1. Introduction*

Kakuya Matsushima and William P. Anderson

The increasing role of knowledge as the key differentiator between dynamic and stagnant regions, the dematerialization of economic output and the transformational role of communications technology are now well-established trends that regional economic analysts have been addressing for decades. Early, rather simplistic assessments predicted that as the movement of goods and people became less desirable and necessary, transportation costs would become irrelevant, the role of cities would decline, telecommuting would replace the morning drive and most economic activities would become footloose. Things did not turn out that way. Ever more of the world's economic activities crowded into a few, very large cities, globally continued growing (at least up to the Great Recession) and nearly all forms of transportation congestion got worse. Thoughtful analysis anticipated and explained much of this, for example noting that face-to-face communication is still critical (Kobayashi et al., 1998) and that transportation and communications services may be complements rather than substitutes (Mokhtarian, 1990).

Now that we are well into the 21st century, regional scientists, spatial economists, geographers, civil engineers and others are exploring the emerging interconnections that drive spatial patterns. While there is no universally accepted theory of the knowledge- and communications-driven space-economy, there is much new insight arising from historical analysis, theoretical development, empirical studies and normative modelling. This volume presents an interesting cross-section of new insight into the complementary roles of transportation and knowledge and their spatial manifestations in modern urban and regional economies.

The collection of 16 original research chapters by international scholars is organized into four major themes. The first is *transportation infrastructure and economic growth*, addressing the historical and contemporary economic impacts of rail, highway and transit infrastructure. The second theme, *models for transportation planning and policy*, includes methods for optimal toll setting and the effect of transport costs on interregional trade. The third theme, which is *the spatial structure of cities*, examines processes

that drive and arise from urban form, including personal interaction, shopping, commuting and residential location. The fourth theme is *transformations in the knowledge economy*, including growing income inequality and the role of knowledge in urban dynamics.

Part I, 'Transportation Infrastructure and Economic Growth', begins with Chapter 2 in which Hans Westlund addresses the fundamental question of how transportation infrastructure directs and accelerates economic development from a historical perspective. Looking at spatial industrial development in Sweden and Norway of a century and a half, he addresses the perennial question of whether railroad expansion pushed the process or was pulled by it. Among other things, his analysis pointed to the importance of the state, as in the case of Sweden, using the railroad's development as a tool of regional policy.

Economic impacts during the construction stage are one of the main selling points for transport infrastructure projects. Anderson, Maoh and Burke report on their assessment of employment generation over a four-year construction period by a major highway project in Canada (Chapter 3). They find that while substantial, employment generation is less than promised and argue that the real economic benefit of a major infrastructure upgrade is to be found in its effect on the regional and national economies after it goes into service.

Perhaps one reason that these broader economic impacts are neglected relative to the short-term stimulus effects is that they present a much greater analytical challenge. This is richly illustrated by Gautam Ray, who in Chapter 4 provides a general equilibrium theoretical framework for assessing the contribution of transportation networks to the growth of an economy.

Understanding is one thing, measuring is something else. But in order to support policy decisions information is needed on how, where and how much infrastructure improvements yield the greatest results. In Chapter 5, Chen and Haynes use a variety of data from the US Northeast Megaregion in both partial and general equilibrium assessments. Overall, they find that investments in all modes of infrastructure, but especially highway infrastructure, stimulate and facilitate regional economic growth. While the nature and intensity of these growth effects evolve over time, they remain important even in mature systems.

Part II, 'Models for Transportation Planning and Policy', starts with Chapter 6 by Segi and Kobayashi, which provides guidance for a growing policy problem. The problem is crumbling road infrastructure, and the option is toll pricing. Economists have advocated road pricing for decades, but in most countries, it applies to a tiny proportion of total highway travel. As technology is making it cheaper and less intrusive to implement, and

as governments continuously fail to address infrastructure maintenance through conventional funding, rigorous assessment of pricing schemes is now imperative. Chapter 6 provides several innovations, including discriminatory pricing for trucks and cars because of their different impact on road conditions and the different ability of subsets of the road network to absorb those impacts.

While the focus of globalization studies is on international trade, increasing specialization and differentiation in the knowledge economy may give rise to intensified interregional trade, which relies on domestic transportation infrastructure systems. Chapters 7 and 8 address interregional trade in Japan via two very different types of modelling framework. First, Sato and Koike address the challenge of estimating Armington elasticities, which measure the substitutability of the goods from different countries or regions in computable general equilibrium (CGE) models, as they apply to trade among Japanese regions. In contrast to the aggregate approach of CGE modelling, Konishi, Mun, Nishiyama and Sung adopt a micro approach by precisely specifying the transportation cost structure of transportation services, which are conceived as a bundle of multiple characteristics rather than as a homogeneous good. Micro-data is used to calibrate the model which reveals economies of scale in lot size and economies of haul length.

