comparable increase.

These differing movements suggest that increases in export value do not necessarily translate into proportional changes in real economic output. Such divergence is consistent with previous studies showing that the growth effects of exports depend not only on export volumes but also on export composition, domestic value added, investment linkages, and macroeconomic conditions (Lee & Fernando, 2021; Sari, 2024). Furthermore, empirical evidence for Indonesia indicates that the export-growth relationship is dynamic rather than static, with both short-run adjustments and long-run equilibrium mechanisms shaping the interaction between exports and economic growth (Kurniawan & A'yun, 2022; Fitriyanto, 2023; Juliansyah *et al.*, 2022). These observations underscore the importance of employing dynamic time-series models to distinguish temporary fluctuations from persistent long-run relationships between exports and economic growth.

One explanation lies in the distinct characteristics of the two variables. Real GDP is measured at constant prices and therefore reflects changes in production volume, whereas export value is measured in current U.S. dollars on a free-on-board (FOB) basis and is influenced by exchange rate movements, international commodity prices, export volumes, and product composition. Consequently, an increase in export value may simply reflect higher international commodity prices rather than genuine improvements in domestic production or productive capacity (Basnet *et al.*, 2021; Sari, 2024). Moreover, national income is determined by net exports rather than gross exports alone, implying that the contribution of exports to economic growth depends not only on export performance but also on

import intensity and the domestic value added embodied in exported products (Yusoff & Febrina, 2014; Putra *et al.*, 2025).

Recent evidence from the World Bank (2025) indicates that Indonesia's export contribution to economic growth varies considerably across periods because of fluctuations in global demand, commodity price cycles, exchange rate movements, and import dynamics. Likewise, empirical studies on Indonesia demonstrate that export growth does not always translate into proportional increases in real GDP because the transmission mechanism is conditioned by investment, industrial capacity, foreign direct investment, and macroeconomic conditions (Febiyansah, 2017; Lee & Fernando, 2021; Juliansyah *et al.*, 2022). These considerations suggest that movements in export value should not be interpreted as direct evidence of economic growth without accounting for the underlying structural factors that determine how export revenues are transmitted into domestic production and value creation (Adebayo *et al.*, 2022; Surtpto *et al.*, 2025).

Previous empirical studies on Indonesia have produced mixed findings. Using quarterly data from 2011 to 2019, Fitriyanto (2023) reported significant short-run and long-run relationships between exports and economic growth under the Autoregressive Distributed Lag (ARDL) framework. Similarly, Lee and Fernando (2021) and Kurniawan and A'yun (2022) found evidence of a positive long-run association between exports and economic growth in Indonesia, highlighting the important role of exports in supporting economic expansion. In contrast, Juliansyah *et al.*, (2022), employing a Vector Error Correction Model (VECM), found that although exports are positively associated with economic growth, the relationship is statistically insignificant, suggesting that export performance alone may not be sufficient to stimulate domestic output. At the regional level, panel evidence for ASEAN countries generally supports the export-led growth hypothesis, although the direction of causality differs across member countries (Adebayo *et al.*, 2022; Surtpto *et al.*, 2025).

Likewise, Putra *et al.*, (2025) report that trade openness exerts positive long-run effects on Indonesia's economic growth, while short-run impacts remain relatively weak because of adjustment processes and structural rigidities. Furthermore, Sari (2024) argues that improvements in domestic economic conditions and production capacity can themselves stimulate export performance, lending support to the growth-led exports (GLE) hypothesis. Collectively, these inconsistent findings suggest that the export–growth nexus is highly sensitive to sample periods, estimation methods, data frequency, variable definitions, and structural characteristics of the economy. They also indicate that existing evidence may not fully capture the effects of recent structural shocks, particularly the COVID-19 pandemic, subsequent commodity price fluctuations, and changes in global trade patterns, thereby underscoring the need for updated empirical analysis using recent quarterly data and robust time-series techniques (Bank, 2025; Kripfganz & Schneider, 2023).

Despite the extensive literature, several gaps remain. First, relatively few studies incorporate quarterly observations extending through the post-pandemic recovery period and the commodity price adjustments observed up to the first quarter of 2026. Second, many previous studies rely on conventional regression techniques that may produce spurious results when applied to non-stationary time-series data. Third, limited attention has been given to examining whether exports and real GDP maintain a stable long-run equilibrium relationship under substantial macroeconomic disruptions.

To address these gaps, this study employs the Autoregressive Distributed Lag (ARDL) approach to investigate both the short-run and long-run relationship between export value and Indonesia's real GDP using quarterly data from 2010Q1 to 2026Q1. The ARDL framework is appropriate because it accommodates variables integrated of order zero or one, provides reliable estimates in relatively small

samples, and distinguishes between short-run dynamics and long-run equilibrium relationships. Specifically, this study (i) examines the characteristics of Indonesia's export value and real GDP, (ii) tests the stationarity of both series, (iii) investigates the existence of a long-run relationship using the bounds testing approach, (iv) estimates short-run dynamics, and (v) evaluates model stability in the presence of structural disturbances associated with the COVID-19 pandemic.

