Empirical Economics Letters, 24 (12): pp. 1-12, (December 2025) *ISSN 1681 8997*
https://doi.org/10.5281/zenodo.17905424

Eco-Efficiency of Taiwan's Semiconductor Industry: An Application of the Data Envelopment Analysis Approach with Undesirable Output Variable

Chih Cheng Chen

Department of Information Management
Yuan Ze University, Taoyuan, Taiwan
Email: chihcheng@saturn.yzu.edu.tw

Abstract: This study evaluates the eco-efficiency of Taiwanese semiconductor companies in 2022 by applying data envelopment analysis (DEA) with undesirable outputs. We use operational costs, selling and administrative expenditures, and total capital as input variables. For the desirable output variables, we adopted net sales and total assets in the evaluation process. In addition, we use the quantity of carbon dioxide (CO_2) emissions as the undesirable output. Our results calculated from the DEA model indicate that the average eco-efficiency of Taiwan's semiconductor industry is 0.833. The average eco-efficiencies of the highest two subindustries are firms in the lead frame and semiconductor equipment, and the lowest two are IC design and foundry. Finally, the inefficiency in CO_2 emissions indicates that Taiwan's semiconductor industry must continuously improve its eco-efficiency continuously in the future, especially in the foundry subindustry.

Keyword: Eco-Efficiency, Semiconductor Industry, Data Envelopment Analysis, Undesirable Variables

JEL Classification Number: L63, Q56, Q57