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## An Introduction to Geographical Economics

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The need for a better understanding of the role location plays in economic life was made explicit by Bertil Ohlin in 1933. However, it is only recently, with the development of computer packages able to handle complex systems, as well as advances in economic theory (in particular, an increased understanding of returns to scale and imperfect competition), that Ohlin's vision has been met and a framework developed which explains the distribution of economic activity across space.

This book is an integrated, first-principles textbook presenting geographical economics to advanced students. Although not avoiding advanced concepts, its emphasis is on examples, diagrams, and empirical evidence.

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Harry Garretsen and Charles van Marrewijk

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# An Introduction to Geographical Economics

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## Trade, Location and Growth

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Steven Brakman

Harry Garretsen and

Charles van Marrewijk



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## *Symbols*

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$C$	consumption
$c_i$	consumption of manufacturing variety $i$
$D_J$	intermediate good for sector $J = A, B$
$D_{rs}$	distance from region $r$ to region $s$
$E_{rs}$	expenditure in region $r$ on goods from region $s$
$F$	food (representing immobile activity)
$I$	exact price index of manufactures
$i, j$	indices for varieties
$K$	capital stock
$L$	labor force
$l_{ir}$	labor required to produce variety $i$ in region $r$
$M$	manufactures
$N_r$	number of varieties of manufactures produced in region $r$
$P_r$	locally charged price for a variety of manufactures in region $r$
$R$	number of regions
$r, s$	indices for regions
$T$	transport costs; units to be shipped to ensure 1 unit arrives
$t$	time index or iteration index
$U$	utility
$W_r$	wage in region $r$
$w_r$	real wage in region $r$
$\bar{w}$	average real wage
$x_{ir}$	amount of variety $i$ produced in region $r$
$x_r$	total production of manufactures of a representative producer in region $r$
$Y$	income
$y$	real income

## *Parameters*

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$\alpha$	fixed cost
$\beta$	marginal cost
$\gamma$	share of labor force in manufactures
$\delta$	share of income spent on manufactured goods
$\varepsilon$	elasticity of substitution = $1/(1 - \rho)$
$\eta$	speed of adjustment
$\theta$	miscellaneous parameter
$\kappa$	miscellaneous parameter (for Lagrangian multiplier, econometric equations and knowledge spillovers)
$\lambda_r$	share of manufacturing labor force working in region $r$
$\mu$	capital intensity of sector A (factor abundance)
$\pi$	extent of comparative advantage; profits
$\rho$	love of variety
$\sigma$	threshold value for real wage differences in simulations
$\tau$	congestion
$\phi_r$	fraction of food labor in region $r$



## Preface

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This book offers an introduction to an important new field in economics, entitled *Geographical Economics*, which sets out to explain the distribution of economic activity across space. In doing so, it tries to bring together and apply insights from various fields of economics. The book will therefore be of interest to students and scholars of international economics and business, as well as of economic geography, regional economics, and urban economics. The fact that we offer an “introduction” does not mean that we avoid models or shy away from difficult concepts. It indicates that we have made an effort to write a book that is accessible to readers and students who are new to the field of geographical economics.

Although we introduce and discuss various modeling approaches, we keep the required technicalities to a minimum. Whenever possible we draw attention to important concepts and applications in *special interest boxes*, making ample use of examples and diagrams to explain the workings of the models. Chapter 3, which explains the structure of the core model of geographical economics, gives background derivations in six *technical notes*. Throughout the book the level of mathematical competence required does not rise above simple optimization techniques that should be familiar to upper-level undergraduate and graduate students, both in economics and in other fields of social science. The target audience of our book is not limited to these students, but includes professionals working at government agencies, banks, international organizations, and private research firms, as well as students and scholars of international business and economic geography. The latter category may find the book of interest, if only to get to know what they disagree with when it comes to the analysis of the location of economic activity!

