



RESEARCH ARTICLE

The Effect of Inflation and Interest Rate Spread on Real Sector Investment in Banda Aceh City: An ARDL Approach

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Abstract

Real sector investment plays a crucial role in generating employment, expanding production capacity, and strengthening regional economic structures. However, the impact of monetary indicators on investment can vary across regions, influenced by local business structures and financing characteristics. Banda Aceh City has an economic structure primarily dominated by trade, services, and small and medium enterprises, which may lead to an investment response to inflation and interest rate spread that does not align with national trends. This study investigates the effect of inflation and interest rate spread on real sector investment in Banda Aceh City during the 2010–2024 period. A quantitative approach is employed, utilizing 15 annual observations analyzed through the Autoregressive Distributed Lag (ARDL) model. The estimation results of ARDL (1,0,1) indicate that real sector investment exhibits a strong dependence on the value of investment from the previous period. Inflation and interest rate spread do not have a statistically significant effect, either in the short term or the long term. The F-Bounds results reveal the presence of a long-term relationship among the model's components. However, the adjustment coefficient is positive and not significant, indicating that the adjustment mechanism toward long-term equilibrium cannot be statistically confirmed. These findings imply that the variation in real sector investment in Banda Aceh City may also be influenced by structural and non-monetary factors not captured in the model, such as local demand conditions, access to financing, government spending, ease of licensing, and the overall business climate. Consequently, regional investment enhancement policies should focus more on improving the business climate, expanding access to financing, and supporting business actors, while maintaining inflation stability and banking intermediation efficiency as essential conditions. Future research is recommended to adopt a longer observation period and incorporate additional regional economic variables.

Keywords

Inflation; Interest Rate Spread; Real Sector Investment; ARDL; Banda Aceh.

1 | INTRODUCTION

Real sector investment is a key driver of economic development, as it not only generates employment and enhances production capacity but also strengthens regional economic structures sustainably (Rita Zaharah, Efa Rodiah Nur, 2021). The development of the real sector serves as a vital indicator of a region's economic health, as its activities are directly linked to societal needs and have the potential to stimulate local economic growth. In this context, macroeconomic stability is an essential prerequisite, with inflation and interest rates acting as critical variables that influence the direction, intensity, and sustainability of investment. Instability in these factors can create uncertainty for economic actors, whereas well-managed conditions foster a more conducive investment climate (Bona Vintura Suyana Pandiangan et al., 2025).

Within this macroeconomic framework, Banda Aceh City, as the capital of Aceh Province, plays a strategic role in driving the regional economy. The real sector in this city is predominantly characterized by trade, services, and small and medium enterprises, which constitute the backbone of community economic activity. The growth of the real sector in Banda Aceh not only contributes to increasing regional income but also creates employment opportunities for the local workforce and enhances regional economic competitiveness. However, macroeconomic dynamics, such as fluctuations in inflation and changes in interest rate spreads, often generate uncertainty for economic actors. This situation renders economic stability a crucial factor in sustaining real sector investment in Banda Aceh, making research on the influence of these two variables both relevant and urgent (Wulandari, 2024).

The economic characteristics of Banda Aceh City exhibit a pattern that may yield findings distinct from previous studies. On the price front, inflation in Banda Aceh City was observed to fluctuate sharply during the 2024–2025 period: year-on-year annual inflation was recorded at 1.78 percent in February 2024, rising to 2.85 percent in July 2024, then declining to 2.28 percent in November 2024, and dropping drastically to only 0.07 percent in February 2025, before slightly increasing again to 0.40 percent in August 2025 (BPS Kota Banda Aceh, 2024; 2025). This sharp fluctuation within a short timeframe indicates a relatively high level of price uncertainty compared to regions with larger and more stable economic structures. Regarding investment structure, data from DPMPTSP Kota Banda Aceh indicate that investment realization in the first quarter of 2024 reached IDR 193 billion, exceeding the target of IDR 150.6 billion. This comprised foreign direct investment (FDI) of IDR 120.2 billion from 16 business activities and domestic direct investment (DDI) of IDR 72.8 billion from 816 business activities (DPMPTSP Kota Banda Aceh, 2024). The significantly larger number of DDI activities, albeit with a much smaller investment value per project compared to FDI, reflects the dominance of small and medium-scale business actors in the structure of real sector investment in this city. These characteristics, coupled with sensitivity to short-term price shocks and the predominance of small-scale investors who are generally more vulnerable to financing costs, provide a scientific rationale for the potential differences in the effects of inflation and interest rate spreads on real sector investment in Banda Aceh compared to national-level studies or those conducted in regions with larger economic structures (BPS, 2025).

One of the macroeconomic factors influencing the sustainability of real sector investment is inflation. It is one of the indicators most sensitive to real sector activity. A general increase in the prices of goods and services can diminish public purchasing power, elevate production costs, and compress business profit margins. Consequently, this situation reduces investors' interest in allocating capital to the real sector, as price uncertainty complicates profit projections (Samuel Richard Messakh, 2019). Conversely, controlled inflation can foster a more stable business climate, provide certainty for economic actors, and stimulate investment growth. Therefore, understanding inflation dynamics is essential for assessing investment prospects in Banda Aceh City, particularly in the real sector, which is highly dependent on price stability and public purchasing power (Sopiyanti, 2022).

