Title

The Transit-Oriented Global Centers for Competitiveness and Livability: State Strategies and Market Responses in Asia

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Publication Date

2010

University of California Transportation Center
UCTC Dissertation No. UCTC-DISS-2010-02

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2010

The Transit-Oriented Global Centers for Competitiveness and Livability: State Strategies and Market Responses in Asia

by

Jin Murakami

A dissertation submitted in partial satisfaction of the

requirements for the degree of

Doctor of Philosophy

in

City and Regional Planning

in the

Graduate Division

of the

University of California, Berkeley

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Spring 2010

The Transit-Oriented Global Centers for Competitiveness and Livability:
State Strategies and Market Responses in Asia

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Abstract

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Professor Robert B. Cervero, Chair

Over the past two decades, the spatial development patterns of city-regions have increasingly been shaped by global-scale centripetal and centrifugal market forces. Complex managerial tasks and specialized producer services agglomerate in the central locations of global city-regions, whereas standardized assemble lines, wholesale inventories, and customer services stretch over the peripheral locations of global production networks. One explanation for postindustrial agglomeration is the need for face-to-face interactions and knowledge spillovers among the labor-intensive business sectors. On the other hand, the spatial concentrations of knowledge-based activities are also promoted by entrepreneurial city-states' economic development strategies. Since the 1990s, rail transit investments and urban regeneration projects have played a pivotal role in shaping competitive and livable global centers to attract foreign direct investments and qualified international workers. Despite the growing importance of city and regional planning in the global marketplace, existing studies have provided little evidence on transit-oriented urban regeneration projects particularly in global city-regions.

This dissertation examines Hong Kong, Singapore, and Tokyo as three transit-oriented global center models, wherein entrepreneurial city-states have largely integrated rail transit investments with urban regeneration projects to guide postindustrial agglomeration and spur economic development in target locations. For each of the three Asian cases, I classify types of joint development packages on the basis of built environment attributes and estimate the impacts of rail transit investments and joint development packages on market location shifts and land price changes over the last decade. The empirical findings suggest that mixed-use redevelopment projects and urban amenity improvements around terminal stations largely shift the competitive advantages of knowledge-based businesses and the lifestyle preferences of highly skilled professionals towards central locations. The hedonic price models, however, reveal that the synergetic effects of rail transit investments and urban regeneration projects are highly redistributive over the rail transit networks as well as within each station catchment area,

especially where urban districts are already well-developed and development regulations are generously relaxed for commercial profits.

One might argue that the Asian models represent a few extreme cases in terms of transit investment levels and urban agglomeration patterns, having very different evolutional pathways and institutional structures from other global city-regions. In response to this argument, I also attempt to illustrate specific experiences and common themes across the three Asian models and selected global city-regions that have been moving towards transit-oriented urban regeneration. The international statistics and case reviews in this dissertation suggest that there is global momentum to put greater public-private resources together into large-scale rail transit investments and transit-oriented development projects. These entrepreneurial forces tend to generate significant agglomeration impacts on knowledge-based business activities in the global marketplace, while raising transit overcapitalization and social stratification problems in the local context. The cross-cutting lessons drawn from the three Asian cases and global comparisons stress the importance of (i) evaluating urban agglomeration benefits, (ii) choosing adequate transit technologies, (iii) establishing public-private partnerships, (iv) applying value capture techniques and (v) ensuring local community interests in shaping "competitive" and "livable" transit-oriented global centers.

The Power of Passion

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Acknowledgements

I could have never completed this dissertation without the invaluable support from the following people and organizations.

I owe an especial debt of gratitude to Professor Robert Cervero, who gave me extraordinary opportunities to change my life at the University of California, Berkeley. He generously shared his research visions, experiences, skills, times, funds and achievements with me. He was extremely responsible for my academic progress and concerns. I was very inspired by his sense of professionalism and so proud of being his student. I had the good fortune to conduct my doctoral research with very reliable committee members in the College of Environmental Design. I am extremely thankful to Professor Karen Christensen, Professor Harrison Fraker, and Professor Frederick Collignon for helping me overcome difficult times. I am also grateful to Professor Martin Wachs at the RAND Corporation and Professor John Landis at the University of Pennsylvania. During the early years of my education at Berkeley, I relied on these two former faculty members in the Department of City and Regional Planning.

I would like to give a special thanks to Professor Hisao Uchiyama at the Tokyo University of Science for encouraging me to pursue a doctoral degree in the United States. Without his positive advice and priceless assistance, I might not have come to Berkeley. I also owe a debt to Professor Hironori Kato at the University of Tokyo, who provided various kinds of support, information and inspiration throughout my academic years. Many supervisors and colleagues need to be thanked for sending letters of recommendation: Professor Hitoshi Ieda and Secretary Masako Kukita at the University of Tokyo, Professor Yinhai Wang at the University of Washington, Professor Ulugbeck Khasanoff at the University of World Economy and Diplomacy, Professor Naohiko Hibino at the National Graduate Institute for Policy Studies, Dr. Ryuichi Shibasaki at the National Institute for Land and Infrastructure Management, Director Michio Kinoshita and Manager Mikiko Nukata at the City of Yokohama.

Fortunately, I had many international sponsors for my doctoral studies. I am indebted to the Mass Transit Railway Corporation in Hong Kong, the Volvo Research and Educational Foundations in Sweden, the Lincoln Institute of Land Policy in Massachusetts, the Joint Japan/World Bank Graduate Scholarship Programs in Washington, D.C., and the University of California Transportation Center, the Center for Japanese Studies and the Institute of East Asian Studies, the Institute of Urban and Regional Development, the Department of City and Regional Planning and the Institute of Transportation Studies in California. Professional knowledge was an essential part of this dissertation. I want to thank Mr. Steve Yiu at the Mass Transit Railway Corporation in Hong Kong, Dr. Masafumi Ota at the Tokyu Corporation in Tokyo, and officers at the Urban Redevelopment Authority in Singapore for arranging valuable inputs for my doctoral research.

It is my experience that throughout my academic years at Berkeley there were several scholars, colleagues and friends who shared academic insights and private times with me. I very much appreciate the academic interactions with Professor Masami Kobayashi, Professor Hideaki Shimura, Mr. Yoshifumi Komada, Mr. Takahiro Sugita, Mr. Max Nathan and Dr. Shan Yin. I am particularly grateful to Paavo Monkkonen, Jennifer Day, Manish Shirgaokar and Erick Guerra for treating me as a community member in our PhD program. I would also like to thank Aurelio Doetsch, Amy Louise Azuma, Alejandro Luna and Natsuki Otsuka, who mentally supported my academic progress. My daily life at Berkeley could not have been maintained without Leo Vera's generous personality and priceless support. I wish to thank him for providing a comfortable living environment.

