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Rice Production Spillovers from Lampung Supplier Districts on Urban Poverty in Bandar Lampung

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Abstract

This study examines both the long-run relationship and short-run dynamics between urban poverty and hinterland rice supply. The unit of analysis comprises Bandar Lampung City and five rice-producing districts (Central Lampung, East Lampung, South Lampung, Mesuji, and Tulang Bawang) which together form an integrated urban–rural economic system. Quarterly time-series data for the period 2010Q1–2024Q4 (approximately 60 observations) are employed to enhance statistical power. Variables originally available at lower frequencies are temporally disaggregated into quarterly series using linear interpolation, and data consistency is verified through aggregation tests and robustness checks. An Error Correction Model (ECM) is applied to capture equilibrium relationships and short-term adjustments. The long-run results indicate that real GRDP per capita significantly reduces poverty, whereas unemployment and the rice production index are not statistically significant. The Engle–Granger test confirms cointegration among the variables. In the short run, the error correction term is negative and significant, suggesting gradual adjustment toward long-run equilibrium. Overall, income growth emerges as the primary driver of poverty reduction, while the effect of rice supply operates indirectly and more slowly through market transmission mechanisms.

Keywords: Urban Poverty, Rice Production, Hinterland, Bandar Lampung, ECM

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INTRODUCTION

Urban poverty is shaped not only by internal urban factors (employment opportunities, income, and labor market structure) but also by food price increases and food availability (Vilar-Compte et al., 2021). Rising food prices may increase household vulnerability and poverty, particularly among

low-income groups with relatively high shares of food expenditure (Faharuddin et al., 2023). In Indonesia, rice is a strategic staple commodity; therefore, shocks to rice supply and prices can directly affect household welfare and increase poverty risk (Kurniawati & Asprihanto, 2024).

Because poverty dynamics reflect long-run interactions among economic variables and market structures, the dependence of core cities on regional supply systems is relevant to examine within an interconnected regional economy (Nindien et al., 2025).

Table 1. Rice Production in Lampung by Regency/City (tons), 2024

Regency/City	Production of rice	Percent
West Lampung	32,242	2.01
Tanggamus	77,615	4.84
South Lampung	182,708	11.39
East Lampung	277,491	17.29
Central Lampung	352,969	22.00
North Lampung	36,319	2.26
Way Kanan	55,020	0.34
Tulang Bawang	215,650	1.34
Pesawaran	66,645	4.15
Pringsewu	82,723	5.16
Mesuji	156,114	9.73
Tubaba	16,980	0.11
Pesisir Barat	29,674	1.85
Bandar Lampung	1,561	0.10
Metro	16,903	1.05
Total	1,604,614	

Source: Data processed, 2025

In a regional context, vulnerability tends to be more apparent in urban areas that rely on supplies from surrounding regions (hinterlands) (BPS Bandar Lampung City, 2025). Bandar Lampung City plays an important role in economic activities, including rice distribution, and thus depends on rice inflows from hinterland districts.

Consequently, supply disruptions or rice price increases may be transmitted to consumer prices and affect urban household purchasing power (BPS Bandar Lampung City, 2025). This role is also reflected in Bandar Lampung's position as a gateway for goods flows and an important node in the provincial commodity supply chain, including food commodities (BPS Provinsi Lampung, 2025).

In addition, the utilization of Panjang Port to facilitate logistics vehicles during peak mobility periods indicates the strategic role of Bandar Lampung in regional distribution management (Kemenhub, 2022).

Empirically, the city's dependence on its hinterland is evident from its limited local production. Table 1 shows that Bandar Lampung produced only 1,561 tons of rice in 2024, equal to about 0.10% of total provincial production, indicating strong reliance on surrounding producing districts. As a result, production or distribution shocks in the hinterland are likely to be directly transmitted to consumer prices in Bandar Lampung.

Based on Table 1, rice production in 2024 was concentrated in several hinterland districts, namely Central Lampung (352,969 tons), East Lampung (277,491 tons), Tulang Bawang (215,650 tons), South Lampung (182,708 tons), and Mesuji (156,114 tons) (BPS Lampung Province, 2025). This pattern supports the argument that hinterland commodity advantages shape commodity flows toward consumption centers and influence regional dynamics (Achmad et al., 2023).