This study contributes to the literature in three ways. First, it provides updated empirical evidence on the export-growth nexus in Indonesia by incorporating recent quarterly data through 2026, encompassing the pandemic, economic recovery, and commodity price volatility. Second, it re-evaluates the export-led growth hypothesis using a robust time-series framework that explicitly distinguishes short-run from long-run relationships. Third, the findings offer policy implications regarding whether increasing export value alone is sufficient to support sustainable economic growth or whether greater emphasis should be placed on enhancing domestic value added, export diversification, and industrial competitiveness.

The remainder of this paper is organized as follows. Section 2 provides a literature review and hypothesis development. Section 3 presents the research method and design. Section 4 provides the results and discussion. Section 5 presents concluding remarks and Recommendations.

2. Literature Review and Hypothesis Development

2.1 Literature Review

2.1.1 Export-Led Growth and Growth-Led Exports

The relationship between exports and economic growth has long been explained through two competing hypotheses: the export-led growth (ELG) hypothesis and the growth-led exports (GLE) hypothesis. The ELG hypothesis argues that export expansion stimulates economic growth by increasing foreign exchange earnings, encouraging investment, promoting technological diffusion, improving production efficiency, and enabling economies of scale. Under this perspective, exports function as an engine of growth because access to international markets allows firms to expand production, increase productivity, strengthen national competitiveness, and benefit from learning-by-exporting effects (Adebayo *et al.*, 2022; Orhan *et al.*, 2022).

In addition, export growth generates foreign exchange that finances imports of capital goods, advanced technologies, and intermediate inputs, thereby supporting industrial upgrading and long-term economic development (Goh *et al.*, 2017; Lee & Fernando, 2021). Empirical evidence from Indonesia and other Asian economies generally supports this theoretical proposition, showing that export expansion contributes positively to economic growth, particularly when accompanied by investment, technological progress, and improvements in productive capacity (Elfaki *et al.*, 2021; Kurniawan & A'yun, 2022; Fitriyanto, 2023). Nevertheless, the strength of the export-led growth mechanism depends on the domestic value added embodied in exports, industrial competitiveness, and the economy's ability to transform export revenues into sustainable increases in domestic production and productivity (Putra *et al.*, 2025; Bank, 2025).

In contrast, the growth-led exports (GLE) hypothesis suggests that economic growth precedes export expansion. Rising income, technological advancement, improved infrastructure, greater investment, and higher production capacity enable domestic firms to become more productive and competitive in international markets. As domestic industries expand and improve their efficiency, firms are better positioned to penetrate foreign markets and increase export performance. Consequently, exports are viewed as an outcome rather than a determinant of economic growth (Orhan *et al.*, 2022; Goh *et al.*, 2017). Empirical evidence provides support for this perspective. For example, Sari (2024)

argues that stronger domestic economic performance and production capacity can stimulate export growth in Indonesia, while Suripto *et al.*, (2025) demonstrate that the direction of causality between exports and economic growth differs across ASEAN countries, with evidence supporting both the ELG and GLE hypotheses depending on country-specific characteristics.

Similarly, Adebayo *et al.*, (2022) report asymmetric causal relationships between exports and economic growth, suggesting that the interaction between the two variables is more complex than a simple one-way causal link. The coexistence of these two hypotheses indicates that the direction and magnitude of the export–growth relationship may differ across countries depending on their economic structure, industrial composition, trade specialization, institutional quality, and stage of economic development (Putra *et al.*, 2025; Bank, 2025). Therefore, whether exports drive economic growth or economic growth stimulates exports remains an empirical question that requires country-specific investigation using appropriate econometric techniques capable of distinguishing short-run dynamics from long-run equilibrium relationships (Kripfganz & Schneider, 2023).

Furthermore, the relationship between exports and economic growth may not be stable over time. External shocks, fluctuations in commodity prices, changes in global demand, and structural transformations can alter both the strength and direction of the relationship. Therefore, empirical verification remains necessary, particularly for emerging economies whose exports are still dominated by primary commodities.

2.1.2 Empirical Evidence on the Export–Growth Nexus

Empirical findings on the relationship between exports and economic growth remain inconclusive. Using asymmetric causality analysis for ASEAN countries, Adebayo *et al.*, (2022) found evidence supporting the export-led growth (ELG) hypothesis, although the relationship varies across countries and between positive and negative economic shocks. Their findings suggest that export–growth dynamics are nonlinear and country-specific. Similarly, Orhan *et al.*, (2022) report that the direction of causality between exports and economic growth differs over time, indicating that the dominance of either the export-led growth or growth-led exports hypothesis depends on a country's economic conditions and structural characteristics. Evidence from Indonesia is likewise mixed. Lee and Fernando (2021), Kurniawan and A'yun (2022), and Fitriyanto (2023) document significant long-run relationships between exports and economic growth using ARDL-based approaches, supporting the view that export expansion contributes to sustained economic performance.

