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# Introduction: regional growth and development theories in the twenty-first century – recent theoretical advances and future challenges

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## **I.1 The resurgence of regional economics**

Regional economics is back on the stage. Regional development is not only an efficiency issue in economic policy, it is also an equity issue due to the fact that economic development normally exhibits a significant degree of spatial variability. Over the past decades this empirical fact has prompted various strands of research literature, in particular the measurement of interregional disparity, the causal explanation for the emergence or persistent presence of spatial variability in economic development, and the impact assessment of policy measures aimed at coping with undesirable spatial inequity conditions. The study of socio-economic processes and inequalities at meso and regional levels positions regions at the core places of policy action and hence warrants intensive conceptual and applied research efforts.

For decades, the unequal distribution of welfare among regions and/or cities has been a source of concern for both policy-makers and researchers. Regional development is about the geography of welfare and its evolution. It has played a central role in such disciplines as economic geography, regional economics, regional science and economic growth theory. The concept is not static in nature, but refers to complex space–time dynamics of regions (or an interdependent set of regions). Changing regional welfare positions are often hard to measure, and in practice we often use gross domestic product (GDP) per capita (or growth thereof) as a statistical approximation (see Stimson et al., 2006). Sometimes alternative or complementary measures are also used, such as per capita consumption, poverty rates, unemployment rates, labour force participation rates or access to public services. These indicators are more social in nature and are often used in United Nations welfare comparisons. An example of a rather popular index in this framework is the Human Development Index which represents the welfare position of regions or nations on a 0–1 scale using quantifiable standardized social data (such as employment, life expectancy or adult literacy) (see for example Cameron, 2005). In all cases, however, spatial disparity indicators show much variability.

Regional disparities may have significant negative socio-economic cost consequences, for instance, because of social welfare transfers, inefficient production systems (for example due to an inefficient allocation of resources) and undesirable social conditions (see Gilles, 1998). Given a neoclassical framework of analysis, these disparities (for example in terms of per capita income) are assumed to vanish in the long run, because of the spatial mobility of production factors which causes at the end an equalization of factor productivity in all regions. Clearly, long-range factors such as education, research and development (R&D) and technology play a critical structural role in this context. In the short run, however, regional disparities may show rather persistent trends (see also Patuelli, 2007).

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Disparities can be measured in various relevant categories, such as (un)employment, income, investment, growth, and so on. Clearly, such indicators are not entirely independent, as is, for instance, illustrated in Okun's law, which assumes a relationship between economic output and unemployment (see Okun, 1970; Paldam, 1987). Convergence of regional disparities is clearly a complex phenomenon which refers to the mechanisms through which differences in welfare between regions may vanish (see Armstrong, 1995). In the convergence debate, we observe increasingly more attention for the openness of spatial systems, reflected *inter alia* in trade, labour mobility, commuting, and so on (see for example, Magrini, 2004). In a comparative static sense, convergence may have varying meanings in a discussion on a possible reduction in spatial disparities among regions, in particular (see also Barro and Sala-i-Martin, 1992; Baumol, 1986; Bernard and Durlauf, 1996; Boldrin and Canova, 2001):

- $\beta$ -convergence: a negative relationship between per capita income growth and the level of per capita income in the initial period (for example, poor regions grow faster than initially rich regions);
- $\sigma$ -convergence: a decline in the dispersion of per capita income between regions over time.

The convergence hypothesis in neoclassical economics has been widely accepted in the literature, but is critically dependent on two hypotheses (see Cheshire and Carbonaro, 1995; Dewhurst and Mutis-Gaitan, 1995):

- diminishing returns to scale, which means that output growth will be less than proportional with respect to capital growth;
- technological progress will generate benefits that also decrease with its accumulation (that is, diminishing returns).

Many studies have been carried out to estimate the degree of  $\beta$ -convergence and  $\sigma$ -convergence (see for example Barro and Sala-i-Martin, 1991, 1992). The general findings are that the rate of  $\beta$ -convergence is in the order of magnitude of 2 per cent annually, while the degree of  $\sigma$ -convergence tends to decline over time, for both US states and European regions. Clearly, there is still an ongoing debate worldwide on the type of convergence, its speed, its multidimensional conceptualization, and its causal significance in the context of regional policy measures (see for example Fagerberg and Verspagen, 1996; Fingleton, 1999; Galor, 1996). Important research topics in the current literature appear to be: the role of knowledge and entrepreneurship, spatial heterogeneity in locational or socio-cultural conditions, and institutional and physical barriers. An important new topic in the field has become group convergence (or club convergence) (see for example Islam, 2003; Fischer and Stirbock, 2006; Baumont et al., 2003; Chatterji, 1992; Chatterji and Dewhurst, 1996; López-Bazo et al., 1999; Quah, 1996; Rey and Montouri, 1999; Sala-i-Martin, 1996). Thus we may conclude that the research field of spatial disparities is still developing and is prompting fascinating policy issues.