In Chapter 9, Wan and Zhang round out Part II with an approach to modelling optimal airport charges. Because runways are very lumpy infrastructure investments they may be expected to be underutilized at the beginning of their lifetimes but subject to significant congestion as they mature and demand expands. Rather than propose a single best price, they identify a pricing scheme that increases over the runway's lifetime, encouraging demand at the early stage while dampening it in the mature, higher demand stage. This simple observation and model highlight the challenge of making long-term infrastructure investments in a rapidly changing environment.

Part III, 'Studies on the Spatial Structure of Cities', presents an eclectic collection of studies that look at a variety of factors that affect the distribution and spatial interaction of people and firms within urban regions. The first of these factors is face-to-face communication, which has been studied by regional scientists in the context of physical distance and by sociologists in the context of social distance. In Chapter 10, Otazawa and Ohira attempt to bridge that gap by modelling individual choices of where to live and how intensely to interact face-to-face with others in a hypothetical, monocentric city where both transportation and socialization costs are at play. Some of their results are surprising and thought-provoking.

In Chapter 11, Matsushima and Kobayashi address the prominent problem of residential sorting in the evolution of urban land use and

transportation planning. While simple models of transportation mode choice assume that people choose locations and then choose modes based on their accessibility to that location, sorting implies that people with prior preference for a particular mode self-select by choosing locations that are amenable to that mode. Their chapter has both theoretical and empirical elements and makes the important policy prescription that 'soft' policies aimed at altering people's mode preferences may be necessary to achieve goals such as high transit share.

Looking at urban retail, Kobayashi and Onishi identify both a problem and a practical solution in Chapter 12. The problem is the inability of smaller shops in downtown districts to compete with suburban malls, leading to the general decline of the city centre. They see the solution in pricing externalities: since most people want to buy multiple goods in a single shopping trip, the number of people buying from a particular shop depends in part on the variety and the price of goods offered by the shops clustered around it. Focusing on the price, they define an externality whereby the sales of one shop is inversely related to the prices charged by the shops around it. Based on a rigorous analysis, they propose a solution whereby the shops in the retail cluster agree to participate in a discount point scheme.

In a country like Japan that has many cities, inter-city travel is almost as important as intra-city travel for people's work, family and recreation. In Chapter 13 Okumura and Yamaguchi use sophisticated empirical models to explore the drivers between interregional travel. Focusing on private travel for purposes of family interaction, they find that travel patterns reflect earlier migration patterns. They end their chapter with the interesting proposition that since residential mobility is important to achieve the most efficient distribution of labour resources, providing an efficient and affordable system for past migrants to make family-related trips should be a matter of policy concern.

The final chapter in Part III by Laitila, Lundgren and Olsson (Chapter 14) also addresses the issue of labour mobility in Sweden, which is also a country with quite a few small to medium production centres. In this chapter, however, the topic is not migration and inter-city travel, but inter-city commuting. Not surprisingly, their model results show that people go where the labour demand is. But by incorporating an indicator of labour competition, they show that demand may in some cases be offset by the number of workers who have access to the jobs available in a particular town. The results indicate that workers lose utility when they commute out of their home municipality, but they lose even more if they must commute out of the region within which that municipality is set. So a happy balance in a region may be struck if there are municipalities that just provide a

good residential environment, so long as there are a few regional employment centres.

Part IV, 'Transformations in the Knowledge Economy', contains a chapter by two scholars who have been leading figures in regional science over the past 40 years. In Chapter 15, Swedish economists Åke Andersson and Börje Johansson introduce a comprehensive view of the role of knowledge in regional development. Knowledge in their formulation is a multidimensional concept that includes private knowledge embodied in an individual's brain (human capital), technical progress embodied in productive capital or public forms of scientific knowledge. For the individual firm, innovation is driven by the conjunction of its knowledge arising from internal research and external knowledge, which may be more available in some places than others. By rigorously formalizing these concepts they are able to draw conclusions on a number of issues, such as the emergence of some places as knowledge centres and the decline of other research-poor peripheral regions.

NOTE

- * This collection of chapters emerged from a series of sessions organized at Uddevalla Symposium 2014 to mark the sixtieth birthday of Professor Kiyoshi Kobayashi. We thank the organizers who hosted the sessions for their kind support.

REFERENCES

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