In contrast, Juliansyah *et al.*, (2022), using a Vector Error Correction Model (VECM), find that although exports are positively associated with economic growth, their effect is statistically insignificant, implying that export growth alone may be insufficient to stimulate domestic output. Furthermore, Suripto *et al.*, (2025) demonstrate that both the ELG and GLE hypotheses coexist across ASEAN countries, with the direction of causality differing according to country-specific economic structures and stages of development. Collectively, these findings indicate that the export–growth nexus is highly sensitive to sample period, econometric methodology, data frequency, and structural economic conditions, underscoring the need for updated empirical evidence using recent observations and robust dynamic time-series techniques capable of distinguishing short-run adjustments from long-run equilibrium relationships (Kripfganz & Schneider, 2023; Bertelli *et al.*, 2022).

Similarly, Suripto *et al.*, (2025), employing Panel Vector Error Correction Model (PVECM), reported bidirectional causality between exports and economic growth in ASEAN countries, implying that both ELG and GLE hypotheses coexist within the region. However, the magnitude and persistence of the relationship differ among member countries. Evidence from Indonesia is equally mixed. Fitriyanto (2023) found both short-run and long-run relationships between export value and economic growth using the ARDL approach, supporting the export-led growth hypothesis. Conversely, Juliansyah *et al.*, (2022), using the Vector Error Correction Model (VECM), reported that exports have a positive but statistically insignificant impact on economic growth after controlling for imports and investment.

Other studies have highlighted the importance of broader trade conditions in shaping the export–growth relationship. Putra *et al.*, (2025) show that trade openness contributes positively to Indonesia's long-run economic growth, although its short-run effects may be weaker because of adjustment costs and structural rigidities during the transition toward greater trade integration. Similarly, Goh *et al.*, (2017) and Saleem *et al.*, (2020) demonstrate that the interaction between trade openness, foreign direct investment, and economic growth differs between the short and long run, suggesting that the benefits of trade materialize gradually as economies adjust and productive capacity expands. Meanwhile, Sari (2024) finds that stronger domestic economic performance encourages export expansion, lending support to the growth-led exports (GLE) hypothesis.

Evidence from Indonesia also indicates that exports, foreign direct investment, and economic growth are closely interconnected, implying that export performance is influenced not only by external demand but also by domestic investment, industrial development, and macroeconomic conditions (Febiyansah, 2017; Lee & Fernando, 2021). These inconsistent findings indicate that the export–growth relationship depends on several factors, including the sample period, data frequency, estimation technique, model specification, trade composition, structural economic changes, and external shocks. Consequently, updated empirical evidence remains necessary, particularly using data that encompass the COVID-19 pandemic, the subsequent global economic recovery, and recent shifts in international trade patterns, while employing robust dynamic time-series methods capable of distinguishing short-run dynamics from long-run equilibrium relationships (Bank, 2025; Kripfganz & Schneider, 2023; Bertelli *et al.*, 2022).

2.1.3 The ARDL Approach in Export–Growth Analysis

Time-series analysis of macroeconomic variables requires appropriate econometric techniques because many economic indicators exhibit stochastic trends and are often characterized by non-stationarity. Estimating regressions with non-stationary variables may produce spurious relationships, leading to biased parameter estimates and misleading statistical inference. Therefore, testing for stationarity and cointegration is essential before interpreting long-run relationships among macroeconomic variables (Kripfganz & Schneider, 2023; Bertelli *et al.*, 2022). In this context, the Autoregressive Distributed Lag (ARDL) approach has become one of the most widely applied methods because it can simultaneously estimate short-run dynamics and long-run equilibrium relationships while accommodating variables integrated of order $I(0)$, $I(1)$, or a combination of both, provided that none is integrated of order $I(2)$ (Kripfganz & Schneider, 2023). Furthermore, bootstrap cointegration procedures have been shown to improve the reliability of statistical inference, particularly in finite samples and when conventional cointegration tests exhibit size distortions (Bertelli *et al.*, 2022). Owing to these methodological advantages, the ARDL framework has been extensively employed in studies investigating the relationship between exports, trade openness, and economic growth in Indonesia and other developing economies (Lee & Fernando, 2021; Kurniawan & A'yun, 2022; Fitriyanto, 2023; Saleem *et al.*, 2020). Consequently, the ARDL approach provides an appropriate and robust framework for examining both the short-run and long-run effects of exports on Indonesia's real economic growth over the study period.