Consistent with this pattern, Bandar Lampung City produced only 1,561 tons of rice (0.10%), reinforcing its role as a consumption

and distribution center rather than a production area. This spatial configuration strengthens the conceptualization of the hinterland as the primary food supplier for the core city and helps explain why production or distribution disturbances in key producing districts can be rapidly transmitted to consumer prices and urban household purchasing power in Bandar Lampung (BPS Kabupaten Lampung Tengah, 2023). Such interconnections may give rise to dynamic short-run and long-run relationships between supply, prices, and welfare (Nindien et al., 2024).

Based on this core city–hinterland linkage, this study proposes a supply spillover hypothesis. The shocks to rice production or supply flows in key producing districts (Central Lampung, East Lampung, South Lampung, Tulang Bawang, and Mesuji) may affect household welfare in Bandar Lampung through (i) retail rice price stability, (ii) commodity availability in traditional markets and modern retail, and (iii) distribution costs (transportation, storage, and intermediary margins).

Evidence on rice price transmission in Indonesia indicates both short-run and long-run linkages along market chains, meaning upstream shocks may not be immediately reflected downstream and require an adjustment process (Asrin et al., 2022). This is relevant for Bandar Lampung because consumer rice prices are likely influenced by supply dynamics in producing districts through market integration and distribution efficiency (Kharisma & Indrawan, 2023).

In addition, welfare impacts are theoretically not instantaneous, as production fluctuations need time to enter distribution systems, influence retail prices and food access, and then affect purchasing power and poverty status. This argument is consistent with findings that rice dynamics (production/prices) may exert stronger welfare effects in the medium to long run and relate to changes in income distribution and food expenditure patterns (Fitrawaty et al., 2023).

Besides food-related factors, urban poverty is also associated with regional macroeconomic conditions such as GRDP per capita and labor market performance. Urban studies in Indonesia suggest that economic capacity and labor market characteristics contribute to poverty variation, although the magnitude and significance may differ across regions and periods (Faturohim et al., 2023).

Therefore, incorporating indicators of economic capacity (e.g., GRDP per capita) and unemployment, while linking them to regional food supply factors, is important for a more comprehensive analysis of urban poverty determinants (Stephanus et al., 2024).

Methodologically, annual time-series indicators of poverty and macroeconomic variables often exhibit non-stationary trends. Accordingly, cointegration approaches and the Error Correction Model (ECM) are appropriate to distinguish long-run equilibrium relationships from short-run adjustments. Studies on rice markets and price transmission in Indonesia show that ECM/VECM frameworks can capture market integration and adjustment mechanisms following shocks in the food system (Kharisma & Indrawan, 2023).

Policy debates on rice self-sufficiency and food security also indicate that food issues are not only about production, but also about changing development objectives with implications for household welfare, including in urban areas (Fisher et al., 2025). Although many studies have examined rice price transmission

and poverty determinants, empirical work explicitly linking hinterland rice production spillovers to urban poverty in a core city within a specific regional setting remains limited.

This study addresses this gap by focusing on rice production spillovers from key supplier districts in Lampung Province to urban poverty in Bandar Lampung City. Using an ECM framework, this study aims to (i) test whether a long-run (cointegrated) relationship exists between urban poverty in Bandar Lampung and hinterland rice supply factors, and (ii) estimate the speed of adjustment when deviations from long-run equilibrium occur.

RESEARCH METHODS

This study adopts a quantitative time-series design to examine the relationship between urban poverty in Bandar Lampung City and rice supply spillovers from supplier districts in Lampung Province. Given that macroeconomic variables are typically non-stationary at levels but may exhibit long-run co-movement, the analysis employs the Engle–Granger two-step Error Correction Model (ECM).

This approach enables the estimation of both long-run equilibrium relationships and short-run adjustment dynamics following deviations from long-run equilibrium, and is widely applied in recent empirical studies in Indonesia (Astutik & Nugroho, 2024; Faisal & Ichsan, 2020; Sijabat, 2023).

The study utilizes quarterly time-series data covering the period 2010Q1–2024Q4, yielding approximately 60 observations. The use of quarterly frequency increases degrees of freedom, improves statistical power, and enhances the identification of short-run dynamics that cannot be adequately captured using annual data. The unit of analysis consists of Bandar Lampung City as the urban consumption center and five rice-producing hinterland districts: Central Lampung, East Lampung, South Lampung, Mesuji, and Tulang Bawang.

Data on urban poverty, open unemployment, and real Gross Regional Domestic Product (GRDP) per capita are obtained from official publications of Statistics Indonesia. While GRDP is available at quarterly frequency, poverty and unemployment indicators are reported only semi-annually.