Finally, my single largest debt is to my parents: Takehiko Murakami and Noriko Murakami. Thanks to their sincere support and liberal attitude, I could choose this extraordinary life path with a strong passion.

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Berkeley, California

Chapter One
Introduction

1.1 Introduction

Over the past two decades, urbanization has been indelibly shaped by the global economy. The evolution of telecommunication technologies enables both firms and households to move out from congested central places to lower cost and higher amenity locations beyond city edges and country borders. In fact, routinized assembly lines, wholesale inventories, and customer services have extended to peripheral locations and the urban footprints of city-regions have become increasingly edgeless in some capitalist countries. On the other hand, destandardized managerial tasks and specialized producer services intensively agglomerate in the central locations of city-regions. These high-density clusters are the centers of global production networks. A series of urban economic theories explain that local knowledge spillovers and economic innovations accelerate as the physical proximity of knowledge-based firms and highly skilled labors increases in given dense and compact clusters.

The spatial concentration of labor-intensive activities is not simply a market-driven phenomenon. Entrepreneurial city-states play a proactive role in upgrading the physical attributes of target locations (e.g., central business district, international airport, urban waterfront, and science park) to attract foreign direct investment and qualified human capital. Urban elites and local policymakers of the global centers are increasingly committed to the promotion of urban regeneration projects because the quality of urban living in central locations is regarded as essential to competitive global city-regions. The state-led urban regeneration package usually accommodates prestigious office, shopping, residential, leisure, and cultural properties, improves the physical conditions of regional infrastructures, and mitigates the diseconomies of agglomeration with human-scale urban amenities. Yet, it is still understudied how these "place-making" strategies influence the spatial intensification and redistribution of production and consumption activities in global city-regions.

Transportation investment is still an important strategy even though the linkage between transportation and urban form has gradually been diminishing in the telecommunication era. As massive roadway expansion projects in outlaying territories have become inadequate for the postindustrial urbanization patterns and urban political environments, the major categories of public spending have been shifting towards transit access and pedestrian space improvements especially in central locations. It is generally expected that human-scale transit capital improvements increase accessibility to diverse urban services and regional facilities and encourage face-to-face interactions within dense and compact space settings.

Over the last decades, the combinations of rail transit investments and urban regeneration projects have gained political popularity in Europe and North America, but the transit-oriented urban regeneration projects have gained particular ascendance in Asia. Hong Kong, Singapore and Tokyo have been especially proactive in integrating rail transit investments with urban regeneration projects. This model has been embraced for two policy outcomes: "competitiveness" and "livability." Despite their novel planning practices and excellent economic performances, few academic studies have probed the experiences of the three Asian cases.

1.2 Objectives and Structure

Many entrepreneurial city-states incorporate transit investments into their spatial development strategies for enhancing intercity competitiveness and living quality in target locations. However, the spatial transformations of city-regions are very dynamic and highly complex in the global economy, so the relationships between state strategies and market responses are still poorly understood. The lack of market profiles often misleads on the feasibility of mega-projects and the project failures seriously undermine the competitiveness and livability of global city-regions. Therefore, it is important to study the experiences of transit-oriented city-region cases in the past decade.

The goal of this dissertation is to gain insights into the effects of transit-oriented urban regeneration projects based on case experiences in Hong Kong, Singapore and Tokyo. Indeed, the transit-oriented global center models are controversial due to their redistributive effects. Some argue that the Asian transit-oriented development strategies have achieved global competitiveness by reducing local livability. Yet, this argument has often depended upon theoretical or even ideological perspectives derived from limited evidence. This dissertation conducts a set of descriptive and empirical analyses that aim to achieve three research objectives:

Objective 1: A functional classification of transit-oriented urban regeneration projects in Hong Kong, Singapore and Tokyo with a focus on physical attributes such as site area, floor area ratio, land use pattern and mixture, which illustrate the visions and strategies conceived by the three Asian city-states.

Objective 2: An empirical examination of the spatial impacts of transit-oriented urban regeneration projects and rail transit investments on knowledge-based jobs, high-skilled labors, and urbanized land prices on the basis of both classic and contemporary location theories.

Objective 3: An international comparison of the Asian transit-oriented global center models to different urban development strategies in Europe and North America, from which key practices and lessons are drawn for achieving competitiveness and livability in other emerging global city-regions.

This dissertation consists of seven chapters. The second chapter following this introduction presents the underlying theories of the transit-oriented global centers through a literature review. This dissertation draws key research topics from several disciplines: globalization and economic development, urban economics, transportation and land use planning, urban design and public policy. To make the logical linkages among these multiple perspectives, the literature review is organized in three sections: urban agglomerations in the global economy; entrepreneurial city-state strategies; and contemporary transit investments.

The third, fourth and fifth chapters present case-study materials in Hong Kong, Singapore and Tokyo. Each of the chapters builds a typology of recent transit-oriented urban regeneration projects, examines the relationships between state strategies and market responses, and highlights key findings from the city-region case.

In the sixth chapter, other global city-regions are compared with Hong Kong, Singapore and Tokyo in regard to population sizes and growth trends, transit investment levels and urban agglomeration patterns, and contemporary transit investments and urban regeneration projects. Both different and common experiences across the three Asian cases and selected global city-regions are discussed based on international statistics and case reviews. The final chapter summarizes cross-cutting themes across the transit-oriented global centers and draw key lessons for policymakers and planners.

This dissertation relies on quantitative analyses, generating numerous figures and models. Many of these materials are found in appendices.

1.3 Contributions

Researchers in transportation planning have long debated the linkage between transportation and urban form in the context of informational revolutions. American literature suggests that rail transit investments have had weaker impacts on land use patterns in already developed city-regions and contemporary urban forms have become more non-centric largely due to the diseconomies of agglomeration. This dissertation, however, finds counter-arguing market reactions in the three Asian city-regions and emphasizes the increasing importance of transit investment and land use coordination in the central locations of global city-regions.

Urban economic studies view central locations as having competitive advantages in postindustrial production and consumption. Less studied are the urban amenity impacts on the location changes of firms and labors, particularly in the emergence of new economic sectors or “the creative economy.” This dissertation probes the degree to which urban amenity improvements affect the location shifts of innovative businesses and creative talents and increase the competitiveness and livability of global city-regions.

On the other hand, global capitalism theorists in urban sociology have more pessimistic views on these physical capital improvements as “gentrification.” The critics have often argued that entrepreneurial city-states’ urban place-marketing practices have led to social inequity and spatial polarization within a global city-region, yet many of these arguments have provided little empirical evidence on such gentrification effects caused by urban regeneration projects. In particular, this dissertation quantitatively finds the spatial redistribution effects of urban regeneration projects around rail transit stations.

