Chapter 4
Optimizing Operational Efficiency in Islamic Banking Integrating Data Envelopment Analysis and Monte Carlo Simulations: Optimizing Operational Efficiency in Islamic Banking

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ABSTRACT

Operational efficiency is crucial for the competitiveness and sustainability of banks, particularly in Islamic banking, which adheres to principles such as the prohibition of interest (riba) and asset-backed financing. This study integrates Data Envelopment Analysis (DEA) with Monte Carlo (MC) simulations to evaluate the operational efficiency of Islamic banks. It focuses

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on three key analyses: assessing Tamweel Bank's efficiency from 2013 to 2023 using historical financial data; generating simulated data with MC simulations to stabilize efficiency estimates; and comparing Tamweel and Alizz Islamic Banks for 2023. Both Constant Returns to Scale (CCR) and Variable Returns to Scale (BCC) DEA models are applied to capture diverse efficiency dimensions. Findings show significant variability in Tamweel Bank's efficiency, peaking in 2019 but declining by 2023. MC simulations provide an aggregated efficiency benchmark, emphasizing the value of combining deterministic and stochastic methods. The comparative analysis highlights an efficiency gap, offering strategic insights for improvement.

INTRODUCTION

Operational efficiency stands as a cornerstone of competitiveness and sustainability within the banking sector. For financial institutions, the ability to maximize outputs while minimizing inputs not only enhances profitability but also ensures resilience in fluctuating economic landscapes. In the realm of Islamic banking, which operates under distinct principles such as the prohibition of interest (riba), avoidance of speculative activities (gharar), and the requirement for asset-backed financing, assessing operational efficiency presents unique challenges and opportunities. These principles necessitate specialized frameworks for efficiency evaluation, differentiating Islamic banks from their conventional counterparts.

This study seeks to provide a comprehensive evaluation of operational efficiency in Islamic banks by employing a dual-methodological approach that integrates Data Envelopment Analysis (DEA) with Monte Carlo (MC) simulation. DEA is a non-parametric technique renowned for its ability to benchmark the relative efficiency of decision-making units (DMUs) based on multiple inputs and outputs without requiring predefined weights. However, DEA's deterministic nature can limit its capacity to account for the inherent uncertainties and variability present in financial data. To address this limitation, Monte Carlo simulations are incorporated to generate synthetic datasets that introduce stochastic elements, thereby enhancing the robustness and generalizability of the efficiency assessments.

The methodology is systematically structured into three primary analyses: