
Introduction

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1. INTRODUCTION

The most striking feature of the geography of economic activity is concentration. (Krugman, 1991, p. 5)

1.1 Background – Geography Matters

Whatever type of human and economic activity we study, we find that it is not evenly spread out in space, but instead concentrated to a rather limited number of countries, regions and cities. What in particular is noticeable is that certain places, typically large city regions, host a large share of the wealth and knowledge generated in the modern world. Despite what we can read in the popular press that distance doesn't matter in a world with container and air transport and the Internet, the reality is that distance matters as much as or perhaps even more than in earlier times.

Modern theoretical and empirical research in economic geography, regional economics and regional science indeed convincingly shows that 'the tyranny of distance' is still a reality in the life of households as well as firms. The concept of a region is used with many different meanings. By a region we mean here a geographical area of limited areal size characterized by high intra-regional mobility of factors of production, goods, services, people, ideas and knowledge (cf. Ohlin, 1933).

Even if proximity to natural resources has declined in importance, distance and location are still at the centre of economic life for both firms and households. The economic landscape of today is characterized by many spatial differences and inequalities, but it is reshaped by old as well as new forces. Some of the new forces have been released by reductions in transportation and communication costs that started as early as the 1950s with the introduction of container transport, followed in the 1960s and 1970s by the development of global air transport networks and from the 1980s with the communications revolution that culminated in the birth of the Internet.

Developments of these kinds imply that the rationales for concentration of economic activities may change over time. An example is provided by a recent article on 'Cities, regions and the decline in transportation costs' published in *Papers in Regional Science* in 2004 by Edward Glaeser and Janet Kohlhase. They show that the costs of moving manufactured goods have fallen by about 90 per cent in real terms over the twentieth century. The classic view that cities exist to save on costs of transporting manufactured goods is from this perspective hard to motivate. Still, cities exist and continue to attract households as well as firms, in particular in knowledge-intensive economic activities. Glaeser and Kohlhase (2004, p. 225) maintain that cities today 'serve mainly to facilitate contact between people', rather than to save on transportation costs.

It is clear that economic development is still a 'selective' dynamic process in the sense

that it does not manifest itself everywhere at the same time, and appears with varying intensity in different regions and cities (cf. Perroux, 1955). The large spatial differences in productivity, profitability and welfare levels naturally induce research on their sources and consequences. Likewise, policy-makers are struggling with how to deal with these spatial disparities and often ask for policy advice regarding ways in which the spatial heterogeneities in economic outcomes can be mitigated. Policy-makers devoted to reducing spatial inequalities and to promoting economic growth, particularly in lagging areas, are today facing very tough challenges. It is for example often argued that since different regions and places differ in terms of their resources as well as in terms of economic, political and social history, there is no single 'one-size-fits-all' policy portfolio that all regions can use. Instead, it is maintained, policy should be tailored to meet the different conditions in different regions.

It follows that it is of fundamental importance to have a good understanding of spatial economic outcomes and of the forces and mechanisms that influence the geography of economic growth and well-being. Such understanding naturally demands substantial theoretical and empirical research in economic geography, spatial economics and regional science. Furthermore, high-quality research and relevant policy advice and evaluation in this field are critically dependent on good and reliable empirical research methods. It is here that this handbook aims to contribute by providing a broad overview of up-to-date empirical research methods and approaches in economic geography.

1.2 Purpose and Organization of the Handbook

The main purpose of this *Handbook of Research Methods and Applications in Economic Geography* is to collect contributions that provide overviews and assessments of the state of the art regarding research methods, approaches and applications central to economic geography. Economic geography should not be understood here as an academic discipline, but rather as a line of research that deals with the geography of economic activities and economic outcomes. This is a deliberate choice that is also reflected in the types of contributions in the Handbook. The chapters are written by researchers with backgrounds in different academic disciplines, such as economics and economic, human and cultural geography, economic history, and by researchers working according to different scholarly traditions, for example geographical economics, regional science and economic geography proper. This implies that the Handbook covers a broad spectrum of methodologies and approaches applicable in analyses pertaining to the geography of economic activities and economic outcomes.

The Handbook consists of 29 contributions, which we have organized into four parts:

1. General methods in economic geography and regional science
2. Methods and approaches of regional analysis
3. Methods and approaches of interregional analysis
4. Specific issues in economic geography and regional science.

Part I gathers contributions that present methods that are general in the sense that they are tools that can be applied in analyses of many different topics. It includes presentations and overviews of general methods and tools such as spatial econometrics,

spatial computable general equilibrium models, geographic information system (GIS), shift-share analyses, neural network analysis, measurement of spatial concentration and dispersion, and social accounting analyses.

Part II presents methods and approaches of regional analysis. By this we mean methods and approaches in analyses that focus primarily on analysing economic structures within regions and ways in which their consequences for regional development and growth can be assessed. This part includes contributions dealing with issues such as economic base models and local multiplier analysis, regional extensions of endogenous growth analysis, empirical analysis of agglomeration economies and the specialization/diversity debate, empirical advances in evolutionary economic geography, analyses of regional innovation systems, regional social network analysis and methods for analysing the impact of new firm formation on regional development.