The Autoregressive Distributed Lag (ARDL) model has become one of the most widely used approaches for examining both short-run dynamics and long-run equilibrium relationships in macroeconomic time-series analysis. Unlike conventional cointegration techniques, such as the Engle–Granger and Johansen approaches, the ARDL framework accommodates variables integrated of order zero, $I(0)$, or order one, $I(1)$, provided that none are integrated of order two, $I(2)$. The method is particularly suitable for relatively small samples because it simultaneously estimates long-run coefficients and short-run adjustment dynamics within a unified error-correction framework, thereby improving estimation efficiency and inference (Kripfganz & Schneider, 2023). In addition, recent methodological advances demonstrate that bootstrap-based cointegration procedures further enhance

the robustness of ARDL estimation by addressing potential size distortions and improving the reliability of hypothesis testing in finite samples (Bertelli *et al.*, 2022). These advantages have contributed to the widespread application of ARDL in studies examining the relationships among exports, trade openness, foreign direct investment, and economic growth, particularly in developing and emerging economies (Saleem *et al.*, 2020; Goh *et al.*, 2017). Likewise, several empirical studies focusing on Indonesia have successfully employed the ARDL framework to investigate the dynamic interactions between exports and economic growth, confirming its suitability for analyzing both short-run adjustments and long-run equilibrium relationships under varying macroeconomic conditions (Lee & Fernando, 2021; Kurniawan & A'yun, 2022; Fitriyanto, 2023).

Recent methodological developments have further strengthened the reliability and applicability of the Autoregressive Distributed Lag (ARDL) approach in empirical macroeconomic research. Bertelli *et al.*, (2022) demonstrate that bootstrap-based cointegration tests improve statistical inference in finite samples by reducing size distortions and enhancing the robustness of long-run parameter estimation. These methodological improvements are particularly valuable when conventional cointegration tests may exhibit low power or produce unreliable results in small samples. Likewise, Kripfganz and Schneider (2023) emphasize that the ARDL framework provides a flexible and efficient approach for simultaneously estimating short-run dynamics and long-run equilibrium relationships while accommodating variables integrated of mixed orders, $I(0)$ and $I(1)$.

Owing to these advantages, the ARDL methodology has been widely adopted in studies investigating the relationships among exports, trade openness, foreign direct investment, and economic growth in emerging economies (Goh *et al.*, 2017; Saleem *et al.*, 2020). In the Indonesian context, several studies have successfully applied ARDL models to examine the dynamic interactions between exports and economic growth, confirming the suitability of this approach for capturing both immediate adjustment processes and long-run equilibrium effects (Lee & Fernando, 2021; Kurniawan & A'yun, 2022; Fitriyanto, 2023). Therefore, these methodological advantages make the ARDL framework particularly suitable for evaluating the export-growth relationship in Indonesia using quarterly observations that encompass major structural changes, including the COVID-19 pandemic and the subsequent global economic recovery (Bank, 2025).

2.2 Hypothesis Development

According to the export-led growth (ELG) hypothesis, higher exports increase aggregate demand, generate foreign exchange earnings, stimulate investment, improve production efficiency, and enhance productivity through economies of scale and technological learning, ultimately promoting long-term economic growth (Adebayo *et al.*, 2022; Orhan *et al.*, 2022). Empirical evidence from ASEAN generally supports this theoretical proposition, although the strength and direction of the relationship differ across countries because of variations in economic structure, industrial competitiveness, and stages of development (Adebayo *et al.*, 2022; Surtiyo *et al.*, 2025). Evidence from Indonesia is likewise supportive. Using an ARDL framework, Fitriyanto (2023) reports significant short-run and long-run relationships between exports and economic growth, while Lee and Fernando (2021) and Kurniawan and A'yun (2022) also document a positive long-run association between export performance and economic growth.

Nevertheless, other studies indicate that the export-growth relationship is not always straightforward. Export values may be strongly influenced by fluctuations in international commodity prices, exchange rate movements, and the high import content of exported products rather than by genuine increases in domestic production and value added (Juliansyah *et al.*, 2022; Basnet *et al.*, 2021). Furthermore, the World Bank (Bank, 2025) emphasizes that Indonesia's export contribution to economic growth depends not only on export expansion but also on improvements in domestic productivity, industrial upgrading, and the integration of domestic firms into global value chains. Consequently, the existence and magnitude of a long-run equilibrium relationship between export value and real GDP remain empirical questions that require further investigation using updated quarterly data and

appropriate dynamic econometric techniques. Based on the theoretical arguments and previous empirical evidence, this study proposes the following hypothesis:

H1: *Export value has a significant long-run relationship with Indonesia's real gross domestic product.*

Because the ARDL model simultaneously estimates long-run equilibrium and short-run adjustment dynamics through the error-correction mechanism (Kripfganz & Schneider, 2023), the following hypothesis is further proposed:

H2: *Changes in export value have a significant short-run relationship with changes in Indonesia's real gross domestic product.*

