

Retail Strategy to Reduce Waste Keeping High Profit Utilizing Taylor's Law in Point-of-Sales Data

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Abstract : Waste reduction is a fundamental problem for sustainability. Methods for waste reduction with point-of-sales (POS) data are proposed, utilizing the knowledge of a recent econophysics study on a statistical property of POS data. Concretely, the non-stationary time series analysis method based on the Particle Filter is developed, which considers abnormal fluctuation scaling known as Taylor's law. This method is extended for handling incomplete sales data because of stock-outs by introducing maximum likelihood estimation for censored data. The way for optimal stock determination with pricing the cost of waste reduction is also proposed. This study focuses on the examination of the methods for large sales numbers where Taylor's law is obvious. Numerical analysis using aggregated POS data shows the effectiveness of the methods to reduce food waste maintaining a high profit for large sales numbers. Moreover, the way of pricing the cost of waste reduction reveals that a small profit loss realizes substantial waste reduction, especially in the case that the proportionality constant of Taylor's law is small. Specifically, around 1% profit loss realizes half disposal at ≈ 0.12 , which is the actual value of processed food items used in this research. The methods provide practical and effective solutions for waste reduction keeping a high profit, especially with large sales numbers.

Keywords : food waste reduction, particle filter, point-of-sales, sustainable development goals, Taylor's law, time series analysis

Conference Title : ICESMFA 2020 : International Conference on Econophysics and Statistical Mechanics for Financial Applications

Conference Location : Dublin, Ireland

Conference Dates : January 30-31, 2020