In addition to inflation, financing costs, as reflected in the interest rate spread, represent an important consideration for investors when making investment decisions. The interest rate spread refers to the difference between the lending rate charged by banks to borrowers and the deposit rate offered to customers. The magnitude of this spread serves as both an indicator of financial system efficiency and a determining factor in investment decisions. An excessively wide spread reflects high banking intermediation costs, which may discourage business actors from borrowing capital and investing in the real sector. Conversely, a relatively narrow spread indicates more affordable access to financing, thereby encouraging investment activity and bolstering regional economic growth. In the context of Banda Aceh City, where the real sector is highly reliant on bank financing, the dynamics of the interest rate spread have direct implications for the sustainability of investment and the development of local businesses (Agha Hekmatyar Hamid, Irawati Abdul, 2025).

Previous studies have yet to produce consistent conclusions regarding the effects of inflation and interest rates on investment. Some studies indicate that increases in inflation and financing costs can suppress investment, while others find weak or insignificant effects. These discrepancies suggest that the relationship between monetary variables and investment is contextual, influenced by economic structure, business scale, financing patterns, and regional characteristics. Furthermore, most prior studies have been conducted at the national or provincial level, failing to fully capture investment dynamics at the city level.

Banda Aceh City has an economic structure dominated by trade, services, and relatively small-scale domestic

business activities. These characteristics allow investment decisions to be more influenced by local demand, access to financing, regional policy, and the business climate than by direct changes in national monetary indicators. This study addresses the empirical and spatial gap by analyzing the short-term and long-term relationships among inflation, interest rate spread, and real sector investment in Banda Aceh City through the ARDL approach. The contribution of this study lies in its application of a city-level regional economic perspective to assess the transmission of inflation and banking intermediation margins to real sector investment. This research also indicates that the insignificance of monetary variables still provides valuable empirical insights regarding the potential dominance of structural and institutional factors in regional investment formation. Therefore, this study aims to analyze the effects of inflation and interest rate spread on real sector investment in Banda Aceh City.

2 | BACKGROUND THEORY

Inflation is defined as a general and continuous increase in the prices of goods and services within an economy. According to the quantity theory of money, inflation occurs when the growth of the money supply exceeds the growth of real output. High inflation introduces uncertainty, reduces public purchasing power, and diminishes investors' interest in allocating capital to the real sector. Conversely, controlled inflation can foster a stable business climate that encourages productive investment (Riadina & Sugianto, 2024). In the context of real sector investment, inflation stability is crucial, as this sector is highly dependent on production costs and profit expectations. Price instability often leads investors to postpone investment decisions or shift their capital toward safer assets. Thus, controlling inflation not only preserves public purchasing power but also serves as a foundation for the sustainability of productive investment (Sekarsari et al., 2024).

In addition to inflation, another critical factor influencing investment is the interest rate. The interest rate represents the cost of using borrowed funds, and according to the loanable funds theory, interest rates are determined by the interaction between the demand for and supply of funds in the financial market. The demand for funds originates from businesses and government entities that require capital for investment, while the supply of funds comes from public savings and financial institutions. When interest rates are high, the cost of capital increases, thereby suppressing investment interest. Conversely, low interest rates make financing more affordable and encourage business expansion. Research by Malihatunnisa and Ika Nurfarikha (2023) confirms that interest is the price of using loanable funds in the investment market. In line with this, Budiono (1994), in *Pengantar Ekonomi Makro* (Introduction to Macroeconomics), states that the supply of funds originates from public savings, while demand arises from the need for business capital. Furthermore, a study by Sasmiharti and Nurhayati (2026) indicates that the interest rate spread affects the distribution of credit to micro, small, and medium enterprises (MSMEs). High interest rates restrict access to financing, thereby negatively impacting real sector investment. This underscores that interest rate policy not only influences macroeconomic stability but also has direct implications for the sustainability of small and medium-sized enterprises, which form the backbone of the national economy (Sasmiharti & Nurhayati, 2026).

The relationship between inflation, interest rate spread, and real sector investment decisions can be explained more robustly through three complementary investment theory frameworks. Keynesian Investment Theory positions investment decisions as a function of the comparison between the marginal efficiency of capital and the prevailing interest rate; investors will increase capital investment as long as the expected return from the investment exceeds its cost. Thus, an increase in interest rates, as reflected in a widening spread, theoretically suppresses investment volume by raising the feasibility threshold for projects. Neoclassical Investment Theory emphasizes that investment decisions are determined by the user cost of capital, where the real interest rate and inflation expectations are key components. When inflation is not fully anticipated, the real cost of capital can become distorted, leading to investment responses to inflation that do not align with predictions from simple models. Third, Tobin's q theory posits that investment is a function of the ratio between the market value of capital assets and their replacement cost; when expectations of macroeconomic stability are low due to fluctuating inflation, the q value tends to be depressed, reducing the incentive to invest even if the nominal cost of financing remains relatively unchanged. Collectively, these three frameworks illustrate that the effects of inflation and interest rate spread on real sector investment are not mechanical or unidirectional; rather, they depend on how business actors form expectations regarding future capital costs and price stability, a proposition that warrants empirical testing in the context of Banda Aceh City (Robert S. Chirinko, 2017).