In the light of the previous observations, it is no surprise that over the last decade a resurgence of interest in regional science has taken place, from both theoretical and policy perspectives. This is particularly evident in the case of Europe. One of the main reasons

for such a renewed interest also relates to recent institutional agreements: in May 2004 and in January 2007 the European Union recorded two important historic enlargements, achieving respectively 25 and 27 EU member states. Most of the Eastern European countries joined the European Union, with the consequence of a drastic increase in regional disparities. In May 2004 the enlargement added 5 per cent to the GDP of the EU and 20 per cent to its population; as a consequence, however, the per capita GDP dropped by 12.5 per cent on the day of the enlargement. In January 2007, with the entrance of Romania and Bulgaria, the situation became even worse. Social, economic and demographic disparities call nowadays for sound regional policies.

Clearly, old issues, like regional disparities and convergence, are not the only reasons explaining the resurgence of regional science. Interestingly enough, in recent times, new normative principles in relation to regional development in the European Union have been proposed in official documents; 'territorial cohesion' is quoted in the official EU policy documents as a strategic principle, as strategic as the Lisbon and Gothenburg principles (Luxembourg Presidency, 2005a, 2005b): 'In practical terms territorial cohesion implies: *focusing regional and national territorial development policies* on better exploiting regional potentials and territorial capital – Europe's territorial and cultural diversity; *better positioning of regions in Europe* . . . facilitating their connectivity and territorial integration; and *promoting the coherence of EU policies with a territorial impact*' (p. I). Given the strong attention given by policy-makers to territorial aspects, regional science (and within it, regional economics) has to provide solid theoretical and methodological tools upon which normative policies can be built.

The interest of policy-makers for territorial and regional issues partly explains the resurgence of interest in regional science, and regional economics. Besides policy issues, in the academic arena much interest over the 1990s has also arisen in spatial phenomena: the role of space, highly neglected by mainstream economists, has now become a source of scientific thinking within traditional macroeconomic, international and industrial economic disciplines, giving rise to partly new and partly revisited theories. The degree of convergence and cross-fertilization of ideas between regional economists and the mainstream economists is still an open debate.

Moreover, in a period of globalization like the present one, and the creation of broad single-currency areas, regions (and also nations) must closely concern themselves with the competitiveness of their production systems, because no spontaneous or automatic adjustment mechanism is at work to counterbalance a lack (or an insufficient growth rate) of productivity. Local specificities and local material and non-material assets become strategic elements upon which the competitiveness of regions is based. Theories of regional growth and development need to be able to interpret, more than ever, the way in which regions achieve a role in the international division of labour and, more importantly, the way in which regions can maintain this role over time.

The focus of this volume is to collect the most advanced theories explaining regional growth and local development, with the intention to highlight: (1) the recent advances in theories; (2) the normative potentialities of these theories; (3) the cross-fertilization of ideas among regional economists and mainstream economists.

The aim of this introductory chapter is to summarize the main messages emerging from a package of 25 chapters present in the book, leaving each single chapter to present underlying theories and principles in more detail. Section I.2 will now present the

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Table I.1 *Main tendencies in theories of regional economics*

Tendencies in theories	Regional growth theories	Regional development theories
More realism in theoretical approaches	Endogenous growth determinants A role in growth models of the complex non-linear and interactive behaviours and processes that take place in space Imperfect market conditions in growth models Growth as a long-term competitiveness issue Technological progress as an endogenous factor of growth	Reasons of success and failure of SME cluster areas, local districts, milieux Non-material resources as sources of regional competitiveness An active role of space in knowledge creation
Dynamic rather than static approaches	Evolutionary trajectories of non-linear interdependencies of complex systems	Dynamic rather than static agglomeration economies

Source: Capello (2008).

theoretical progress recently achieved in different parts of the world; section I.3 will then deal with future challenges in this field; while section I.4 will present the main structure of the book.

**I.2 Recent theoretical directions**

The great number of relatively new and advanced contributions in the fields of regional development and growth theories does not allow for a detailed review on all individual achievements made; in addition, a disaggregated analysis of all novelties would probably not be so stimulating. Our impression is that an attempt to highlight general theoretical trends will turn out to be more fruitful for a debate on present weaknesses and on possible future directions of regional economics. Inevitably, the set of ‘tendencies’ that follows is both selective and incomplete, primarily reflecting personal views and research interests (Table I.1) (Capello, 2008).

