

Contents

<i>List of figures</i>	xiii
<i>List of tables</i>	xiv
<i>Preface</i>	xv
1 Network economics	1
<i>Introduction</i>	1
<i>Networks and network industries</i>	1
<i>High-risk investments and sunk costs</i>	5
<i>Economies of scale</i>	6
<i>Network externalities</i>	7
<i>Complementarity, compatibility, and standardization</i>	10
<i>The rationale of strategic alliances</i>	12
<i>Setting standards</i>	13
<i>References</i>	14
2 Network size and value	16
<i>Introduction</i>	16
<i>Perspectives on network externalities</i>	17
<i>Hypotheses on network externalities</i>	17
<i>Technology adoption and network industries</i>	18
<i>References</i>	19
3 Technology adoption in networks	21
<i>Introduction</i>	21
<i>Examples: present and past</i>	21
<i>The simple mechanism of technology adoption</i>	22
<i>Compatibility through bridging technology</i>	24
<i>Resolving empirical puzzles</i>	27
<i>Review of related work</i>	28

x	<i>Contents</i>	
	<i>A coordination game</i>	30
	<i>Antitrust policy</i>	32
	<i>Strategic pricing</i>	33
	<i>Conclusions</i>	35
	<i>References</i>	36
4	Technological racing in network industries	37
	<i>Introduction</i>	37
	<i>State of research</i>	39
	<i>A model framework for a simple stochastic race</i>	42
	<i>Statistical measurements of industrial racing patterns</i>	45
	<i>Discussion</i>	51
	<i>References</i>	55
5	Networks and competition	56
	<i>Introduction</i>	56
	<i>Issues in the telecommunications industry</i>	58
	<i>Evaluating complex network competition cases</i>	63
	<i>Leveraging market power</i>	71
	<i>Raising rivals' costs</i>	73
	<i>Increasing barriers to entry and foreclosure</i>	74
	<i>References</i>	75
6	Strategic alliances, mergers, and acquisitions	77
	<i>Introduction</i>	77
	<i>Integration</i>	79
	<i>Screening of market power</i>	80
	<i>Exclusion of access to alliance</i>	81
	<i>Exclusionary strategies in vertical alliances</i>	86
	<i>Tying in strategic alliances</i>	90
	<i>Grantback provisions and cross licensing</i>	92
	<i>Vertical integration</i>	93
	<i>International conflicts</i>	97
	<i>Conclusions</i>	98
	<i>References</i>	99
7	Standards, compatibility, market share, competition, and quality	101
	<i>Introduction</i>	101
	<i>Networks and industrial organization: a review</i>	102

	<i>The model</i>	106
	<i>Competition and market share</i>	107
	<i>Social welfare</i>	108
	<i>Assessment of profits</i>	109
	<i>Network externality and choice of product quality</i>	111
	<i>Modelling product quality</i>	113
	<i>Some equilibrium results</i>	115
	<i>Quality comparisons</i>	116
	<i>Cost of quality</i>	118
	<i>Assessing social welfare</i>	119
	<i>Free entry and consumer expectations</i>	121
	<i>Conclusions</i>	124
	<i>References</i>	125
8	Network economies for the Internet: conceptual models	127
	<i>Introduction</i>	127
	<i>Design goals</i>	128
	<i>The rationale of economic models in networking</i>	129
	<i>Internet resources</i>	130
	<i>Modelling approach</i>	136
	<i>Network economy</i>	140
	<i>Conclusions</i>	148
	<i>References</i>	149
9	Network economies for the Internet: application models	151
	<i>Introduction</i>	151
	<i>Two examples</i>	152
	<i>Results from the network economy</i>	155
	<i>Price equilibrium</i>	156
	<i>Agent routing and admission</i>	158
	<i>The server economy</i>	160
	<i>Transaction routing</i>	163
	<i>Conclusions</i>	164
	<i>Appendix: proofs of Pareto optimal allocations</i>	165
	<i>References</i>	165
10	Macroeconomics of network industries	167
	<i>Introduction</i>	167
	<i>Economic transformation</i>	168
	<i>Assessing the transformation</i>	170

The productivity paradox 173

The global network economy 176

Intangible assets 178

Information markets 179

Conclusions 179

References 180

Appendix A	The Japanese telecommunications industry	182
Appendix B	Network size, value, and cycles	200
Appendix C	Quality of service parameters in queueing networks for the Internet	216
	<i>Index</i>	225

Figures

1.1	Star network	2
1.2	Tree network	2
1.3	Crystal structure	3
1.4	Web structure	3
1.5	Learning curve of wafer production	6
1.6	Economies of scale effect	7
2.1	The S-hypothesis	18
3.1	Product lock-ins under increasing returns	24
3.2	Introduction of a partially compatible converter	25
3.3	Perfectly compatible converter	26
3.4	One-way partially compatible converter	27
3.5	One-way perfectly compatible converter	27
3.6	Social welfare game	31
3.7	Coordination game	31
5.1	Allocative efficiency	64
5.2	Production efficiency and consumer surplus	64
5.3	Demand-induced consumer surplus	65
5.4	Supply-induced consumer surplus	65
5.5	Competition effects	67
5.6	Exclusionary practice through reduced innovation	71
7.1	Quality comparison with respect to quantity	121
7.2	Social welfare vs network size with a linear network externality	122
8.1	Traffic classes, agents to generate multiple routes between sources and destination	130
8.2	Packet switch (node) with output links and output buffers	133
8.3	Resource partitions for K agents on N link suppliers	135
8.4	Economic players	139
8.5	Agent QoS set, given constraint	143
8.6	Edgworth Box diagram	146
9.1	Several sessions (session classes) request for transaction or multimedia services from servers	152
9.2	Non-sharing model	162
B.1	Three assumptions of the network size/value relationship	204
B.2	The S-hypothesis	204
B.3	Potential distortion over time	211

Tables

3.1	Agent payoffs for technology choices	23
3.2	Agent payoff with converters	24
3.3	Agent decision payoffs for technology purchases with prices	34
4.1	Pushing the frontier	47
4.2	Domination period statistics	47
4.3A	More innovations when behind or ahead	49
4.3B	Firm jump sizes larger behind or ahead?	50
4.4	Nature of jumps: leapfrogging or frontier-sticking	50
4.5	Inter-jump times and jump sizes	50
B.1	Regression variables and predicted signs	207
B.2	Full regression results	209
B.3	Final regression results	210