Based on Keynesian investment theory, an increase in the cost of capital will reduce the number of feasible investment projects, as the expected rate of return must exceed the interest rate. Neoclassical investment theory further explains that interest rates and inflation affect investment through the cost of using capital. Meanwhile, Tobin's q theory indicates that uncertainty in macroeconomic conditions can lower business actors' assessments of investment profit prospects. Nevertheless, all three theories also suggest that the investment response is not

automatic; it is influenced by profit expectations, financing structure, market demand, and firm characteristics. Therefore, the effects of inflation and interest rate spread on real sector investment in Banda Aceh City require empirical testing, as the local business structure may yield responses that differ from the general predictions of macroeconomic theory. Based on this theoretical framework and the review of previous research, this study formulates the following hypotheses:

H1: Inflation has a significant effect on real sector investment in Banda Aceh City in both the short term and the long term.

H2: Interest rate spread has a significant effect on real sector investment in Banda Aceh City in both the short term and the long term.

H3: There is a long-term relationship among real sector investment, inflation, and interest rate spread in Banda Aceh City.

3 | METHOD

This study employs a quantitative approach utilizing econometric analysis based on time series data. The objective is to analyze the relationship between inflation and interest rate spread with real sector investment in Banda Aceh City, both in the short term and long term. The data used consist of annual secondary data covering the period from 2010 to 2024, resulting in an initial dataset of 15 observations. The choice of annual data is based on the availability of Gross Fixed Capital Formation (GFCF) data for Banda Aceh City, which has not been consistently published on a monthly or quarterly basis. After accounting for the use of lags in the ARDL model, the effective number of observations utilized in the estimation reduces to 14.

The dependent variable in this study is real sector investment, proxied by the Gross Fixed Capital Formation (GFCF) of Banda Aceh City. The independent variables include inflation and interest rate spread. GFCF data were obtained from the publication of Gross Regional Domestic Product by Expenditure for Banda Aceh City published by the Central Bureau of Statistics, while inflation data were sourced from publications by the Central Bureau of Statistics of Banda Aceh City. Interest rate spread data were obtained from the Indonesian Economic and Financial Statistics published by Bank Indonesia. The interest rate spread is calculated as the difference between the commercial bank working capital loan interest rate and the one-month commercial bank time deposit interest rate. In this study, the interest rate spread represents the banking intermediation margin, or the difference between credit costs and deposit returns. Therefore, this variable is not treated as Bank Indonesia's benchmark interest rate but rather as an indicator of financing intermediation costs through the banking sector (Roflin & Zulvia, 2017).

Prior to estimation, the interest rate spread variable was transformed into natural logarithm form and denoted as LN_SSB. This transformation was performed to reduce scale differences, stabilize data variation, and facilitate the interpretation of relative changes in the interest rate spread. The use of national-level interest rate spread data is necessitated by the unavailability of a consistent data series specifically for Banda Aceh City throughout the entire study period. This limitation highlights a potential constraint of the study, as the national-level spread may not fully reflect the financing costs faced by business actors in Banda Aceh City. Data analysis was conducted using the Autoregressive Distributed Lag (ARDL) model with the assistance of EViews 13 software. The ARDL approach was selected because it can analyze short-term dynamic relationships and long-term level relationships among variables with a mixed order of integration between $I(0)$ and $I(1)$, provided that no variable is integrated at the second order, or $I(2)$ (Pesaran, M. H., Shin, Y., & Smith, n.d.).

The analysis stages include stationarity testing using the Augmented Dickey-Fuller test, lag length determination based on the Akaike Information Criterion, ARDL model specification selection, level relationship testing through the Bounds Test, short-term and long-term estimation, and diagnostic testing, which consists of residual normality, heteroskedasticity, and parameter stability through CUSUM and CUSUM of Squares. The sample size of this study is relatively limited, consisting of only 15 initial observations and 14 effective observations after accounting for lags. The small number of observations may reduce degrees of freedom, estimation precision, and the statistical power of the test in detecting the effects of relatively small-sized variables. Therefore, the estimation results should be interpreted with caution and positioned as contextual empirical evidence for Banda Aceh City. The findings of this study are not intended to be generalized broadly to other regions with different economic structures, financing patterns, and investment characteristics.

Since this study utilizes secondary data with an ARDL econometric approach, the research instrument is not in the form of a questionnaire or interview guide. The instrument employed is a secondary data collection sheet, designed to compile, record, and standardize the annual data for each research variable throughout the observation period (2010–2024). This instrument ensures consistency in units, sources, and data periods prior to processing using EViews 13 software. The following table presents the details of the research instrument.

Variable	Symbol	Indicator	Unit	Source
Real Sector Investment	Y	Gross Fixed Capital Formation (GFCF) of Banda Aceh City	Billion Rupiah	BPS (Central Bureau of Statistics) Banda Aceh City
Inflation	X1	Annual Inflation Rate	Percent (%)	BPS Banda Aceh City
Interest Rate Spread	X2	Difference between Working Capital Loan Interest Rate and 1-Month Deposit Interest Rate	Percent (%)	Bank Indonesia (SEKI)

4 | RESULTS AND DISCUSSION

4.1 Results

4.1.1 Stationarity Test

Before conducting estimations using the Autoregressive Distributed Lag (ARDL) model, the initial step is to test the stationarity of the data to ensure that no variable is integrated at the second order, $I(2)$, since the ARDL model is only valid when all variables are stationary either at the level, $I(0)$, or at the first difference, $I(1)$. This test was conducted using the Augmented Dickey-Fuller (ADF) test to assess whether each time series meets the stationarity criteria, both at the level and after first differencing. A summary of the test results at the level and first difference is presented in Table 1 as the basis for further decisions in the ARDL model specification.

