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# Introduction to Spatial Spillovers: Viewpoints from Asia<sup>1</sup>

by

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# **Introduction to Spatial Spillovers: Viewpoints from Asia**

## **Abstract**

There are no book length treatments of spatial spillovers that provide theoretical and empirical analyses of this topic within different regions in the continent of Asia. As such, the primary objective of this book is to provide expansive studies of spatial spillovers and their salience by focusing on several regions in Asia. Following this introductory chapter, which comprises Part I of the book, there are eleven chapters and each of these chapters discusses a particular research question or questions about spatial spillovers in Asia. For ease of comprehension, we have divided the present volume containing twelve chapters into four parts. Part II of this book focuses on theoretical approaches to studying spatial spillovers and this part consists of three chapters. Part III concentrates on agriculture and the environment and this part of the book consists of two chapters. Finally, part IV provides a variety of regional perspectives on spatial spillovers in Asia.

**Keywords:** Asia, Economic Development, Economic Growth, Region, Spatial Spillover

**JEL Codes:** Q10, R11, R50

## 1.1. Preliminaries

Our world is not a collection of isolated spatial units. Decisions, events, and activities in one point in space can have cascading effects on other points. This phenomenon, in general, is known as a spatial spillover and such spillovers play a crucial role in shaping the growth, development, and environmental health of regions. Therefore, comprehending these spillovers is essential for effective policymaking and fostering balanced regional prosperity (Ramajo *et al.* 2008).

We can also say that spatial spillovers are a particular type of spatial *interaction* effect. Beginning with the seminal work of Harris and Ullman (1945) on the conceptualization and principles of spatial interactions, a substantial body of literature has been published on this topic (see Wilson 1970; Nijkamp and Reggiani 1992; Fotheringham 2001). In contrast to the multi-directional nature of spatial interactions caused by spatial dependence and impedance factors in an interlinked spatial-economic system, spatial spillover effects, whether positive or negative, represent ripple effects originating from a given source in space (e.g. a geo-political conflict, an environmental disaster, a pandemic) and affecting areas elsewhere. Therefore, such effects may spread to other urban areas, regions, or countries (see Su *et al.* 2021). The analysis of spillover effects has become a topic of intense interest in several social science disciplines, such as sociology (spread of ideas among people), transportation and trade theory (logistic distribution of goods), political science (dissemination of radically new policy perspectives), innovation science (distribution of new products or services), economics (system-wide effects of shocks like a banking crisis), and so forth. Such effects have also been studied in the context of gravity-type models or spatial econometric models (see Elhorst *et al.* 2021). The study of

spillovers has meanwhile gained a prominent position in both geography and regional science.

At their core, spatial spillovers are *externalities*, i.e., consequences that are the outcomes of one or more actions experienced by parties that are not directly involved in the action or actions (Batabyal 2023). These externalities can be positive or negative in nature. For instance, the establishment of a high-tech company in a region can create a positive spillover by attracting skilled workers, boosting local businesses, and fostering innovation in surrounding regions. This is often referred to as a knowledge spillover (Doring and Schnellbach 2008). However, a polluting factory might generate negative spillovers in the form of air and water pollution, impacting the health and well-being of residents in nearby communities (Li and Guo 2021).

Spillovers can occur through various channels. Labor mobility plays a significant role (Mohamedou 2022). Workers with new skills acquired at a high-tech company may be more likely to find jobs in neighboring areas, thereby spreading knowledge and expertise. Trade and investment linkages create another channel (Zhao 2021). When a successful company thrives in one region, it is likely to increase the demand for goods and services from surrounding regions, thereby stimulating their economies. Similarly, infrastructure networks also facilitate spillovers (Yilmaz *et al.* 2002). The development of a new transportation hub in one location can improve accessibility for businesses in nearby regions, enhancing their connectivity to markets and resources.

The spatial extent of these spillovers can vary. Local spillovers are restricted to immediate neighboring areas. A bustling city center might attract more customers to nearby shops and restaurants. On the other hand, global spillovers transcend geographical boundaries. A pandemic outbreak in one country can have severe economic repercussions worldwide due to

disrupted supply chains and travel restrictions (Magableh 2021).

