

Table of Contents

List of Figures	xi
List of Tables	xv
List of Boxes	xvii
List of Abbreviations	xix
1. Innovative Places in Europe	1
1.1. Introduction and Motivation	1
1.2. Outline of the Thesis and Research Questions	15
2. Research Clustering, Co-Inventor Networks and Innovative Places: A Literature Survey	21
2.1. A Survey of the Theoretical Literature	21
2.1.1. The Co-Evolution of Research Strands in the Cluster Literature	21
2.1.2. From First-Nature Agglomerations to Knowledge-Intensive Industries	25
2.1.3. Agglomeration, Indivisibilities and Fragmentation	28
2.1.4. Agglomeration, Clustering and External Economies	31
2.1.4.1. Industrial Districts and External Economies	31
2.1.4.2. Interpretations of Marshall's Agglomeration Economies	34
2.1.4.3. Agglomeration Economies, Spillovers and Networks: A Taxonomy	36
2.1.5. Agglomeration, Research Clustering and Pecuniary Externalities	37
2.1.5.1. Pecuniary Externalities, Local Scale and Efficiency	37
2.1.5.2. Localization Economies	39
2.1.5.3. Urbanization Economies	41
2.1.5.4. A Taxonomy of Urbanization and Localization Economies	42
2.1.5.5. Core-Periphery Structures and Endogenous Location	43
2.1.5.5.1. The Origins of the New Economic Geography	43
2.1.5.5.2. Industry Agglomeration, Core-Periphery and Footloose Labor	46
2.1.5.5.3. Alternative Core-Periphery Models	48
2.1.5.5.4. Critical Remarks and Discussion	49
2.1.6. Industry and Research Clustering and Innovation Externalities	51
2.1.6.1. Non-Pecuniary Externalities	51
2.1.6.2. Marshall-Arrow-Romer Externalities and Specialized Clusters	53
2.1.6.3. Jacobs Externalities and Diversity in Cities	55
2.1.6.4. Porter Externalities and the Competitive Advantage of Regions	57
2.1.6.5. A Taxonomy of Innovation Externalities	58
2.1.6.6. Endogenous Growth Theory and Research Clustering	59
2.1.6.6.1. Knowledge Stocks and Knowledge Spillovers	59

2.1.6.6.2.	Technological Externalities and Specialization	61
2.1.6.6.3.	Conclusions and Critical Remarks	62
2.1.6.7.	Research Clustering and Knowledge Flows in Core-Periphery Models . .	64
2.1.6.7.1.	Agglomerations, Blueprints and Technological Externalities	64
2.1.6.7.2.	Growth-Cum-Geography Models and R&D	66
2.1.6.7.3.	Critical Remarks and Discussion	70
2.1.7.	Agglomerations, Networks and Knowledge Transmission	71
2.1.7.1.	Knowledge Flows, Network Linkages and Spillovers	71
2.1.7.2.	Tacit versus Codified Knowledge and the Embodiment Concept	72
2.1.7.3.	Agglomerations, Innovative Milieus and the Proximity Hypothesis . . .	75
2.1.7.4.	Long-Distance Linkages and R&D Collaboration Networks	78
2.1.7.5.	Localized Networks versus Inter-Regional Network Linkages	80
2.1.7.6.	City Networks and Inter-Regional Research Collaborations	81
2.1.7.7.	Agglomeration vs. Networks: Critical Remarks	84
2.2.	A Survey of the Empirical Literature	86
2.2.1.	The Co-Evolution of Different Strands of Empirical Research	86
2.2.2.	Regional Disparities, Urbanization and Research Clustering	87
2.2.3.	The Regional Knowledge Production Function	91
2.2.3.1.	The Origins of the Knowledge Production Function	91
2.2.3.2.	The Regional Knowledge Production Function	93
2.2.3.3.	Knowledge Flows and R&D Spillovers in Europe and the US	94
2.2.4.	Localization, Urbanization and Regional Development	100
2.2.5.	Patent Citations, Paper Trails and Real Spillovers	102
2.2.6.	Researcher Mobility, Social Networks and Diaspora	106
2.2.7.	Research Collaborations and Co-Patenting Networks	110
3.	Innovative Places, Research Clustering and Co-Agglomeration	117
	in Europe	
3.1.	Analyzing Research Clustering in Europe	117
3.2.	Patent Data as Indicators in Empirical Analysis	122
3.2.1.	Advantages of Patent Data as Indicators	122
3.2.2.	Drawbacks and Technical Issues of Patent Data	125
3.3.	The Database: Patent Data, Regions and Research Activity	126
3.3.1.	Overview and General Information	126
3.3.2.	The Spatial Classification System	128
3.3.3.	The IPC-Technology Field Concordance	129
3.4.	Geographic Concentration and Regional Disparities of Research Activities	130
3.4.1.	Measuring Geographic Concentration and Regional Disparities	130
3.4.1.1.	Aggregate Distribution, Specialization and Disparity	130
3.4.1.2.	Skewness and Kurtosis	132
3.4.1.3.	The Herfindahl-Hirschman Index	133
3.4.1.4.	The Location Quotient and Relative Technological Advantage	134
3.4.1.5.	The Relative Technology Density	135
3.4.1.6.	The Locational Gini Coefficient	135
3.4.1.7.	The Spatial Gini Coefficient	140
3.4.2.	Three Decades of EPO Patenting in Europe	141