Table 1. Results of Stationarity Testing at Level and First Difference

Variable	t-Statistic (Level)	Prob.	Note	t-Statistic (1st Diff.)	Prob.	Note
Inflation	-4.356024	0.0250	Stationary	-4.016004	0.0449	Stationary
Real Sector Investment	-2.087729	0.5047	Non-Stationary	-5.247926	0.0106	Stationary
LN_SSB	-4.312071	0.0266	Stationary	-3.763273	0.0685	Non-Stationary

Source: Processed Data

Based on the results of the Augmented Dickey-Fuller (ADF) test in Table 1, the Inflation and log Interest Rate Spread (LN_SSB) variables were stationary at the level, $I(0)$, with probability values below the significance level $\alpha = 0.05$ (5 percent), specifically 0.0250 and 0.0266. In contrast, the Investment variable was not stationary at the level ($p = 0.5047 > 0.05$), necessitating further testing at the first difference stage. At this stage, Investment became stationary at first difference, $I(1)$, with a probability of 0.0106. For LN_SSB, since it was already stationary at the level, testing at first difference was not strictly necessary to determine its order of integration; however, as an additional test, the result showed a probability of 0.0685, which is above the 5 percent significance level, indicating that LN_SSB is considered non-stationary at first difference. This does not alter the conclusion regarding the order of integration of LN_SSB, which remains determined as $I(0)$ based on the level result. These findings confirm that all research variables have only a mixed order of integration: $I(0)$ for Inflation and LN_SSB, and $I(1)$ for Investment, with none integrated at the second order, $I(2)$. With this prerequisite met, the Autoregressive Distributed Lag (ARDL) model can be appropriately applied for further analysis.

4.1.2 Optimal Lag and ARDL Model Determination

After confirming that all variables are stationary, the next step was to determine the optimal number of lags in the Autoregressive Distributed Lag (ARDL) model. The optimal lag was determined using the Akaike Information Criterion (AIC). The AIC criterion was chosen because it minimizes the trade-off between model goodness of fit and the number of estimated parameters, ensuring that the selected model remains efficient while adequately capturing the dynamics of the relationships among variables (Pesaran, M. H., Shin, Y., & Smith, n.d.), with a maximum of one lag for the dependent variable and one automatic dynamic lag for the regressors. Of the four models evaluated, the model with the lowest Akaike Information Criterion (AIC) value (-5.061598) was ARDL(1,0,1), wherein the Investment variable uses one lag, Inflation is included without an additional lag, and LN_SSB uses lags at both the current period and one prior period. In other words, the notation ARDL(1,0,1) indicates that Investment uses one lag of its own value (autoregressive), Inflation is entered without an additional lag (contemporaneous), while LN_SSB is entered at the current period and one period prior. The complete equation estimation of the ARDL(1,0,1) model is presented in Table 2.

Table 2. Estimation Results of the ARDL (1,0,1)

Variable	Coefficient	t-value	Sig.	Decision
Investment (-1)	1.034371	21.06179	0.0000	Significant
Inflation	-0.002432	-1.022832	0.3331	Not significant
LN_SSB	-0.053912	-1.469935	0.1757	Not significant
LN_SSB(-1)	0.063592	1.835224	0.0997	Not significant

Source: EViews 13 output, data processed by the researcher (2026).

Referring to Table 2, the ARDL (1,0,1) model produces an R^2 value of 0.9864 and an Adjusted R^2 of 0.9804. This indicates that approximately 98.64 percent of the variation in real sector investment during the study period can be explained by the previous period's investment variable, inflation, and LN_SSB, while the remaining 1.36 percent is influenced by factors outside the research model. Additionally, the model has a Prob(F-statistic) value of 0.0000, indicating that the model as a whole is significant and thus appropriate for explaining the relationships among the research variables. Partially, the previous period's investment variable has a coefficient of 1.034371 with a probability value of 0.0000, indicating a positive and significant effect on real sector investment. This result shows that investment exhibits a persistent characteristic (investment persistence), meaning that investment decisions made in the previous period tend to continue into the following period, as most investment projects require a relatively long completion time.

Meanwhile, the inflation variable has a negative coefficient of -0.002432 with a probability value of 0.3331, indicating that it has no significant effect on real sector investment. This finding suggests that changes in the inflation rate during the study period have not been a major factor influencing investment decisions in Banda Aceh City. The LN_SSB variable in the current period has a coefficient of -0.053912 with a probability value of 0.1757, while the previous period's LN_SSB has a coefficient of 0.063592 with a probability of 0.0997. Both probability values exceed the 5 percent significance level, leading to the conclusion that the interest rate spread has no significant effect on real sector investment, either in the current or previous period. These findings indicate that real sector investment decisions in Banda Aceh City are more influenced by the continuity of previously made investments than by changes in inflation or interest rate spread. Thus, other factors such as regional economic conditions, market demand prospects, government policy, and the investment climate are presumed to play a greater role in influencing investment decisions than the monetary indicators used in this study.