Spatial spillovers pose unique challenges for policy makers (Capello 2009). Since the benefits or burdens of an activity can extend beyond the location where it takes place, traditional, localized policies are likely to be *insufficient*. For instance, a city investing in education might see its skilled workforce benefit neighboring regions with higher-paying jobs. To address this issue, policy makers may consider regional cooperation initiatives. In this regard, joint infrastructure projects, coordinated economic development strategies, and knowledge-sharing programs can harness positive spillovers for the collective benefit of a broader region.

Spatial spillovers can also have unintended consequences (Francetic *et al.* 2022). Uncontrolled positive spillovers, such as rapid gentrification around a booming city center, can displace residents and exacerbate social inequalities. Negative spillovers, like pollution from an industrial zone, can disproportionately impact disadvantaged communities. Policy makers need to consider the potential *spatial* distribution of impacts when designing interventions. Targeted incentives for businesses to locate in designated areas, regulations to mitigate negative externalities, and investments in social infrastructure can help ensure that economic growth benefits a wider section of the population.

In sum, spatial spillovers are a fundamental concept in understanding *regional* dynamics. Even so, our central claim here is that there are *no* book length treatments of spatial spillovers that provide theoretical and empirical analyses of this topic within different regions<sup>5</sup> in the continent of Asia. As such, the primary objective of this book is to provide expansive studies of spatial spillovers and their salience by focusing on several regions in Asia.

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We are using the word “region” expansively to refer to geographical entities that are either smaller than a nation or identical to a nation.

At this point, some commentary is needed to justify our focus on Asia. To this end, let us begin with some historical observations. Several observers such as Mahbubani (2008) and Batabyal and Nijkamp (2017) have contended that in the last two centuries, as the West (North America and Western Europe) was holding sway on the world stage, Asian nations were mainly bystanders, reacting to progressive surges of Western commerce, thought, and power. However, there is now an ongoing shift in the global center of gravity. Specifically, and as noted by Cox (2012), geopolitical and economic power are steadily moving away from the West to Asia. As a result, Asia is returning, according to Mahbubani (2008), to the global center stage it occupied for eighteen centuries before the rise of the West.

This situation has led to a significant amount of handwringing and soul-searching in the West (Allison 2017; Rachman 2017). Specifically, the rise of Asia has led to some rebalancing in America's foreign policy and specifically to President Obama's pivot to Asia, then to President Trump's trade war with China, and now, most recently, to President Biden's diplomatic and military partnership with Japan and the Philippines.<sup>6</sup> The geopolitical and economic rise of Asia raises important questions about the role that spatial spillovers play in influencing economic development in this vast continent. In addition, given the contemporary significance of Asia, Sen (2001) has rightly noted that lessons learned about regional economic growth and development in Asia are likely to prove useful for the design and implementation of apposite policies in other parts of the world.

Following this introductory chapter, which comprises Part I of the book, there are eleven chapters and each of these chapters—written by an expert or by a team of experts—discusses,

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See Batabyal (2019), Shambaugh (2013), and Shear (2024) for additional details on this point.

either explicitly or implicitly, a particular research question or questions about spatial spillovers in Asia. For ease of comprehension, we have divided the present volume containing twelve chapters into four parts. Part II of this book focuses on theoretical approaches to studying spatial spillovers and this part consists of three chapters. Chapter 2 provides a detailed discussion of consumption spillovers, pollution cleanup in the Ganges river, and welfare in the cities of Kanpur and Varanasi in India. Chapter 3 sheds light on dynamic games of regional monopolies when there are spillovers and delays to contend with. Chapter 4 uses a two-region, overlapping generations model to discuss the nature of transboundary pollution, population migration, and fertility.

Part III concentrates on agriculture and the environment and this part of the book consists of two chapters. Chapter 5 first provides evidence to document the existence of gender differences in the agricultural sector of Asian nations and then discusses how women's participation in the agricultural workforce might be enhanced. Chapter 6 focuses on environmental regulations in Asia and demonstrates how to better comprehend the spatial spillovers stemming from the enforcement of myriad environmental regulations.

Part IV provides a variety of regional perspectives on spatial spillovers in Asia. Chapter 7 studies what it calls "growth spillovers" and shows how such spillovers shape regional economic development in India. Chapter 8 first classifies different cities in India into different categories and then connects the growth of Indian cities with spatially varying service sector performance. Chapter 9 investigates whether the concept of financial inclusion in various Indian states has spatial determinants. Chapter 10 looks at recreational mobility, spatial spillovers stemming from tourism, and how these spillovers impact livability in a number of urban centers in China.