In Part III, the primary focus is on analyses of interdependencies between regions. Interdependence arises from interaction between regions and localities in the form of gross flows of people, products, technology and knowledge. Interdependence also implies that investments in one region may ‘spill over’ to other regions, and the strength of such spillovers often depends on geographic distances and underlying accessibility structures. This part includes methods and approaches that deal with issues related to interregional flows and spillover effects. It comprises contributions that address methods and approaches in interregional input–output modelling, analyses of interregional migration, technological spillovers, market access and consequences of reductions in trade costs, as well as methods and approaches to measure regions’ accessibility and market potentials in respect of different types of resources.

Part IV, finally, collects contributions that address methods and approaches in specific issues of importance in analyses of the geography of economic activities. This part comprises contributions on qualitative methods in regional planning, methods of local social and economic impact assessments, regional knowledge production function analysis, as well as analyses of the geography of high-impact entrepreneurship and regional labour markets.

1.3 Outline

The rest of this introduction is organized as follows. In Section 2 we present a brief historical account of some analytical approaches and empirical methods that researchers have developed to understand drivers of location of economic activity and regional growth and development. This exposé serves as a general backdrop for the chapter contributions. The contributions to this Handbook are presented in Section 3.

2. A BRIEF AND SELECTED HISTORICAL EXPOSÉ OF EMPIRICAL METHODS AND ANALYTICAL APPROACHES IN ANALYSES OF THE GEOGRAPHY OF ECONOMIC ACTIVITIES

In this section we present a brief historical account of some analytical approaches and empirical methods that have been developed to understand the geography of economic

activities as well as the geography of growth and economic development. Important publications in the 1950s and early 1960s came from Isard (1956 and 1960). These works can be claimed to have laid a foundation for spatial analyses, including issues such as:

- the determinants of industrial location (within a nation or a region);
- the regional impact of the arrival or departure of a firm;
- the determinants of internal migration patterns, where the debate concerning the appropriateness of the disequilibrium model of migration versus the equilibrium model of migration is still unresolved (Graves, 1983; Evans, 1990 and 1993; Hunt, 1993);
- the determinants of land-use patterns;
- regional specialization;
- local environmental impacts of social and economic change; and
- the geographical association of economic and social conditions.

It is impossible to cover all these areas in a comprehensive way in this introduction. We limit the presentation to a brief and selected historical account of analytical and empirical approaches in research on (i) the location behaviour of firms and households and the consequent spatial structures, and on (ii) factors driving regional growth and development. The idea is to provide a general backdrop to the Handbook that can be used as a point of reference.

2.1 Location Behaviour and Spatial Structures

The roots of research on location of economic activities go back as far as to von Thünen (1826) – the father of location theory – who designed a model of the use of agricultural land using strict assumptions. The starting point is a city located centrally in the ‘isolated state’, which is surrounded by wilderness. The land around the city is plain, without rivers or mountains, and has a constant climate and soil quality. Farmers are assumed to maximize profits. Von Thünen’s simple model generated a location pattern with rings, where the land in the first ring, closest to the city, was used for dairying and intensive farming, such as farming of vegetables and fruits. In the second ring the land was used for the production of timber and firewood. The third ring was characterized by extensive field crops such as grains, while the land in the fourth ring was devoted to ranching, with the animals walking to the market in the central city.

Almost 50 years after von Thünen’s contribution, another German – Wilhelm Launhardt – made contributions including a theory of network location (1872), a model of plant location (1882) and a model of market areas. Perhaps most interesting is his analysis of the economic and social consequences of the transport revolution (Launhardt, 1910).¹

At the same time as Launhardt performed his theoretical analyses in Germany, Alfred Marshall, in England, wrote about forces inducing firms in the same industry to co-locate, that is, to cluster (Marshall, 1890). The positive co-location economies included (i) a common labour market with a demand for and a supply of labour specialized in skills relevant to the industry, which reduces the risks for both workers and employers,

(ii) a common supply of specialized input suppliers, which increases the efficiency in the production of inputs, and (iii) a common information and knowledge base, which through knowledge spillovers facilitates research and innovation among the co-located firms. Interestingly, Marshall's co-location economies aroused renewed interest one hundred years later when researchers started to analyse how the so-called new industrial spaces could function as major centres of innovation (Scott, 1988; Saxenian, 1994; Keeble and Wilkinson, 1999) and how industrial clusters could generate competitive advantages of regions (Porter, 1990). The renewed interest in industrial clustering has followed different theoretical avenues, and Gordon and McCann (2000) identify three major such avenues: (i) pure agglomeration; (ii) industrial complexes; and (iii) social networks.

Another major contribution to location analysis came with Hotelling (1929). He laid the foundation for spatial competition theory by showing that the coexistence of economies of scale and transport costs gives rise to a spatial division of the market among firms. His contribution has become known as Hotelling's law, that is, the principle that in many markets it is rational for firms to make their products as similar as possible. This law is also referred to as the 'principle of minimum differentiation'. One example is shops selling products that have a tendency to locate close to each other, that is, to agglomerate.²

Four years after Hotelling's contribution, Christaller (1933) presented his central place theory, which showed that a hierarchical urban system can exist automatically with a variety of different-sized spatial markets.³ His central conclusion was that the trade areas of those central places that provide a particular good must be of equal size and that a hierarchical system of centres of various sizes will emerge due to:

- a threshold effect, which is the minimum market (population or income) needed for a supply to be established, and which varies for different goods and services; and
- a range effect, where the range is the maximum distance consumers are willing to travel to acquire different goods and services – a range that varies for different goods and services.