4.1.3 Bound Test

The F-Bounds test was conducted to assess the existence of a long-term level relationship among real sector investment, inflation, and interest rate spread in the ARDL model. The testing decision is made by comparing the F-statistic value with the lower bound, $I(0)$, and the upper bound, $I(1)$. If the F-statistic value exceeds the upper bound, $I(1)$, the null hypothesis, which states that there is no long-term level relationship, can be rejected. The test results are presented in Table 3.

Table 3. Bound Test Results

Test Statistic	Value	Signif.	$I(0)$	$I(1)$
F-statistic	9.899769	10%	2.63	3.35
		5%	3.10	3.87
		1%	4.13	5.00

Source: Processed Data ($k = 2$; $n = 14$; asymptotic critical values, Pesaran et al., 2001)

The F-statistic value in the F-Bounds test is 9.899769, which exceeds the upper bound, $I(1)$, at the 10 percent, 5 percent, and 1 percent significance levels. Based on this result, the null hypothesis stating that there is no long-term level relationship among the model's components can be rejected. Thus, the F-Bounds results indicate the existence of a long-term level relationship among real sector investment, inflation, and interest rate spread in the ARDL specification used. However, this result must be interpreted alongside the adjustment coefficient in the conditional error correction form. The adjustment coefficient, which is positive and not significant, indicates that the convergence mechanism toward long-term equilibrium cannot be statistically confirmed. Therefore, in this study, the F-Bounds result is treated as an indication of a long-term level relationship, while the process and speed of adjustment cannot yet be convincingly demonstrated.

4.1.4 ARDL Estimation Results

The Autoregressive Distributed Lag (ARDL) model is a dynamic approach used in this study to assess the effect of inflation and interest rate spread on real sector investment over time. This model incorporates the value of real sector investment from the previous period as a lag variable, thereby allowing a clear identification of both the short-term effects and the long-term equilibrium relationship formed among real sector investment, inflation, and interest rate spread.

4.1.5 Short-Term Estimation

Short-term analysis in the ARDL model is used to assess the direct impact of changes in variables from the previous period on the dependent variable in the current period. This approach provides a more detailed picture of the variables' rapid response to various changes or shocks. The estimation results related to the short-term effect are presented as follows:

Table 5. Short-Term Estimation Results (Conditional Error Correction Regression)

Variable	Coefficient	t-Statistic	Std. Error	Prob.	Note
ECT (-1)	0.034371	0.699851	0.049111	0.5017	Non-significant
INFLATION	-0.002432	-1.022832	0.002377	0.3331	Non-significant
LN_SSB(-1)	0.009680	0.243655	0.039729	0.8130	Non-significant
Δ LN_SSB	-0.053912	-1.469935	0.036676	0.1757	Non-significant

Source: EViews 13 output, data processed by the researcher (2026).

The short-term estimation results in Table 5 represent the Conditional Error Correction Regression form produced in the Bounds Test procedure. In this form, the coefficient of INVESTMENT(-1) represents the adjustment coefficient toward the long-term equilibrium relationship. The coefficient obtained is 0.034371 with a probability of 0.5017. Theoretically, a convergent error correction mechanism is generally indicated by a coefficient that is negative and significant. However, the coefficient in this study is positive and not significant, so the process of investment adjustment toward long-term equilibrium after a shock cannot be statistically confirmed during the observation period. In the short term, inflation has a coefficient of -0.002432 with a probability of 0.3331. This result shows a negative relationship direction, but the effect is not statistically significant. LN_SSB(-1) at the first lag has a coefficient of 0.009680 with a probability of 0.8130, while the change Δ LN_SSB in the current period has a coefficient of -0.053912 with a probability of 0.1757. Thus, changes in inflation and interest rate spread have not demonstrated a direct effect on real sector investment in the short term. These results indicate that investment dynamics during the study period are more influenced by investment persistence from the previous period than by changes in inflation or interest rate spread. Consequently, the short-term variation in real sector investment is presumed to be more influenced by other factors outside the variables used in the research model.

The interpretation of these short-term estimation results should be read in conjunction with the F-Bounds Test results. The F-statistic value, which exceeds the upper bound critical value, indicates the presence of a long-run relationship among real sector investment, inflation, and interest rate spread. Nevertheless, the ECT coefficient, which is positive and not significant, indicates that the adjustment mechanism toward long-term equilibrium has not been statistically demonstrated. These two results do not contradict each other, as the F-Bounds Test examines the existence of a level relationship among the variables, while the ECT measures the direction and speed of adjustment toward equilibrium after a short-term deviation occurs. The lack of an identified adjustment mechanism is likely influenced by the relatively limited number of effective observations, namely 14 observations, the high dependence of investment on its previous period's value, and the presence of other factors not yet included in the model. Such factors may include government spending, growth in local demand, credit distribution, infrastructure conditions, ease of licensing, and business actors' expectations. However, these factors are only possible explanations, as they were not empirically tested in this study. Therefore, this study concludes that the F-Bounds Test results provide an indication of a long-term level relationship, but there is not yet empirical evidence showing that the adjustment process toward long-term equilibrium has proceeded in a stable manner.