Since ECM estimation requires a consistent temporal frequency across variables, these lower-frequency indicators are converted into quarterly observations using a temporal disaggregation procedure based on linear interpolation.

Temporal disaggregation is a formally recognized statistical and econometric procedure for reconciling mixed-frequency macroeconomic data rather than a simple gap-filling technique. The method assumes smooth intra-period movements and is particularly appropriate for slow-moving macroeconomic indicators such as poverty and unemployment.

This practice follows official statistical standards recommended by the OECD (2022) and Bloem et al., (2001), which explicitly advocate interpolation and temporal disaggregation techniques when higher-frequency observations are unavailable for quarterly national accounts.

Recent methodological developments further support the reliability of temporal disaggregation and mixed-frequency reconstruction approaches. Contemporary studies demonstrate that smoothing-based interpolation, benchmarking, and high-

frequency reconstruction methods improve approximation accuracy and statistical consistency in macroeconomic time-series analysis (Acedanski, 2024; Mosley et al., 2024; Quilis et al., 2024; Vera-jaramillo, 2025).

To ensure methodological rigor and data integrity, several validation procedures are implemented. First, an aggregation consistency test reconstructs annual values from the interpolated quarterly series and compares them with official statistics to verify that the procedure preserves the original data structure.

Second, approximation reliability is evaluated using Root Mean Square Error (RMSE) and Mean Absolute Error (MAE), which are widely used performance metrics for assessing the accuracy of time-series estimation and forecasting models in recent applied econometric research (Alghamdi et al., 2024).

Third, robustness checks are conducted by re-estimating the ECM under alternative specifications, including annual raw data and spline interpolation. Stability of coefficient signs, magnitudes, and statistical significance across specifications indicates that the empirical findings are not artifacts of the disaggregation process.

The variables are defined as follows: urban poverty rate (POV); open unemployment rate (TPT); real GRDP per capita in logarithms (LNPDRBPC); and the logarithm of the rice production spillover index (LNRPI); constructed from hinterland production data.

Rice supply spillovers are measured using a Regional Rice Production Index (RPI) constructed as the equally weighted average of the logarithm of rice production in the five supplier districts:

$$\text{LNRPI}t = \frac{1}{5}\sum_{j=1}^{5} \ln\left(\text{RiceProduction}_{j,t}\right)$$

This log-based aggregation reduces the influence of extreme values and facilitates elasticity interpretation in the ECM framework (Ziesemer, 2024). The long-run relationship is specified as:

$$\text{POV}_t = \beta_0 + \beta_1\text{TPT}_t + \beta_2\text{LNPDRBPC}_t + \beta_3\text{LNRPI}_t + u_t$$

Cointegration is tested using the Engle–Granger residual-based ADF test. Upon confirmation of cointegration, the short-run dynamics are estimated using the ECM:

$$\Delta\text{POV}_t = \alpha_0 + \alpha_2\Delta\text{TPT}_t + \alpha_3\Delta\text{LNPDRBPC}_t + \alpha_1\Delta\text{LNRPI}_t + \lambda ECT_{t-1} + \varepsilon_t$$

where the error correction term (ECT) is the lagged residual from the long-run equation. The coefficient λc aptures the speed of adjustment toward long-run equilibrium and is expected to be negative.

Estimation follows standard ECM procedures: unit root testing to determine integration orders, long-run estimation and residual extraction, cointegration testing, and short-run ECM estimation. To ensure robustness, diagnostic tests for residual autocorrelation, heteroskedasticity, and parameter stability are conducted. Given the small annual sample size, statistical significance at the 10% level is considered acceptable, consistent with recent Indonesian time-series studies (Astutik & Nugroho, 2024).

RESULTS AND DISCUSSION

To ensure that the temporal disaggregation process does not introduce statistical distortion, three validation procedures were conducted: (i) an aggregation consistency test; (ii) approximation accuracy assessment using Mean Absolute Error (MAE) and Root Mean Square Error (RMSE); and (iii) robustness checks through re-estimation of the ECM under alternative data specifications.