Lösch (1940) was the first researcher in spatial science to present a full general equilibrium system based on microeconomic assumptions describing the interrelations of all locations. In his work, he analysed the interrelationships of individual production and consumption units, the resulting location of markets and production centres, the transport lines and the distribution of population and centres, which all are simultaneously determined. Lösch's primary contribution is that he shows that industrial concentration and urbanization can arise independently of local peculiarity or particularity (Parr, 2002).

Ohlin (1933) made an interesting contribution to spatial analysis by stressing the importance of different economies of scale:

- firm-internal scale economies due to the existence of fixed costs in all firms;
- localization economies due to the co-location of many firms in a specific industry in a given location; and

- urbanization economies due to the existence of several ‘clusters’ of firms in different industries in a given location – a city (cf. Jacobs, 1969).

Hoover (1937 and 1948) built on and developed Bertil Ohlin’s ideas about localization and urbanization economies. One can here also mention Dunn (1954), who extended von Thünen’s work on land-use patterns in agriculture. The same year Harris (1954) published an important paper on the role of the market for industrial location. Greenhut (1956 and 1960) also analysed how the interplay of market size and transport costs affected the location of industrial firms. In the late 1950s, Moses (1958), using production theory, studied how the possibilities of input substitution affected the location of firms. Ponsard (1958) made a contribution to spatial competition theory by showing that whenever sellers and buyers are separated in space, markets are no longer in perfect competition. Later, Greenhut analysed how spatial price discrimination may increase the spatial market areas of individual firms, increase the average distance over which goods are shipped and thereby induce a tendency towards firm dispersion (Greenhut, 1970; Greenhut and Ohta, 1975).

An interesting development in spatial research was the emergence of the specialized field of urban economics and geography, with Harris and Ullman (1945) as an early contribution. Alonso (1964) made an important contribution to urban economics when he presented a model approach on the formation of land rents in urban areas. He based his results on a monocentric city model of a disc-shaped central business district (CBD) with a surrounding residential region, which was an application of von Thünen’s location theory to an urban area. Further contributions to the field in the 1960s and early 1970s came from Muth (1969), Mills (1972) and Evans (1973), which focused not least on the determinants of land values in urban regions. Capozza and Helsey (1989) and DiPasquale and Wheaton (1996) showed that the relationship between the price of land and the urban location is partly determined by the relationship between the consumption and investment values of land over long-run periods of urban growth, but also by the structure of land ownership (Dynarski, 1986). Another line of research focused on the question of the optimal size of cities (Alonso, 1971; Richardson, 1972). A more analytical approach to urban economics was delivered by Fujita (1988), when he adapted the monopolistic model of Chamberlain (1933) to generate spatial agglomeration of economic activities.

2.2 Regional Growth and Development

In the 1950s and, in particular, the 1960s researchers with an interest in economic geography started to examine the factors and mechanisms that enable regions to grow and achieve higher levels of output, incomes per capita and wealth, and to achieve lower levels of unemployment. Many such factors and mechanisms have been identified over the years and include (i) an increased (external as well as internal) demand for products produced in the region, (ii) an increased regional production capacity, (iii) an increased supply of fixed and semi-fixed regional production factors, (iv) an increased regional savings ratio, (v) increased adoption of external innovations, (vi) increased investments in R&D and (vii) increased entrepreneurial activities.

One of the early approaches in analyses of regional growth focused on the external

demand for products produced in the region as well as on impact analyses of direct and indirect effects from, for instance, a new production activity in a region. Over the years researchers have shown that estimating regional multipliers is a complicated matter since the different rounds of expenditures tend to be overlapping (Sinclair and Sutcliffe, 1978). Researchers also early started to analyse the role of regional balances of payments.⁴ Regional balances of payment are critical, since a region with a deficit in its trade balance has to find a way to pay for this deficit (Dow, 1986).

In the 1950s, a number of researchers independently of each other developed the so-called export-base model using aggregated Keynesian macro-variables (Andrews, 1953; North, 1955; Tiebout, 1956). The underlying idea here is that small and medium-sized regions, which often are specialized, cannot rely on endogenous capacities only to grow and develop. Hence their growth and development are to a high extent conditioned on external factors but also on their production specialization. Thus the model also highlights the risks specialized small and medium-sized regions have to face when international demand fluctuates or when the structure of international demand changes. A limitation of export-base models is that they do not treat the supply side, and thus there are in principle no economic and/or physical constraints on economic growth. Furthermore, the standard economic-base theory, to which the economic-base models belong, does not concern itself with processes of divergence or convergence among regions. In the late 1970s, a dynamic version of the economic-base model was presented (Richardson, 1978). This version dealt with one of the main criticisms of the economic-base model, namely the assumption of a constant ratio between service employment and total employment.