3.4.2.1.	Skewed Distributions and Core-Periphery Structures	141
3.4.2.1.1.	Whisker Box-Plot	141
3.4.2.1.2.	Core-Periphery Structures and Patent Densities	144
3.4.2.1.3.	Kurtosis, Skewness and Herfindahl-Hirschman Index	145
3.4.2.2.	Regional Patenting Activity and EPO Inventors in Europe	153
3.4.2.2.1.	Patent Applications by Technology Field	153
3.4.2.2.2.	EPO Inventors by Technology Field	156
3.4.2.2.3.	Revealed Technological Advantage	156
3.4.2.3.	Regional Disparities of EPO Patenting Activity	158
3.4.2.3.1.	Locational and Spatial Gini Coefficients by Technology Field	158
3.4.2.3.2.	Dynamics of Gini Coefficients by Technology Field	176
3.5.	Identifying Research Clusters and Co-Agglomeration in Europe	180
3.5.1.	Research Clusters, Cities and Inventorship	180
3.5.2.	The Research Cluster Index	181
3.5.2.1.	Constructing a Research Cluster Index	181
3.5.2.2.	Interpretation of the Research Cluster Index	183
3.5.3.	Patent Data, Regional Typology and Technology Fields	184
3.5.4.	Research Clusters in Europe by Technology Field	185
3.5.4.1.	Global Statistics: Research Clusters by Technology Field and Country	185
3.5.4.2.	Local Statistics: Innovative Places and Leading Regions	200
3.5.5.	Co-Agglomeration of Research Clusters in Europe	210
3.5.6.	Research Clustering in Urban Areas and Capital Regions	213
4.	European Co-Patenting Networks and Inter-Regional Linkages	219
4.1.	Analyzing European Research Collaborations	219
4.2.	Spatial Interdependence of European Patenting Activity	224
4.2.1.	Measuring Spatial Interdependence	224
4.2.1.1.	Explanatory Spatial Data Analysis	224
4.2.1.2.	Spatial Analysis and the Modifiable Areal Unit Problem	226
4.2.1.3.	Neighborhood Effects, Distances and Weight Matrices	227
4.2.1.4.	Spatial Dependence and Regional Spillovers	229
4.2.2.	Spatial Interdependence of Patenting Activity in Europe	232
4.3.	European Co-Patenting Networks and Foreign Co-Inventors	235
4.3.1.	International versus Inter-Regional Co-Patenting Linkages	235
4.3.2.	The Relational Database	236
4.3.2.1.	Regional Classification and Raw Data	236
4.3.2.2.	From IPC to Technology Field Aggregates	237
4.3.3.	The Research Methodology	238
4.3.3.1.	Calculating Co-Patenting Network Linkages	238
4.3.3.2.	Measuring Network Centralities of Regions	241
4.3.4.	Foreign Co-Inventors and Research Collaborations in Europe	243
4.3.5.	European Regional Co-Patenting Networks: Global Network Statistics	246
4.3.5.1.	Network Size and Structure by Technology Field	246
4.3.5.2.	Spatial Proximity versus Inter-Regional Linkages	249
4.3.5.3.	Core-Periphery Structures and the East-West Gradient	260
4.3.6.	European Regional Co-Patenting Networks: Local Network Statistics	276

4.3.6.1.	Co-Patenting Networks and the Centrality of Regions	276
4.3.6.2.	Co-Agglomeration of Co-Patenting Networks	280
5.	Research Clustering, Income Disparities and the Growth of Regions in Europe	283
5.1.	Analyzing Regional Disparities and Growth	283
5.2.	The Database: Regions, Patents and the Settlement Structure	291
5.3.	The Development of Income Disparities in Europe	292
5.3.1.	A Descriptive Overview	292
5.3.2.	Measures of Concentration, Disparity and Inequality	298
5.3.2.1.	Regional Disparities and the Gini Coefficient	298
5.3.2.2.	Measures of Regional Disparity and Inequality Decomposition	301
5.3.3.	The Development of European Income Disparities	304
5.3.3.1.	Global Income Disparities in Europe	304
5.3.3.2.	Regional Disparities within and between European Countries	308
5.4.	Research Activity, Settlement Structure and Regional Growth	309
5.4.1.	Income Levels and Regional Growth: A Descriptive Overview	309
5.4.2.	Unconditional Convergence and European Regional Growth	313
5.4.3.	Conditional Convergence and Regional Growth in Europe	316
5.4.3.1.	Conditional Convergence and Regional Growth	316
5.4.3.2.	Regional Growth in the EU-15	321
5.4.3.3.	Regional Growth in the New Member States	323
5.4.4.	European Regional Growth and Spatial Spillovers	325
5.4.4.1.	A General Spatial Model	325
5.4.4.2.	Regional Growth Models and Spatial Interdependence	327
5.4.4.3.	Estimation Results	330
6.	Summary, Conclusions and Future Research	337
6.1.	The Literature Review	337
6.2.	Research Clustering in Europe	342
6.3.	Inter-Regional Co-Patenting Linkages in Europe	345
6.4.	Regional Growth and Income Disparities in Europe	349
A.	Appendix: Figures	xxiii
B.	Appendix: Tables	lxxiii
	Bibliography	lxxxvii