



Productivity and Efficiency Measurement

Course: Data Envelopment Analysis and Stochastic Frontier



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Introduction:

Productivity and efficiency measurement with data envelopment analysis and stochastic frontier is a 1-week course for performance, planning, budget and economic analysis units that ends with a Unit Efficiency Review and Resource Reallocation Plan for a case organisation. Ministries, sector supervisors and multi-site operators often rank hospitals, schools, branches or utilities on single ratios that ignore case mix, scale and random shocks, so budgets reward the wrong units. Nominees already prepare performance or cost data for comparison and build frontier models on spreadsheets and solver tools with anonymised unit datasets. CoreConcept Training Center delivers this productivity and efficiency measurement course.

Course Objectives:

- Select defensible input and output variables for a set of comparable decision-making units and test the dataset for homogeneity, outliers and sufficient unit numbers
- Build input-oriented and output-oriented DEA models under constant and variable returns to scale and read efficiency scores, slacks, peer sets and improvement targets
- Estimate a stochastic production or cost frontier and separate measured inefficiency from random noise for each unit
- Measure productivity change between periods with the Malmquist index and attribute it to catch-up and frontier shift
- Validate efficiency results through sensitivity runs, bootstrapped confidence intervals and cross-checks between DEA and SFA
- Convert efficiency evidence into budget allocation rules, unit targets and a review cycle that managers accept as fair

Target Audience:

- Performance analysis units responsible for comparing the results of hospitals, schools, clinics or service centres
 - Planning and budget units responsible for allocating operating funds across regional offices or branches
 - Economic analysis teams responsible for efficiency studies of utilities, transport operators or other network services
 - Strategy and transformation offices responsible for setting productivity targets across multi-site organisations
 - Statistics and data units responsible for preparing unit-level activity, staffing and cost datasets for comparison
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Course Outline:

Day 1: Productivity Concepts, Frontiers and Unit Datasets

- Partial Labour Productivity Versus Total Factor Productivity Ratios
- Technical, Allocative and Scale Efficiency Concepts on Frontiers
- Decision-Making Unit Definition and Peer Group Homogeneity Tests
- Input and Output Variable Selection With Correlation Screening
- Unit Dataset Audit for Missing Values and Outlier Records

Day 2: Data Envelopment Analysis Models and Returns to Scale

- CCR Model Under Constant Returns to Scale Formulation
- BCC Model Under Variable Returns to Scale Formulation
- Input Orientation Versus Output Orientation Choice per Policy Question
- Spreadsheet Solver Build for Envelopment Form DEA Scores
- Scale Efficiency Decomposition From CCR and BCC Results

Day 3: DEA Targets, Peers and Stochastic Frontier Estimation

- Slack Analysis and Radial Projection to Efficient Targets
- Peer Set Lambdas and Reference Unit Selection for Learning
- Super-Efficiency and Cross-Efficiency Ranking of Efficient Units
- Stochastic Frontier Composed Error With Noise and Inefficiency Terms
- Cobb-Douglas and Translog Frontier Specification With Half-Normal Inefficiency

Day 4: Productivity Change, Robustness and Contextual Factors

- Malmquist Index Across Two Periods for Each Unit
- Efficiency Change and Technical Change Decomposition of Malmquist Results
- Bootstrapped DEA Confidence Intervals and Bias-Corrected Scores
- Second-Stage Regression of Scores on Environmental Variables
- Weight Restrictions and Assurance Regions for Implausible Weights

Day 5: Modelling Build: Unit Efficiency Review and Reallocation Plan

- Case Organisation Unit Dataset Cleaning and Variable Choice
 - Case DEA and SFA Model Runs With Result Comparison
 - Case Malmquist Trend Table for Units Across Periods
 - Efficiency-Linked Budget Allocation Rule and Unit Target Sheet
 - Unit Efficiency Review and Resource Reallocation Plan Completion
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Skills You Will Gain:

- Decision-Making Unit Specification
- Frontier Model Building
- Returns to Scale Diagnosis
- Stochastic Frontier Estimation
- Malmquist Productivity Decomposition
- Bootstrap Inference for Efficiency Scores
- Efficiency-Based Resource Allocation

Why Attend This Course:

- Deliver a Unit Efficiency Review and Resource Reallocation Plan for a case organisation to the budget committee, the planning director or the sector oversight board
- Decide which units serve as learning peers, which receive improvement targets and how operating funds shift between them on frontier evidence
- Avoid penalising units for size, case mix or random shocks that single ratios cannot separate from genuine waste
- Share the DEA solver template, SFA specification sheet and Malmquist trend table with analysts in other directorates

Conclusion:

Back at work, the participant hands the Unit Efficiency Review and Resource Reallocation Plan to the budget committee, the planning director and the managers of the units compared. They use it to set unit targets, select peer units for site visits and adjust operating allocations on frontier evidence rather than single ratios. After the first budget cycle under the plan, the analysis unit should rerun the models with new period data, compare the Malmquist results with the targets set and revisit variable choice and weight restrictions.

Frequently Asked Questions FAQ:

What should participants know before the productivity and efficiency measurement course on DEA and stochastic frontier?

Participants should be comfortable with spreadsheets and basic regression and should already prepare unit-level activity, staffing or cost data. No linear programming background is needed. A laptop with a spreadsheet solver is used, and an anonymised unit dataset from the participant's own organisation helps.

How does productivity and efficiency measurement with DEA differ from benchmarking or work measurement courses?

Frontier efficiency measurement compares whole units statistically, using several inputs and outputs at once. Benchmarking courses compare practices and maturity against excellence models, and work measurement courses set standard times for individual tasks inside one process.

When should productivity and efficiency measurement use stochastic frontier analysis instead of data envelopment analysis?

Stochastic frontier analysis suits large samples with noisy data where random shocks must be separated from inefficiency. Data envelopment analysis suits smaller samples with several outputs and no agreed functional form. Running both and comparing the rankings strengthens the evidence.

What do participants take back from the productivity and efficiency measurement course with DEA and stochastic frontier?

Participants take back a Unit Efficiency Review and Resource Reallocation Plan for a case organisation, with a DEA solver template, SFA specification sheet, Malmquist trend table, bootstrap results and an efficiency-linked budget allocation rule.