The importance of exports as drivers was stressed again in the early 1980s by Thirlwall (1980). He gave exports a critical role in the regional development process in the sense that they ensure the regional trade balance by securing the financing of the imports necessary to satisfy regional demand when no other financing mechanism exists. The various empirical tests that have been carried out on this relationship have yielded mixed results (McGregor and Swales, 1983; Bairam, 1988). Krugman (1989) suggested an alternative interpretation of the relationship between growth of output and the ratio of export to import elasticities, and argued that the causal relationship goes in the opposite direction to what Thirlwall proposed. Krugman maintained that it is growth of output that determines export and import elasticities, and that a larger supply of input factors will induce an increase in output growth. However, the view that Thirlwall's 'law' does not hold has been seriously questioned (McCombie, 1992; McCombie and Thirlwall, 1997).

A second approach to the understanding of regional growth and development was the application of the Harrod–Domar growth model to interpret the growth dynamics of regions (Richardson, 1969). The underlying assumption here is that imports as a channel through which capital goods and savings come from other regions determine the growth rate of the regional economy. Imports also imply that the equilibrium growth conditions become less restrictive and, thus, more sustainable over time. This approach implies that regional growth can be driven by investments coming from other regions.

Another approach to explaining regional growth and development has been to focus on technological progress and the regional supply of production factors, building on the contributions by Solow (1956 and 1957). The neoclassical growth model makes the fundamental prediction that, over the long run, the spatial differences in income per

capita will converge. A distinction is often made between two types of convergence: (i) β -convergence, which occurs when poor regions grow faster than rich regions, and (ii) σ -convergence, which is a measure of the dispersion of income per capita between regions. The first major empirical studies showed that there had been β -convergence over the very long run for US states according to the predictions of the neoclassical growth model (Barro and Sala-i-Martin, 1991 and 1992). However, the general picture appears to be that regional convergence of incomes per capita generally has been very slow in the industrialized economies (Sala-i-Martin, 1996a and 1996b). A limitation of the earlier convergence studies is that they do not take into account spillover effects from neighbouring regions. It seems as if spillover effects at least marginally reduce the estimated convergence effects (Rey and Montouri, 1999). Furthermore, even if convergence has taken place, there is no guarantee that the adjustment mechanism is the neoclassical mechanism. Convergence can also be the result of diffusion of new technologies and/or public policies (Fingleton and McCombie, 1998).

Turning now to a third approach to regional growth and development, we first have the 'big push' theory launched by Rosenstein-Rodan (1943). Second, we have Perroux (1950), who, employing the ideas of Schumpeter (1934), launched the concept of growth poles. His theory of regional development assumed selective growth at certain points in space, where a propulsive industry triggered the regional development process. The propulsive industry can generate a growth-pole effect through a Keynesian multiplier effect on regional incomes, a multiplying effect *à la* Leontief via intersectoral input–output effects and an acceleration effect on firms' investment. He stressed that development does not appear everywhere at the same time. Development becomes manifest at points or poles of development, with variable intensity, and spreads through different channels, with various final effects on the whole economy. Hägerstrand (1953) contributed with an empirical study of the spatial diffusion of innovations and by introducing the concept of space-time geography. He maintained that the temporal diffusion of innovations follows an S-shaped pattern, like an epidemic process represented by a logistic function, and that the temporal phases should be combined with a spatial one, generating a spatial–temporal diffusion of innovations with three phases.

The contributions by Myrdal (1957) and Hirschman (1958) represented a more dynamic view of regional development. The dynamic approach was followed up by Vernon (1966), when he presented his (international) product cycle theory, which was actually based on earlier observations of city clusters in Vernon (1960). Vernon's original idea was later taken up by Norton and Rees (1979) and transformed into a theory of regional life cycles based on the idea that the logistical model can represent the spatial diffusion of innovation as a continuing process in time. Their model assumes that regional differences in technological capacities are the result of technological ageing processes, where technological development has three stages, each represented by a specific location: (i) the take-up of a new product in metropolitan regions; (ii) the maturing of products, leading to a need for large-scale production that can be located in peripheral regions in developed countries; and (iii) a full standardization of the product and the related production process that can be located in regions in developing countries. The model describes interregional technological development in the industrial society, but its capacity to explain the same processes in the post-industrial society, with its shorter

product cycles, has been questioned. It has also been criticized for describing interregional technology development as a simple, linear process (Davelaar, 1991).

Another avenue to analyses of regional growth and development is the theory of regional development potential (Biehl, 1986). This potential is determined by the infrastructure endowment of a region, together with its geographical location and the degree of sectoral agglomeration. A better infrastructural endowment in relative terms attracts the location of firms in the region and may strengthen their competitiveness, even if some of them may be outcompeted by more efficient firms in other regions. Transport infrastructure increases the productivity of other factors of production as well as general accessibility, which, by reducing the geographical transaction costs, generates positive externalities stimulating regional development (cf. Aschauer, 1989; Barro, 1990).⁵