Chapter 11 studies the nexuses between the trinity of environmental regulations, the efficiency of land use, and the concept of industrial structure upgrading in China. The final chapter 12 concentrates on the capital city of South Korea, i.e., Seoul, and then examines how the spatial accessibility of road and urban railway networks influences housing prices.

With this preliminary discussion out of the way, we now proceed to briefly comment on the intellectual contributions of the individual chapters in this book.

## **1.2. Theoretical Approaches**

### ***1.2.1. Water pollution cleanup in the Ganges river***

What are the connections between *consumption spillovers* and water pollution cleanup in the Ganges river in India? This is the central question that is addressed in chapter 2. As this chapter explains, these spillovers arise in two cities, namely, Kanpur and Varanasi, and the object of inquiry here is the aggregate economy composed of these two cities.

The water pollution that is cleaned up in each of these two cities is conceptualized as a local public good and it is understood that a local public good---see Dur and Staal (2008)---is a public good that is provided in a particular geographic location. In addition, the so-called representative citizen in Kanpur and Varanasi faces a tradeoff between the consumption of a private good and clean river water. The fact that the spillovers stem from consumption means that the utility function of the representative citizen in Kanpur (Varanasi) depends in part on the amount of water pollution cleaned up in Varanasi (Kanpur).

The microeconomic analysis conducted in this chapter yields five interesting results. First, this chapter computes the optimal amount of polluted water that is cleaned up in Kanpur and Varanasi. Second, the analysis demonstrates that the total amount of polluted water cleaned

up depends *only* on the sum of the incomes of the two representative citizens in the two cities and *not* on any other aspects of the problem being studied.

Third, this chapter compares the amount of water pollution cleaned up in the case of the two representative citizens with the amount cleaned up by a so-called social planner. Fourth, suppose the incomes of the two representative citizens in Kanpur and Varanasi can be linked functionally. In this scenario, chapter 2 calculates income ranges within which the amounts of polluted water that are cleaned up are always positive. Finally, for the two cities being studied in this chapter, the analysis shows that the social welfare from water pollution cleanup in the aggregate economy depends on the income of the representative citizen in Varanasi.

While chapter 2 rightly concentrates on explicating the nature of the consumption spillovers in river water pollution control, the analysis in this chapter is *static*. Therefore, the analysis here is unable to shed light on how spatial spillovers matter in a dynamic environment. This question of dynamics comprises the core of the issues that are analyzed in chapter 3.

### ***1.2.2. Regional monopolies with spillovers***

The motivation for the analysis conducted in chapter 3 is provided by the observation that in many nations, because of economies of scale and high startup costs, industries that are responsible for the provision of electricity, natural gas, and telecommunications, are monopolized. Further, in nations like Japan, these monopolized industries have been broken up into regional monopolies. For instance, with respect to electricity provision, Japan is divided into nine regions and a single firm is responsible for the provision of electricity in each of these nine regions.

Even though these firms are regional monopolies, there is some inter-regional

competition between them. As such, these firms do engage in some amount of research and development (R&D). The outcome of this R&D gives rise to spillovers and these spillovers, in principle, can be either positive or negative. This chapter studies an economic environment in which the regional monopolies in the same industry such as electricity experience increases in costs as a result of negative spillovers and production delays.

The sophisticated mathematical analysis conducted in this chapter shows that because some model features are playing out in discrete time while others are playing out in continuous time, the model analyzed displays rich dynamics. In addition, we learn that because each regional monopoly requires time to produce output and to obtain information about the spillovers, there can arise cyclic oscillations via what is called a Hopf bifurcation.<sup>7</sup> An interesting feature of the economic environment analyzed in this chapter is that the production delays give rise to a *destabilizing* effect but, in contrast, the information delays give rise to a *stabilizing* effect. Therefore, the stability of the model consisting of two regional monopolies depends on the relative magnitudes of these two impacts with opposite signs.

How do dynamics influence human populations when economic activity gives rise to impacts such as pollution that spills over from one region to another? The effects of this kind of transboundary pollution are analyzed in chapter 4.

### ***1.2.3. Economic activity and transboundary pollution***

The question of pollution that spills over the boundary of one region into another or transboundary pollution has been the subject of sustained research activity in economics and regional science in the last three decades.<sup>8</sup> Even so, there are very few analyses of transboundary

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See Hassard *et al.* (1981) for additional details on the Hopf bifurcation.