4.1.6 Long-Term Estimation

Long-term analysis in the ARDL model is conducted to assess the existence of a more permanent equilibrium relationship between the dependent variable and its explanatory variables. The long-term parameter estimation for this study can be seen in the following table:

Table 6. Long-Term Estimation Results (Levels Equation)

Variable	Coefficient	Std. Error	t-Statistic	Prob.	Note
INFLATION	0.070749	0.133193	0.531172	0.6082	Not significant
LN_SSB	-0.281639	0.992128	-0.283874	0.7829	Not significant
C	11.09200	2.430902	4.562915	0.0014	Significant

Source: Processed Data

From this estimation, the following equation is derived.

$$\text{INVESTMENT} = 11.09200 + 0.070749 \times \text{INFLATION} - 0.281639 \times \text{LN_SSB}$$

This equation illustrates the direction and magnitude of the relationship between inflation and interest rate spread with real sector investment in the long term, based on the ARDL model specification used. However, since the adjustment coefficient in the short-term estimation is positive and not significant, the results of this levels equation should be treated as indicative findings and interpreted with caution. The constant value of 11.09200 with a probability of 0.0014 indicates the predicted value of investment when inflation and LN_SSB are assumed to be zero. Although statistically significant, the constant does not have a strong economic interpretation, as the condition where all independent variables are zero may not necessarily reflect the actual economic condition of Banda Aceh City.

The inflation coefficient of 0.070749 indicates a positive relationship between inflation and real sector investment in the long term. However, this coefficient is not statistically significant, with a probability of 0.6082. Thus, this study has not obtained empirical evidence that changes in inflation are systematically followed by changes in real sector investment in Banda Aceh City. This positive direction only reflects the tendency of the relationship within the study sample and cannot be interpreted as a causal effect. The LN_SSB coefficient of -0.281639 demonstrates a negative relationship between interest rate spread and real sector investment. This direction aligns with capital cost theory, where a widening interest rate spread can increase financing costs and reduce the feasibility of investment projects. Nevertheless, this coefficient is not statistically significant, with a probability of 0.7829. Therefore, the study has not been able to prove that changes in interest rate spread consistently affect real sector investment in the long term. This coefficient merely indicates a negative direction of relationship within the model and cannot yet serve as a basis for concluding the existence of a real effect. Since the research method only states that the interest rate spread variable was transformed into natural logarithm form, the LN_SSB coefficient should not be directly referred to as a full elasticity. Elasticity interpretation can only be applied if the investment variable is also expressed in natural logarithm form. To avoid misinterpretation, this study limits the reading of the LN_SSB coefficient to its direction of relationship and statistical significance.

Overall, the estimation results indicate that inflation and interest rate spread have not been proven to have a significant individual effect on real sector investment in Banda Aceh City in the long term. This finding does not imply that the two variables have no relationship with investment at all; rather, it suggests that the magnitude of the relationship identified within the sample is not strong enough to be statistically distinguished from zero. This result also needs to be interpreted with consideration of the limited number of effective observations, namely 14 observations, which can reduce degrees of freedom, estimation precision, and the power of statistical testing. The insignificance of inflation in this study is consistent with the findings of Samuel Richard Messakh (2019), which indicate that inflation has no significant effect on domestic investment in Indonesia. In the context of Banda Aceh City, changes in annual inflation are likely not yet the primary basis for investment decision-making, as real sector investment is generally planned for the medium to long term. Business actors can also adjust selling prices, input use, and production scale when facing changes in price levels, so the effect of inflation on investment decisions does not always manifest directly within the same year. The insignificance of the interest rate spread may be related to the financing characteristics of business actors in Banda Aceh City.

The regional business structure, dominated by small and medium enterprises, allows for the use of financing sources beyond commercial bank credit, such as personal capital, retained earnings, family financing, subsidized credit, and non-bank financing institutions. Additionally, the interest rate spread used is a national-level indicator of banking intermediation margins, which may not fully reflect the financing costs specifically faced by business actors in Banda Aceh City. This finding suggests that variations in real sector investment may also be related to other factors not included in the model, such as growth in local demand, government spending, regional credit distribution, infrastructure quality, ease of licensing, business certainty, and profit expectations. However, these factors have not been directly tested in this study, so they can only be positioned as possible explanations and an agenda for future research rather than as empirical conclusions.

4.1.7 Normality Test

The normality test was conducted to ensure that the model residuals are normally distributed, which is one of the important assumptions in regression models, allowing the estimation results and hypothesis testing to be considered reliable. The test was conducted using the Jarque-Bera test on the residuals of the ARDL(1,0,1) model.