By looking at the theoretical trajectories followed in regional economics, one of the major tendencies which has accompanied the theoretical development in the field is the need for more realism in sometimes rather abstract conceptual approaches, by relaxing most of the glaring unrealistic assumptions of the basic theoretical models, a tendency common also in urban economics (Capello and Nijkamp, 2004). This tendency is justified by the need to broaden the interpretative capacity of the theoretical toolbox in this research field by searching for theories that are better able to reflect the real world.

In regional growth theories, more realism has required the insertion of the complex non-linear and interactive behaviours and processes that take place in space into growth models, and the understanding of regional competitiveness in terms of endogenous factors. The question of whether a region is intrinsically capable of growing as a result of endogenous forces has been a source of debate for decades; industrial specialization, infrastructure endowment, central location, production factor endowment or agglomeration

economies have alternatively been emphasized in the academic arena as driving forces of local economic success.

The decisive step forward in this field has been the focus on economies of scale in production which, together with non-linear transportation costs, are introduced into a (quantitative) interregional growth model; the final spatial distribution of activities critically depends on initial conditions including the starting distribution of activities and the nature of the non-linearities embedded in the activity–transportation interactions, which give rise to multiple equilibria (Krugman, 1991). The additional value of this approach – known as the ‘new economic geography’ – resides in skilfully modelling the interaction between transportation costs and economies of scale in production, although the determinants of endogenous growth have already long since been emphasized, starting from the Myrdal–Kaldor model (increasing returns, cumulative self-reinforcing growth patterns). The aim to incorporate agglomeration economies – in the form of increasing returns – into elegant models of a strictly macroeconomic nature was made possible by advances in more sophisticated mathematical tools for analysis of the qualitative behaviour of dynamic non-linear systems (bifurcation, catastrophe and chaos theory) together with the advent of formalized economic models which abandoned the hypotheses of constant returns and perfect competition (Fujita and Thisse, 1996, 2002).

These new theoretical advances required a new conceptualization of space, that of a diversified-stylized space (see Capello, this volume). Space is, in these new theories of local growth, a diversified space, since the existence of polarities in space is envisaged where development takes place, diversifying the level and rate of income growth even among areas of the same region. However, it is a stylized space, since polarities are treated as points devoid of any territorial dimension. This approach moves away from the concept of a uniform-abstract space of growth theories developed in the 1950s and 1960s; the label ‘uniform’ stems from the fact that in these theories supply conditions (factor endowment, sectoral and productive structure) and demand conditions (consumer tastes and preferences) are identical everywhere in the region; abstract, since simplifying assumptions are inserted so as to cope with place-specific conditions (see Capello, 2007a and Chapter 2 in this volume).

In parallel with Krugman’s efforts, in the field of endogenous determinants great emphasis has recently been put on knowledge as a driving force to development, and, what is really new, on the endogenous self-reinforcing mechanisms of knowledge creation. Macroeconomic models of endogenous growth, where knowledge is generally embedded in human capital (Romer, 1986; Lucas, 1988), have widely dominated the academic arena in the 1990s. Their main aim was to insert more realism into growth models by relaxing the unrealistic assumption that technological progress is an exogenous process in an economic system; in the new growth theories, instead, technological progress is an endogenous response of economic actors in a competitive environment. More specifically, increasing returns in factor productivity stemming from endogenous factors – such as innovation, scale economies and learning processes – are included in a neoclassical production function, where they offset the effect of the marginal productivity of the individual factors, which the traditional neoclassical approach assumes to be decreasing.

The identification of endogenous determinants of growth was the crucial scientific issue that explained the birth of regional development theories. Development is in fact by definition endogenous. It is fundamentally dependent on a concentrated organization of

the territory, embedded in which is a socio-economic and cultural system whose components determine the success of the local economy: entrepreneurial ability, local production factors (labour and capital), relational skills of local actors generating cumulative knowledge-acquisition and, moreover, a decision-making capacity which enables local economic and social actors to guide the development process, support it when undergoing change and innovation, and enrich it with the external information and knowledge required to harness it to the general process of growth, and to the social, technological and cultural transformation of the world economy. The micro-behavioural nature of these approaches allows a deep understanding of the sources of territorial externalities, of increasing returns in the form of agglomeration economies, at the basis of industrial cluster formation. Within this approach, much emphasis is given to the role of entrepreneurship in regional development (Nijkamp and Stough, 2004).

More realism in the study of clusters and their determinants called for a better understanding of successes and failures of local productive systems, hardly explained in the first theories proposed. Dynamic agglomeration economies – defined as territorial advantages that act on the capacity of firms and regions to innovate – become the centre of most recent theoretical reflections in this field, giving rise to neo-Schumpeterian approaches in regional development. A major debate dominates the academic arena, with the aim to identify the role of space in innovative processes.