Table 2. Interpolation Accuracy Metrics

Variables	MAE	RMSE
POV	0.000	0.000
TPT	0.000	0.000
LNPDRBPC	0.000	0.000
LNRPI	0.000	0.000

Source: Data processed, 2025

An aggregation consistency test was conducted by re-aggregating the interpolated quarterly series back to annual frequency and comparing them with the officially reported annual observations. The reconstructed values perfectly matched the original data for all variables, yielding zero differences across all years. This result indicates perfect aggregation consistency and confirms that the temporal disaggregation procedure fully preserves the original annual information without introducing measurement distortion.

Approximation accuracy was further evaluated using Mean Absolute Error (MAE) and Root Mean Square Error (RMSE), which measure the deviation between reconstructed and original annual observations. The near-zero MAE and RMSE values confirm that the interpolated quarterly series are statistically consistent with the official annual data and do not generate artificial volatility (Alghamdi et al., 2024). The long-run relationship was estimated using OLS on level variables:

$$POVBL = -34.876508 + 0.029095 * TPTBL - 12.37436566988 * LNPDRBPC + 0.195260252075 * LNRP$$

Table 3 presents the long-run OLS estimation results examining the relationship between urban poverty and its macroeconomic determinants in Bandar Lampung. The estimation results show that real GRDP per capita (LNPDRBPC) has a negative and statistically significant association with poverty ($\beta = -12.3744$; $p < 0.01$).

Table 3. Long-Run OLS Estimation Results

Variables	Coefficient	Std. Error	t-Statistic	Prob.
C	-34.87651	8.404177	-4.14990	0.0001
TPTBL	0.029095	0.04249	0.684694	0.4964
LNPDRBPC	-12.37437	0.733003	-16.8817	0.0000
LNRPI	0.19526	0.66360	0.294242	0.7697

Source: Data processed, 2025

This implies that improvements in regional income substantially reduce poverty incidence, supporting the pro-growth and pro-poor development hypothesis that economic expansion enhances household welfare in the long run.

In contrast, open unemployment (TPT) and the rice production spillover index (LNRPI) are not statistically significant ($p = 0.7697$ and $p = 0.4964$, respectively). These findings suggest that although labor market conditions and price or production spillovers may influence poverty dynamics, their effects are likely short-term or

indirect rather than persistent structural determinants of poverty.

Table 4 reports the R-squared of 0.8839 and adjusted R-squared of 0.8777 indicate strong explanatory power, suggesting that approximately 88% of the variation in urban poverty is explained by the included variables.

Table 4. Goodness-of-Fit for the Long-Run Model

Statistic	Value
R-squared	0.883963
Adjusted R-squared	0.877747
F-statistic	142.2017
Prob(F-statistic)	0.000000
Durbin–Watson	1.217480
S.E. of regression	0.706078

Source: Data processed, 2025

The F-statistic is highly significant (Prob = 0.0000), confirming that the model is jointly meaningful. Although the Durbin–Watson statistic (1.217) suggests some serial correlation, this is common in level time-series regressions and is subsequently addressed through the ECM framework. Overall, these results indicate that the long-run specification is statistically robust and reliable.

Based on Table 5, cointegration was assessed by testing the stationarity of the residuals obtained from the long-run equation using the Augmented Dickey–Fuller (ADF) test with no exogenous terms and SIC-based lag selection. The residual series is stationary at level, as the ADF statistic (–2.025443) is more negative than the 5% critical value and statistically significant (p = 0.0419).

This finding confirms the presence of a long-run equilibrium (cointegration) relationship among poverty, unemployment, GRDP per capita, and the rice spillover index, thereby validating the use of the Error Correction Model (ECM) framework. After confirming cointegration, the short-run ECM was estimated:

$$\Delta POV_t = -0.066867 + 0.015056 * TPTBL - 5.105664 * LNPDRBPC + 0.326891 * \Delta LNRPI - 0.100916 * ECT(-1) + \varepsilon_t$$

Based on Table 6 the error correction term is negative and significant at the 10% level (ECT(-1)= -0.100916; p = 0.0805), implying that about 10% of deviations from the long-run equilibrium are corrected within one year.

Table 5. Engle–Granger Cointegration Test (ADF on Residuals)

Item	Value
ADF t-statistic	-2.025443
Probability	0.0419
Critical value (1%)	-2.604746
Critical value (5%)	-1.946447
Critical value (10%)	-1.613238
Decision	Residuals are stationary → Cointegration confirmed

Source: Data processed, 2025

However, short-run changes in LNRPI, TPT, and LNPDRBPC are not statistically significant (p > 0.10). Table 7 reports the goodness-of-fit statistics of the short-run ECM. The model explains about 30.85% of short-term poverty variation (R^2 = 0.3085; Adj. R^2 = 0.2573).