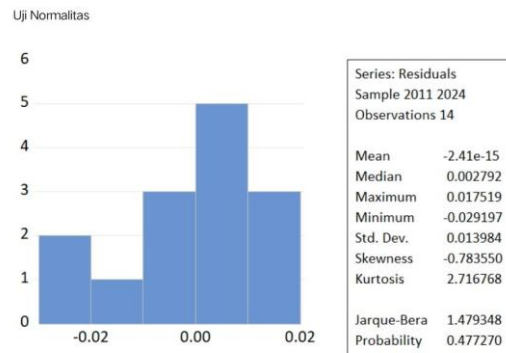


Figure 1. Histogram and Residual Normality Test (Jarque-Bera)
Source: Processed Data (Sample 2011–2024; Observations = 14)

The test results show a Jarque-Bera statistic value of 1.479348 with a probability of 0.477270. Since this probability value is well above the 5 percent significance threshold ($0.4773 > 0.05$), the null hypothesis (H_0), which states that the residuals are normally distributed, cannot be rejected. The skewness value of -0.7836 indicates a distribution that is slightly left-skewed, while the kurtosis value of 2.7168 is close to the normal distribution value (3.0). Thus, it can be concluded that the residuals of the ARDL(1,0,1) model are normally distributed, satisfying the classical assumption regarding residual normality.

4.1.8 Diagnostic Test

To ensure that the regression model satisfies the classical assumptions, a heteroskedasticity test was conducted using the Breusch-Pagan-Godfrey Test. This test is important because the presence of heteroskedasticity can cause standard error estimates to become inefficient, thereby rendering statistical inference invalid. The complete test results are presented in Table 4.

Table 4. Heteroskedasticity Test Results (Breusch-Pagan-Godfrey)

Statistic	Value	Prob.
F-statistic	1.042189	Prob. F(4,9) = 0.4373
Obs*R-squared	4.431898	Prob. Chi-Square(4) = 0.3507
Scaled explained SS	1.572173	Prob. Chi-Square(4) = 0.8138

Source: Processed Data

Based on the test results, all probability values are above the 5 percent significance threshold, so the null hypothesis (H_0), which states homoskedasticity, cannot be rejected. Thus, it can be concluded that the regression model used is free from heteroskedasticity problems, and the residual variance is constant, indicating that the classical assumption regarding the homogeneity of variance is well satisfied.

4.1.9 Stability Test

The stability test, using the CUSUM Test and CUSUM of Squares Test methods, was conducted to ensure that the parameters of the model remain constant and stable throughout the observation period. The test results are presented in Figures 2 and 3.

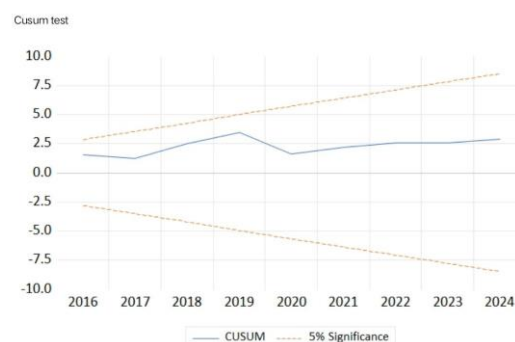


Figure 2. CUSUM Test Results
Source: Processed Data

Based on Figure 2, the stability test results using CUSUM remain stable around the value of 0 to 3 throughout the 2016–2024 period and stay well within the 5 percent confidence bounds (dashed lines) throughout the observation period, without ever approaching or crossing the upper or lower limits. This result indicates that there is no structural break in the model during the study period.

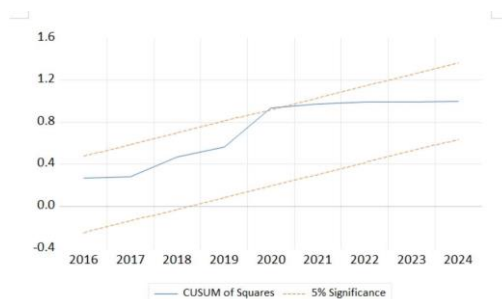


Figure 3. CUSUM of Squares Test Results
Source: Processed Data

In Figure 3, the stability test results using CUSUM of Squares show an upward pattern during the 2019–2020 period, coming very close to the upper bound of the 5 percent significance line in early 2020. Nevertheless, the line did not cross this upper bound, and after this period, it returned to stable movement, approaching a value of 1 until the end of the observation period (2024), without exiting the confidence bounds. This period, in which the line approached the significance bound in early 2020, should be noted as an indication of pressure on the stability of the residual variance during that time, which is relevant to the economic shock conditions at that moment; however, since the line did not cross the critical bound, the model as a whole can still be considered structurally stable. Taking the results of both tests together, the estimated ARDL(1,0,1) model can be considered stable and reliable for further interpretation, although there was a brief period in 2020 showing pressure on the stability of the residual variance, which should be noted as an additional remark in the discussion.

4.2 Discussion

The research findings indicate that real sector investment in Banda Aceh City is more influenced by the value of investment in the previous period than by changes in inflation or interest rate spread. This suggests the presence of investment persistence, characterized by the tendency for ongoing investments to continue into the following period, as investment projects are generally medium- to long-term in nature. Given these characteristics, investment decisions are not easily altered solely due to fluctuations in inflation or changes in financing costs within a single observation period. Theoretically, these findings imply that the transmission mechanism of monetary policy on investment in Banda Aceh City has not yet operated robustly. According to Keynesian Investment Theory, investment decisions are influenced by the comparison between the marginal efficiency of capital and the interest rate. An increase in the cost of capital should reduce the number of feasible investment projects. Additionally, Neoclassical Investment Theory explains that investment is influenced by the user cost of capital, where interest rates and inflation are key components determining investment decisions. However, the research findings demonstrate that neither inflation nor interest rate spread significantly affects real sector investment. This condition indicates that, in the context of Banda Aceh City, investment decisions are likely more influenced by factors outside of monetary indicators.

