

TABLE OF CONTENTS

CHAPTER 1 INTRODUCTION 1

1.1 Why Study Population? 1

Local-Scale Applications Require Broad System-Scale Perspectives 2

1.2 The World Scale: Potential Consequences of Population Change 2

Fibonacci's Rabbits 2

Current and Past Rates of World Population Growth 4

Implications of Falling Birth Rates 7

1.3 The National Scale: Age Composition and Migration Pattern Shifts 8

Impact of the Baby Boom 8

Broad-Scale Migration Pattern Changes 10

The Repercussions of Age Composition Changes on Migration Patterns 12

1.4 The Local Scale: A School Reassignment Case Study 13

Case Study: Catalina Foothills School District Elementary School Reassignment Problem 14

Reasons for Our Focus on the Local Scale 18

1.5 The Interdisciplinary Organization of Population Research 19

Demography and Population Studies 19

Population Geography 19

Population Analysis in Planning, Marketing, and Regional Science 20

1.6 Sources of Population Data 21

U.S. Census 21

Private-Sector Sources 22

CHAPTER 2 POPULATION DISTRIBUTION AND COMPOSITION 23

2.1 Introduction 23

2.2 Population Distribution 23

Population Dot Maps 24

Population Density 25

The Index of Concentration 28

The Lorenz Curve 29

Centers of Population 31

2.3 Measuring Accessibility 37

The Threshold Accessibility Index 37

The Aggregate Accessibility Index 38

2.4 Population Composition 41

Median Age 42

The Dependency Ratio 42

Economic Participation Measures 43

The Sex Ratio 44

Population Pyramids 46

Location Quotients 48

2.5 Geographic Association 50

2.6 Summary 53

CHAPTER 3 DESCRIBING DEMOGRAPHIC CHANGE 57

3.1 Introduction 57

3.2 Population Growth (and Decline) 53

Percentage Changes 58

Geometric Rates of Change 58

Exponential Rates of Change 59

Determining the Geometric and Exponential Rates of Change 61

Logistic Growth 62

3.3 Components of Change and Demographic Accounting 64

Demographic Rates and Probabilities 64

Components of Change 65

Demographic Accounting 66

Illustrative Example: Minor Flows 68

3.4 Measures of Mortality 70

Standardized Death Rates 71

Measures of Infant Mortality 74

3.5 Life Tables: Construction and Interpretation 75

Interpretation of a Life Table as a Cohort of Individuals 75

Alternative Interpretation as a Stationary Population 77

Life Table Construction 77

Survival Ratios 78

3.6 Measures of Fertility 81

Period versus Cohort Rates 86

3.7 Summary 86

CHAPTER 4 MIGRATION: ANALYZING THE GEOGRAPHIC PATTERNS 91

4.1 Introduction 91

4.2 Migration Definition and Measurement 92

Importance of Areal Unit Definition 93

Fixed Period versus Registry-type Data 94

4.3 Measures of Migration 95

Transition Probabilities 95

Gross Migration Rates 97

Net Migration Rates 98

Demographic Effectiveness 98

4.4 The Relationship Between In- and Out-Migration 100

The Intuitive Perspective 100

The Positive Correlation Perspective 100

Lowry's "Asymmetrical" Relationship of In- and Out-Migration 102

Beale's Findings 102

Kriesberg and Vining's Measure of In- and Out-Migration Contributions 103

*The Nonlinearity of the Relationship between Out-Migration and
Net Migration 104*