The F-statistic is significant (6.0228; p = 0.000441), indicating joint model validity. The Durbin–Watson value of 2.0331 suggests no serious autocorrelation, and the standard error

of 0.2897 indicates relatively small prediction errors. Overall, these results confirm that the ECM specification is statistically adequate.

Table 6. Short-Run ECM Estimation Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant (C)	-0.066867	0.039534	-1.69139	0.0965
ΔTPTBL	0.015056	0.024145	0.623591	0.5355
ΔLNPDRBPC	-5.105664	1.178224	-4.33335	0.0001
ΔLNRPI	0.326891	0.466637	0.700525	0.4866
ECT(-1)	-0.100916	0.056659	-1.78111	0.0805

Source: Data processed, 2025

The robustness analysis using the original annual data confirms that the error correction term remains negative and statistically significant, indicating the presence of a stable long-run equilibrium relationship even without temporal disaggregation.

Table 7. Goodness-of-Fit for the ECM Model

Statistic	Value
R-squared	0.308500
Adjusted R-squared	0.257278
F-statistic	6.022776
Prob(F-statistic)	0.000441
Durbin–Watson	2.033091
S.E. of regression	0.289742

Source: Data processed, 2025

Although short-run coefficients become statistically weaker due to the small number of annual observations, the consistency in the sign and significance of the adjustment parameter demonstrates that the core findings are not driven by the interpolation procedure. Therefore, the empirical results can be considered structurally robust.

Based on Table 8 the robustness checks indicate that the estimated relationships remain stable across alternative specifications, suggesting that the results are not sensitive to the temporal disaggregation procedure. With this confirmation, the short-run ECM estimation results indicate that the differenced variables capture short-term dynamics, while the error correction term reflects the speed at which deviations from the long-run equilibrium are adjusted.

Table 8. Robustness Comparison of ECM Results

Variable	Quarterly	Spline	Annual
ECT(-1)	-0.101*	-0.101*	-0.472*
ΔLNPDRBPC	-5.106***	-5.106***	-3.068
ΔTPTBL	ns	ns	ns
ΔLNRPI	ns	ns	ns
Obs	59	59	14

Notes: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively; ns denotes not significant.
Source: Data processed, 2025

The short-run ECM estimation results indicate that the differenced variables capture short-term dynamics, while the error correction term reflects the speed at which deviations from the long-run equilibrium are adjusted. The results indicate that changes in real GRDP per

capita have a negative and statistically significant effect on urban poverty in the short run ($p < 0.01$), suggesting that income growth immediately contributes to poverty reduction.

In contrast, short-run changes in the unemployment rate and the rice production spillover index are not statistically significant, implying that their impacts on poverty are indirect or delayed rather than immediate. This is consistent with development and poverty literature emphasizing that improvements in income and economic capacity can reduce poverty through higher purchasing power, better access to basic needs, and improved livelihood opportunities (Imantria, 2024).

By contrast, TPT is not significant in the long-run equation. One plausible explanation is that urban labor markets in Indonesia are characterized by informality and underemployment, so the open unemployment rate may not fully capture labor vulnerability and income instability. Consequently, the statistical relationship between unemployment and poverty may appear weak when measured solely using TPT, as also noted in Indonesian urban poverty studies (Faturohim et al., 2023).

The LNRPI coefficient is also not significant in the long-run equation. This suggests that changes in hinterland rice production capacity do not directly translate into poverty reduction in the city. Substantively, supply-side effects on urban welfare are typically indirect and mediated through food prices, market integration, and distribution/logistics costs.

Evidence from Indonesian rice markets highlights gradual price transmission and adjustment along the supply chain, implying that production shocks may not immediately manifest in downstream welfare outcomes without explicitly modeling intermediary mechanisms (Aini & Yurisinthae, 2025; Kharisma & Indrawan, 2023).

The residual-based ADF test confirms cointegration, indicating that the variables share a long-run equilibrium path, even if they deviate in the short run. This supports the relevance of a cointegration–ECM framework for capturing long-run linkages and short-run adjustments, as commonly applied in rice market and price transmission studies (Shaffitri et al., 2024).

The ECM results provide additional support through the negative and significant ECT (-0.100916; $p = 0.0805$), indicating meaningful adjustment toward equilibrium. In practical terms, the system corrects nearly half of the disequilibrium within one year, consistent with ECM applications in macro–poverty settings that emphasize distinguishing long-run effects from short-run dynamics (Amar et al., 2025).

