

Contents

Dedication	v
List of Figures	xi
List of Tables	xv
Preface	xvii
Acknowledgments	xxi
1. INTRODUCTION	1
1.1 What this work is about	1
1.2 Improving the nonparametric approach in frontier analysis	4
1.3 An outline of the work	8
Part I Methodology	
2. THE MEASUREMENT OF EFFICIENCY	13
2.1 Productivity and Efficiency	13
2.2 A short history of thought	16
2.3 The economic model	19
2.4 A taxonomy of efficient frontier models	25
2.5 The nonparametric frontier approach	30
2.5.1 Data Envelopment Analysis (DEA)	31
2.5.2 Free Disposal Hull (FDH)	33
2.6 Recent developments in nonparametric efficiency analysis	39
3. STATISTICAL INFERENCE IN NONPARAMETRIC FRONTIER ESTIMATION	43
3.1 Statistical foundation	43
3.2 Introducing stochastic noise in the model	45

3.3	Asymptotic results	47
3.3.1	Consistency	47
3.3.2	Sampling distributions	49
3.4	Bootstrap techniques and applications	50
3.4.1	Bootstrap in frontier models	52
3.4.2	Correcting the bias	54
3.4.3	Bootstrap confidence intervals	55
3.4.4	Is the bootstrap consistent?	56
3.4.5	Applications of the bootstrap	63
3.4.6	Bootstrapping FDH estimators	64
4.	NONPARAMETRIC ROBUST ESTIMATORS: PARTIAL FRONTIERS	65
4.1	A re-formulation based on the probability of being dominated	66
4.2	Order- m frontiers and efficiency scores	68
4.3	Order- α quantile-type frontiers	72
4.4	Properties of partial frontier estimators	77
4.4.1	Statistical properties	77
4.4.2	Robust estimators of the full frontier	77
4.4.3	Advantages of using partial frontiers	78
4.4.4	Detection of outliers	79
4.5	Summary of the results for the output oriented case	81
4.6	Parametric approximations of robust nonparametric frontiers	85
4.6.1	Two stage methods	87
4.6.2	The bootstrap algorithms	89
4.7	Multivariate parametric approximations	90
4.7.1	Generalized Cobb-Douglas parametric model	91
4.7.2	Translog parametric model	93
5.	CONDITIONAL MEASURES OF EFFICIENCY	95
5.1	Explaining efficiency in the literature	96
5.2	Introducing external-environmental variables	100
5.2.1	Conditional full frontier measures	100
5.2.2	Conditional order- m measures	101
5.2.3	Conditional order- α measures	103
5.2.4	Summary for the output oriented case	105
5.3	Bandwidth selection	108
5.3.1	Univariate case	109
5.3.2	Multivariate case	110

<i>Contents</i>	ix
-----------------	----

5.4	An econometric methodology	113
5.4.1	Global effect of Z on the production process	113
5.4.2	A decomposition of conditional efficiency	119
5.5	Simulated illustrations	121
5.5.1	Univariate Z	122
5.5.2	Multivariate Z	124

Part II Applications

6.	ECONOMIES OF SCALE, SCOPE AND EXPERIENCE IN THE ITALIAN MOTOR-VEHICLE SECTOR	135
6.1	Introduction	135
6.2	Data description	139
6.2.1	Definition of outputs and inputs	142
6.2.2	An exploratory investigation	145
6.2.3	Aggregation of inputs and outputs	148
6.3	Testing returns to scale and bootstrapping efficiency scores	151
6.4	Economies of scale	157
6.5	Economies of scope	160
6.6	Economies of experience	163
6.7	Conclusions	164
7.	AGE, SCALE AND CONCENTRATION EFFECTS IN A PUBLIC RESEARCH SYSTEM	167
7.1	Introduction	167
7.2	Data description	176
7.3	Scale and concentration effects	178
7.4	Age effects on CNR scientific productivity	181
7.5	Robust parametric approximation of multioutput distance function	186
7.6	Conclusions	191
8.	EXPLORING THE EFFECTS OF MANAGER TENURE, FUND AGE AND THEIR INTERACTION	193
8.1	Introduction	193
8.2	Data description	196
8.3	Impact of mutual fund manager tenure on performance	199
8.4	Interaction between manager tenure and fund age	208

8.5 Conclusions	216
9. CONCLUSIONS	217
References	221
Topic Index	243
Author Index	245