

CONTENTS

1. INTRODUCTION	6
1.1. INTRODUCTORY REMARKS	6
1.2. OUTLINE OF THE BOOK	9
2. STEIN-TYPE ESTIMATORS OF THE MEANS	
OF A MULTIVARIATE NORMAL DISTRIBUTION	11
2.1. A REPRESENTATION OF THE RISK DIFFERENCE	13
2.2. THE CLASSICAL JAMES-STEIN ESTIMATOR AS IMPROVED ESTIMATOR	16
2.3. A BAYESIAN APPROACH TO THE JAMES-STEIN ESTIMATOR . .	23
2.4. THE POSITIVE-PART JAMES-STEIN ESTIMATOR	27
2.5. A CLASS OF ESTIMATORS THAT DOMINATE THE USUAL ONE. . .	30
2.6. IMPROVED ESTIMATORS WITH GOOD BAYES PROPERTIES . . .	35
2.6.1. A GENERALIZED JAMES-STEIN ESTIMATOR	35
2.6.2. A SMOOTHING MODIFICATION OF THE POSITIVE-PART ESTIMATORS	38
2.7. ADMISSIBLE IMPROVED ESTIMATORS	44
2.8. IMPROVED ESTIMATORS SHIFTING $\bar{x}$ TOWARDS SOME DATA-BASED POINT	53
2.9. THE CASE OF A GENERALIZED QUADRATIC RISK	55
2.10. THE ROBUSTNESS OF STEIN-TYPE ESTIMATORS	56
2.11. THE CASE OF A MORE GENERAL COVARIANCE STRUCTURE . .	59
2.12. APPLICATION TO LINEAR REGRESSION	63
2.13. BIBLIOGRAPHICAL NOTES	65

3. IMPROVED ESTIMATION OF PARAMETERS

IN CONTINUOUS EXPONENTIAL FAMILIES	69
3.1. THE CASE OF A ONE-PARAMETER CANONICAL EXPONENTIAL FAMILY	71
3.1.1. PAIRS OF ESTIMATORS WITH POSITIVE RISK DIFFERENCE	73
3.1.2. SUFFICIENT CONDITIONS FOR THE INADMISSIBILITY OF ESTIMATORS	79
3.2. THE CASE OF A MULTIPARAMETER CANONICAL EXPONENTIAL FAMILY	86
3.2.1. PAIRS OF ESTIMATORS WITH POSITIVE RISK DIFFERENCE	87
3.2.2. λ -SUPERHARMONIC FUNCTIONS	92
3.2.3. ESTIMATORS DOMINATING THE MINIMUM VARIANCE UNBIASED ESTIMATOR	96
3.2.4. CONSTRUCTION OF IMPROVED ESTIMATORS FOR A SUBCLASS OF INADMISSIBLE ESTIMATORS . .	104
3.3. GENERALIZATIONS TO NONCANONICAL EXPONENTIAL FAMILIES	109
3.4. BIBLIOGRAPHICAL NOTES	120

4. IMPROVED ESTIMATION OF PARAMETERS IN DISCRETE

EXPONENTIAL FAMILIES WITH UNBOUNDED SUPPORT . .	121
4.1. THE ADMISSIBILITY OF THE MINIMUM VARIANCE UNBIASED ESTIMATOR IN THE UNIVARIATE CASE . . .	122
4.2. ESTIMATORS DOMINATING THE MINIMUM VARIANCE UNBIASED ESTIMATOR UNDER SQUARED ERROR LOSS IN THE MULTIVARIATE CASE	129
4.3. IMPROVED ESTIMATORS UNDER NORMALIZED SQUARED ERROR LOSS	134
4.4. THE PROBLEM OF IMPROVING NONSTANDARD ESTIMATORS . .	140
4.5. BIBLIOGRAPHICAL NOTES	142

5. APPENDIX	145
REFERENCES	154
AUTHOR INDEX.	168
SUBJECT INDEX	172
NOTATIONAL CONVENTIONS.	174