In the short run, the differenced variables (ΔLNRPI and ΔTPT) are not statistically significant. This pattern is common in annual time-series with limited observations, especially when transmission mechanisms involve delays and omitted intermediary variables (e.g., retail rice prices, food access, and logistics costs).

Empirical work on rice price transmission in Indonesia also indicates that short-run adjustments across market levels may be weak or statistically unstable, while long-run linkages remain detectable through the error correction component (Aini & Yurisinthae, 2025; Kharisma & Indrawan, 2023; Nazilah et al., 2025; Shaffitri et al., 2024).

Similarly, annual changes in GRDP per capita may not immediately shift poverty status due to rigidities in labor markets and household adjustment processes, making longer horizons

more relevant for poverty reduction dynamics (Imantria, 2024). Overall, the findings support the existence of a long-run relationship (cointegration) and an adjustment mechanism toward equilibrium, as evidenced by a significant ECT. However, the direct effect of hinterland rice production spillovers on urban poverty is not statistically significant in either the long run or the short run.

This implies that rice supply factors may operate primarily through intermediary channels (retail rice prices, market integration, and distribution costs) consistent with the broader Indonesian literature on rice market integration and gradual price transmission along the supply chain (Aini & Yurisinthae, 2025; Shaffitri et al., 2024)

The results suggest that poverty reduction in Bandar Lampung is more strongly associated with long-run improvements in regional economic capacity (GRDP per capita) than with short-run fluctuations in the selected variables. Therefore, policy efforts should prioritize strategies that enhance productive capacity and stable income generation, including job quality improvements, support for micro–small enterprises, and human capital development.

At the same time, although the rice production spillover index does not show a direct statistical effect on poverty, the confirmed cointegration and significant adjustment mechanism indicate that food-system shocks can still matter through indirect channels. Accordingly, strengthening distribution efficiency and market integration may help stabilize retail rice prices and protect urban purchasing power, especially during periods of supply disruption.

This study has several limitations. First, some variables, particularly poverty and unemployment, are originally available at lower frequencies and are converted into quarterly data using linear interpolation, which may smooth short-term fluctuations.

Second, the model uses hinterland production as a proxy for supply spillovers but does not explicitly include key mediating variables such as retail rice prices, food inflation, distribution costs, or market integration indicators, which may be the main transmission pathways to urban welfare.

Future research could incorporate retail rice price series, logistics cost proxies, and policy or shock dummies (e.g., major supply disruptions) and consider richer dynamic specifications (e.g., lag structures, ARDL-ECM, or VECM when appropriate). Expanding the dataset (longer period or higher-frequency data) and testing alternative index constructions for rice supply exposure would also improve robustness and deepen policy relevance.

Overall, the findings highlight that urban poverty in Bandar Lampung is embedded in a system characterized by long-run economic linkages and gradual adjustment processes rather than immediate responses to short-term shocks.

While hinterland rice production spillovers do not exert a direct and instantaneous effect on urban poverty, the presence of cointegration and a significant error correction mechanism indicates that food-system dynamics remain relevant through indirect and delayed channels.

These results underscore the importance of adopting an integrated perspective that combines economic capacity, labor market conditions, and regional food supply structures when analyzing urban poverty. The following section concludes the study by summarizing the

main findings and outlining key policy-oriented conclusions.

CONCLUSION

This study examines the relationship between hinterland rice production spillovers and urban poverty in Bandar Lampung City using an Engle–Granger Error Correction Model (ECM) with quarterly time-series data for 2010Q1–2024Q4. The residual-based ADF test confirms cointegration, indicating a long-run equilibrium relationship among urban poverty, unemployment, real GRDP per capita, and the rice spillover index.

In the long run, real GRDP per capita is significantly and negatively associated with urban poverty, while unemployment and the rice spillover index are statistically insignificant.

In the short run, differenced variables show limited immediate effects; however, the error correction term is negative and significant at the 10% level, implying that approximately 10% of deviations from equilibrium are corrected each quarter.

Overall, the findings suggest that rice supply influences urban poverty indirectly and gradually through price stability, market integration, and distribution channels rather than through immediate production effects. Therefore, policy efforts should prioritize strengthening regional income growth and employment quality while improving the resilience and efficiency of food distribution systems.

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