To help the reader in developing his or her intuition for different aspects important in determining the interaction between location decisions and economic performance, and to get a better feel for the modeling structure and empirical relevance of geographical economics, we include discussions of many real-world examples, and present and evaluate the currently available empirical evidence. In addition, we explain in detail an important but often neglected aspect of the geographical economics approach: *computer simulations*. We discuss their advantages and disadvantages, show what is needed to perform such simulations, and give the reader access to a few user-friendly simple

simulations (see below). The emphasis on examples, diagrams, and empirical evidence, together with the introductory nature of the book, the limited technical requirements in our analysis, and the attention to explaining simulation exercises, sets our book clearly apart from, and makes it a suitable introduction to, *The Spatial Economy*, the seminal contribution of Masahisa Fujita, Paul Krugman and Anthony Venables which appeared in 1999 and caters to the needs of the academic world (Ph.D. students and fellow researchers).

For a number of reasons, a dedicated *website* is available for this book. First, the site gives brief general background information on the structure of the book. Second, it deals with the *exercises* to be found at the end of every chapter. The exercises not only test the reader's knowledge of the contents of the chapter but are also used to introduce some additional material. Third, the website provides some illustrations and data material on economic location, for example on the rank–size distribution for cities (see chapter 7). Fourth, it provides some simple and user-friendly simulation models, which can familiarize the reader with this aspect of the geographical economics approach. Fifth, for the interested reader the website provides some additional derivations of technical details not dealt with in the book itself, as well as some more advanced (working) papers. Sixth, the website is a source of information for links to relevant researchers and institutions. Finally, it provides some background information on the authors.

In our view, the approach in this book is best characterized as an attempt to put more geography into economics. It is the main reason for us to prefer the term *geographical economics* to alternatives, such as new regional science or the widely used term *new economic geography*. Not only does the label “new” inevitably wear off after some time, but the latter term also has the disadvantage that it suggests that the theory was developed by economic geographers. This is not the case. Instead, geographical economics has its roots firmly in international economics and modern international trade and economic growth theory. It adds the location of economic activity to these theories.

In the end a label is just a label and what really matters, of course, are the topics covered in geographical economics. In 1933 the Swedish economist Bertil Ohlin published a book called *Interregional and International Trade* in which he strongly advocated a closer collaboration between regional economics and what is now called international economics, as they share, in Ohlin's view, the same research objective. To a large extent, geographical economics can be looked upon as a (somewhat belated) reply to Ohlin's call, originating from within international economics. As Paul Krugman, the founding father of geographical economics, puts it, it is an attempt “to resurrect economic geography as a major field within economics.”<sup>1</sup> Moreover, it is an attempt in which the modern tools of mainstream economic theory are used to explain the *who*, *why*, and *where* of the location of economic activity.

Geographical economics takes as its starting point the empirical fact that economic activity is not distributed randomly across space. A quick look at any map suffices to

<sup>1</sup> Krugman (1991b, p. 7).

make clear that the clustering of people and firms is the rule and not the exception. Geographical economics seeks to give a micro-economic foundation for this fact using a general equilibrium framework. The building-blocks in this framework use *increasing returns to scale*, *technological and pecuniary spillovers*, as well as *imperfect competition*. These aspects make geographical economics models difficult to solve analytically, so the approach relies to a large extent on *computer simulations* to determine the distribution of economic activity across space and to develop intuition about the strength of the forces involved. Throughout the book we will also often use computer simulations.

Given the target audience, the heart of the book, in chapters 3 and 4, explains in detail the structure and main results of the so-called core model of geographical economics. This is preceded by an introduction in chapter 1 and a discussion of the antecedents of geographical economics in chapter 2. Chapters 5–11 deal with a wide variety of extensions to, and modified empirical applications of, the core model. In our selection of these extensions we deliberately chose ones that require only relatively small modifications of the core model.