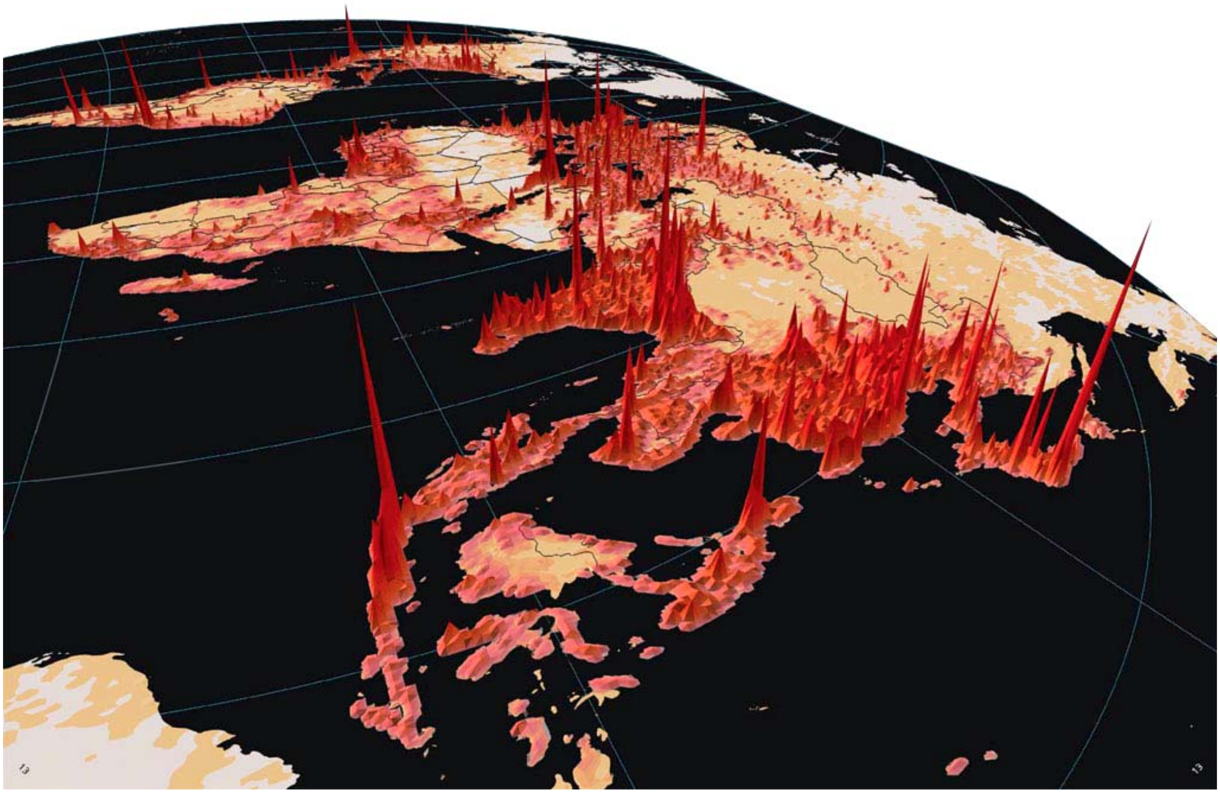
In addition to the three academic discussions, there are practical needs for conducting this dissertation research. Decision makers and planning officers are more concerned with the question of whether transit-oriented urban regeneration projects effectively promote local economic development. Real estate developers and property owners also ask whether having their businesses around transit stations yields net profits. In response to these concerns, this dissertation examines location shift patterns and property price changes as agglomeration and accessibility benefits and clarifies between effective and ineffective development types.

The empirical evidence on urban activity concentration and property price appreciation near railway stations support the introduction of value capture practices through transit-joint developments. In Hong Kong and Singapore, the entrepreneurial city-states have relied on public land leasing programs around railway stations to finance new rail expansion projects. Also rail transit operators in Hong Kong and Tokyo have long taken an entrepreneurial approach to utilizing land parcels near railway stations and increasing financial returns from property developments. Both the public and private aspects with the entrepreneurial city-states' transit joint development practices are useful information for other global city-regions to think of making more effective, efficient and equitable financing schemes.

Chapter Two
Literature Review

2.1 Urban Agglomerations in the Global Economy

The world population has rapidly grown over the past two decades and its growth rate will be much faster for the next two decades. One of the central issues we currently face is how economic and social activities will be distributed over the world. According to "Human Development Report" (UNDP, 2009), annually over 5 million people move across international borders to live in wealthier countries, more people move to emerging city-regions within countries, and a larger number of people in both origin and destination places are affected by the massive movements of money, knowledge and ideas. This report suggests that the global distribution of opportunities is extremely uneven and the largest movements are driven by city-regions in Asia (Figure 2.1).



Source: National Geographic Atlas of the World, Eighth Edition (2004).

Figure 2.1 Human World: Population Density Image from Asia

International development studies project that the countries of Asia will become highly urbanized societies with more than 50% of their population living in urban areas by the year 2020 (Clark, 2003; McGee and Robinson, 1995; Stubbs and Clarke, 1996). Rapid urbanization has increased the weight of city-regions in their national economic systems. In fact, most city-regions have a higher gross domestic product (GDP) per capita and faster economic growth rates than their national averages, and the spatial structure of city-regions is dramatically changing along with the formation of urban transportation networks as other developed societies experienced during the late 20^{th} century (OECD, 2006).

In most Western countries, the spatial transformations of city-regions have featured suburbanization and motorization (Hall, 2002; Muller, 2004). Garreau (1991) described that business offices, high-tech manufacturing lines and shopping malls formed high-density, mixed-use, self-containable agglomerations as "edge cities" near the highway intersections of outlying areas and the locational advantages of the new suburban centers surpassed those of their old city centers in both production and consumption. A number of empirical studies showed that major city-regions in North America transformed from a classic monocentric model to polycentric agglomeration patterns by the late 1980s (Cervero, 1986; Cervero and Wu, 1998; 1997; Gordon et al., 1986; McMillen and McDonald, 1998).

The inside-out growth pattern continues in many American city-regions. Lang (2003) noted that the locational advantages of most edge cities have been declining because of severe traffic congestion and inefficient land management around the suburban highway interchanges; consequently, urban growth evolves beyond the polycentric agglomerations. Isolated buildings spread over vast swaths and transform exurban spaces into "edgeless cities." Cervero (2005a; 2003) pointed out that the unplanned, piecemeal urbanization patterns have led to the escalating demands for road capacity; however, conventional road expansion projects have lagged behind the increasing many-to-many travel demands. In addition, there are the increasing location-liberating effects of telecommunications on exurban landscapes (Slabbert, 2005).