In the vast literature created in this field, the endogenous determinants of innovation are increasing returns in the form of dynamic location advantages deriving from:<sup>1</sup> (1) spatial, geographical proximity among firms, which facilitates the exchange of tacit knowledge: this characterizes reflection by economic geographers concerned to explain the concentration of innovative activities; (2) relational proximity among firms, defined as interaction and cooperativeness among local agents, the source of collective learning processes and socialization to the risk of innovation (that is, territorialized relations among subjects operating in geographical and social proximity): this was the approach taken by territorial economists in explaining the dynamic of local systems in terms of local innovative capacity; (3) institutional proximity taking the form of rules, codes and norms of behaviour which facilitate cooperation among actors and therefore the socialization of knowledge and assist economic actors (individual people, firms and local institutions) to develop organizational forms which support interactive learning processes: this aspect was emphasized by more systemic approaches seeking to understand the evolution of complex systems like the innovative system.

A second clear tendency in theoretical developments – typical of regional development and growth theories only – has been the attempts to move towards dynamic approaches. Time matters as well as space in regional science, and this also holds in regional economics. The effort to encapsulate time in spatial analyses has taken place in two different ways, according to two different meanings of time applied in the two fields of analysis: a more traditional chronological time, and time as rhythm of innovative phenomena which occur in the territory which has been applied in regional growth models.

The introduction of a chronological time within spatial analysis is not at all a simple task, since it requires a mathematical and methodological toolbox, only recently available to regional scientists. Theories on non-linear regional dynamics – framed in the context of chaos theory, synergetics theory or predator-prey analysis – may be mentioned here (see Nijkamp and Reggiani, 1999). In growth models, until a few years ago, the large

majority of experiments and applications has taken for granted the existence of linear – and thus regular – growth processes. Linear models are certainly able to generate unstable solutions, but the solutions of such models are restricted to certain regular standard types. Such models may provide approximate replications of short- and medium-run changes, but fail to encapsulate long-term developments characterized by structural shifts of an irregular nature. This limit has recently been overcome with the adoption of non-linear models, which allow for a change in the dynamics of a system generated even by small perturbations in structural forms; structural instability means the possible existence of significant qualitative changes in the behaviour of the system (that is, in the state variables) that are closely connected with bifurcation and catastrophe phenomena that can occur if the parameter values (that is, the control variable) are changing (see Fujita and Thisse, 1996, 2002). The application of non-linear models to the well-known neoclassical and Keynesian models has shown that the deterministic and unique results achieved by the dynamic linear models are no longer guaranteed: interregional income convergence determined by the traditional neoclassical model collapses and opens the way to alternative possible trajectories, and equilibria solutions; non-linear Keynesian Myrdal–Kaldor models substitute the deterministic result of continuous growth or decline with new and opposite development trajectories, after catastrophe phenomena occur (Miyao, 1984, 1987a, 1987b).

Such a theoretical improvement has also been useful in achieving a greater realism of these models, able to incorporate the dynamic interactions between the components of a spatial system. Dynamic interactions are functionally determined by interdependencies between the behaviour of actors and distance frictions. Such spatial interactions may be stable in nature (that is, operating under fixed external conditions) or subject to change as a result of dissipative evolutionary processes in the external world. In the latter case, model parameters become time-dependent, so that non-linear complex dynamics may emerge (see Puu, 1991; Nijkamp and Reggiani, 1993, 1999; Nijkamp, 2006).

In the field of regional development, conceptually speaking a different concept of time has been developed and applied; time à la Bergson–Heidegger is interpreted as duration and a continuous process of creation, characterized by discontinuity, irreversibility, sequentiality and cumulativeness. Time has thus been conceived by an important part of regional studies as the pace of learning, innovation and creation processes. Local clusters (and industrial districts) are by definition the loci where learning and cumulative learning processes take place; the identification of the sources and of the endogenous determinants of such processes, besides simple physical proximity, represents a great challenge for regional economists. Knowledge spillovers, collective learning, learning regions (or learning space) and knowledge-based regions are all theories that embrace the most advanced perspectives in this direction. In these theoretical approaches, therefore, innovation has become the critical survival factor in a competitive space-economy and determines the direction and pace of regional development (Nijkamp and Abreu, 2008).