The F-Bounds Test results indicate the presence of a long-term relationship among real sector investment, inflation, and interest rate spread. However, the Error Correction Term (ECT) coefficient is positive and not significant, meaning that the adjustment mechanism toward long-term equilibrium cannot be statistically demonstrated. Therefore, this study cannot conclude that real sector investment automatically returns to equilibrium following an economic shock. Thus, the existence of a long-term relationship in this study should be understood as indicative of a level relationship rather than as evidence that the convergence process has occurred in a stable manner. The insignificance of inflation's effect suggests that changes in the price level have not yet been a primary consideration in real sector investment decisions in Banda Aceh City. This finding aligns with the study by Messakh et al. (2019), which concluded that inflation has no significant effect on investment. In contrast, this study's findings differ from those of Bona Vintura Suyana Pandiangan et al. (2025), who found that inflation affects investment at the national level. This discrepancy is presumed to arise from the economic characteristics of Banda Aceh City, which is dominated by the trade, services, and micro, small, and medium enterprise (MSME) sectors, suggesting that investment activity is more influenced by developments in local demand than by changes in annual inflation.

Similarly, the interest rate spread does not have a significant effect on real sector investment, either in the short term or the long term. Theoretically, a widening interest rate spread reflects an increase in banking intermediation costs, which

should reduce business actors' interest in pursuing investment. However, this condition has not been observed in this study. One possible explanation is that some business actors in Banda Aceh City do not fully rely on commercial bank credit as a source of financing; instead, they utilize personal capital, retained earnings, family financing, and various government financing programs. Additionally, the use of national-level interest rate spread data means that this indicator may not fully capture the financing costs specifically faced by business actors in Banda Aceh City. These findings suggest that variations in real sector investment in Banda Aceh City are likely more influenced by structural factors than by monetary indicators. Factors such as growth in local demand, regional government spending, infrastructure quality, ease of licensing, productive credit distribution, business certainty, and profit expectations are presumed to play a greater role in determining investment decisions. Nevertheless, these factors have not been empirically tested in this study, so they remain possible explanations that require further investigation in future research.

From a policy perspective, the research findings imply that increasing real sector investment in Banda Aceh City cannot rely solely on inflation stability and banking intermediation efficiency. The regional government needs to enhance the investment climate by simplifying business licensing, improving infrastructure quality, expanding access to productive financing for MSMEs, and creating greater business certainty. Thus, while monetary policy continues to function as a supporting condition for economic stability, structural policy should be the primary instrument in driving regional investment growth. Unlike most previous studies that utilize national or provincial-level data, this study provides city-level empirical evidence indicating that the effectiveness of monetary indicator transmission to investment can vary according to regional economic characteristics. These findings underscore the importance of region-based investment analysis as a foundation for formulating more targeted regional economic development policies.

5 | CONCLUSIONS AND FUTURE WORK

This study analyzes the relationship between inflation and interest rate spread with real sector investment in Banda Aceh City during the 2010–2024 period using the ARDL(1,0,1) model. The results indicate that current-period investment has a strong dependence on the value of investment in the previous period. Meanwhile, inflation and interest rate spread do not demonstrate a statistically significant effect, either in the short term or the long term. The direction of the long-term coefficients shows a positive relationship between inflation and investment and a negative relationship between interest rate spread and investment; however, both relationships cannot yet be statistically distinguished from zero. The F-Bounds results provide an indication of a long-term relationship among investment, inflation, and interest rate spread. However, the adjustment coefficient is positive and not significant, so the convergence process toward long-term equilibrium cannot be confirmed. Thus, the long-term results in this study must be interpreted with caution and should not be treated as conclusive causal evidence. The research findings suggest that variations in real sector investment in Banda Aceh City may also be related to structural and non-monetary factors outside the model. For the Banda Aceh City Government, investment enhancement policies should focus on easing licensing processes, strengthening business infrastructure, expanding access to financing, mentoring business actors, and creating business certainty. While inflation stability and banking intermediation efficiency remain important as supporting conditions, the research findings do not indicate that these two factors are the primary individual determinants of regional investment. Future research is recommended to utilize a longer observation period and to include variables such as economic growth, bank credit, government spending, and business climate indicators.

This study has several limitations. First, the number of effective observations is only 14, as GFCF data for Banda Aceh City is consistently available only on an annual basis. The small sample size may reduce estimation precision and the power of statistical testing. Second, the interest rate spread uses national-level data, which may not fully reflect the banking intermediation costs specifically faced by business actors in Banda Aceh City. Third, the model only includes inflation and interest rate spread, whereas real sector investment may also be influenced by factors such as economic growth, bank credit, government spending, infrastructure, market demand, and business certainty. Fourth, the positive and non-significant adjustment coefficient limits the interpretation of the adjustment mechanism toward long-term equilibrium. Therefore, the research findings should be understood as contextual empirical evidence and should not be overgeneralized.

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