The long-term impacts of telecommunications on the spatial transformations of city-regions remain unknown, but it has been hypothesized that the progress of information and communication technologies would diminish the needs for spatial proximity and accelerate the flexible time-space arrangements of business production and living consumption beyond physical locations (Giuliano, 1998; Gottman, 1977; Graham and Marvin, 1996). Yet, the emerging urban geography is rather characterized by both "centripetal" and "centrifugal" forces on a global scale: complex managerial tasks and specialized producer services densely agglomerate in the central locations of city-regions, whereas standardized assemble lines, wholesale inventories and customer services widely disperse over the peripheral locations of the world (Castells, 2000; Friedmann, 1997; Hall, 2002; 1984; Knox and Taylor, 1995; Sassen, 2006; 2001).

These locational patterns raise the question of why particular economic activities intensively agglomerate in a small number of places. There have been an increasing number of economic studies explaining the advantages of urban agglomeration in the informational economy. One of their common understandings is the existence of "knowledge spillovers" and the needs for "face-to-face communications" among advanced firms and skilled labors in dense and compact urban settings (Fujita and Thisse, 1996; Glaeser, 1998; Glaeser et al., 1992; Jacobs, 1969; OECD, 2006; Quigley, 1998). In the context of globalization, Sassen (2001) focused upon the extremely dense concentrations of transnational corporations, international legal and accounting services, management consulting, and financial services in the central locations of New York, London, and Tokyo. She discussed that these three financial business centers are not only nodal points for the coordination of global production networks but also industrial sites for the production of advanced business services. As the organizational structure of contemporary business entities become more complex with many-to-many horizontal interactions, very specific tasks that have high internal transaction costs are outsourced to external niche markets (Williamson, 1975). Therefore, many transnational corporations' headquarters and local business service firms closely agglomerate together to share knowledge-based resources in the three global centers.

A series of Porter's studies (2008; 2001; 2000; 1997; 1995) stressed the strategic importance of central locations in global business competition. According to his conceptual framework, economic innovations take place disproportionately in central locations because their micro-geographic "clusters" offer competitive advantages such as input and demand conditions, context for business strategy and rivalry, and related and supporting industries. He argued that central locations also contain several physical disadvantages inflicted by conventional state interventions (e.g., inefficient land use regulations and transportation infrastructure investments). Under these circumstances, urban business entities have increased the demand for more entrepreneurial city-state strategies to refine the competitive edges of central locations in the global economy (OECD, 2006).

2.2 Entrepreneurial City-State Strategies

As urban agglomerations have been shaped according to global capitalist criteria, the nature of city-states has been shifting towards entrepreneurialism for the past two decades. Harvey (1989) discussed that urban governance in North America faced the erosion of fiscal bases in large cities and their city-states have taken an entrepreneurial approach to stimulating local economic development. This entrepreneurialism is embedded in intercity competition for global capital flows; thus, entrepreneurial city-states have more oriented to the rehabilitation of urban infrastructure systems and the acceleration of international real estate investments through public-private partnerships (Fainstein, 2001). The outgrowth of Harvey's entrepreneurialism can be observed in other parts of the world. Especially today's Asian city-states have aggressively engaged with global capital for funding mega transportation infrastructure and urban regeneration projects (Dimitriou, 2006; Dimitriou and Trueb, 2005; Hall, 2002; Jessop and Sum, 2000).

Since the 1990s entrepreneurial city-state strategies have placed increasing emphasis on the quality of urban living environments because "livability" has been regarded as the profile of a competitive city-region to attract human capital (Hall, 2002; Rogerson, 1999). The central locations of city-regions have long been dedicated to business production, but they could have been advantageous in living consumption on the basis of high wages, short commutes, and diverse lifestyles (Glaeser et al., 2006; 2001). As the economic and social potentials of being in central locations have increased, entrepreneurial city-states have turned to urban regeneration projects, typically accommodating dense, mixed-use properties, urban amenity settings, and public transit systems in stagnating districts (Cervero, 2009a; ULI, 2003; Urban Task Force, 1999).

In the marketplace, certain kinds of people have gradually recognized the economic and social benefits of living closer to central locations without depending upon automobile uses (Glaeser and Shapiro, 2003; Hinshaw, 2007). Florida (2008; 2005a; 2005b; 2002) have discussed that creative talents in new knowledge-based sectors tend to choose the central locations of city-regions that offer openness, diversity, and tolerance with sidewalks, cafes, art galleries, and public plazas. These high-amenity places allow the creative-class people to maintain a work-life balance in their demanding schedules and to share collective experiences with other various talents. On the basis of Jane Jacobs's urban economic theory (1969; 1961), such demographic diversities and social interactions would accelerate economic innovations in cities. Many entrepreneurial city-states are increasingly initiated to take a Jane-Jacobs-style "place-making" approach to facilitating the creative economy in central locations (ULI, 2002).

Despites its political popularity, Florida's creative-city strategy is controversial (Peck, 2005). Schott (2008) argues that the engine of urban regeneration is not the unilateral accumulation of particular kinds of people in the given places but rather the mutual causation between the supply of and the demand for labor force. Indeed, empirical studies in American city-regions have not yet clearly grasped the impacts of urban amenity settings on the locational choices of certain kinds of people who would cause urban regeneration (Glaeser and Shapiro, 2003; Gottlieb, 1995; 1994; Whitehead et al., 2006). It has been assumed that very few social groups could afford authentic urban living or high-end amenity settings would follow the locations of high-income consumers (Storper and Manville, 2006).

Many concerns over entrepreneurial city-state strategies are associated with the issue of social inequity and spatial polarization. Especially global capitalism theorists have long discussed about urban regeneration projects as "gentrification" (Bridge, 2007; Fainstein, 1996; Sassen, 2002; Schott, 2008; Smith, 2002; Sudjic, 1992). Their studies suggest that too capitalistic "place-marketing" strategies would emphasize the physical discontinuities between central locations and other parts of a region and such urban elitism would diminish socioeconomic diversities and dynamic interactions in central locations. This socio-geographic fragmentation would seriously undermine the competitiveness and livability of city-regions, yet existing studies have provided little empirical evidence on the locational relationships between urban regeneration projects and regional market divisions.