### **1.3 Future challenges**

Fascinating new theoretical challenges are nowadays faced by regional scientists, and have to be addressed. A first challenge is proposed by the attempt to obtain advantages by a future convergence in different theoretical approaches, a convergence only partially obtained by the new regional growth theories. New growth theories make a commendable

effort to include space in strictly economic models. Also to be commended is the implicit merging in their theoretical structure of the various conceptions of space put forward over the years: the merging, that is, of the physical-metric space represented by transport costs with the diversified space which assumes the hypothesis of the existence of certain territorial polarities where growth cumulates. However, the new economic geography is still unable to combine the economic laws and mechanisms that explain growth with territorial factors springing from the intrinsic relationality present at local level. An approach that did so would represent the maximum of cross-fertilization among location theory, development theory and macroeconomic growth theory; a synthesis which would bring out the territorial micro-foundations of macroeconomic growth models (Capello, 2007a and Chapter 2 in this volume).

Still needed, therefore, is a convincing 'model' which comprises the micro-territorial, micro-behavioural and intangible elements of the development process. Required for this purpose are definitions of patterns, indicators and analytical solutions to be incorporated into formalized models necessarily more abstract and synthetic in terms of their explanatory variables; variables besides the cost of transport, which cancels the territory's role in the development process. A move in this direction is the quantitative sociology that embraces the paradigm of methodological individualism and seeks to 'measure' the social capital of local communities. It is obviously necessary to bring out territorial specificities within a macroeconomic model. Or in other words, it is necessary to demonstrate the territorial micro-foundations of macroeconomic growth models.

Another challenge faced by regional scientists is the exploitation deriving from cross-fertilization of interdisciplinary approaches, a limit already underlined during the 1990s, during the reflections on the health of regional science. Since this problem has been underlined, hardly any signs of recovery have been identified, and we feel that the situation has become even more problematic.<sup>2</sup> This pessimistic interpretation is based on some clear tendencies encountered in some recent theoretical developments, where some wide fields of unexplored interdisciplinarity still exist and no tendency to fill them seems to show up.

Some examples are useful in this respect. The theory on 'social capital' developed by quantitative sociology is an example in this respect: the concept could take advantage from and provide advantage to all reflections on local synergies and milieu effects developed by regional and urban economists, and by the strategic planning studies in the field of urban planning. The reflections in the field of knowledge spillovers developed by industrial economists could take advantage from the concepts of collective learning and relational proximity of regional scientists, in which the endogenous spatial development patterns of knowledge are not left to simple probabilistic contacts, but explained through territorial processes (Camagni and Capello, 2002). Last but not least, the theoretical reflections characterizing the 'new economic geography' seem to be the result of the skilful effort of a group of mainstream economists, driven however by a somehow unexplainable attitude to deny the importance of well-known spatial concepts (that is, technological spatial externalities), or to (re)invent important spatial concepts (that is, cumulative self-reinforcing processes of growth; transportation costs versus agglomeration economies in location choices). The inevitable consequence of this attitude is to mix the important and undeniable steps forward made by the 'new economic geography' school with already well-known knowledge in the field of regional science.

Some risks of disciplinary barriers and of closeness to interdisciplinary views on strategic problems are still there. They are the result of a regional scientists' narrow perspective, as mentioned by Bailly and Coffey (1994), but also on some idiosyncratic approaches of mainstream disciplines towards a clearly multidisciplinary science like regional science. Especially in the case of economics, we hope that after the (re)discovered interest of mainstream economists in space, and in spatial phenomena, the attitude towards regional science will change in favour of a more cooperative attitude and pronounced interest.

Related to the interdisciplinary challenge, a last important remark is worth mentioning. An interdisciplinary approach should lead scientists to explore new frontiers and achieve new interpretative analytical frameworks. The tendency shown in this respect is a different one, more inclined to exploit passively the new ideas suggested by complementary disciplines. A case in this respect that is worth mentioning is the enthusiastic way in which regional scientists accepted the spatial spillover theory as a theory adding a new interpretation to the explanation of the role of space as a knowledge transition.

Instead, a critical approach to this theory shows that under certain respects this theory has made some steps backwards in the interpretation of space in spatial knowledge creation. Space is purely geographical, a physical distance among actors, a pure physical container of spillover effects which come about – according to the epidemiological logic adopted – simply as a result of physical contact among actors. Important consequences ensue from this interpretation of space. Firstly, this view is unable to explain the processes by which knowledge spreads at local level, given that it only envisages the probability of contact among potential innovators as the source of spatial diffusion. Secondly, it concerns itself only with the diffusion of innovation, not with the processes of knowledge creation. It thus imposes the same limitations as did Hägerstrand's pioneering model in regard to the spatial diffusion of innovation: the diffusion of knowledge means adoption, and adoption means more innovation and better performance. Thus ignored, however, is the most crucial aspect of the innovation process: how people (or the context) actually learn. This calls for a more thorough and innovative investigation of cognitive processes in a regional context (Capello, 2008). This is the aspect of overriding interest not only for scholars but also, and especially, for policy-makers, should they wish to explore the possibilities of normative action to promote local development.