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pollution in a two-regions, overlapping generations model, in which the environment affects and is affected by economic activity.

Chapter 4 addresses this lacuna in the literature by analyzing a model in which individuals live for three time periods delineating childhood, adulthood, and retirement. They select the region,  $r$  or  $u$ , in which they would like to live in the beginning of adulthood, and they are immobile between the two regions after retirement. There is a stock of the environment, and the different production technologies are capital-intensive in region  $u$  and labor-intensive in region  $r$ . In addition, capital-intensive production in region  $u$  uses both labor and capital whereas labor-intensive production in region  $r$  uses only labor.

A central question that is addressed in this chapter is the following: How does transboundary pollution that is caused by production in one region affect the distribution of individuals in the two regions under study? The analysis demonstrates that when the ratio of pollution emitted in region  $u$  to region  $r$  increases, the damage caused by pollution emitted from production in region  $u$  decreases. In this circumstance, the equilibrium level of utility of individuals in region  $u$  can exceed the corresponding utility level in region  $r$ . In addition, there are cases where the transboundary pollution rate has *no* impact on the interregional distribution of individuals.

Finally, an increase in transboundary pollution can lead to the *concentration* of the total population in the region from where pollution originates. Related to this, an increase in the transboundary pollution rate can lead to a *decrease* in the total fertility rate of individuals in the model under study.

With this discussion of the three chapters about theoretical approaches that comprise Part

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See the various chapters in Batabyal and Beladi (2001) and La Torre *et al.* (2021) for a more detailed corroboration of this claim.

II of this book out of the way, we now turn to the two chapters on agriculture and the environment that make up Part III of this book.

### **1.3. Agriculture and the Environment**

#### ***1.3.1. Agricultural sector and women's work***

We now know that there exist substantial *gender* differences in the agricultural sector of many nations in Asia. Given this saturnine state of affairs, chapter 5 examines the evidence on these gender differences, paying particular attention to gendered labor access and to opportunities across Asia's developing nations in "three domains."

In the first domain, i.e., the gender-based division of labor in the market sphere, there is considerable occupational segregation by gender, with women getting paid less and holding jobs that have lower social status. A gender-based division of unpaid work marks the second domain in which women spend more time than men on these unpaid tasks that are also less visible and less valued. The third domain is the division of labor across paid and unpaid work in which men are disproportionately present in the market sphere, carrying out wage labor or being self-employed, and women are present largely in unpaid work activities.

The analysis in this chapter shows that existing gender gaps in agricultural productivity tend to have spillover effects at both the microeconomic and the macroeconomic levels. At the microeconomic level, the spillovers relate frequently to the nexuses between gender gaps, farm productivity, and the education of neighbors. At the macroeconomic level, we see a connection between gender gaps, a nation's poverty level, and this nation's per capital gross domestic product (GDP).

This chapter concludes with a number of useful lessons for policy makers that are based

on the empirical analysis that is undertaken. For instance, we learn about the salience of reallocating women's labor time away from unpaid work and the many benefits from providing opportunities to women to improve their skills. A key point made here concerns the need to improve women's access to *credit*. The rationale for this point is based on two observations. First, women tend to remain isolated from all manner of networks and therefore they tend to have limited access to credit markets. Second, because women tend to have lower levels of education and skills, formal lending institutions often tend to view women as risky clients who may, in addition, not be "bankable." In this regard, it is worth emphasizing a positive spillover emanating from India's rural banking reform. Even though this reform is not directed at women *per se*, this reform has succeeded in releasing women from funding constraints.

### ***1.3.2. Spillovers from environmental regulations***

From women's work in the agricultural sector of Asian nations, in chapter 6, we move to an investigative review of the literature on the spatial spillovers caused by environmental regulations in Asia. This chapter begins by pointing out that even though environmental regulations in many Asian nations have been studied for quite some time, these studies have tended to focus on the direct and the local impacts of these regulations, thereby overlooking *spillover* effects, despite their theoretical and practical significance.

After discussing alternate theoretical frameworks that have been used to study the impacts of environmental regulations, this chapter concentrates on what is often called the "pollution haven hypothesis."<sup>9</sup> The chapter points out that although this hypothesis provides a rationale for the existence of spatial spillovers, we need to comprehend that the effects generated

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See Bashir (2022) for an exhaustive literature review of the pollution haven hypothesis.

by this hypothesis are often attenuated by the existence of two opposite forces that this chapter calls the “home market effect” and the “pollution halo effect.”

