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Economic growth and emissions in cattle systems: Evidence from developing regions

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Abstract

The projected increase in global demand for livestock products presents both an opportunity for economic development and an environmental challenge. From an environmental economics perspective, the Environmental Kuznets Curve (EKC) provides a useful framework to examine the relationship between sectoral growth and environmental impact. The EKC hypothesis posits an inverted U-shaped relationship, whereby environmental degradation initially increases with economic growth, reaches a turning point, and subsequently declines as higher income levels enable cleaner technologies and stronger regulatory frameworks. We estimate the EKC for the cattle sector (meat and milk production) by analysing the relationship between economic growth and greenhouse gas emissions (CO₂-eq) across countries in Latin America, Africa, and Southeast Asia over the period 2000–2020. Using panel data econometric methods applied to 66 countries, the analysis incorporates a comprehensive set of socioeconomic and institutional variables derived from FAO and World Bank databases, including governance quality, energy efficiency, and development flows. The results confirm a strong and statistically significant positive association between cattle sector growth and environmental degradation. While the estimated coefficients support the theoretical inverted U-shaped EKC, the calculated turning point is exceptionally high and remains far beyond current production values. Consequently, none of the countries in the sample has reached the income threshold at which emissions begin to decline. Instead, cattle systems remain in the initial phase of the EKC, characterised by rising emissions alongside increasing production. Further findings highlight the critical role of institutional and structural factors in shaping environmental outcomes. Improvements in governance quality, political stability, and energy efficiency are associated with lower emission intensities and can accelerate progress toward the turning point. In contrast, development flows directed toward agriculture may reinforce emission-intensive production systems, while targeted environmental funding contributes to emission reductions. This suggests that economic growth alone is insufficient to reduce environmental degradation in the cattle sector. A transition toward sustainable intensification, e.g., through practices such as improved forages and silvopastoral systems, is essential to decouple production from emissions. Achieving this transition will require coordinated policy support, including instruments such as Nationally Appropriate Mitigation Actions (NAMAs), to align livestock development with long-term environmental sustainability.

Keywords: Cattle production, environmental degradation, environmental Kuznets curve (EKC), greenhouse gas emissions, panel data analysis, sustainable intensification

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