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Economic Analysis of Industrial Agglomeration

产业集聚的经济学分析（英文版）

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Preface

This book investigates the industrial agglomeration and dispersion within a country under trade liberalization and interregional integration by considering both economic forces and geographical elements. First, it provides a detailed explanation of Krugman's new economic geography (NEG) model and reviews the subsequent refinements of the original model from mainly geographical viewpoints. It points out that many existing models are isomorphic and their two-region assumptions seem unrealistic. Second, this book extends Krugman's original model to a two-country and three-region case where the domestic regions are fully asymmetrical in terms of their sizes and accessibilities to global markets. The simulation results show that when international trade liberalization continues but domestic regions remain poorly integrated, the gate region experiences a change from partial to full agglomeration. When the home country is closed to international trade, the decrease in domestic transport costs makes the hinterland more attractive for manufacturing. However, when it is open to global markets, more manufacturing is undertaken in the gate region during the regional integration. Third, to better explain the reality of developing countries, this book presents an analytical model which assumes that unskilled workers are employed in both traditional and manufacturing sectors. The analytical results show that when the international trade cost is very high, the space economy of home country has full agglomeration in its hinterland and then experiences a process of dispersion until an even industrial distribution exists between the gate and hinterland regions. When the home country is open enough to world markets, firms will first concentrate in the hinterland and then gradually move to the gate region until full agglomeration occurs during regional integration. With further regional economic integration, half of the firms will relocate to the hinterland again, with the other half remaining in the gate region.

Furthermore, the regional economy is assumed to have one manufacturing sector and each manufacturing firm has a unit fixed requirement of capital and a marginal input of labor. Even with constant elasticity substitution (CES) utility function, it can be demonstrated that spatial disparity in terms of wage presents an inverted U-shape respect to regional integration. Accordingly, this book empirically

investigates the home market effect (HME) in terms of wages in the case of China by using panel data for the period 1980–2012. It is found that the wages in coastal regions are higher than those in the interior, due to the size differences between regions. Additionally, regional inequality in wages between the coastal and interior regions evolves in an inverted U-shaped curve during periods of regional integration. The evolution of the space economy in China during the past three decades supports the inverted U-shaped pattern predicted by the theoretical models of spatial economics.

By incorporating the geographical elements into the original NEG model, this book explains the increasing industrial agglomeration in countries in the process of international trade liberalization and regional integration. Additionally, the analytical model provides a reasonable explanation for industrial dispersion. Furthermore, it is also successful in explaining that where the agglomeration arises, in addition to providing the rationales for the occurrence of industrial agglomeration. Based on these results, this book suggests that NEG models should incorporate the geographical elements to better explain the reality of developing countries. Moreover, the conclusion about industrial redispersion implies that further improvements of infrastructure between domestic regions represent a feasible way to alleviate the increasing trend of excessive industrial agglomeration.

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Chapter 1
Introduction

1.1 Background of the Book

The agglomeration of economic activities is a universal phenomenon. There are diverse spatial disparities and concentrations at different geographical scales. It is well known that the northern hemisphere dominates the south in terms of the economic development at the global level. Specifically, in the year 2000, the North American Free Trade Area (NAFTA) produced 35% of the world gross domestic product (GDP), the EU (15 countries) 25%, and East Asia 23%; moreover, this agglomeration of GDP in these three regions has increased in recent years. Regional economic disparity is also reflected in the diversity of regions and cities within a country. The core regions attract most of the population and industries from the periphery, like the Tokyo metropolitan area in Japan and the three metropolitan circles (Yangtze River delta, Pearl River delta, and area surrounding the Bohai Sea) in China. In many countries, there is a specific region that leads the nation in manufacturing activity, job creation, and drawing population from other regions. At a more micro scale, industrial districts as a typical case involving large volume of firms with linkages of information and production, such as the Silicon Valley and Wenzhou industrial clusters in China, demonstrate various types of local specialization. It is observed that peaks and troughs in the spatial distribution of population, wages, and manufacturing are striking features of the real world economy. To some extent, economic activities exist in time and space, and we cannot imagine that spatial element to be absent in the study of economics. Nevertheless, traditional mainstream economics has seldom been concerned with where firm production and household consumption occur. Studies charting the evolution of spatial disparities are always notably ignored, and the research on economic geography at best plays a marginal role in economic theory.

It was not until Paul Krugman's seminal paper "Increasing returns and economic geography" (1991), which used a general equilibrium framework, that microeconomic rationales concerning the occurrence of industrial agglomeration began to

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emerge. Krugman successfully obtained endogenous agglomeration to explain the economic structure of the core-periphery in a corresponding geographical space. Since then, there have been numerous refinements to this perspective related to investigating the mechanism of economic agglomeration and formation of the core-periphery structure. The main conclusions of these core-periphery models tell us that high transport costs lead to the dispersion of industry into two symmetrical regions and that industrial agglomeration occurs when transport costs are low (Krugman 1991; Ottaviano et al. 2002; Forslid and Ottaviano 2003). The emergence of these studies has accordingly created a new field of economics often referred to as new economic geography (NEG).

