

Contents

1	Data Envelopment Analysis	1
1.1	Performance Evaluation and Tradeoffs	1
1.2	Data Envelopment Analysis	3
1.3	Performance Metrics Classified as Inputs and Outputs.....	5
1.4	Number of DMUs vs Number of Inputs and Outputs	7
1.5	Measuring and Managing Performance	8
	References	9
2	Envelopment DEA Models	11
2.1	Introduction	11
2.2	Variable Returns-to-Scale (VRS) Model	12
2.3	DEA Slacks	17
2.4	Other Envelopment Models.....	19
2.5	Envelopment Models in Spreadsheets.....	21
2.5.1	Input-Oriented VRS Envelopment Spreadsheet Model	22
2.5.2	Using Solver.....	23
2.5.3	Setting the Objective Cell and Changing Variable Cells	24
2.5.4	Adding Constraints and Selecting Solving Method.....	24
2.5.5	Solving the Model.....	26
2.5.6	Automating the DEA Calculation	27
2.5.7	Second-Stage Slack Calculation	32
2.5.8	Other Input-Oriented Envelopment Spreadsheet Models	34
2.6	Output-Oriented Envelopment Spreadsheet Models.....	34
2.7	Using OpenSolver	39
2.8	Solving DEA Using DEA Frontier Software	42
2.8.1	Data Sheet Format.....	44
2.8.2	Envelopment Models	45
	References	48
3	Multiplier DEA Model	49
3.1	Multiplier Models in Spreadsheets.....	49
3.2	Weight Restrictions in Multiplier Models	54

3.3 Solving Multiplier Models Using DEA Frontier.....	58
References	60
4 DEA Cross Efficiency	61
4.1 Introduction	61
4.2 Cross Efficiency	62
4.3 Cross Efficiency in Spreadsheets	65
4.4 Game Cross Efficiency	66
4.4.1 Input-oriented Game Cross Efficiency	67
4.4.2 Output-oriented Game Cross Efficiency	73
4.4.3 Output-oriented VRS Game Cross Efficiency	77
4.5 Maximum Log Cross Efficiency	81
4.5.1 Multiplicative DEA Model	81
4.5.2 Maximum Log Cross Efficiency	86
References	92
5 Slack-Based DEA Models.....	93
5.1 Slack-Based Models	93
5.2 Slack-Based Models in Spreadsheets	95
5.3 Solving Slack-Based DEA Model Using DEA Frontier Software	100
References	101
6 Measure-Specific DEA Models	103
6.1 Measure-Specific Models	103
6.2 Measure-Specific Models in Spreadsheets	105
6.3 Performance Evaluation of Fortune 500 Companies	106
6.3.1 Identification of Best Practice Frontier	107
6.3.2 Measure-Specific Performance	108
6.3.3 Benchmark Share	112
6.4 Solving Measure-Specific Models Using DEA Frontier Software	119
References	119
7 Non-radial DEA Models and DEA with Preference	121
7.1 Non-radial DEA Models	121
7.2 DEA with Preference Structure and Cost/Revenue Efficiency	123
7.3 DEA/Preference Structure Models in Spreadsheets	127
7.4 DEA and Multiple Objective Linear Programming	128
7.4.1 Output-oriented DEA	129
7.4.2 Input-oriented DEA	133
7.4.3 Non-Orientation DEA	134
7.5 Using DEA Frontier Software	135
7.5.1 Non-radial Models	135
7.5.2 Preference-Structure Models	135
7.5.3 Cost Efficiency, Revenue Efficiency and Profit Efficiency	137
References	140

8	Modeling Undesirable Measures	141
8.1	Introduction	141
8.2	Efficiency Invariance	141
8.3	Undesirable Outputs	143
8.4	Undesirable Inputs	145
8.5	Solving DEA Using DEA Frontier Software	148
8.6	Negative Data	148
	References	151
9	Context-dependent Data Envelopment Analysis	153
9.1	Introduction	153
9.2	Stratification DEA Method	154
9.3	Input-oriented Context-dependent DEA	158
9.3.1	Attractiveness	158
9.3.2	Progress	164
9.4	Output-oriented Context-dependent DEA	166
9.5	Solving DEA Using DEA Frontier Software	171
	References	174
10	Super Efficiency	175
10.1	Super-Efficiency DEA Models	175
10.2	Infeasibility of Super-efficiency DEA Models	177
10.2.1	Output-Oriented VRS Super-Efficiency Model	183
10.2.2	Other Output-oriented Super-efficiency Models	188
10.2.3	Input-Oriented VRS Super-Efficiency Model	188
10.2.4	Other Input-oriented Super-efficiency Models	192
10.3	Models for Dealing with Infeasibility	193
10.4	Zero Data and Infeasibility	197
10.5	Slack-Based Super Efficiency	201
10.6	Solving Super-Efficiency Using DEA Frontier	203
	References	205
11	Sensitivity Analysis	207
11.1	DEA Sensitivity Analysis	207
11.2	Stability Region	209
11.2.1	Input Stability Region	209
11.2.2	Output Stability Region	213
11.2.3	Geometrical Presentation of Input Stability Region	215
11.3	Infeasibility and Stability	222
11.4	Simultaneous Data Change	226
11.4.1	Sensitivity Analysis Under CRS	228
11.4.2	Sensitivity Analysis Under VRS	237
11.4.3	Spreadsheet Models for Sensitivity Analysis	239
11.5	Sensitivity Analysis Using DEA Frontier	243
	References	244