2.3 Contemporary Transit Investments

Transportation investments lie at the heart of entrepreneurial city-state strategies in a transit-oriented manner. Especially in developed societies, the major categories of transportation investments have shifted towards rail transit improvements with urban regeneration projects, as the economic value of new highway constructions declines, the demographic share of immigrants escalates, and the economic importance of urban amenities increases (Altshuler and Luberoff, 2003; Banister and Berechman, 2000; Pucher, 2004; 2002). Policymakers, however, have been increasingly concerned with the inefficiency, ineffectiveness, and inequity of contemporary transit investments in the rise of new knowledge-based economies.

Transportation researchers have long discussed about the ability of rail transit investments to shape urban development (Badoe and Miller, 2000; Handy, 2005; Huang, 1995; Knight and Trygg, 1977). In automobile-oriented societies, there has been skepticism about the ability of rail transit investments to reshape the urban footprints of low-density city-regions. Opponents argued that transit-based accessibility would be no longer a key locational consideration for footloose information-based firms and transportation costs would be a relatively small portion of telecommuting household expenditures (Giuliano, 2004, 1995). From these viewpoints, the opponents concluded that rail transit investments could not sufficiently guide both travel mode choices and urban growth patterns; on the other hand, the recent public policies for transit-oriented high-density developments would rather escalate traffic congestion in central locations and its social costs would seriously damage the competitiveness and livability of city-regions (Gordon and Richardson, 1997; Wachs, 2002; 1993; Weisbrod et al., 2003).

Another criticism of rail transit investments is based on their poor financial performances. Across many city-regions, rail transit projects have chronically suffered from overcapitalization (Taylor, 2004). Researchers have long recognized that conventional project evaluation frameworks systematically overestimate benefits and underestimate costs to justify rail transit investments favored on the basis of local urban politics (Flyvbjerg, 2007; Flyvbjerg et al., 2003; Pickrell, 1992; Gomez-Ibanez, 1985; Wachs, 1987). It has also been criticized that entrepreneurial city-states often facilitate rent-seeking activities around rail transit stations and their modest tax increment revenues from the speculative commercial properties fail to cover huge infrastructure expenses (Gordon and Richardson, 1997). Mega-project literature points out that recent transit investments in Asian city-regions would unfairly benefit global business interests at the expense of local social welfare, yet their existing project evaluation frameworks are outdated to examine the unconventional effects of mega transit investments in the spatial transformations of global city-regions (Dimitriou, 2006; 2005; Dimitriou and Trueb, 2005).

According to classic location theories, rail transit investments largely change regional accessibility and increase the locational advantages of central business districts and railway corridors (Alonso, 1964; Mills, 1972; Muth, 1969). Contemporary empirical studies in North American and European city-regions, however, revealed that the impacts of rail transit investments in the last decades were geographically localized and redistributive within a city-region (Banister and Berechman, 2000; Giuliano, 2004). These locational shifts suggest that the agglomerations of urban activities around transit nodes could increase productivity, profitability, and creativity through increased face-to-face contact, improved access to specialized skills, and easier external transactions (Bhatta and Drennan, 2003; Cervero and Aschauer, 1998; Weisbrod, 1996; Weisbrod and Grovak, 1998). Notably, the agglomeration benefits of rail transit investments in the knowledge-based sectors were highly limited to the central locations of global city-regions where local redevelopment authorities provided financial incentives and assistance in land assemblage for encouraging transit-oriented developments (Berechman and Paaswell, 2005; Cervero and Landis, 1997; Hess and Lombardi, 2004).

The term "transit-oriented development" (TOD) was originally coined to address an anti-automobile urban design concept, envisioning traditional neighborhoods with high-density, pedestrian friendly built environments around rail transit stations in American city-regions (Calthorpe, 1993; Bernick and Cervero, 1997). On the other hand, today's TOD programs in global city-regions are rather practiced as urban regeneration instruments, shaping modern business agglomerations and stimulating local economic developments (Curtis et al., 2009; Bertolini and Spit, 1998; Cervero, 1998). In many advanced capitalist countries, entrepreneurial city-states have proactively invited international real estate developers around high-access terminal stations to convert stagnating central locations into global office towers. Yet, urban regeneration sites near railway stations are not always suitable for global business production; thus, entrepreneurial city-states need to learn appropriate development "types" near railway stations from market profiles (Belzer and Autler, 2002; Dittmar and Ohaland, 2004; Dunphy et al., 2006; 2003).

One of the important types in the central locations of global city-regions is "urban neighborhood redevelopment" (Bernick and Cervero, 1997; Dittmar and Ohaland, 2004). It is generally recognized that creative workers in arts, cultural, and entertainment industries have moved back to central locations, seeking socioeconomic richness, housing affordability, and transit accessibility (Florida, 2005). Given unique competitive advantages, many entrepreneurial city-states in North America, Europe and Asia have recently made substantial public spending on large-scale arts, cultural, and entertainment regeneration projects in the selected central locations well-served by rail transit systems. Thus, recent urban economic literature has increasingly addressed the potentialities of a new creative economy as drivers of urban regeneration (Indergaard, 2009; Hutton, 2009; Pratt, 2009; Schott, 2008). Despite the importance of transit components in forming urban neighborhoods, transportation literature has not yet quantitatively examined the relationships between rail transit investments, urban regeneration projects, and creative labor markets particularly in global city-regions.

Another important type is "airport-linked development." In the global economy, international airports offer advantageous locations for clustering time-sensitive firms and labors along high-access ground transportation corridors, so the potential benefits of airport-linked developments are greater than those of TODs in stagnating central locations (Kasarda, 2009; 2004). However, the negative externalities of airport proximity (e.g., noise, traffic congestion, and air pollution) cancel out the benefits of airport accessibility and impede the opportunities of airport-linked developments (McMillen, 2004; Tomkins et al., 1998). Concerns over the negative externalities of international airports have emphasized the importance of rail transit investments in airport ground access planning (de Neufville, 2006; Gosling, 1997; Humphreys et al., 2004). Especially high-speed rail investments are being projected for many American city-regions to replace short-distance aviation trips, mitigate freeway congestion, and shape new global centers around airport-rail interchanges (Hagler and Todorovich, 2009; Leinback, 2004; RPA, 2006). The impacts of airport-linked developments are still unprecedented in many American city-regions; thus, more research is needed into recent experiences in other global city-regions.

Chapter Three
Hong Kong:
Rail + Property in the Densest Marketplace

3.1 Background

Hong Kong is an extremely dense global center for world trade, finance, business, and telecommunication networks with nearly 7 million people living in a small urban area and over 3 million service-based jobs agglomerating with skyscrapers along Victoria Harbour (Table 3.1; Figure 3.1). This modern landscape was already conceived in a series of the British colonial planning reports by the late 1940s, but the remarkable economic development and territorial transformation of Hong Kong have rather been realized by the parallel strategies of high-density land use management and world-class rail transit development since the 1980s (Ambercrombie, 1948; Dimitriou and Cook, 1998).