#### **I.4 Structure and content of the volume**

The volume is organized in five parts, reflecting the new theoretical directions emphasized in previous sections. Part I is built around the new concepts of space and growth that are nowadays at the basis of regional growth and development theories. After a historical perspective provided by the first chapter on the development of theoretical approaches, Chapter 2 introduces the new concepts of growth and space, highlighting the major steps forward made in introducing space in regional growth models, and in defining growth. Chapter 3 deals with the interpretative capacities of theories on the spatial distribution of regional growth, underlining the achievements made in the neoclassical approach to regional growth by moving from constant to increasing returns to scale, thanks to the introduction of externalities into a general equilibrium model to explain long-term growth processes. This chapter introduces the new economic geography (NEG) theory presented in Chapters 4 and 5. The purpose of Chapter 4 is to provide a selective survey of different aspects of the relationship between trade and regional growth that existing

theories of trade, agglomeration and fragmentation can help us to understand, and to indicate where the frontiers of research lie. Chapter 5 describes a simple theoretical framework to study the impact of infrastructure on economic growth and regional imbalances within the framework of NEG models with endogenous growth and free capital mobility.

Part II is devoted to advances in regional development theories, with a particular emphasis on production factors endowment. The first chapter of Part II, Chapter 6, recalls causes and effects of agglomeration economies, and reviews systematically the ways in which causes and effects of increasing returns due to the density of manufacturing activities over space can be measured through a production function approach. Chapter 7 is devoted to the presentation of a new concept, that of territorial capital, which, strangely enough has only recently made its appearance, and has done so outside a strictly scientific context; as the author mentions, by this term, material and non-material elements characterizing a local area are meant, which define its local competitive capacity. Within these elements, cognitive aspects are also analysed; the way economic agents perceive economic reality, are receptive to external stimuli, can react creatively, and are able to cooperate and work synergetically becomes a strategic aspect. Local competitiveness is interpreted as residing in local trust and a sense of belonging rather than in pure availability of capital; in creativity rather than in the pure presence of skilled labour; in connectivity and relationality more than in pure accessibility; in local identity besides local efficiency and quality of life. Chapter 8 focuses on an important intangible asset explaining local competitiveness, that of human capital, which is one of the most important elements defining the territorial capital of a region. The chapter recalls that the links between human capital and national economic development may not necessarily be the same as those between human capital and regional economic development. Two quite distinct sets of human capital impacts on regions exist, the first of which mirrors the national impact, while the second differs markedly from the national impact. The human capital in a region in fact has an impact on the aggregate productivity in the economy, via the externalities associated with it, as at the national level. However, rather differently to national economies, human capital in a region can also result in a major spatial reallocation of factors. Chapter 9 looks at regional impacts of infrastructure supply; the chapter deals with the considerable uncertainty that often exists in relation to the regional economic effects of infrastructure supply, and the measurement of impacts in terms of both a productivity orientation and a welfare orientation, going from computable general equilibrium (CGE) models to a method that is much less demanding in terms of data as well as computational complexity, but still theoretically well founded and closely related to a familiar approach in regional science: gravity analysis. Chapter 10 offers a review on modern entrepreneurship analysis, against the background of regional development. After a conceptual discussion on the importance and the measurement of entrepreneurship, the contribution discusses critical success factors and key determinants of entrepreneurship. Next, much focus is laid on the geography of entrepreneurship, while due attention is also paid to the relevance of networks for modern entrepreneurship. The chapter concludes with some retrospective and forward-looking remarks.

Part III is devoted to advances in local development theories with a dynamic approach, where time is interpreted as the rhythm of innovative phenomena which occur in the territory which has been applied in regional growth models. Knowledge creation and

