

ABSTRACT

This study aims to analyze the impact of climate variability on regional economic output (GRDP) in Indonesia, considering non-linear relationships. Utilizing panel data from 31 provinces in Indonesia over the 2003–2024 period, the model is estimated using the Fixed Effects approach with Driscoll–Kraay standard errors to address violations of heteroskedasticity, autocorrelation, and cross-sectional dependence assumptions. The macro production function employs the natural logarithm (ln) of Gross Regional Domestic Product (GRDP) as the dependent variable, alongside the ln of Gross Fixed Capital Formation (GFCF) and ln of Labor as economic control variables. The estimation results reveal that air temperature exhibits a non-linear U-shaped relationship, while rainfall shows an inverted U-shaped relationship with regional output. Mediation analysis confirms a decoupling effect for the temperature variable, but agricultural output serves as a partial mediator transmitting the impact of rainfall to total GRDP. Furthermore, the number of natural disasters is identified as a quasi-moderator that significantly conditions the impact of temperature fluctuations on economic output. These findings underscore the importance of formulating asymmetric climate adaptation policies in Indonesia, distinguishing between macro-urban temperature resilience strategies and water management modernization in the agricultural sector to sustain long-term regional economic output.

Keyword: *Climate variability, Regional Economic output, Driscoll-Kraay Fixed Effects, Non-Linear Effects, Mediation-moderation analysis*

INTISARI

Penelitian ini bertujuan menganalisis dampak variabilitas iklim terhadap output ekonomi regional (PDRB) di Indonesia dengan mempertimbangkan hubungan non-linear. Menggunakan data panel dari 31 provinsi di Indonesia selama periode 2003 -2024, estimasi model dilakukan melalui pendekatan *Fixed Effects* dengan *Driscoll-Kraay standard errors* guna mengendalikan pelanggaran asumsi heteroskedastisitas, autokorelasi, dan *cross-sectional dependence*. Fungsi produksi makro dalam penelitian ini menggunakan variabel dependen logaritma natural (ln) Produk Domestik Regional Bruto (PDRB) dengan ln Pembentukan Modal Tetap Bruto (PMTB) dan ln Tenaga Kerja (TK) sebagai variabel kontrol ekonomi. Hasil estimasi menunjukkan bahwa suhu udara memiliki hubungan non-linear berbentuk *U-shaped*, sedangkan curah hujan memiliki hubungan *inverted U-shaped* terhadap output regional. Analisis mediasi mengonfirmasi terjadinya gejala pemutusan hubungan (decoupling effect) pada variabel suhu, namun output pertanian terbukti bertindak sebagai mediator parsial yang mentransmisikan dampak curah hujan terhadap PDRB total. Lebih lanjut, jumlah bencana alam teridentifikasi sebagai kuasi-moderator yang signifikan mengondisikan dampak fluktuasi suhu terhadap output ekonomi. Temuan menegaskan pentingnya perumusan kebijakan adaptasi iklim asimetris di Indonesia, yang memisahkan antara strategi ketahanan suhu makro-urban dan modernisasi manajemen air pada sektor pertanian guna menjaga stabilitas output ekonomi regional jangka panjang.

Kata kunci: Variabilitas iklim, Output Ekonomi Regional (PDRB), *Fixed Effects Driscoll-Kraay*, Efek Non-Linear, Analisis mediasi-moderasi