The bulk of this book was written during our visit to the School of Management, Yale University in the summer of 1999 and our stay at Trinity College, University of Cambridge in the summer of 2000. We are grateful to both institutions for their hospitality and their willingness to provide us with the facilities necessary to carry out the research for this book. In particular, we would like to thank Jeffrey Garten, Stanley Gartska, Dick Wittink, Peter Leeflang, Willem Buiters, and David Coleman for making these two visits possible. We are also grateful for the financial support we received from our respective faculties, the Department of Economics, University of Groningen (Brakman), the Nijmegen School of Management and NICE (Garretsen), and the Department of Economics of the Erasmus University and the Erasmus University Trust Fund (van Marrewijk).

A number of fellow researchers have been very helpful by commenting on (parts of) this book and by their willingness either to discuss the ideas for this book or to let us use part of their research. We are especially grateful to the following: Xavier Gabaix, Vernon Henderson, Yannis Ioannides, Peter Neary, Ron Martin, Paul Krugman (for pointing out the location of the \$100 bill!), and (closer to home) Thijs Knaap, Dirk Stelder, Jolanda Peeters, Marc Schramm, Albert de Vaal, Wilfred Slegers, Huib Ernste, Rien Wagenvoort, Richard Gigengack, Marianne van den Berg, and Jan Oosterhaven. In addition we would like to thank Stefan Schueller for excellent research assistance and students of international economics at Erasmus University for their comments on drafts of various chapters of this book. At Cambridge University Press, we would like to thank Ashwin Rattan for guidance and support during this project, the five referees whose comments helped to shape the book and Chris Doubleday who prevented us from making embarrassing mistakes. Finally, we are grateful to our respective families for continuous support and for agreeing to let us set up summer camps in New Haven and Cambridge. Without those two stays this book would not have been written.

*Website:* <http://luk.cambridge.org/economics/resources/>

## *Suggested course structure for An Introduction to Geographical Economics*

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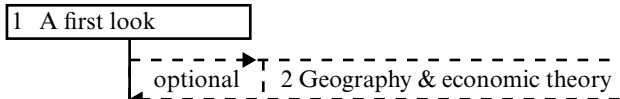
An introductory course in geographical economics will have to cover all the basics of the approach and at the same time motivate students by applying their newly developed apparatus. We therefore suggest the rather flexible four-part course structure for our book illustrated in the figure below. First, an introduction into geography, trade, and development based on chapter 1. Optionally, this part may include chapter 2 on earlier theoretical developments, of which Box 2.1 and section 2.3 are recommended. Second, the analysis of the core model of geographical economics based on chapters 3 and 4 (sections 4.8 and 4.9 may be skipped on first reading). Optionally, this part may include chapter 5 on empirical evidence, of which sections 5.5 and 5.6 are recommended. Third, applying the geographical economics model to various fields of research, based on a study of chapter 6 (extensions in general) and a selection of chapters 7 to 10 (cities, multinationals, international trade, and dynamics). Section 7.2 on congestion is recommended for a better understanding of chapters 9 and 11. Fourth, and finally, a concluding part based on chapter 11, which discusses the policy implications of geographical economics and gives a critical assessment of the approach.

**Suggested course structure for An Introduction to Geographical Economics**

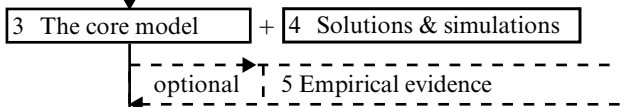
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Course structure for *An introduction to geographical economics*

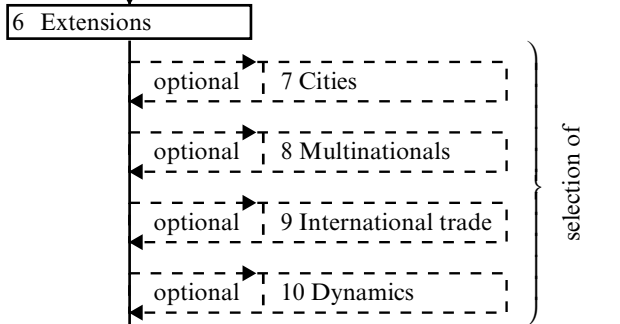
## I Introduction



## II Core



## III Applications



## IV Conclusions