During the last decades of the twentieth century a wave of interest in what could be termed neo-Marshallian theories of regional development focusing on explaining the development in individual regions based on endogenous intraregional factors emerged. These theories looked at regions as potential sources of increasing returns due to positive externalities generated by agglomeration economies, that is, localization and urbanization economies. These increasing returns can increase the efficiency of the regional production system by reducing production and/or transaction costs, and/or stimulate its innovative capacity. We may assume that the dominating type of agglomeration economies differ between locations. In the literature, researchers often make a distinction between three types of agglomeration externalities (Glaeser et al., 1992): (i) Marshall–Arrow–Romer (MAR) externalities, which refer to the benefits of specialization; (ii) Jacobs externalities, which refer to the benefits of diversity (Jacobs, 1969); and (iii) Porter externalities, which refer to the benefits of regional competition (Porter, 1990). The evidence concerning the relative roles of these three different types of externalities is rather mixed and seems to be dependent on sector, type of region and time, which implies that there is substantial heterogeneity. Theories rather closely related to the Marshallian theories were presented under names such as ‘indigenous potential’ (Ciciotti and Wettman, 1981), ‘bottom–up development’ (Stöhr, 1990), ‘Marshallian industrial districts’ (Becattini, 1990), and ‘localised industrial systems’ (Ganne, 1992).⁶

In recent decades, the development of endogenous growth theory (Romer, 1986 and 1990; Lucas, 1988) has attracted much attention among scholars interested in regional development (Nijkamp and Poot, 1998). The endogenous growth theory has stimulated a large number of systematic studies of the geography of innovation and R&D activities and the geographic extent of the spillovers they generate. Studies include (i) patent citations (Jaffe et al., 1993), (ii) R&D activities (Cantwell and Iammarino, 2000), and technology-related infrastructure, such as universities (Ács et al., 1992), which opens up wider questions about the role of universities in influencing regional development through forward linkages (Felsenstein, 1996; Luger and Goldstein, 1997). Other studies analysed the different abilities of entrepreneurs and small and large firms to exploit knowledge spillovers (Ács et al., 1994) and the relative role of diversified and specialised spillovers of scientific knowledge (Feldman and Audretsch, 1999).⁷

It is obvious that a region’s capacity to absorb new technologies, whatever the source, is not only a function of its investments in new capital goods embodying such technologies and/or new human capital capable of mastering the new technologies. It is also a function of the formal and informal institutions and their capacity to provide

a knowledge-rich regional environment that allows and encourages collective learning processes within which individuals with diverse skills, education and competencies may network, that is, interact and exchange information, ideas and knowledge, and thereby generate a diverse output of new ideas and new knowledge. The implication is that technological progress is by no means an automatic outcome of investments in R&D, but a function of how rapidly and to what extent the new ideas and knowledge are adopted and diffused in the regional production system. Since the institutional environment differs between regions, it is natural that some regions have better capacity than others to gain from technical progress (Fagerberg, 1996).

Over the years the role of cities as growth engines has become clearer. Cities are drivers of regional growth and development by being sources of increasing returns for firms and individuals located there. They provide spatial clusters of productive activities and facilities for urban transportation and commuting. The concentration of these activities and the density of contacts they offer bring advantages not only in terms of good access to knowledge and qualified information, but also in terms of other positive urbanization economies. These include a well-functioning labour market with a diversified supply of labour in terms of education, occupation, experience and skills, and a diversified supply of knowledge-intensive business services, such as specialized lawyers, accountants, consultants, freight-forwarding agencies and financial institutions, as well as of household services including cultural and recreational activities and public services, such as schools and hospitals.

3. PRESENTATION OF THE CONTRIBUTIONS IN THE HANDBOOK

The content of the chapters making up the four parts of this handbook is briefly described below.

3.1 General Methods in Economic Geography and Regional Science

In Chapter 1 James LeSage introduces the usefulness of spatial regression models in quantifying spatial spillovers, a commonly occurring problem in applied regional science. By using a simple non-spatial example, LeSage motivates the statistical issues that arise with observation-level dependence in data vectors. A family of spatial regression models useful for analysing spatially dependent data is then introduced, with a focus on estimating and interpreting estimates of direct and indirect impacts that arise when data exhibit spatial dependence. Direct impacts are changes in the own-region (say region i) dependent variable that result from changes occurring in region i 's explanatory variables. Indirect impacts are spatial spillovers reflected in changes that occur in a neighbouring region's (say region j 's) dependent variable as a result of changes occurring in region i 's explanatory variables.

In Chapter 2 Johannes Bröcker deals with multiregional (or spatial) computable general equilibrium models. General equilibrium analysis is a computational method to study quantitatively the impact of exogenous changes, so-called 'shocks', in an economy on a wide range of variables of interest, such as prices, quantities of consumption,

production and trade, and – most importantly – on welfare. Bröcker introduces several regions into the model and additionally allows for economies of scale and imperfect competition. He concludes that the strength of the model is the full coverage of direct and indirect impacts of shocks to the economy, but there is considerable arbitrariness in implementing the approach empirically.

Steven Brakman and Charles van Marrewijk examine the implications on factor prices of geographical economics models in Chapter 3. Unlike the predictions of the Heckscher–Ohlin model, agglomeration of economic activity generally results in non-factor price equalization in core geographical economics models. Thus factor price inequality is an equilibrium outcome; making standard welfare analysis more complicated compared to neoclassical trade models. In addition, standard neoclassical trade models, extended with the possibility of within-country agglomeration, have ambiguous trade consequences. The authors review these agglomeration consequences for trade and factor prices, and argue that agglomeration can explain some of the recent puzzles in the international trade literature, making geographical-economics-based models more relevant in practice.

