CONTENTS

FOREWORD v

INTRODUCTION AND SUMMARY x

CHAPTER 1 CHARACTERISTICS OF THE ELEMENT OF SPACE 1
1.1. Categories of Space Units. Order of Subdivision 1
1.2. Mobility of Factors Products and Consumers 4
1.3. Shiftability of Activities (Differences in Production Costs) 6
1.4. The Optimal Level of the Use of Means of Economic Policy 7
1.5. Space Economics of the First Order; without Prices 9
1.6. Space Economics of the First Order; with Prices 10
1.7. Space Economics of Higher Order; without Prices 12
1.8. Space Economics of Higher Order; with Prices 13

CHAPTER 2 DEVELOPMENT PLANNING WITHOUT SPACE: A SUMMARY 15
2.1. Purpose of the Chapter 15
2.2. The Macro Stage 16
2.3. The Sector Stage: Demand and Costs 18
2.4. Scarce Factors Different among Eras and Areas 21
2.5. The Project Stage: Bunches 23
2.6. The Project Stage: Criterion and Prices 24
2.7. The Time Horizon 26

CHAPTER 3 THE ELEMENT OF SPACE IN WORLD PLANNING; SECOND ORDER SUBVIDISION OF A CLOSED ECONOMY; TRANSPORTATION COSTS IMPLICIT 29
3.1. Introductory; Objective of Chapter; Nature of Problem 29
3.2. Summarizing the Assumptions and the Data of the Simplest Version 32
3.3. Factors Determining Comparative Advantages 33
3.4. Formulation of the Simplest Version as a Transportation or Hitchcock Problem 36
3.5. Solution of the Simplest Version with the Aid of the uv-Method 39
3.6. Reducing the Volume of Work 43
3.7. The Model with Pre-Determined Zero Activities 47

CHAPTER 4 THE ELEMENT OF SPACE IN NATIONAL DEVELOPMENT PLANNING; SECOND ORDER SUBDIVISION OF AN OPEN ECONOMY; TRANSPORTATION COSTS IMPLICIT 49

4.1. Choice of Regions and Their Frontiers 49
4.2. Choice of Sectors 51
4.3. Nature of the National Planning Problem with Regional Subdivision 52
4.4. Solution of the Simplest Version of the National Planning Problem 57
4.5. Normalized Form of Problem; Problem with Predetermined Zeros 61
4.6. Costs of Regional Policy 63
4.7. Introduction of Employment Targets 67
4.8. Introduction of Input-Output Relations 68
4.9. Decomposition of the National Planning Problem 73
4.10. The Estimation of Interregional Transport Flows 75
4.11. Introduction of Bounds for Some Variables 79
4.12. Integration of Countries into an Area 84
4.13. A Case Study: Mexico 85

CHAPTER 5 WORLD DEVELOPMENT PLANNING; SECOND ORDER SUBDIVISION OF A CLOSED ECONOMY; EXPLICIT TRANSPORTATION COSTS FOR HEAVY PRODUCTS 89
5.1. Heavy Products 89
5.2. Models with Explicit Transportation Costs for Heavy Products; an Example of a Model for a Closed Economy 91
5.3. A Numerical Example for a Closed Economy and its Solution 97
5.4. Comparison of the Simultaneous Solution with the Successive Solution of the Numerical Example 107
5.5. Decomposition of the Model 113

CHAPTER 6 AN ITERATIVE IMPROVEMENT PROCEDURE; APPLICATION TO WORLD OR NATIONAL DEVELOPMENT PLANNING; SECOND ORDER SUBDIVISION OF A CLOSED OR OPEN ECONOMY; EXPLICIT TRANSPORTATION COSTS FOR HEAVY PRODUCTS 117
6.1. The Iterative Improvement Method and its Application to a Closed Economy Model 117
6.2. A Simple Model of an Open Economy with a Heavy Sector and its Solution 133
6.3. The Introduction of Transport Costs Dependent on the Dominant Flow along a Route 145

CHAPTER 7 A SURVEY OF THE MODELS, THEIR ASSUMPTIONS AND SOLUTION METHODS 169
7.1. Introduction 169
7.2. The General Model 170
7.3. From the General Model to the Basic Model 180
7.4. Derivation of the Models of Chapters 3-6 from the Basic Model 192
7.5. Schematic Representation of the Assumptions and Models 207

CHAPTER 8 THE INTRODUCTION OF INDIVISIBILITIES; NO FULL SPECIFICATION OF TOPOGRAPHY 211
8.1. The Hierarchy Model; No Foreign Trade; Agriculture Evenly Spread over the Country; Vertical Integration 211
8.2. Appropriate Choice of Groups of Industries 219
8.3. The Hierarchy Model: Non-Shiftable Industries 225
8.4. The Hierarchy Model: Foreign Trade 227
8.5. Corrections for Industries with Heavy Agricultural Inputs 229
8.6. No Vertical Integration; Input-Output Relations 232
8.7. Agglomeration Effects 235
8.8. Stepwise Spatial Planning 236
8.9. An Empirical Investigation for the Netherlands 238

CHAPTER 9 INCREMENTAL SPATIAL PLANNING 243
9.1. Differences in Variability of the Elements Involved 243
9.2. Optimal Location of a New Plant 245
9.3. Growth of Existing Centres 245
9.4. The Development of a New Region 247
9.5. Small Additions to an Existing System of Centres 248
9.6. Bigger Changes in a System of Centres 249
9.7. Instruments for Spatial Planning 250

CHAPTER 10 PREPARATORY STUDIES; SOME COEFFICIENTS 253
10.1. Spontaneous Migration 253
10.2. Optimum Size of Production Units 255
10.3. Local, Regional, National and International Industries; A Ten-Country Study 258
10.4. International Comparability of Input-Output Tables 261
10.5. Capital-Output Ratios 266

APPENDIX I The Characterization of Spatial Units 269
APPENDIX II Data and Solutions of the Mexican Model 274
APPENDIX III Mathematical Remarks on the Decomposition Procedures in the Chapters 4 and 6 280
APPENDIX IV Heavy Products 296
APPENDIX V Classification of Sectors 314
APPENDIX VI Cost Coefficients 318
References 320
List of Symbols 324
Author Index 335
Subject Index 336