Research Method

This study employs a quantitative explanatory research design using time-series data to examine the relationship between export value and Indonesia's real gross domestic product (GDP). The unit of analysis is the Indonesian economy, while the unit of observation is quarterly data. The dataset comprises 65 quarterly observations covering the period from 2010Q1 to 2026Q1. Because time-series analysis requires preserving the chronological sequence of observations and lag structures, the entire population of available observations is analyzed rather than selecting a sample. Secondary data were obtained from Statistics Indonesia (Badan Pusat Statistik/BPS). Real GDP, measured at constant 2010 prices (billion rupiah), is used as the dependent variable, while export value, measured in million U.S. dollars on a free-on-board (FOB) basis, serves as the independent variable. Monthly export data were aggregated into quarterly totals to ensure consistency with the GDP reporting frequency. Prior to estimation, the dataset was examined for missing observations, duplicate records, inconsistent units of measurement, and outliers. Extreme observations associated with major economic events, particularly the COVID-19 pandemic, were retained because they reflect actual economic conditions rather than measurement errors.

To reduce scale differences and stabilize variance, both variables were transformed into natural logarithms, denoted as LGDP and LEXP. The logarithmic transformation also enables the estimated coefficients to be interpreted as elasticities. In addition, quarterly seasonal dummy variables (Q2, Q3, and Q4), with Q1 as the reference category, were included to control for potential seasonal effects in economic activity. The empirical analysis employs the Autoregressive Distributed Lag (ARDL) approach to estimate both short-run dynamics and long-run equilibrium relationships between export value and real GDP. The ARDL model is particularly suitable because it can be applied when variables are integrated of order zero, $I(0)$, or order one, $I(1)$, but not of order two, $I(2)$, and performs well in relatively small samples (Kripfganz & Schneider, 2023). Stationarity was first examined using the Augmented Dickey-Fuller (ADF) unit root test. The optimal lag length was then determined using the Bayesian Information Criterion (BIC). The existence of a long-run relationship was evaluated through the ARDL bounds testing procedure, while short-run dynamics were estimated using the associated error-correction specification when cointegration was supported. Finally, a series of diagnostic tests—including tests for serial correlation, heteroskedasticity, residual normality, and parameter stability (CUSUM and CUSUMSQ)—were conducted to assess the robustness of the estimated model.

Following data preparation, the analysis began with descriptive statistics, graphical analysis, and pairwise correlation to provide an overview of the characteristics and preliminary relationship between the variables. The stationarity properties of the series were subsequently examined using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests at both the level and first-

difference forms. The ARDL approach is appropriate when the variables are integrated of order zero, $I(0)$, order one, $I(1)$, or a combination of both, provided that none is integrated of order two, $I(2)$ (Kripfganz & Schneider, 2023).

Table 1. Operational Definition of Variables

Variables	Definition and units	Transformation	Role
Real GDP	Quarterly real gross domestic product at constant 2010 prices, billion rupiah	$LGDP = \ln(GDP)$	Dependent variable
Export value	Quarterly value of goods exports based on FOB, million US\$	$LEXP = \ln(EXP)$	Independent variable
Seasonal dummy	Q2, Q3, and Q4 are equal to 1 in the corresponding quarter	No transformation applied	Deterministic component

Source: Processed research data, 2026.

The optimal lag length was selected using the Bayesian Information Criterion (BIC) with a maximum lag order of four quarters to capture annual dynamics while maintaining a parsimonious model specification. The ARDL framework simultaneously estimates short-run dynamics and long-run relationships within a single specification, making it particularly suitable for small-sample time-series analysis (Kripfganz & Schneider, 2023). Moreover, Bertelli *et al.*, (2022) demonstrate that ARDL-based cointegration testing provides reliable inference in finite samples, particularly when supported by robust diagnostic procedures. The baseline ARDL model is specified as follows:

$$LGDP_t = \alpha_0 + \sum_{i=1}^p \alpha_i LGDP_{t-i} + \sum_{j=0}^q \beta_j LEXP_{t-j} + \delta_2 Q2 + \delta_3 Q3 + \delta_4 Q4 + \varepsilon_t$$

Where LGDP denotes the natural logarithm of real GDP, LEXP represents the natural logarithm of export value, Q2–Q4 are quarterly seasonal dummy variables, and ε is the error term. The existence of a long-run equilibrium relationship was examined using the ARDL bounds testing procedure. The null hypothesis states that the level coefficients are jointly equal to zero, indicating the absence of cointegration. Cointegration is supported when the calculated F-statistic exceeds the upper critical bound, rejected when it falls below the lower critical bound, and considered inconclusive when it lies between the two critical values. If no cointegration is detected, the estimated level coefficients are not interpreted as long-run elasticities, and an Error Correction Model (ECM) is not estimated.

To evaluate model adequacy, several diagnostic tests were performed, including the Breusch–Godfrey test for serial correlation, Breusch–Pagan–Godfrey test for heteroskedasticity, Jarque–Bera test for residual normality, and Ramsey RESET test for functional form misspecification. Model stability was further assessed using the CUSUM and CUSUMSQ tests. When heteroskedasticity was detected, the statistical significance of the estimated coefficients was re-evaluated using heteroskedasticity and

autocorrelation consistent (HAC) standard errors. Finally, a sensitivity analysis was conducted by incorporating an impulse dummy for 2020Q2, representing the peak of the COVID-19 economic disruption. Statistical inference was based on a 5% significance level, while substantive interpretation also considered coefficient signs, confidence intervals, diagnostic test outcomes, and overall model robustness.