The Cross-Regional Variance of In-Migration and Out-Migration 105

The Entropy of In- and Out-Migration 105

4.5 Disaggregating by Migrant Characteristics 106

Migration Age Schedules 107

Migration Expectancies and Migraproduction Rates 108

Migrant Selectivity 111

Beaten Paths and the Role of Information 112

Return Migration 113

Duration of Residence Effects and Cumulative Inertia 114

4.6 Methods for Analyzing Geographic Patterns of Migration 115

Principal Component Analysis 115

The Extremal Tendencies of Sonis 118

Spatial Shift-Share Analysis 121

4.7 Summary 124

CHAPTER 5 POPULATION ESTIMATION 127

5.1 Introduction 127

The Parlance of Estimates 128

The Principal Types of Estimation Techniques 130

5.2 Simple Interpolation and Extrapolation 130

Linear Interpolation 130

Alternative Extrapolation Techniques 132

5.3 The Regression or Ratio-Correlation Method 134

A Real World Ratio-Correlation Equation 136

Problems with Ratio-Correlation Estimates 136

5.4 Component Methods 137

Component Method II 137

The Administrative Records Method 140

5.5 Housing-Unit Methods 142

Monitoring Temporal Change in the Number of Housing Units 142

Measuring Occupancy Rates 144

The Persons-per-Housing-Unit Factor 145

5.6 Evaluating Estimates 146

Two Methods for "Testing" Estimation Procedures 146

Some Rules of Thumb to Improve Estimates 147

A Case Study in the Pitfalls of Unequal Weighting 150

5.7 Summary 151

CHAPTER 6 POPULATION PROJECTIONS 155

6.1 Introduction 155

6.2 Elementary Extrapolative Methods 156

Linear Extrapolation 157

Geometric and Exponential Extrapolation 158

6.3 The Single-Region Cohort Component Model 160

Matrix Form of the Cohort Component Model 164

Example 166

6.4 Cohort Component Models with Migration 169

Cohort Survival with Constant Net Migration Rates 169

The Markov Model for Population Redistribution 170

The Interregional Cohort Component Model 174

Accounting-Based Population Projections 176

Other Applications of the Cohort Concept 177

6.5 School Enrollment Projections 177

The Grade Progression Ratio Method 178

The Housing Unit Method 181

6.6 Projecting the Demographic Structure of Organizations 183

6.7 Summary 184

CHAPTER 7 MODELING AND FORECASTING MIGRATION 189

7.1 Introduction 189

7.2 What Migration Quantity to Model? 190

The Volatility of Net Migration 191

The Fallacy of Using Net Migration Rates for Forecasting 192

7.3 The Gravity Model 196

Distance Deterrence 197

Constrained and Unconstrained Gravity Models 199

Fitting an Unconstrained Model 200

Singly Constrained Gravity Models 203

Other Forms of the Gravity Model 204

7.4 The Intervening Opportunities Model 206

An Example: The Opportunity and Constrained Gravity Models Compared 208

7.5 Temporally Varying Transitional Probabilities 211

The Causative Matrix Model 211

Feeney's Model 215

The Destination Population Weighted (DPW) Model 218

Improving on the Basic DPW Model 218

7.6 Economic Gravity Models 219

Lowry's Model 220

The Role of Amenities 222

The Need for a Micro Perspective in Behavioral Migration Research 223

An Important Accounting Constraint: Milne's "Seemingly Unrelated Regression Approach" 224

7.7 Toward Economic–Demographic Models 225

Comprehensive Economic–Demographic Modeling Frameworks 227

7.8 Summary 227

CHAPTER 8 THE ROLE OF POPULATION IN INFRASTRUCTURE PLANNING 231

8.1 Introduction 231

8.2 Urban Travel Forecasting 232

*The Role of Free Choice and Constraints in Urban Travel
Demand Analysis 232*

Steps in the Urban Travel Forecasting Process 233

8.3 Recreation Facilities Planning 245

Recreation Supply 248

Recreation Demand 248

Matching Forecasts of Demand with Supply 254

- 8.4 Site Location 255**
- 8.5 Impediments to the Production of Improved Forecasts 259**
- 8.6 Optimal Demand Assignment Methods 260**

The Un-unified–Unified School District Problem 261

- 8.7 The Use of Forecasts in Decision Making 269**
- 8.8 Summary 270**

CHAPTER 9 HOUSEHOLD DEMOGRAPHY 275

- 9.1 Introduction 275**
- 9.2 A Brief Look at Households, Location, and Relocation in the United States 276**
- 9.3 Geographic Concepts Relevant to the Study of Households 279**

Vacancy Chains 280

- 9.4 Demographic and Geographic Analysis of Households 284**

Householders and Markers 285

Householder Rate Method 285

The Household Membership Rate Method 287

Microsimulation 291

Matching Housing Demand with Housing Supply 293

- 9.5 Summary 296**

CHAPTER 10 DEMOGRAPHICS 299

- 10.1 Introduction 299**
- 10.2 The Measurement of Diversity and Segregation 301**

Diversity Measures 301

Segregation Measures 303

“Cracking and Packing”: Diversity and Segregation in Political Redistricting 307

- 10.3 Factorial Ecology 308**

Case Study: Postindustrial Demographic Change in Cleveland 309

- 10.4 Cluster Analysis for Defining Socially Homogeneous Areas 320**

Similarity Measures 322

Agglomerative Clustering 323

Iterative Clustering 327

- 10.5 Life-Style Clustering for Market Segmentation and Targeting 328**

Case Study: The Geography of Grit Magazine Subscription 329

- 10.6 Summary 334**

**CHAPTER 11 DEMOGRAPHIC AND GEOGRAPHIC
INFORMATION SYSTEMS FOR
POPULATION ANALYSIS 339**

11.1 Introduction 339

**11.2 A Brief Historical Account of Early
Population Mapping 340**

11.3 TIGER: A Digital Cartographic Database 341

The TIGER System 343

11.4 Geographic Information Systems 345

**11.5 Demographic and Geographic Information Systems for Pop-
ulation Analysis 345**

**11.6 Some Capabilities of Demographic and
Geographic Information Systems Relevant to
Population Analysis 350**

Areas of Polygons 350

Areal Interpolation 351

Dasymetric Mapping 352

Choropleth Maps and Geographic Scale 354

11.7 Limitations of GIS Used for Population Analysis 356

11.8 Prospects 357

11.9 Summary 358

CHAPTER 12 CONCLUSIONS 361

**12.1 Importance of the Geographical Analysis of
Population 361**

12.2 Scale 361

Scale Dependence in Choice of Method 361

Different Questions for Different Scales 362

The Modifiable Areal Unit Problem 362

Positive Benefits from Studying Phenomena at Alternative Spatial Scales 363

Results at a Given Scale May Hide Significant Spatial Variation 364

12.3 Long-Term Perspectives on Population Change 366

The Interaction Between Rates and Composition 366

**12.4 Geographic Perspectives on Future
Population Change 369**

**APPENDIX A ADDRESSES FOR U.S. ORGANIZATIONS OF
INTEREST 373**

**APPENDIX B GEOGRAPHICAL SUBUNITS AND
HIERARCHICAL RELATIONSHIPS 374**

APPENDIX C LOGARITHMS 379

APPENDIX D MATRIX ALGEBRA 380

REFERENCES	382
SOLUTIONS TO SELECTED EXERCISES	397
AUTHOR INDEX	408
SUBJECT INDEX	410