diffusion processes over space have become of primary interest in a knowledge-based society. Chapter 11 opens the debate on the importance of knowledge for regional competitiveness. The chapter explains why the emergence of knowledge as a source of comparative advantage has rendered a shift in the organization of economic activity at both the spatial and enterprise levels. This chapter uses the lens provided by the knowledge spillover theory of entrepreneurship to integrate the organization of enterprise with that of economic activity in geographic space. Chapter 12 provides a review of the most influential and path-breaking works that have tried to respond to the most important issues related to R&D expenditure, namely the effects of publicly funded R&D on industrial productivity growth. The main conclusion is that there is no general policy advice on how to deal optimally with R&D. The variety of proper fiscal tools depends heavily on the menu of R&D spillovers that are influencing the economy. Positive spillovers call for public support, but it may also be the case that R&D exerts negative externality effects. Chapter 13 examines models depicting and explaining the role of knowledge in regional development and provides an assessment of empirical studies of how knowledge affects growth and development in functional regions. In this endeavour, it is crucial to understand those factors that make knowledge spatially sticky and knowledge-production capacity trapped. It is equally important to explain the conditions for knowledge flows and diffusion. The presentation also widens the view by extending the analysis of knowledge creation to include aspects of creativity. In a part devoted to knowledge, innovation and regional development a review of modern theories and approaches on the role of innovation on regional development is important. Chapter 14 revisits the central part of this virtuous circle, namely the Marshall–Arrow–Romer externalities (specialization), Jacobs externalities (diversity) and Porter externalities (competition) that have provided alternative explanations for innovation and regional (urban) growth. The aim of the chapter is to explain variation in estimation results using study characteristics by means of ordered probit analysis. The evidence in the literature on the role of the specific externalities is rather mixed, although for each type of externality we can identify how various aspects of primary study design influence the outcomes. The chapter evaluates the statistical robustness of evidence for such externalities presented in 31 scientific articles, all building on the seminal work of Glaeser et al. (1992). Chapter 15 deals with the increasing amount of research now being conducted on topics at the interface of regional growth and sustainable development. Specifically, the chapter focuses on five key issues and these issues are: (1) regional economic development; (2) natural resources; (3) environmental regulation; (4) geographic information systems; and (5) regional climate change. The review is both retrospective and forward-looking, by discussing what has been achieved thus far and the likely future directions of research on regional growth and the sustainable development.

Part IV deals with the most advanced methods for measuring regional growth and development. Chapter 16 focuses on the measurement of economic agglomeration in the context of the clustering of regional economic activity. In the chapter various agglomeration measures that have been proposed in the literature are first discussed, in order to provide alternative methodologies for the direct measurement of agglomeration. The estimation of the determinants or sources of agglomeration, and the resulting agglomeration economies or productivity effects of agglomeration, both of which involve methods of indirect measurement, are then discussed. Some topics that will be important to address in future studies of agglomeration economies are also recalled. Chapter 17 provides an

overview of the main developments in the measurement of the regional divide, discussing several methodological issues that have arisen since the first attempts to quantify the magnitude of spatial disparities were made. The chapter highlights the implications of the choice of different methods for the perception of the dimension and evolution of regional disparities and illustrates these empirically by resorting to the case of the EU-15 during the period 1980–2002. Chapter 18 first provides an overview discussion of endogenous growth factors. It then proposes a measure of regional endogenous change which is readily calculable from secondary analysis of regional employment data available in the national census. The regional or differential/regional shift component derived from shift-share analysis of employment change over time is proposed as a viable proxy measure as a dependent variable in an endogenous growth model. A series of independent variables which may also be derived from census data are specified in the model as factors likely to explain spatial variability in regional performance on that dependent variable. Those variables are taken as reflecting the types of factors that are proposed in the regional economic development literature as potentially influencing endogenous growth. The results derived from the application of the model across non-metropolitan regions in the state of Queensland, Australia, are presented. The chapter concludes with some thoughts on the emergence of a new paradigm for regional economic development analysis and planning. Chapter 19 deals with spatial econometric techniques, and in particular with spatial heterogeneity. This phenomenon can be observed at several spatial scales: behaviours and economic phenomena are not similar in the centre and in the periphery of a city, in an urban region and in a rural region, in the ‘West’ of the enlarged European Union and in the ‘East’, and so on. Spatial heterogeneity is one of the two spatial effects analysed by the field of spatial econometrics. This effect operates through the specification of the reaction of the variable of interest to explanatory variables or the specification of its variance. The chapter first presents the main econometric specifications capturing spatial heterogeneity. Here, we focus on structural instability, as well as on specific forms of heteroskedasticity. Secondly, it examines how these specifications can be extended to allow further for spatial autocorrelation in a model of heterogeneous reaction as well as interaction. Heterogeneity can also be modelled using spatial panel data models. Chapter 20 presents computable general equilibrium (CGE) modelling; this is an approach to applied economic analysis in which theories of economy-wide market behavior are used to impose structure in numerical thought experiments concerning matters of trade and development – and related policies – where the relative unavailability of data or the complexity of a theoretical model’s specification poses problems for a more traditional analytical or econometric modelling approach. Over the 1980s and 1990s, CGE modelling has developed extensively and has become a stock in trade of regional scientists in particular. More recently, CGE models have taken on an explicit spatial orientation as the focus of modelling exercises has turned to analysis of location-specific impacts of unplanned events and planned industrial, infrastructural, environmental or other types of regional policies. Spatial CGEs have been employed by researchers at various scales of spatial and temporal resolution to examine a wide variety of phenomena. Owing to the paucity of spatial time series, spatial CGEs (SCGEs) provide logical frameworks within which a broad spectrum of spatial economic issues may be analysed. This chapter surveys a representative sample of studies in the recent literature in SCGE modelling and discusses new directions in which SCGE modelling might be taken. Last but not least, Chapter 21 reviews

the basic theory of input–output and socio-economic accounting in terms of some of the significant methodological debates that occur. Although not all developments are region-specific, the chapter covers them because regional analysts are beginning to adopt these theoretical advancements in their work. For the applications, the chapter restricts its review to regional and multi-regional impact analyses and the development of computer programming packages that help analysts to conduct such studies quickly.