What does the available empirical evidence tell us about the existence of spatial spillovers from environmental regulations? The discussion of this question in this chapter provides a number of interesting findings. Here are three examples. First, we learn that when analyzing an open economy, environmental regulations can give rise to international R&D spillovers, particularly for developing countries. Second, many studies demonstrate that there can be a change in the direction of spatial spillovers around a *threshold* and this finding is consistent with the environmental Kuznets curve hypothesis.<sup>10</sup> Finally, we discover that the strength and the sign of spatial spillovers generated by environmental regulations can be affected by which regulatory variables one chooses to include in one’s analysis.

This completes our discussion of the two chapters that comprise Part III of this book. We now shift gears and proceed to Part IV of the book. This part provides alternate perspectives on spatial spillovers from different regions within Asia.

## **1.4. Regional Perspectives**

### ***1.4.1. Growth spillovers in India***

There is no gainsaying the fact that in the last three decades, the Indian economy has grown and is continuing to grow at a relatively rapid rate.<sup>11</sup> This rapid economic growth has given rise to a number of spillovers in various regions or states within India. The central point of chapter 7 is that these growth spillovers have played a non-trivial role in shaping regional or state level economic development in India. As such, this chapter first examines the process that

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See Dinda (2004) for an informative review of the literature about this hypothesis.

<sup>11</sup>

leads to the generation of regional growth spillovers and then it analyzes the nexuses between this economic growth and *inequality* within the different regions.

This chapter utilizes data from the Economic and Political Weekly Foundation, the Census of India, and the Reserve Bank of India, and conducts econometric analysis where the dependent variable is the per capita income in a region and this variable is assumed to be functionally related to the region's market potential and to economic inequality measured with the Gini coefficient.

The empirical analysis in chapter 7 demonstrates that beyond a *threshold* level of inequality, regional economic growth is compromised because the rising inequality leads to negative market potential and higher transaction costs that play out as reduced communication flows between the different regions.

On a more practical level, increasing digitization, rising highway construction, and growing urbanization have collectively played a great role in creating what this chapter calls “industrial production complexes” in India. In turn, this has generated important spatial externalities across the different regions. Interestingly, some of the econometric analysis in this chapter shows that in certain ways, India is benefiting more from the phenomenon of agglomeration and spatial spillover processes than from the utilization of the more traditional factors of production such as capital and labor.

Some of these themes are analyzed further in chapter 8 but the focus in this chapter is on Indian cities and *not* on Indian regions or states.

#### ***1.4.2. City growth and spillovers in India***

Chapter 8 utilizes a new, Indian company level dataset, to classify and map the financial

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See Anonymous (2022) and Travelli (2024) for a more detailed corroboration of this claim.



performance indicators of key urban service sectors at the city level. An objective of this exercise is to comprehend the growing number of service clusters in different Indian cities. A related objective is to aggregate key urban service sectors to better comprehend every sector's financial performance at the city level and to discuss how spatial performance differences are driving the growth of Indian cities.

Based on a “micro-level examination,” this chapter identifies Mumbai, Delhi, and Bangalore as the key cities with regard to financial, hardware, and software agglomerations in India. It then classifies each city's activity as a fraction of Mumbai's, and this classification leads to a further categorization of cities into alpha, beta, and gamma cities. So, for instance, for a city to be classified as an alpha city, this city would have to have service sectors that are 80 percent or higher than the service sector headquarters operations in Mumbai.

An examination of sector-based city activity using the metric of “number of firms” shows that Mumbai is India's commercial capital, commanding 38 percent of the operations of banking firms throughout India. Building on its historical status as a port-city since colonial times, Mumbai has the highest number of service companies and hence is an alpha city even though Delhi is catching up to Mumbai in certain respects. When the metric under consideration is changed to “total assets,” once again, Mumbai turns out to be dominant as an alpha city.

Since cities can be thought of as agglomerations of activities, if, for instance, one comprehends urban services' agglomerations, then one can shed light on the implied spillover effects that support economic activities across India. More specifically, knowledge spillovers benefit not only firms that are operating within a metropolitan cluster but also those that are clustered in geographically contiguous or close cities. Finally, we learn that agglomerating firms,

depending on their size, can face negative externalities when they experience difficulties in sustaining their activities because of competition from larger firms.