With regard to the attention to space in economics research, NEG is obviously not ahead of the game. As antecedents, urban economics and regional science traditionally dealt with the question of how economic activities organize use of space. In particular, urban economics has given valuable insights into land use within a city and the formation of an urban system. On the other hand, regional science offers valuable insights using more rigorous models (Fujita et al. 1999, p. 25). However, leaving aside other shortcomings, the core weakness of urban economics and regional science is that they deal with agglomeration as a black box where they assume that economies of agglomeration bring about economic agglomeration. Unlike its antecedents, therefore, NEG attempts to enter the black box of agglomeration economies and show the self-reinforcing character of spatial concentration using more fundamental considerations (Fujita et al. 1999, p. 4).

NEG is successful in explaining the riddle of spatial disparity and the cluster of economic activities in geographical space. The story of economic agglomeration is represented as the outcome of the interaction between centripetal forces that pull economic activities together and centrifugal forces that separate them. In addition, the mechanism of the model is explicitly derived based on a full microeconomic foundation. The modeling tricks of NEG succeed in synthesizing increasing returns, monopolistic competition, transport costs, and evolution dynamics in a reasonable way. Thus, NEG is also regarded as the fourth wave of the increasing-returns revolution in economics in the last decades.[1]

Admittedly, NEG models precisely investigate the nature of pecuniary externalities and help us to understand the origins of agglomeration forces. To some extent, NEG has reached a certain level of conceptual and theoretical maturity. However, despite its countless refinements and rapid progress following Krugman's seminal paper, NEG still has several deficiencies. First, it is imperative for us to step back and consider what is lacking in the original NEG model. As Behrens et al. (2006a) commented, NEG has allowed us to combine the old ingredients through a new recipe to increase the understanding of economic agglomeration. However, NEG models overemphasize the role of pure economic mechanism in explaining

[1]Since the end of the 1970s, the models of monopolistic competition have become tractable in the presence of increasing returns. It was initially proposed by Dixit and Stiglitz (1977). Then, this framework developed into the engine of theoretical models in various studies and applied in terms of industrial organization, new trade theory, and new growth theory (Fujita et al. 1999, p 3).

the formation of agglomeration and neglect the complexities and difference of natural endowment, such as geographical features in the real world. Although the models are simple and illuminating, they are unable to explain the rich and complex hierarchy that characterizes the space economy (Ottaviano and Thisse 2004). For analytical tractability, in terms of the spatial setup, only a hypothetical and simple two-region economy is assumed.

Second, as economic integration proceeds, the question arises of how the economic landscape will change over time after the core-periphery pattern. We have seen that extreme agglomeration in one region may give rise to various extra costs related to production and living that can trigger a process of industrial dispersion. However, it is fair to say that industrial dispersion still receives little attention. Similarly, there have been no definitive investigations combining geographic features and industrial dispersion to explain the actual industrial location patterns. It is worth noting that although NEG models tell us why agglomeration occurs, they are largely unconcerned with where the agglomeration arises. The early core-periphery model claimed that the decrease in transport costs leads to industrial agglomeration in one of the two regions. In other words, the two homogeneous regions seem to enjoy the same opportunity to become the center. This is obviously inconsistent with the real economic world.

We find that the springboard of NEG has focused entirely on the advanced economies, mainly that of the United States. NEG originally attempted to give a reasonable explanation for the uneven distribution of manufacturing. Today, however, most manufacturing growth takes place in emerging nations. Developing economies, particularly Brazil, Russia, India, China, and South Africa (the BRICS countries), bear the main task of manufacturing production for the world. Within these countries, the economic landscape is reshaped in the process of international trade liberalization and regional integration. Asymmetrical geographical features play an important role in shaping the space economy. Especially in developing countries, the geographic accessibilities and original regional size cannot be assumed to be symmetrical. Moreover, the internal space economy is simultaneously affected by domestic regional integration and globalization. The original two-region model of NEG does not distinguish these symmetrical geographical features.

1.2 Purposes of the Book

Despite the success of NEG theories, we find that some refining of the original NEG model needs to be done to make it closer to the real world. This book has multiple purposes geared toward settling the issues mentioned above. Its first purpose is to provide a detailed review of related literatures after Krugman's core-periphery model (1991) and demonstrate that the most of the existing NEG models are symmetrical in that regions or countries are assumed to have the same sizes and accessibilities to markets, which is not realistic and is unable to explain the real

spatial economy. Since several surveys already exist on the review of the development of NEG, this book focuses on the geographical viewpoints and shows that it is important for NEG to take into account the full asymmetry in terms of different regional sizes and accessibilities so that it can adapt its theories to more accurately reflect the real word.