Results and Discussion

4.1 Analysis Results

4.1.1 Trends and Descriptive Statistics

The dataset comprises 65 quarterly observations spanning the period from 2010Q1 to 2026Q1. Data screening confirmed that the dataset contained no missing values, duplicate observations, zero values, or negative values, ensuring its suitability for time-series estimation. Table 1 reports the descriptive statistics for the study variables. The average quarterly real GDP was IDR 2,524,750.45 billion, while the average export value reached USD 50,534.70 million. Export value exhibited greater variability than real GDP, as indicated by its higher coefficient of variation (24.79% compared with 20.11% for real GDP), reflecting the greater sensitivity of exports to fluctuations in global demand, commodity prices, and exchange rate movements. Over the observation period, real GDP followed a generally upward trend and reached its highest level in 2025Q4, whereas export value peaked earlier in 2022Q3 following the post-pandemic commodity boom. The different timing of these peaks provides preliminary evidence that changes in export value do not necessarily coincide with changes in domestic economic output, thereby highlighting the importance of formally examining both the short-run and long-run relationship between the two variables using the ARDL framework.

Tabel 2. Descriptive Statistics of Research Variables

Statistic	Real GDP (billion rupiah)	Export Value (million US\$)
Number of observations	65	65
Mean	2,524,750.45	50,534.70
Median	2,552,296.90	45,653.10
Minimum	1,642,356.30	33,710.70
Maximum	3,474,461.20	78,107.90
Standard deviation	507,823.39	12,525.20
Coefficient of variation	20.11%	24.79%

Source: Processed research data, 2026.



Source: Processed research data, 2026.

Figure 1. Development of Real GDP and Export Value of Indonesia, 2010Q1–2026Q1

4.1.2 Correlation Analysis and Unit Root Tests

Table 2 presents the pairwise correlation between the study variables. At the level form, LGDP and LEXP exhibit a positive and statistically significant correlation ($r = 0.632$, $p < 0.001$), suggesting that both variables tend to move together over time. However, after first differencing, the correlation decreases substantially to 0.227 and becomes statistically insignificant ($p = 0.071$). This decline indicates that the strong association observed at the level is largely attributable to their common time trends rather than contemporaneous short-run co-movements. To avoid spurious regression, the stationarity properties of the series were examined using the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) unit root tests. As reported in Table 3, both LGDP and LEXP are non-stationary in levels but become stationary after first differencing. The results consistently indicate that both variables are integrated of order one, $I(1)$. Since neither variable is integrated of order two, $I(2)$, the integration properties satisfy the prerequisite for applying the Autoregressive Distributed Lag (ARDL) approach. The findings therefore support proceeding with lag selection and cointegration analysis.

Table 3. Unit Root Test Results

Variable	Form	ADF	p ADF	PP	p PP	Decision
LGDP	Level	−2.404	0.377	−18.783	0.071	Non-stationary
ΔLGDP	First Difference (I)	−3,266	0.016	−41.707	0.010	Stationary
LEXP	Level	−1,774	0.717	−7,511	0.671	Non-stationary
ΔLEXP	First Difference (I)	−7,585	<0.001	−63.049	0.010	Stationary

Source: Processed research data, 2026.

4.1.3 ARDL Estimation and Long-Run Relationship

Based on the Bayesian Information Criterion (BIC), the ARDL(1,1) specification was selected as the optimal model, yielding 61 effective observations after accounting for lagged terms. The estimated model reports a high coefficient of determination ($R^2 = 0.9956$). However, this value should be interpreted with caution because it is largely driven by the strong persistence of the lagged dependent variable rather than indicating the existence of a long-run equilibrium relationship. The coefficient of the lagged real GDP variable, LGDP, is 0.9790 and statistically significant, indicating a high degree of persistence in Indonesia's real economic output over time. For the export variable, the contemporaneous coefficient of LEXP is 0.0619 ($p = 0.019$), suggesting a positive short-run association with real GDP, whereas the lagged export coefficient is -0.0464 ($p = 0.077$), indicating a weaker and statistically insignificant delayed effect at the 5% significance level. Among the seasonal dummy variables, Q2 and Q3 exhibit positive and statistically significant coefficients, while the Q4 dummy is not statistically significant.

The existence of a long-run equilibrium relationship was evaluated using the ARDL bounds test for cointegration. The estimated F-statistic of 0.874 is substantially lower than the 5% lower critical bound ($I(0) = 5.173$). Consequently, the null hypothesis of no level relationship cannot be rejected, indicating that export value and real GDP are not cointegrated over the sample period. In the absence of cointegration, the estimated level coefficients cannot be interpreted as long-run elasticities, and an Error Correction Model (ECM) is not estimated. These findings suggest that, although export value may exhibit short-run associations with economic activity, it does not establish a stable long-run equilibrium relationship with Indonesia's real GDP during the study period.