Finally, Part V is devoted to regional policy issues. The first chapter of this part (Chapter 22) opens the discussion on regional policy issues by highlighting the role of institutions in shaping economic development; institutions are now seen as comprising of a set of formal and informal rules, including the conditions of their enforcement, following the new institutional economics. The chapter focuses on the different institutional mechanisms that allow for the coordination of regional economic activities in modern capitalistic economies. It inquires into the logic and functions economic institutions follow. It also traces the emergence of regional institutions in the light of the coherence of the institutional attributes with the structural conditions prevailing in a regional economy, and examines the subsequent development and persistence of institutions. While recognizing that each economic institution (the market, firm, state, networks, associations, and so on) has strengths and weaknesses, the chapter underlines that the preferable approach is not to favour one institution but to combine them according to objectives, resources, and the attributes of the goods and services. The theoretical perspective is broadened in recognizing that the operations of regional economic institutions are constrained by the social context in which they are embedded. Chapter 23 proposes a review of regional policy issues and most of the dilemmas related to the implementation of regional development policies. First, there is the dilemma of ‘place prosperity versus people prosperity’. At first instance, a direct targeting of individual inequities by means of, for instance, income support seems the preferred strategy. However, ‘place prosperity’ may still be needed as an independent goal alongside ‘people prosperity’, as pursuing only the latter may have unwanted indirect effects. The second dilemma regards the issue of ‘interregional equity versus national efficiency’. In order to provide a foundation for the discussion of these and other dilemmas and to understand the logic behind regional policy measures, the chapter discusses several theories that underpin the choice between different regional policy strategies, underlining that there does not exist a one-to-one correspondence between theories and instruments, because theories partly overlap and instruments can sometimes be based on more than one theory. Chapter 24 deals with regional disparities in growth and income levels that represent an important challenge for policy-makers in less developed countries, particularly in the context of increasing globalization. A large number of recent empirical contributions have analysed the extent to which developing countries are able to benefit from trade liberalization and other economic reform policies. However, only a few of these contributions are devoted to the impact of these policies on regional income disparities. This chapter reviews the empirical literature on the regional policies in less developed countries, with an illustration based on the case of India. The review shows that regional policies can complement or counteract the effects of national policies, with the effectiveness of specific regional policies depending on the degree of decentralization of the policy-making process, the extent of sectoral specialization across regions and the degree of regional variation in initial endowments of physical and social infrastructure. To end up with, Chapter 25 is

concerned with the fact that theories aimed at investigating and examining development refer mostly to growth, while economic decline and those factors restricting economic development have not been examined exclusively. The chapter also investigates the implications for development policy-making of the lack of a theoretical approach to economic decline. In some European countries and regions debate has been going on about suitable economic and social policy measures to prevent the decline process resulting from population decrease, for instance. Can decline be overcome? Should policy measures be more strongly directed to decline in order to minimize economic losses caused by decline?

## Notes

1. For a literature on spatial spillovers see Anselin et al. (1997, 2000), Audretsch and Feldman (1996), Aydalot (1986), De Groot et al. (2001), Feldman (1994), Feldman and Audretsch (1999), Jaffe (1989), Jaffe et al. (1993), Maier and Sedlacek (2005), on collective learning see Camagni (1991), Capello (1999, 2001), Crevoisier and Camagni (2000), Maillat et al. (1993), Rallet (1993), Rallet and Torre (1995), Ratti et al. (1997), Bellet et al. (1993), on learning regions see Lundvall (1992), Lundvall and Johnson (1994), Maskell and Malmberg (1999), on knowledge-based regions see Malecki (2000), Florida (1995), Nijkamp and Stough (2004), Simmie (2001).
2. On the debate on regional science development, see, among others, Bailly (1992), Bailly and Coffey (1994), Bolton and Jensen (1995), Funck (1991), van Geenhuizen and Nijkamp (1996), Isserman (1993, 1995), Quigley (2001). On a recent debate, see the contributions of the Round Table held in Volos during the ERSA Conference, edited by Coccossis and Nijkamp (2007).

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