

Contents

List of Contributors	xi
1 Introduction	1
<i>Lóránt Tavasszy and Gerard de Jong</i>	
1.1 Background and Objectives	1
1.2 Conceptual Framework for Freight Decisions	2
1.2.1 Goods: Production, Consumption and Trade	3
1.2.2 Inventory Networks	4
1.2.3 Transport Organisation	4
1.3 Freight Models – Theoretical Perspective of the Book	6
1.4 Freight Models – Practical Perspectives Addressed	9
1.5 Organisation of This Volume	10
References	11
2 Modelling Inter-Regional Freight Demand with Input–Output, Gravity and SCGE Methodologies	13
<i>Olga Ivanova</i>	
2.1 Introduction	13
2.2 State-of-the-Art in of Inter-Regional Freight Demand Modelling	16
2.3 Forecasting Inter-Regional Trade Using Gravity	19
2.3.1 The History of Gravity Model	19
2.3.2 Theoretical Foundations of Gravity Equation	20
2.4 Multi-Regional I/O Framework	21
2.4.1 Multi-Regional IO Models with Fixed Trade Coefficients	21
2.4.2 Introduction of Variable Trade Coefficients Using Random Utility Theory	22
2.4.3 Overview of Empirical Inter-Regional IO Models	23
2.5 Spatial General Equilibrium Models and NEG Effects	25
2.5.1 Overview of the Methodology	25

2.5.2	Calibration of SCGE Models	26
2.5.3	Simple Mathematical Formulation	27
2.5.4	Including the Spatial Dimension	29
2.5.5	Capital and Labour Mobility	30
2.5.6	Agglomeration/Dispersion Forces	30
2.5.7	Review of the Empirical SCGE Models	31
2.5.8	The RAEM Family of SCGE Models	35
2.6	Conclusions and Ideas for Further Research	37
	References	39
	Suggestions for Further Reading	40
3	Freight Generation and Freight Trip Generation Models	43
	<i>José Holguín-Veras, Miguel Jaller, Ivan Sánchez-Díaz, Shama Campbell and Catherine T. Lawson</i>	
3.1	Introduction	43
3.2	Literature Review	44
3.2.1	FTG Models	44
3.2.2	FG Models	47
3.3	Logistical Interpretation of FG/FTG	47
3.4	Factors to Take into Account when Estimating or Applying FG and FTG	50
3.4.1	Classification Systems	51
3.4.2	Level of Aggregation	52
3.4.3	Aggregation Procedures	52
3.5	Case Study: FTG in the New York City Metropolitan Area	53
3.5.1	Transferability of FG and FTG Models	55
3.5.2	Spatial Effects on Freight Trips Attraction	57
3.6	Conclusion	57
	References	60
4	Distribution Structures	65
	<i>Hanno Friedrich, Lóránt Tavasszy and Igor Davydenko</i>	
4.1	Introduction	65
4.2	The Micro Level	66
4.2.1	Drivers and Their Developments	68
4.2.2	Micro-Level Normative Models	70
4.2.3	Applicability for Descriptive Purposes	76

4.3 From Micro to Macro Level	77
4.3.1 Challenges in Aggregate Models	77
4.3.2 Aggregate Modelling of Inventory Structures	79
4.4 Conclusion	85
References	86
5 Inventory Theory and Freight Transport Modelling	89
<i>François Combes</i>	
5.1 Inventory Theory	89
5.1.1 The Economic Order Quantity Model	90
5.1.2 Extensions of the EOQ Model	92
5.1.3 Models of Optimal Shipment Size with Uncertain Demand	95
5.2 Microeconomics of Logistics and Freight Transport	97
5.2.1 The TLC Function	97
5.2.2 The TLC in the EOQ Model: A Simple Freight Mode Choice Model with Logistics	98
5.2.3 The TLC in the Context of a Dynamic Model: A Partial Theory of the Value of Time and Value of Reliability in Freight Transport	100
5.2.4 The Inventory Theoretic Model of Freight Transport Demand of W. J. Baumol and H. D. Vinod	101
5.2.5 The Structure of Freight Transport Costs	102
5.3 Databases	103
5.3.1 Commodity Flow Surveys	103
5.3.2 The ECHO Shipper Survey	104
5.3.3 Inventory Theory and the Need for Adequate Data	104
5.4 The Econometrics of Freight Mode Choice and Shipment Size	105
5.4.1 Exploratory Analyses	105
5.4.2 Structural Analyses	106
5.5 Perspectives for Simulation	111
References	112
6 Mode Choice Models	117
<i>Gerard de Jong</i>	
6.1 Introduction	117