The aim of Chapter 4 by Kingsley Haynes and Jitendra Parajuli is to review shift-share models with a focus on the classical Dunn model and a number of extensions. Shift-share analysis is a decomposition methodology commonly used for measuring regional change of smaller regions that are embedded in larger regional systems. The authors argue that the classical approach is simple but contains a number of issues: for example, the regional share is obtained as residuals and does not account for factors such as productivity, temporal effects, regional interaction and spatial dependence. Both the Rigby–Anderson and Haynes–Dinc extensions presented in this chapter attempt to address the limitations of the classical Dunn model.

Almost everything that happens happens somewhere. In Chapter 5 Paul Longley introduces the topic of geographic information systems (GIS), which are widely used tools that help us to answer the question, ‘Where?’ This chapter reviews the science of geographic problem solving, and the ways in which GIS can be used to understand not only the way the world looks (e.g. through measurement and representation of spatial location patterns), but also the ways in which the world works (e.g. as the outcome of spatial interaction and flows). Longley describes the anatomy of GIS, and the ways in which they can be used to measure, monitor and evaluate economic systems as well as assess some of the problems and pitfalls that may arise in the management of apparently ubiquitous geographic information.

The aim of Chapter 6, by Giuseppe Arbia, Giuseppe Espa and Diego Giuliani, is to present a number of statistical approaches to the study of the spatial concentration and dispersion of economic activities. Traditionally the problem of the spatial location of economic activities has been approached by looking at the distribution of the agents within geographical partitions: the so-called mesoeconomic approach. However, this approach is flawed since any conclusion depends intrinsically on the specific geographical partition chosen. For this reason, a spatial microeconomic approach is presented in this chapter. It turns out that the spatial microeconomic measures are those that fulfil the highest number of theoretical criteria and hence are closer to the ideal measure of spatial concentration.

Timo Mitze and Andreas Stephan are the authors of Chapter 7, which reviews

simultaneous equation models (SEM) in a regional setting. These models can handle both simultaneity in systems of several equations as well as spatial dependence, which is likely to be present if the unit of analysis is a region. Given that the merits and pitfalls of SEM estimation are not always easy to see, this chapter aims at providing some guidance for applied researchers in terms of model selection and application. Specifically, two strands of empirical applications of SEMs are summarized, namely the estimation of 'structural models' as well as 'vector autoregressive' approaches.

The primary aim of Chapter 8 by Manfred Fischer is to discuss some issues that are crucial for the design and understanding of neural network models, with a strong emphasis on their practical use for solving regression and classification problems. The attention is focused on a particular class of neural networks that have been shown to be of greatest practical value, namely the class of feedforward neural networks. Feedforward networks are attractive since they are non-parametric, non-linear regression models that can also be used to classify via regressions.

In Chapter 9 Demetrios Psaltopoulos and Dimitris Skuras present the analytical properties of social accounting analyses methods, especially models based on simple and extended social accounting matrices (SAM), and their application to the investigation of spatial economic interactions and flow patterns. This chapter shows how such models can be applied to the analysis and interpretation of economic-geography-specific issues, such as spatial concentration and dispersion of economic activity. The chapter concludes with a short critical evaluation of advantages and shortcomings of the SAM approach in analysing and interpreting the determinants of the spatial distribution of economic activity, and suggests future research directions.

3.2 Methods and Approaches of Regional Analysis

In Chapter 10 Per Thulin introduces the reader to the economic-base model and the local multiplier. The economic-base model gives a snapshot view of a region's aggregated industrial structure, but is mainly used to explain and predict overall growth effects due to exogenous shocks to the local economy. What is the total effect on the local economy when a new firm in the basic sector sets up shop in the region? To what extent will local employment be affected by the firm entry? How will local purchasing power and future housing demand be affected? The economic-base model and the local multiplier have been developed to aid in assessing these and similar questions and, hence, help local agents to make better-informed decisions.

Chapter 11 by Roberto Basile and Stefano Usai provides a critical survey of the growing literature on regional extensions of endogenous growth analysis. Endogenous growth theory has deeply influenced regional growth analyses and inspired regional development policies. The focus of the chapter is on those theoretical and empirical studies that have tried to explain lack of regional convergence, multiple equilibria and spatial polarization. Unlike previous reviews of the literature on regional growth and convergence, this chapter points out the link between the advances in endogenous growth theory and the evolution of regional growth analysis.

Frank van Oort overviews the agglomeration theory and the role of the specialization/diversity debate in Chapter 12. This debate concerns whether regions should specialize in certain products or technologies to benefit locally from economies of scale, shared

labour markets and input–output relations, or if they should diversify over various products and industries and hence have both growth opportunities from inter-industry spillovers and portfolio advantages to hedge a regional economy in times of economic turmoil. Van Oort argues that it is clear that the specialization/diversity debate is an unproductive line of argument in addressing the nature, magnitude and determinants of agglomeration externalities. Empirically it is harmful, as it does not acknowledge the spatial, sectoral and firm-level heterogeneity that moulds agglomeration economies in certain places while not in others.

In Chapter 13 Bjørn Asheim, Lars Coenen and Jerker Moodysson assess the fundamentals of the regional innovation systems (RIS) approach and arrive at an overview of some key methodological challenges for RIS research. In the past two decades the RIS approach has demonstrated its value as a framework for formulating and evaluating policy to strengthen regional innovativeness and competitiveness, as well as for analysing the organization of innovation processes and determinants of innovativeness in a regional context. It has established a new tradition to analyse regional innovation in a systemic perspective, incorporating actors, networks, organizations and institutions involved in the exploration and exploitation of knowledge to develop new products, processes and services.

