I	Intro	duction	I
	1.1	Complex Networks	2
		1.1.1 Three Levels of Network Analysis	3
		1.1.2 Economic Networks	5
		1.1.3 Ownership Networks	6
	1.2	Elements from Economics	8
		1.2.1 The Corporation: Ownership and Control	8
		1.2.2 Ownership and Control Patterns	10
		1.2.3 Ownership Networks Revisited	13
	1.3	On the Horizon	15
	Refe	rences	17
2	The	Main Methodology: Computing Control	
	in O	wnership Networks	23
	2.1	Introduction	23
	2.2	Direct and Indirect Ownership	24
		2.2.1 A First Try: Group Value and Integrated Ownership	24
		2.2.2 Application to Ownership Networks	26
		2.2.3 Example A	29
		2.2.4 Integrated Ownership: Refinements	30
		2.2.5 Modifying the Group Value	31
	2.3	Introducing Network Value and Integrated Value	33
		2.3.1 Integrated Value	33
		2.3.2 Network Value	34
		2.3.3 The Whole Picture	35
		2.3.4 The True Corrections	35
		2.3.5 Example B: And the Next Problem on the Horizon	37
	2.4	A New Perspective: The Notion of Flow in Networks	39
		2.4.1 Flow in Ownership Networks	41



xii Contents

	2.5	The Final Corrections: Adjusting Network Value			
		and Integrated Value for Bow-Tie Topologies	42		
		2.5.1 The Analytical Solution	42		
		2.5.2 The Algorithmic Solution	43		
		2.5.3 Revisiting Example B: A Summary and Discussion	46		
	2.6	The General Setting: The Notion of Centrality in Networks	49		
	2.7	Moving from Ownership to Control	52		
	2.8	The Relative Majority Model of Control	55		
		2.8.1 Extending the Notions of Degree			
		for Weighted Networks	57		
		2.8.2 Interpretation as a New Model of Control	58		
	2.9	Computing the Flow of Control in an Ownership Network	59		
	2.10	· · · · · · · · · · · · · · · · · · ·			
	2.11	A Brief Summary	63		
		rences	65		
	Refer		0.		
3	Back	bone of Complex Networks of Corporations:			
-		Flow of Control	67		
	3.1	Introduction	67		
	3.2	The Dataset	68		
	3.3	A 3-Level Network Analysis	69		
	5.5	3.3.1 Level 1: Topological Analysis	70		
		3.3.2 Level 2: Extending the Notions of Degree	72		
		3.3.3 Distributions of s and h	73		
		3.3.4 Level 3: Adding Non-Topological Values	75		
	3.4	Identifying the Backbone of Corporate Control	77		
	3.4	3.4.1 Computing Cumulative Control	77		
		3.4.2 Extracting the Backbone	80		
	•	3.4.3 Generalizing the Method of Backbone Extraction	81		
		3.4.4 Defining Classification Measures	82		
	3.5	Ç	87		
	3.3	Analyzing the Backbones	88		
		3.5.2 The Seat of Power	90		
	26		91		
	3.6	Summary and Conclusion			
	Keiei	ences	92		
4	The l	Network of Global Corporate Control	95		
-	4.1	Introduction	95		
	4.2	The Anatomy of the Global Corporate Ownership Network	96		
		4.2.1 The TNC Network Construction	96		
		4.2.2 Level 1 & 2 Network Measures: Degree and Strength	97		
		4.2.3 Unveiling the Topology at Level 1 & 2	99		
		4.2.4 Weakly Connected Components	90		

Contents xiii

		4.2.5	Strongly Connected Components	100
		4.2.6	The Emerging Bow-Tie Structure	102
		4.2.7	Community Analysis	104
		4.2.8	Summary	106
	4.3	The N	letwork of Global Corporate Control	106
		4.3.1	Economics Embedding	106
		4.3.2	Level 3: The Flow of Control	108
		4.3.3	Uncovering the Concentration of Control	109
		4.3.4	The Emerging Picture	112
		4.3.5	In Closing	115
	Refe	rences .		117
5	The	Bow-Ti	e Model of Ownership Networks	121
,	5.1		Tie Components Size of Networks	122
	5	5.1.1	Theoretical Components Size of Directed Networks	122
		5.1.2	Components Size of Directed Random Networks	124
		5.1.3	Empirical TNC Components Size	126
		5.1.4	Components Size of Generalized Directed	
		3.1.1	Random Networks	127
	5.2	A Ger	neric Network-Modeling Framework	130
	5.2	5.2.1	An Overview of Existing Network Models	130
		5.2.2	The Bow-Tie Modeling Framework	132
		5.2.3	Applying the Framework	135
	5.3		Bow-Tie Model of Ownership Networks	140
	5.5	5.3.1	Modeling Preliminaries	140
		5.3.2	Scanning the Parameter-Space	141
		5.3.3	The Bow-Tie Model of the TNC Network	141
		5.3.4	Summary and Conclusion: The Economics	
		3.3.1	Interpretation	143
	Refe	rences		147
6				149
	6.1		World Relevance	152
		6.1.1	Control from Ownership	152
		6.1.2	Cross-Country and Global Analysis	153
		6.1.3	Mutual Funds and Control	154
		6.1.4	The Importance of Natural Persons	155
		6.1.5	Concentration of Control	155
		6.1.6	The Economic "Super-Entity"	157
		6.1.7	Are the Results Really New?	158
	_	6.1.8	Self-Organization Versus a Global Elite	159
	6.2		nary of Possible Implications	159
		6.2.1	Market Competition	159
		6.2.2	Financial Systemic Risk	160

xiv	Contents
-----	----------

6.3	Future Work	161
6.4	Contributions in a Nutshell	162
	6.4.1 Results for the Study of Complex Networks	162
	6.4.2 Results for Economics: Theoretical	163
	6.4.3 Results for Economics: Empirical	163
Refere	ences	164
Appendix	A: Laws of Nature	167
Appendix	B: Elements of Complex Network Theory	187
Appendix	C: Scaling Laws	195
Appendix	D: Some Technical Aspects	199
Appendix	E: Who are the Global Key Economic Actors?	205
Appendix	F: Media Coverage	209
Curriculu	ım Vitae	219
Reference		222