Table 4. Summary of ARDL Results, Limit Tests, and Short-Run Relationships

Components	Coefficients/ Statistics	p or critical limit	Decision
LPDBt-1	0.9790	<0.001	High persistence
LEXPt	0.0619	0.019	Positive in the initial estimate
LEXPt-1	-0.0464	0.077	Not significant at the 5% level
F-statistic bounds test	0.874	$I(0) 5\% = 5.173; I(1) 5\% = 6.000$	There is no cointegration
Δ LEXPt, standard error HAC	0.0619	0.305	Not robustly significant

Source: Processed research data, 2026.

4.1.4 Diagnostic and Sensitivity Tests

There is no evidence of autocorrelation at the 5% level, according to the Breusch-Godfrey test, which yields $p = 0.053$. However, the Breusch-Pagan-Godfrey test indicates heteroscedasticity ($p = 0.048$), and the Jarque-Bera test finds non-normal residuals ($p = 0.001$). Ramsey RESET detected no error in the functional form ($p = 0.743$). Although CUSUMSQ passes the critical threshold, the variance remains, although CUSUM states that the mean parameter is stable. The coefficient of export change (p) increases from 0.019 to 0.305 after using the HAC standard error, and the confidence interval encompasses zero. This indicates that the short-run positive relationship does not survive more robust testing. The addition of a dummy for the second quarter of 2020 changes the selected model to ARDL (4,1), with a significant

dummy value of -0.0931 . However, the bounds test F-statistic of 5.598 falls between the lower bound of 5.142 and the upper bound of 5.992. Therefore, the sensitivity results do not provide strong evidence of cointegration.

4.2 Discussion

4.2.1 Export Dynamics and Real GDP

The descriptive analysis reveals that both Indonesia's real GDP and export value exhibited an upward trend over the study period, although export value fluctuated considerably more than real GDP. This difference reflects the distinct economic nature of the two variables. Real GDP measures domestic production at constant prices and therefore captures changes in real economic activity, whereas export value is recorded in current U.S. dollars and is highly sensitive to exchange rate movements, international commodity prices, external demand, and global supply chain disruptions.

Consequently, increases in export value do not necessarily represent proportional increases in domestic production. Following the COVID-19 pandemic, Indonesia experienced a sharp recovery in export value driven largely by higher commodity prices, while the recovery of real GDP was comparatively gradual. This finding supports the argument that nominal export growth may reflect price effects rather than improvements in productive capacity.

Moreover, exports constitute only one component of aggregate demand. Economic growth is simultaneously determined by household consumption, investment, government expenditure, and net exports. Higher export earnings may be offset by rising imports of intermediate and capital goods, thereby reducing the net contribution of exports to domestic output. As noted by the World Bank (2025), Indonesia's economic performance remains strongly influenced by domestic demand, while Sari (2024) emphasizes that exchange rates, foreign direct investment, inflation, and per capita income also shape export performance.

4.2.2 Absence of a Long-Run Relationship

The principal finding of this study is the absence of a long-run cointegrating relationship between export value and real GDP. This result suggests that although exports contribute to economic activity, aggregate export value alone is insufficient to explain Indonesia's long-run growth trajectory. Consequently, the export-led growth (ELG) hypothesis is not supported within the bivariate framework employed in this study.

Several factors may explain this finding. First, export value reflects not only export volume but also international price movements, particularly for commodity-based exports. Second, Indonesia's export basket consists of sectors with heterogeneous domestic value-added content, implying that increases in export revenue do not necessarily generate equivalent increases in domestic production. Third, many export-oriented industries rely heavily on imported intermediate inputs, limiting the domestic multiplier effects of export expansion. Finally, causality may operate in the opposite direction, whereby stronger domestic production capacity enhances export competitiveness, consistent with the growth-led exports (GLE) hypothesis proposed by Orhan *et al.*, (2022).

These findings are consistent with Juliansyah *et al.*, (2022), who reported a positive but statistically insignificant relationship between exports and Indonesia's economic growth. However, they differ from Fitriyanto (2023), who identified both short-run and long-run relationships using data ending before the COVID-19 period. The discrepancy may reflect differences in sample periods, model specifications, and the inclusion of recent structural shocks. Likewise, the findings differ from Putra *et*

al., (2025) and Suripto *et al.*, (2025), whose analyses examined trade openness or panel data across ASEAN countries rather than a bivariate quarterly time-series model for Indonesia.