The second purpose of this book is to investigate the impact of international trade liberalization and regional integration on the distribution of industrial activities within countries such as China. The related NEG literature simply emphasizes the economic forces reshaping the space economy, and these are always considered second nature (self-reinforcing economic forces). Evidently, the success of coastal regions in China relative to other regions is accounted for by the interaction of geographical advantage (first nature) and self-reinforcing economic forces (second nature). A similar phenomenon can be witnessed in the border regions of Mexico. The self-reinforcing forces have been extensively studied in recent NEG models. However, the combination of this kind of second nature and the first nature remains to be pursued. How the space economy evolves during regional integration and international liberalization will therefore be investigated here.

The third purpose of this book is to study industrial agglomeration and dispersion using an analytical model. From the early models of NEG, most of the literature relied heavily on the simulation method. The intractability of early studies prevented the spread of NEG and the elucidation of policy implications to some extent. This book will attempt to provide analytical results to explain the industrial dispersion. Moreover, to better explain the reality of developing countries, it is assumed that unskilled workers are employed in both the traditional and manufacturing sectors. In fact, we know from the work of Williamson (1965) and others that the spatial disparities undergo a process from increasing to decreasing. This means that as development proceeds, economic agglomeration spreads from core regions to peripheral ones. This raises the following questions: Is there a normal pattern whereby industrial redispersion occurs during the economic integration? When the regions are asymmetrical in terms of accessibility, what are the industrial location patterns? Do the center regions always dominate the whole economic system? This book takes some steps towards addressing these issues and attempts to give a reasonable explanation for such characteristics.

1.3 Organization of the Book

This book comprises six chapters. This chapter explains the background and purposes of this book. Chapter 2 gives a selective and related literature review of NEG models. It presents the standard seminal core-periphery model (Krugman 1991) more formally and introduces those extensions that step outside the canonical framework. This discussion is mainly concerned with spatial scale from a geographical viewpoint and divides previous works into symmetrical and asymmetrical cases based on how they deal with the accessibility to markets and region sizes.

Chapter 3 extends Krugman's original NEG model to account for a two-country, three-region case where the home country is fully asymmetrical in terms of its size and access to global markets. Under the full asymmetry consideration, the effects of regional integration and international liberalization on the space economy within a country are investigated.

Chapter 4 mainly develops an analytical model to explain industrial redispersion. Unskilled workers are assumed to be employed in both the traditional and manufacturing sectors. The analytical results could explain both why and where industrial agglomeration and dispersion arise.

Chapter 5 steps forward and analytically investigates the definition of home market effect. By employing one manufacturing sector and two production inputs, i.e. capital and labor, it can successfully be revealed that spatial disparity in terms of wage presents a bell-shape respect to regional integration. Moreover, using data from China, this book empirically studies the HME in terms of wages in the case of China using panel data for the period 1980–2012. During regional integration, regional inequality in wages between the coastal and interior regions seemed to evolve in an inverted U-shaped curve.

Chapter 6, the final chapter in this book, first summarizes the insights that have been illustrated in the various chapters and discusses implications relative to the NEG models. Finally, topics for further research are listed.

Chapter 2
Review of New Economic Geography

2.1 Introduction

Economic activities are always relevant to the two dimensions of time and space. While time is often integrated into economic theoretical considerations, the study of where economic activities take place is almost always ignored by mainstream economists. In fact, in the real world, spatial distributions of population and employment are never smooth. In addition to the uneven endowment of natural resources, economic forces called the second nature also play a dominant role in shaping economic geography. Though this subject was once regarded intractable, some exciting new models dealing with increasing returns and monopoly competition have emerged (Dixit and Stiglitz 1977). In the wave of increasing-returns revolution, the new trade and new growth theory are born successively. Based on them, Paul Krugman's seminal paper "Increasing returns and economic geography" (1991) endogenously reaped the mechanism of economic agglomeration and inaugurated the new era of spatial economics, which became known as New Economic Geography (NEG). Since then, a large amount of improved works under this framework have been developed to analyze the impacts of globalization and regional integration on the spatial economy.

It has been two decades since the birth of New Economical Geography. Its theoretical merits have encouraged mainstream economists to pay much more attention to the spatial dimension of the economy. NEG has been successful in offering rationales for the formation and existence of economic agglomeration or the cluster in geographical space. NEG provides an equilibrium framework to explain the market access forces pulling economic activities together and the market-crowding ones pushing them apart, resulting from the tradeoffs between increasing returns and mobility costs. Compared to its antecedents such as regional science and urban economics, NEG attempts to enter the black box of agglomeration economies and show the self-reinforcing character of spatial concentration from more fundamental considerations (Fujita et al. 1999, p. 4). Another merit of

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