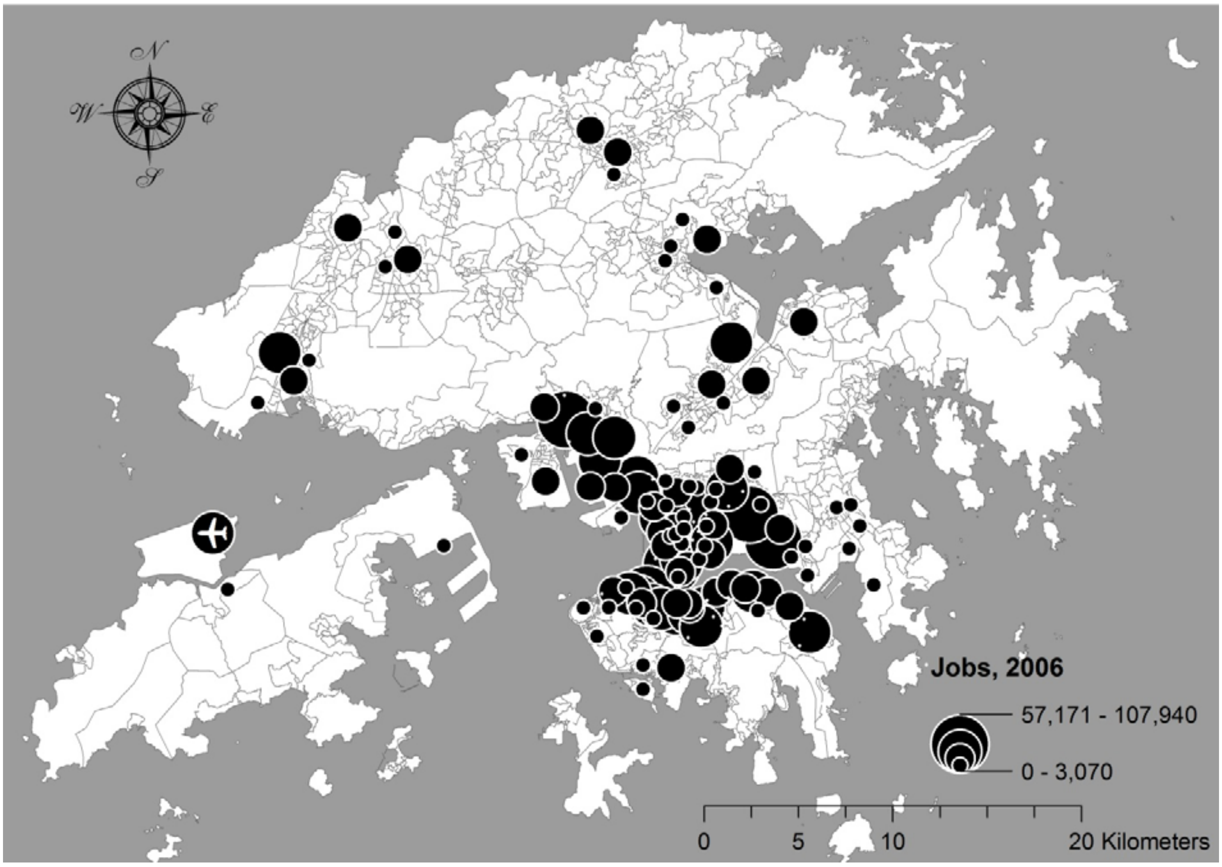
Table 3.1 Background Information on Hong Kong, 2008

Population		6,977,700
Total Land Area [sq km]		1,104
Urban Area [sq km]		261
Total Land Population Density [people sq km]		6,460
Urban Population Density [people sq km]		26,734
Average Annual Population Growth Rate, 2003-08 [%]		+0.7
Gross Domestic Product (GDP), [HK$ Billion Current Market Price]		1,678.5
GDP per Capita [HK$ Current Market Price]		240,554
Average Annual GDP Growth Rate, 2003-08 [%]		+6.3
Number of Jobs		3,538,100
	Primary Sector %	0.3
	Secondary Sector %	12.5
	Tertiary Sector %	87.2
Number of Labors		3,667,600

Sources: HKSAR (2009a; 2009b).
Note: 1 HK$ = 0.128 US$ in 2008.

The provision of living space had long been problematic in the central locations of Hong Kong. Due to the growing demand for industrial lands and the inefficient procedure of urban renewal, the existing town districts of Hong Kong Island and Kowloon became seriously overcrowded by the late 1970s. This inadequate living condition forced residential decentralization to the New Territories. Therefore, the 1980s was a critical period for the city-states of Hong Kong to have a comprehensive, long-term vision of urban development accompanied by transportation investments. The “Territorial Development Strategy” took a series of sub-region studies to identify target areas for future growth and encouraged the creation of “balanced” and “self-contained” satellite towns along new railway development (Dimitriou and Cook, 1998).

During the 1980s the first generation of new railway development was implemented largely by the Mass Transit Railway Corporation (MTRC). With the combination of high population density, public land ownership, and low automobile dependency, Hong Kong was the most suitable case for applying the "value capture" principle to finance massive railway investments. This means that the owner-operator of the railway system can recoup the costs of railway investment and yield a net profit from nearby property developments (Callies, 1979; Hagman and Misczynski, 1978). The first generation of MTRC's "Railway + Property" (R+P) programme was simply a financing instrument for practicing the principle (Cervero and Murakami, 2009). MTRC completed the Urban Line development without governmental subsidies but with high-rise single-use properties above new stations (Black, 1985; Strandberg, 1989; Runnacles, 1990).



Source: Author, with data from HKSAR (2007a; 2002).

Figure 3.1 Job Agglomerations in Hong Kong, 2006

Throughout the 1990s Hong Kong's economic base drastically shifted from manufacturing to services in the context of globalization. The central locations of Hong Kong increasingly attracted foreign direct investments and international property developers around high-access railway stations (Haila, 2000; Tong and Wong, 1997). R+P programme became more widely recognized as a range of planning instruments for shaping postindustrial agglomeration and stimulating local economic development. The second and third generations of R+P programme largely placed pedestrian-friendly, mixed-use town development packages along the new Airport Express and Tseung Kwan O Line extensions to improve a job-population balance over the city-region (HKSAR, 1998; Lau et al., 2005; Tiry, 2003). This "place-making" approach synergistically generated substantial railway ridership bonuses and appreciable property price premiums (Cervero and Murakami, 2009; Lo et al., 2008; Tang et al., 2004).