4.2.3 Short-Run Dynamics and Robustness of the Results

The initial ARDL estimation indicates a positive contemporaneous relationship between export value and real GDP. However, this relationship becomes statistically weaker after applying heteroskedasticity and autocorrelation consistent (HAC) standard errors. This result highlights the importance of robust inference when diagnostic tests indicate heteroskedasticity and non-normal residuals. Conventional standard errors may underestimate sampling uncertainty, leading to overstated statistical significance.

The weak short-run relationship may also reflect production and export timing. Exported goods are often produced in previous quarters, while current production responds to new orders and future demand. Furthermore, export values can change rapidly because of commodity price fluctuations, whereas real GDP adjusts more gradually. These dynamics suggest that contemporaneous changes in export value do not necessarily translate into immediate changes in real economic output. The findings also support the argument of Adebayo *et al.*, (2022), who demonstrate that the export-growth nexus in ASEAN countries is asymmetric and varies across economic conditions. Consequently, a linear ARDL specification may not fully capture nonlinear responses to positive and negative export shocks.

4.2.4 Economic Persistence, Seasonality, and the COVID-19 Shock

The highly significant coefficient of the lagged dependent variable indicates substantial persistence in Indonesia's economic activity. Such persistence is expected because production capacity, industrial structure, labor utilization, and capital accumulation evolve gradually rather than changing abruptly between quarters. The significant seasonal dummy variables for the second and third quarters further indicate the presence of systematic seasonal patterns in economic activity. Controlling for seasonality is therefore essential to avoid attributing predictable quarterly fluctuations to export performance.

The stability tests additionally reveal that the COVID-19 pandemic constituted a major structural disturbance, particularly during the second quarter of 2020. Although incorporating a pandemic dummy improves model robustness, the bounds test continues to reject the existence of cointegration. This suggests that the absence of a long-run relationship cannot be explained solely by the pandemic but instead reflects broader structural characteristics of the Indonesian economy, including export composition, commodity dependence, and evolving global market conditions. Similar time-varying export-growth relationships have also been documented by Orhan *et al.*, (2022).

5. Conclusion

This study examined the short-run and long-run relationship between export value and Indonesia's real gross domestic product (GDP) using quarterly data from 2010Q1 to 2026Q1 and the Autoregressive Distributed Lag (ARDL) approach. The empirical findings indicate that both real GDP and export value are integrated of order one, $I(1)$. However, the ARDL bounds test provides no evidence of a long-run cointegrating relationship between the two variables. Although export value exhibits a positive contemporaneous coefficient in the initial estimation, the relationship becomes statistically insignificant after applying heteroskedasticity and autocorrelation consistent (HAC) standard errors, indicating that the short-run association is not robust. These findings suggest that increases in aggregate export value alone are insufficient to sustain long-run economic growth in Indonesia. Rather, the contribution of exports depends on broader structural factors, including export composition, domestic value added, import intensity, productivity improvements, and overall macroeconomic conditions. Consequently,

policies aimed at promoting economic growth should prioritize strengthening export quality, industrial competitiveness, and domestic production linkages instead of focusing solely on increasing export values.

This study contributes to the export-growth literature by providing updated evidence using quarterly data that encompass the COVID-19 pandemic and the subsequent economic recovery, while distinguishing explicitly between short-run dynamics and long-run equilibrium relationships. Nevertheless, the findings should be interpreted in light of several limitations. The analysis employs a bivariate framework and therefore does not account for other macroeconomic determinants of economic growth, such as investment, household consumption, imports, exchange rates, inflation, commodity prices, and global demand. Future research should extend the analysis using multivariate models, sectoral export measures, real export volumes, and nonlinear or regime-switching approaches to provide a more comprehensive understanding of Indonesia's export-growth nexus. The findings imply that export-led growth should be viewed as a conditional rather than universal development strategy. Export expansion is more likely to stimulate sustainable economic growth when accompanied by higher domestic value added, greater productivity, industrial upgrading, and stronger backward linkages with domestic suppliers. Accordingly, export performance should not be evaluated solely on the basis of transaction value but also in terms of export diversification, domestic content, manufacturing competitiveness, and the contribution of net exports to national income.

This study contributes to the literature in three ways. First, it provides updated evidence on Indonesia's export-growth relationship using quarterly observations extending through the post-pandemic recovery period (2010Q1–2026Q1). Second, it distinguishes explicitly between short-run dynamics and long-run equilibrium using the ARDL framework. Third, it demonstrates the importance of robustness analysis by showing that statistical significance observed under conventional estimation weakens after correcting for heteroskedasticity using HAC standard errors. Nevertheless, several limitations should be acknowledged. The analysis is restricted to a bivariate specification and therefore does not account for other macroeconomic determinants of economic growth, including imports, investment, household consumption, exchange rates, inflation, commodity prices, and global demand. Furthermore, export value is measured in aggregate and does not distinguish between manufacturing, mining, agricultural, oil and gas, or service exports. Future research should employ multivariate models, sectoral export data, real export volumes, and nonlinear econometric approaches to better capture the complexity of the export-growth relationship in Indonesia.

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