12 Benchmarking Models	245
12.1 Introduction	245
12.2 Variable-benchmark Model	245
12.3 Fixed-benchmark Model	255
12.4 Fixed-benchmark Model and Efficiency Ratio	259
12.5 Minimum Efficiency Model	263
12.6 Buyer-seller Efficiency Model	267
12.7 Acceptance System Decision.....	270
12.8 Solving Benchmarking Models Using DEA Frontier	274
12.8.1 Variable-Benchmark Models.....	274
12.8.2 Fixed-Benchmark Models.....	275
12.8.3 Minimum Efficiency Models.....	275
References	276
13 Returns-to-Scale	277
13.1 Introduction	277
13.2 RTS Regions.....	277
13.3 RTS Estimation.....	278
13.3.1 VRS and CRS RTS Methods	278
13.3.2 Improved RTS Method	280
13.3.3 Spreadsheets for RTS Estimation.....	282
13.4 Scale Efficient Targets.....	286
13.5 Solving DEA Using DEA Frontier Software	288
References	289
14 DEA Models for Two-Stage Network Processes	291
14.1 Introduction	291
14.2 VRS Two-Stage Model.....	292
14.3 CRS Two-Stage Model: Centralized Model.....	298
14.4 CRS Two-Stage Model: Equivalence	301
14.5 Frontier Projection.....	304
14.6 CRS Two-Stage Model: Leader-Follower Model	305
14.7 Solving Two-Stage Network Process Using DEA Frontier	307
References	309
15 Models for Evaluating Supply Chains and Network Structures	311
15.1 Supply Chain Efficiency	311
15.2 Supply Chain Efficiency	312
15.2.1 Supply Chain as an Input-Output System.....	313
15.2.2 Supply Chain Efficiency Model.....	316
15.2.3 An example	319
15.3 Cooperative and Non-Cooperative Approaches.....	324
15.3.1 The Non-Cooperative Model	325
15.3.2 The Cooperative Model	331
15.4 Additive Efficiency Decomposition to Network Structures.....	334
15.4.1 DEA Model for General Multi-Stage Serial Processes.....	335

15.4.2	General Multistage Processes	338
15.4.3	An Illustrative Application.....	340
	References	344
16	Congestion	345
16.1	Congestion Measure	345
16.2	Congestion and Slacks	350
16.3	Slack-Based Congestion Measure	353
16.4	Solving Congestion Using DEA Frontier.....	359
	References	360
17	Identifying Critical Measures in DEA	363
17.1	Introduction	363
17.2	Performance Evaluation and DEA	363
17.3	Identifying Critical Output Measures.....	368
17.4	Identifying Critical Input Measures	369
17.5	Numerical Example and Extension.....	370
17.6	Application to Fortune E-Companies.....	372
	References	381
18	Interval and Ordinal Data in DEA.....	383
18.1	Introduction	383
18.2	Imprecise Data.....	384
18.3	Multiplier IDEA (MIDEA): Standard DEA Model Approach	387
18.3.1	Converting the Bounded Data into a Set of Exact Data.....	387
18.3.2	Converting the Weak Ordinal Data into a Set of Exact Data.....	388
18.3.3	Numerical Illustration	389
18.3.4	Converting the Strong Ordinal Data and Ratio Bounded Data into a Set of Exact Data	392
18.4	Treatment of Weight Restrictions.....	393
18.5	Envelopment IDEA (EIDEA).....	395
18.6	Conclusions	397
	References	398
19	DEA Frontier Software.....	399
19.1	Introduction	399
19.2	DEA Bootstrapping	399
19.3	Free Disposal Hull (FDH).....	400
19.4	Mamquist Approach	402
19.5	DEA Frontier Models.....	404
	References	407
	Licensing and Warranty Agreement	409
	Index.....	411

Quantitative Models for Performance Evaluation and
Benchmarking

Data Envelopment Analysis with Spreadsheets

Zhu, J.

2014, XVII, 414 p. With online files/update., Hardcover

ISBN: 978-3-319-06646-2