From this discussion of city growth and agglomerations, we move next to spatial spillovers stemming from financial inclusion in Indian states in chapter 9.

### ***1.4.3. Spatial elements of financial inclusion in India***

Financial inclusion for the poor in India is a critical component of the country's economic development strategy (Kapoor 2014). With a large population living in rural areas and in informal economies, ensuring access to basic financial services like savings accounts, credit facilities, and insurance is of paramount importance. Initiatives like the *Pradhan Mantri Jan Dhan Yojana* (PMJDY)<sup>12</sup> have significantly boosted financial inclusion by encouraging the unbanked to open bank accounts and by providing them with debit cards and access to affordable insurance and pension schemes. Moreover, technology-driven innovations such as mobile banking and digital payment platforms have further facilitated financial access for underserved communities, bridging the gap between rural and urban financial landscapes.

Chapter 9 asks whether the various national efforts to increase financial inclusion in India have effectively reached this nation's states. A related question focuses on the equity implications of these efforts. To answer these two questions, this chapter utilizes a panel of 26 states and two union territories for the 2003-2016 time period. After constructing an index of financial inclusion (IFI) for every state, this chapter analyzes the spatial interactions between the IFI, the dependent variable, and a number of explanatory variables whose inclusion in the different spatial models is guided by data constraints and findings in the extant literature.

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See Singh *et al.* (2021) for additional details about this initiative.

We learn that when focusing on a particular Indian state, if income levels in neighboring states are higher then this may lead to a spillover effect in which there is outmigration of both individuals and financial resources from this state. Second and relative to the state under consideration, when individuals are employed in neighboring states, there is an inward spillover involving the repatriation of income. Finally, the better the road connections between the state under study and neighboring states, the greater is financial inclusion in this state.

After three chapters of discussion about spatial spillovers in India, we move next to a consideration of tourism related spillovers in China in chapter 10.

#### ***1.4.4. Tourism spillovers in China***

The growth of urban tourism in China has triggered significant spillover effects across various sectors (Wang 2004). As more and more visitors flock to cities like Beijing, Shanghai, and Guangzhou, there is a noticeable boost in the demand for hospitality services, including hotels, restaurants, and transportation. This influx also drives investments in infrastructure and public amenities to accommodate the rising numbers of tourists. Beyond tourism-specific sectors, urban areas benefit from increased economic activity through higher retail sales and expanded cultural offerings, stimulating local businesses and creative industries. However, this surge in tourism also brings challenges like environmental strain and gentrification (Ryan and Gu 2012).

Chapter 10 utilizes data from 235 Chinese prefecture level cities to analyze how the competition between tourists and urban residents for recreational resources influences the interaction between urban livability and tourism in China. One key variable in the empirical analysis, the level of tourism development, is measured by focusing on domestic tourism

arrivals, inbound tourism arrivals, the income of inbound tourists, and the income of domestic tourists. The second key variable, urban livability, is measured by using an appositely defined index which is itself composed of six dimensions and 18 indicators.

The empirical analysis conducted in this chapter demonstrates how different aspects of recreational mobility affect what is referred to as the “degree of coupling coordination” between tourism development and urban livability. Specifically, we learn that if we are to increase the positive spillovers between urban tourism and urban livability then policy makers will need to increase the supply of recreation resources and enhance internal mobility so that the costs that individuals pay to access recreational resources are *diminished*. The chapter concludes by pointing out that it would be useful to ascertain whether there is a *threshold effect* in the way in which the demand for recreational mobility influences the interaction between tourism spillovers and urban livability in China.

One kind of threshold effect, in the context of environmental regulations in China, is the subject of chapter 11.

#### ***1.4.5. Environmental regulations and industrial structure upgrading in China***

Environmental regulations in China have undergone significant strengthening in recent years, reflecting the government’s commitment to mitigating environmental degradation (Song *et al.* 2022). These regulations aim to curb pollution and promote sustainable development by imposing stricter standards on industrial emissions, waste management, and resource utilization. Concurrently, efforts to enhance land use efficiency have been prioritized, aiming to optimize the allocation of limited land resources while minimizing environmental impacts. China’s industrial sector has also been undergoing a transformative phase, marked by the upgrading of

industrial structures to adopt cleaner technologies and improve energy efficiency.