In Chapter 14 Koen Frenken and Ron Boschma report on empirical advances in the area of evolutionary economic geography and discuss open questions and challenges that remain. Evolutionary economic geography (EEG) explains the spatial evolution of firms, industries, networks, cities and regions from elementary processes of the entry, growth, decline and exit of firms, and their locational behaviour. The focus of the chapter is on the debate on cluster advantages and localization economies. This debate is central to economic geography as a discipline and highlights differences between the evolutionary and other approaches. It is widely believed that new business formation leads to economic growth, although the theoretical as well as the empirical foundations for this belief are remarkably weak.

In Chapter 15 Michael Fritsch provides an overview of methods for empirically analysing the relationship between new business formation and regional development. Much previous work in the field has focused on industries, but Fritsch argues that geographical units of observation are much better suited for such an analysis. The chapter also deals with the issue of causality – are new businesses a source or a symptom of growth?

In Chapter 16 Hans Westlund and Yuheng Li deal with social capital from a certain perspective, that is, *local* social capital. Social capital can be simply described as social networks and/or the norms and values being distributed in these networks. However, many issues surround the concept and there is much controversy regarding the interpretation of social capital. Issues such as whether social capital benefits all parts of society or if it exclusively benefits only certain groups, or whether it has any importance for economic growth or ‘just’ for people’s perceived social welfare, are yet to be resolved. Westlund and Li provide an analysis of what it is that characterizes local social capital and how it is being studied.

Maureen Kilkeny, in Chapter 17, demonstrates the usefulness of regional social network analysis in explaining regional outcomes that core economic geography models sometimes fail to explain. This chapter deals with how to analyse social networks in places to explain what happens where and why some places are richer than others. Kilkeny

briefly summarizes some key theoretical and empirical contributions of network analysts from the fields of sociology, economics, geography, mathematics, physics, engineering and computer science. The bulk of the chapter reviews the technical fundamentals of social network analysis potentially relevant for analysing regions.

3.3 Methods and Approaches of Interregional Analysis

Interregional input–output modelling is the topic of Chapter 18 by Geoffrey Hewings and Jan Oosterhaven. The authors claim that regional economies are becoming both more competitive and more integrated at the same time, creating new challenges for policy analysts. To understand the new challenges to economic development, it is essential to develop and maintain tools – such as interregional input–output models – that can assist in tracking these changes. This chapter focuses on ways in which the modelling of flows of goods and services can be handled, and how the outcomes of such models are different across countries and along the spatial hierarchy.

In Chapter 19 Han-Hsin Chang, Charles van Marrewijk and Marc Schramm discuss recent empirical studies in geographical economics/new economic geography models. They focus on four main issues addressed in this literature: how market access affects factor mobility; how market access affects factor prices; how reductions in trade costs affect core–periphery dynamics; and the shock sensitivity of the spatial distribution of economic activity. In general, the overview finds strong empirical support for the main theoretical implications of the geographical economics literature. The authors argue that future work needs to incorporate urban aspects in geographical economics models, allow for heterogeneity, and focus more attention on services sectors and networks.

The purpose of Chapter 20 by Johan Klaesson, Johan P. Larsson and Therese Norman is to overview the two related concepts of accessibility and market potential. The authors consider the advances in the field of measuring and modelling the influence of geographic market potential or accessibility. In general the models are designed to assess the influence on location choices and growth performance. The authors trace the origins of these two ideas and show how they have been used in the literature. Moreover, the authors introduce an approach that employs the concepts in a somewhat novel way, which involves measuring accessibility in different distance bands while also taking into account the hierarchical structure in a system of regions.

Chapter 21 by Sandy Dall’erba and Irving Llamosas-Rosas relies on a Cobb–Douglas production function approach to investigate the role of physical and human capital on the US states economies over 2000–2008. The chapter makes use of recent theoretical developments on the role of interstate technological spillovers in income. In addition, Dall’erba and Llamosas-Rosas adopt a unique set of data on publicly funded investments in physical and human capital that allows them to bring new insights into the traditional measurements of the Mankiw–Romer–Weil model of regional income distribution and regional growth dynamics.

The aim of Chapter 22 by Alessandra Faggian, Jonathan Corcoran and Mark Partridge is to provide a review of regional science contributions on interregional migration determinants, with a specific focus on more recent debates and advancements. The movement of individuals, families and groups between regions occurs at a variety of

spatial scales throughout the life course. Understanding these complex patterns of movement and capturing the characteristics underpinning the motivation to move is crucial from the perspective of regional economic development. This chapter draws on international studies in the area and proposes a classification of previous research according to the theoretical approach, method and spatial scale used. Using this classification, the authors highlight the merits and limitations of the various approaches in their goal to understand interregional migration.

In Chapter 23 Mark Birkin, Hamzah Khawaldah, Martin Clarke and Graham Clarke present an application of spatial interaction modelling that shows how a model can be built and calibrated to examine the economic impacts of a large new shopping centre development on existing retail trade patterns. The main purpose of the chapter is to illustrate the building and calibrating of a highly disaggregated spatial interaction model. However, a second aim is to consider why, despite the popularity of these types of models within quantitative geography and regional science, the use of such models in UK public sector planning departments declined in the 1980s and 1990s.