For the global competitiveness of Hong Kong, the “Port and Airport Development Strategy” was importantly associated with the recent generation of R+P programme. Due to its very limited capacity and close proximity to residential areas, the old Kai Tak Airport was relocated to North Lantau (HKSAR, 2000; 1994; Dimitriou and Cook, 1998). In 1998, the new Hong Kong International Airport (HKIA) was opened with a total project cost of US$20 billion, including North Lantau Highway and MTRC’s Airport Express to the International Finance Centre (IFC) in Hong Kong Island. Adjacent to the main passenger terminal of HKIA, “SkyCity” is recently being developed as the core of an “airotropolis” which would accommodate huge mixed-use property complexes and encompass millions of jobs and labors along high-access ground transportation corridors (Kasarda, 2009; 2004).

Since the late 1990s, people have increasingly been concerned with the impacts of these mega transportation projects on Hong Kong’s territorial sustainability. Hong Kong has long been famous for the lowest automobile dependency among many wealthy capitalist city-regions (Cullinane, 2003; 2002; Newman and Kenworthy, 1999). Recent studies, however, imply that Hong Kong’s sustainable transportation is gradually being eroded by decentralization and motorization. It has been assumed that the HKIA-linked developments would facilitate heavy freight traffic, short-distance automobile travel, and dispersed spatial growth in the New Territories (HKSAR, 2003; Lo, 1997). The negative externalities of the HKIA-linked developments might fall disproportionately on local industrial communities rather than global business enclaves because there has been little attempt in Hong Kong’s capitalistic governance to prevent such socioeconomic segregation caused by mega transportation projects (Dimitriou and Trueb, 2005; Hopkinson, 2004).

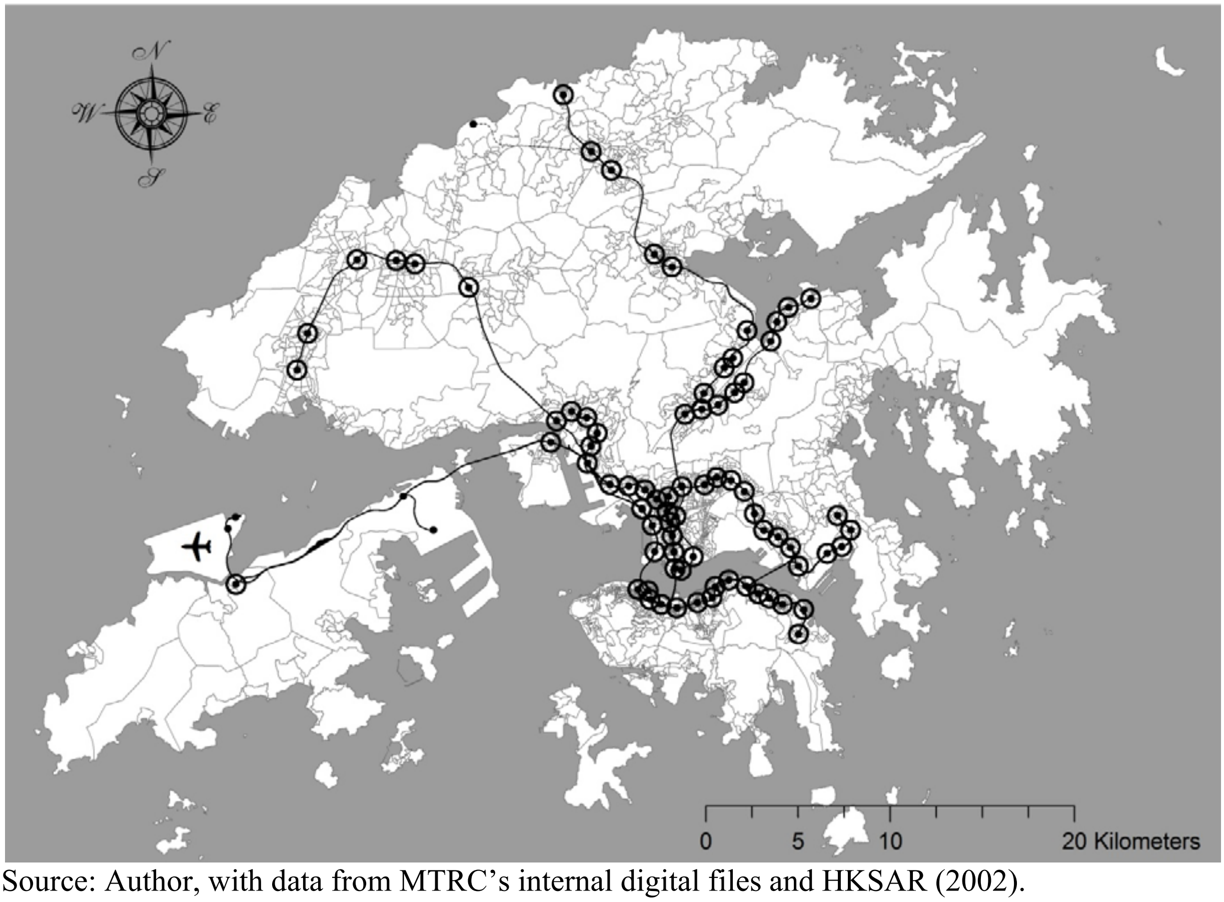
Hong Kong’s socioeconomic geography has been characterized importantly by its public land system. Since the entrepreneurial city-state attempts to maximize public revenues through land leasing auctions, development rights are typically granted to multinational corporations who can competitively bit an upfront lump sum (Hong and Lam, 1998). The large private corporations more efficiently determine the attributes of local social space to circulate global capital flows, but this resource allocation is likely to excavate socioeconomic segregation in Hong Kong (Cuthbert and McKinnell, 1997; Hong, 1998). R+P programme is one kind of the development rights granted to MTRC. However, it is questionable whether R+P programme has seriously decreased socioeconomic diversity around railway stations. MTRC is a public-private organization intended to ensure broader social interests in private property developments. Especially the recent generations of R+P programme are not merely a place-marketing instrument for profitability but rather a variety of place-making packages for livability (Cervero and Murakami, 2009). Yet, there is little analytical work investigating the relationships between MTRC’s recent development practices and Hong Kong’s territorial transformation patterns.

3.2 Methodologies

In the sections that follow, statistical analyses are presented that quantitatively classifies the development types of MTRC’s R+P programme since the 1980s and empirically estimates the locational impacts of railway extensions and property developments on Hong Kong’s job and labor markets between 2001 and 2006. This analytical framework allows us to find out the logical relationships between contemporary state strategies and postindustrial market agglomerations with a focus on global competitiveness and local livability in Hong Kong. Before turning to the empirical results, this section describes the analytical units, modeling approaches, and data sources.