Chapter 11 addresses the trinity of environmental regulations, land use efficiency, and industrial structure upgrading by conducting econometric analysis utilizing panel data from 128 prefecture level cities in the Yangtze River Economic Belt from 2000 to 2020. A spatial Durbin model is estimated to determine how environmental regulations affect the upgrading of industrial structures through their influence on land use efficiency.

This chapter uses the term “industrial structure rationality” or RIS to study the effects of environmental regulations. A key result here is that relative to upstream and even midstream regions, downstream regions experience *higher* levels of rationalization which is a positive outcome. This is fundamentally because upstream regions are characterized by the presence of backward industrial facilities, unchanged transportation, and sparse populations. We also learn that environmental regulations give rise to positive spatial spillover effects in surrounding regions. Finally, this chapter shows that when local environmental regulations become more stringent, they raise production costs, thereby leading polluting industries to relocate to provinces with less stringent policies. As a result of this spillover effect, a “pollution avoidance zone” is created and, at the same time, industrial structure rationality in neighboring provinces declines.

The final chapter 12 in this book focuses on spatial issues and their influence on the price of housing in Seoul, the capital of South Korea.

#### ***1.4.6. Spatial accessibility and housing prices in Seoul***

Road and urban railway connections in general play a pivotal role in shaping housing prices in Seoul, South Korea (Shin *et al.* 2007). The city’s intricate network of highways and

efficient subway system profoundly influences the desirability of residential areas. Proximity to major roads and subway lines not only enhances accessibility but also significantly reduces commuting times, making such locations highly sought after by homebuyers. Areas well connected to these transportation arteries often command premium prices due to the convenience they offer in navigating the bustling metropolis. Moreover, seamless access to transportation hubs increases the appeal of neighborhoods, attracting businesses and amenities, further driving up property values.

Chapter 12 addresses a particular aspect of this transport-housing prices nexus by analyzing the relationship between Seoul housing prices and the accessibility to three major *employment* centers, namely, the central business district (CBD), the Gangnam business district (GBD), and the Yoido business district (YBD). To this end, the chapter estimates a housing price function in which the explanatory variables include a number of accessibility indicators that are measured by the “residence to work” travel times keeping in mind the available road and railway networks.

Interestingly, the empirical analysis in this chapter shows that close distance to either the CBD or the YBD gives rise to a housing price *discount* but proximity to the GBD carries with it a price *premium*. Second, railway accessibility is a significant factor in determining the prices of small and medium-sized homes but not the prices of large homes. In contrast, for large homes, road accessibility is a more salient determinant of price. Finally, focusing specifically on spillover effects, this chapter demonstrates that the housing price disparities between and within the five regions of Seoul that we observe can be lessened greatly by developing and improving the urban railway.

## 1.5. Conclusions

Issues concerning the subject of spatial spillovers are of central concern to regions located in many different parts of Asia. After many millennia of unbalanced growth and development, comprehending the nature and the properties of spatial spillovers will give policy makers the opportunity to implement policies that accelerate regional economic growth and development. As pointed out in section 1.1, the geopolitical and economic rise of Asia give rise to significant questions about how spatial spillovers affect the nature and the intertemporal attributes of economic growth and development in this part of the world. In addition, given the contemporary significance of Asia, lessons learned about how spatial spillovers influence regional economic growth and development in Asia are likely to prove useful for the design and implementation of growth and development enhancing policies in other parts of the world.

Given this state of affairs, an objective of ours in this book is to demonstrate how regional economic growth and development in different regions within Asia can be promoted by comprehending the positive and negative impacts that spatial spillovers typically give rise to. We believe that this objective has been accomplished by virtue of the analytic accounts provided about a variety of research questions written by experts. These experts have great credibility because of two basic reasons. First, they are active researchers themselves. Second, they are also some of the leading contemporary voices on public policy concerning the impacts that spatial spillovers have on regional growth and development in Asia.

In this introductory chapter, we have attempted to provide a holistic and coherent context within which one may view the emergence and the study of the different research questions that are dealt with here. In addition, a perusal of the individual chapters plainly demonstrates the

significance and the policy relevance of the research questions that are analytically studied in this book. Therefore, in the coming years, one may look forward to many stimulating and policy relevant developments concerning the nexuses between spatial spillovers and regional economic growth and development in Asia that are directly or indirectly related to the topics studied in this book.



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