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A New Approach Using the Lindley Distribution in Stochastic Frontier Analysis

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Abstract

Stochastic Frontier Analysis (SFA) plays a crucial role in assessing technical efficiency and modeling production processes across various disciplines. Traditionally, SFA assumes specific error distributions, such as the normal distribution for random effects and the half-normal distribution for technical efficiency. However, the choice of error distributions can significantly impact model estimation and interpretation. This study proposes a novel approach by incorporating the Lindley distribution as a flexible error distribution in SFA, termed Lindley Stochastic Frontier Analysis (L-SFA). This extension offers a more detailed representation of the error structure, potentially enhancing the accuracy of efficiency estimates. The derivation and solution of maximum likelihood estimators for the theoretical foundations of L-SFA are provided. Furthermore, a simulation study demonstrates the advantages of L-SFA over traditional SFA. The findings underscore the importance of flexible error distributions in capturing the complexities of production processes with this new SFA extension.

Keywords: Efficiency; Error distribution; Lindley stochastic frontier analysis; Maximum likelihood estimation; Simulation