6.1.1	Mode Choice at Different Spatial Levels	117
6.1.2	Relevance of Modal Split	118
6.1.3	Dependent and Independent Variables	118
6.1.4	Disaggregate and Aggregate Mode Choice Models	119
6.1.5	Closely Related Choices	119
6.2	The Disaggregate Mode Choice Theory	121
6.2.1	Cost Functions and Utility Functions	121
6.2.2	Different Distributional Assumptions Lead to Different Discrete Choice Models	124
6.2.3	Non-RUM Models	129
6.2.4	Interaction Between Agents in Freight Transport	130
6.3	Practical Examples	132
6.3.1	Aggregate Mode Choice Models	132
6.3.2	Disaggregate Mode Choice Models	134
6.3.3	Joint Models for Mode Choice and Related Choices	135
	References	137
7	Vehicle-Trip Estimation Models	143
	<i>José Holguín-Veras, Carlos González-Calderón, Iván Sánchez-Díaz, Miguel Jaller and Shama Campbell</i>	
7.1	Introduction	143
7.2	Estimation of Loaded Trips	146
7.3	Estimation of Empty Trips	149
7.3.1	Commodity-Based Empty Trip Models	150
7.3.2	Generalised NVE Models	151
7.3.3	Tour Based Empty Trip Models	152
7.3.4	Parameter Estimation Procedures	155
7.3.5	Empirical Evidence	158
7.4	Concluding Remarks	159
	References	160
8	Urban Freight Models	163
	<i>Antonio Comi, Rick Donnelly and Francesco Russo</i>	
8.1	Introduction	163
8.2	Push Models of Urban Freight	166
8.2.1	Classical Urban Truck Models	166
8.2.2	Tour-Based Extensions to Classical Models	168

8.2.3	Urban Input–Output Data and Models	169
8.2.4	Firmographic Models and Business Metrics	171
8.2.5	The Supply Chain Context of Urban Freight	172
8.2.6	Simulation Modelling Frameworks	174
8.3	Pull Models for Urban Freight	176
8.3.1	Retailer’s Standpoint	177
8.3.2	Final Business Standpoint	181
8.3.3	End-Consumers’ Standpoint	182
8.3.4	The Overall Modelling Framework	186
8.4	Emerging Modelling Approaches	187
8.5	Conclusions	190
	Acknowledgements	191
	References	191
9	Freight Service Valuation and Elasticities	201
	<i>Gerard de Jong</i>	
9.1	Introduction	201
9.2	Freight Service Valuation	202
9.2.1	Use of Models Versus Calculation of Factor Cost	202
9.2.2	Different Data and Discrete Choice Models for Freight Service Valuation	203
9.2.3	Outcomes for the Value of Transport Time	209
9.2.4	Outcomes for the Value of Transport Time Reliability	213
9.2.5	Other Freight Service Values	216
9.3	Freight Transport Elasticities	216
9.3.1	Derivation of Elasticities from Transport Models	216
9.3.2	Classification of Response Mechanisms	219
9.3.3	Outcome Range for Price (Cost) Elasticities	221
9.3.4	Consistent Cost and Time Elasticities of the Modal Split	224
	References	225
10	Data Availability and Model Form	229
	<i>Lóránt Tavasszy and Gerard de Jong</i>	
10.1	Introduction	229
10.2	Overview of Different Data Sources for Freight Transport Modelling	229

10.2.1 International Trade Statistics	229
10.2.2 National Accounts	231
10.2.3 Transport Statistics	232
10.2.4 Shipper Surveys	233
10.2.5 Specific Project-Based Interview Data (Especially Stated Preference Data)	234
10.2.6 Consignment Bills and RFIDs	234
10.2.7 Traffic Count Data	235
10.2.8 Transport Safety Inspection Data	235
10.2.9 Network Data	235
10.2.10 Cost Functions	235
10.2.11 Terminal Data	236
10.3 Which Data Sources Can Be Used in Which Type of Model?	236
10.4 Discussion on Data Availability and Model Form	236
10.5 Dealing with Data Limitations Through Estimation	240
10.6 Concluding Remarks	242
References	243
11 Comprehensive Versus Simplified Models	245
<i>Lóránt Tavasszy and Gerard de Jong</i>	
11.1 Introduction	245
11.2 High- and Low-Resolution Models	246
11.3 Model Objectives and Policy Questions and Their Impact on Model Form	248
11.4 Approaches for Simplification	250
11.4.1 Simplification by Omission of Sub-Models	251
11.4.2 Simplification by Integration	253
11.4.3 Simplification by Reduced Data Need	255
11.5 Concluding Remarks on Comprehensive Versus Simplified Models	255
References	256