3.4 Specific Issues in Economic Geography and Regional Science

Attila Varga and Márton Horváth employ exploratory, descriptive methodologies in Chapter 24 to review the widest possible range of regional knowledge production function studies (RKPF). RKPF analysis has become perhaps the most widely used method to study regional innovation. In this chapter, the reader will find out the reasons behind the success of the RKPF framework. The chapter illustrates the development of the basic RKPF framework in three subsequent waves of studies and investigates the robustness of the basic RKPF framework as reflected in several applications. In addition, the authors follow the spread of RKPF analysis over time and space and provide a classification of the main extensions of the basic approach.

In Chapter 25 Frank Vanclay explores issues associated with the evaluation of regional development programmes and provides high-level guidance on designing and undertaking qualitative evaluation research. The chapter outlines the background of various qualitative evaluation methods used in outcomes assessment (e.g. most significant change technique, performance story reporting and collaborative outcomes reporting). In addition, by using an example from Australia, Vanclay highlights how qualitative methods such as the story-based approach can be used to assess performance of regional development programmes. Story-based approaches are especially useful in capturing the broader social benefits of programmes, particularly in situations where empirical attribution may be difficult.

Chapter 26 by Ana Maria Esteves and Galina Ivanova considers how potential social and economic impacts, both positive and negative, can be predicted from the perspective of regional sustainable development. A broad set of indicators and measures is also proposed. The chapter demonstrates how the integration of social and economic impact assessment (SEIA) into sourcing strategy can be an effective tool to optimize the benefits associated with development projects to local communities. Drawing on examples in the mining, oil and gas sectors, mostly from Australia and Canada, the main contribution lies in the application of predictive impact assessment techniques to local procurement policies.

The topic of new firm formation is visited again in Chapter 27 by Sierdjan Koster and Nikos Kapitsinis but this time from a different perspective. The chapter addresses a current issue in the analysis of spatial differences in entrepreneurship: the breakdown of overall entrepreneurship measures into more detailed measures that acknowledge different types of entrepreneurship, and more specifically the identification of high-impact entrepreneurship. Two specific issues related to analysing regional differences in high-impact entrepreneurship are addressed. First the authors discuss the conceptual link between the notion of entrepreneurship and different approaches to identifying high-impact entrepreneurship. Second, the analytical framework generally used to explain regional differences in entrepreneurship is discussed.

In Chapter 28 Inge Noback, Lourens Broersma and Jouke van Dijk provide an empirical example of regional labour market analysis. The authors recognize that there has been a downward trend in hours worked over the past four decades, especially for females, due to declining birth rates and an ageing population. What would the welfare effect be if the negative trend of hours worked could be slowed down or even reversed? This study explores the possibilities for increasing the number of hours worked by analysing observed changes in hours worked by Dutch male and female employees, taking the regional context into account.

NOTES

1. Building on the contributions by Launhardt, Weber (1909) presented a partial-equilibrium static theory of industrial location. Predöhl (1925) made a further contribution to location theory by describing 'the substitution principle' within general equilibrium theory and thereby created the theoretical foundation for understanding how one location factor can be substituted for another.
2. However, it is important to observe that the classical Hotelling results do not hold if firms start to compete on prices (d'Aspremont et al., 1979), since Hotelling's results are based upon the assumption that the demand in his linear market is totally price-inelastic. On the other hand, in many industries firms do not compete on price because a lower price might indicate lower quality (cf. Akerlof, 1970). As a complement, Beckmann (1968) analysed all the location equilibria in various cases of price discrimination.
3. Palander (1935) also made an important contribution to spatial theory by showing that geography and space can confer monopoly power on firms, which encourages them to engage in spatial competition in order to acquire monopoly power through location behaviour. He was also the first economist to fully conceptualize the idea of market areas. Almost at the same time the first attempt to quantify market areas and the distance of shipment of goods was made by Reilly (1929 and 1931), who presented a 'law' of market areas or retail gravitation. Important contributions to the analysis of the spatial organization of urban hierarchies were also made by Parr (1978, 1981 and 1985).
4. For an overview, see Capello (2007).
5. However, it seems as if new transport infrastructure per se is in many cases unable to spur regional growth and development. Similar conclusions can be drawn concerning investments in new information and communication technologies in different regions (see Capello, 2007).
6. Other theoretical approaches highlight that intraregional factors can also be sources of increased dynamic efficiency; that is, they encourage and facilitate innovation (Saxenian, 1994). Spatial concentration of innovative activities and firms in what has become known as 'innovative milieus' (Aydalot, 1986) or 'learning regions' (Cooke, 2002) may generate knowledge and technology spillovers among the actual firms and, thus, generate increasing returns in knowledge production and innovation. Both informal, 'untraded' relationships or interdependencies and formal cooperation agreements between economic agents are assumed to play a critical role in 'innovative milieus' (Storper, 1995).
7. Originally, much focus was on the role of geographical proximity in facilitating the exchange of tacit knowledge, not least through face-to-face interaction. Later, this approach was complemented by other proximity concepts, such as relational, institutional, organizational, cognitive and social proximity.

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