Analytical Units:

In the year 2006, Hong Kong contained 80 mass transit railway (MTR) stations on the 168 km network. As applied for many rail transit studies, "station area" can be defined as a 500 meter circular buffer from each MTR station. On the basis of data availability and case comparability, 77 MTR station areas are sampled as analytical units (Figure 3.2). In the case of Hong Kong, these analytical units are sufficient to examine the relationships between contemporary development strategies and postindustrial market responses. A large percentage of Hong Kong's job and labor markets intensively agglomerated within 500 meters of the 77 MTR stations, whereas 38 MTR station areas of them covered a variety of railway and property development cases in terms of territorial locations, programme generations, and system operations.



Source: Author, with data from MTRC's internal digital files and HKSAR (2002).

Figure 3.2 Analytical Units: 77 MTR Station Areas, 2006

Modeling Approach 1:

Cervero and Murakami (2009) quantitatively classified different types of property packages across the 25 R+P station areas that were developed by the former MTRC between 1980 and 2005. This dissertation extends their approach to the 38 R+P station areas developed by both the former MTRC and the former Kowloon-Canton Railway Corporation (KCRC) between 1980 and 2008. A typology is constructed on property development packages within 500 meters of MTR stations with regard to key built-environment attributes, reflecting the territorial strategies of the Hong Kong government, the three generations of R+P programme, and the project implementations of the two railway owner-operators. Cluster analysis is applied to build a typology. The technique of agglomerative hierarchical clustering systematically combines a number of different cases into a reasonable set of clusters on the basis of their nearness across built-environment variables when expressed as squared Euclidean distances (Aldenderfer and Blashfield; 1984). Table 3.2 shows the built-environment attributes and variables investigated for each of the 38 MTR station areas.

Table 3.2 R+P Built-Environment Attributes and Variables for a Typology

Attributes	Variables
Land Use:	Gross Floor Area (GFA) by Use (office, residential, retail, hotel and others) and Parking Lots (per Total GFA)
Scale:	Site Area and Total GFA
Density:	Floor Area Ratio (FAR =Total GFA/Site Area)
Mixture:	Mixture Index* (ranging from 0 for single-use to 1 for maximally mixed-use)

Note:*This is based on the measurement of an Entropy Index = $\{-\Sigma k\ [(p_i)\ (\ln p_i)]\}/(\ln k)$ wherein: ($0 \leq$ Entropy Index ≤ 1) and k = # of land use types (in this case, k=5); p_i: GFA-based proportion of land use in type i; and i: land use type (office, residential, retail, hotel and others).

Modeling Approach 2:

This research also empirically examines the impacts of the different types of developments by modeling job and labor market locations across the 77 MTR station areas. In developed societies like Hong Kong, it is assumed that the combinations of railway investments and property developments cause the locational shifts of economic and social activities as a result of shifting locational advantages within the territory. Yet, these redistributive effects would not be a zero sum game. The firms and labors moving to more advantageous locations could provide and consume better services or same services at lower cost (Weisbrod and Weisbrod, 1997). In order to deal with the dynamic interactions between development actions and locational shifts, the marginal impacts between 2001 and 2006 are directly estimated because longitudinal modeling is statistically more capable to establish causality than cross-sectional modeling (Giuliano, 2004; Giuliano and Golob, 1990).

In modeling the marginal changes of job and labor markets in the given analytical units, this study tested three interrelated measurements: absolute number (AN); location quotient (LQ); and shift-share (SS). For this intra-territorial scale study, however, the LQ and SS models are less suitable because "change rates" in greenfield developments are more overly represented than those in brownfield redevelopments. In order to properly indicate the "intensifications" of job and labor markets in 500 meters of the 77 MTR stations, this chapter focuses upon the AN models. Yet, the LQ and SS models still include useful information, so the empirical results are attached as appendices. The job and labor markets are broken down into the 5 industrial sectors and 8 occupational categories given by the HKSAR Census and Statistics Department. The sector and category specific models offer greater explanatory powers than the aggregate models. In addition to "urban intensification" (absolute number: AN), this chapter also examines the "socioeconomic mixture" and "job-labor balance" models, using the 5 industrial sectors and 8 occupational categories. Mixture Index (MI) and Balance Index (BI) are calculated for each of the 77 MTR station areas in 2001 and 2006 as follows:

$$\mathbf{MI} = \{-\Sigma k\,[(p_i)\,(\ln p_i)]\}/(\ln k)$$
$$\mathbf{BI_j} = 1 - |Job_j - Labor_j|/(Job_j + Labor_j)$$

Wherein
MI (Mixture Index): ranging from 0 for specialized to 1 for mixed
BI_j (Balance Index): ranging from 0 for polarized to 1 for balanced
p_i: proportion of jobs or labors in sector or category i
Job_j: absolute number of jobs in sector j within 500 meters of a MTR station
$Labor_j$: absolute number of labors in sector j within 500 meters of a MTR station
i: industrial sector or occupational category
j: industrial sector
k: # of the industrial sectors or occupational categories (in this case, k=5 or 8)

Modeling Approach 3:

The locational changes of job and labor markets are attributable not only to railway and property developments but also to many other factors. Postindustrial location studies have suggested several determinants of agglomeration and dispersion with a focus on competitive advantages and lifestyle preferences in knowledge-based societies (Giuliano, 2004; Giuliano and Small, 1999; Ingram, 1998; OECD, 2006). In the case of Hong Kong, the job and labor location changes can be formulated as a function of 8 key attributes.

- **Urban Agglomeration Pattern in Base Year (2001)**: The spatial evolution of a city-region is basically path-dependent. The location changes of jobs and labors would be dependent on given agglomeration patterns such as intensity, specialization, diversity, balance, and housing that characterize economic advantages and social lifestyles in 500 meters of MTR station.

- **Job and Labor Market Access in Base Year (2001)**: The redistributions of job and labor markets are also dependent on given job-labor distribution and railway network patterns. Access to given labor markets would be a factor of job location decisions whereas access to given job opportunities would be a determinant of labor location choices.

- **Territorial Location**: Competitive advantages and lifestyle preferences depend heavily upon the centralities of locations in the overall territory. In the case of Hong Kong, the locational shifts of job and labor markets would be explained largely by the access and proximity to the central business district (CBD) and Hong Kong International Airport (HKIA).

- **Urban Amenity and Regional Institute**: The economic and social importance of urban amenity settings (e.g., open space, leisure parks, waterfronts, and historical buildings) would increase in the location decisions of knowledge-based firms and highly skilled labors. Also regional institutes (e.g., governments and universities) would form service-based clusters near their offices and facilities.

- **Transit Service**: Stations have different functions and operations on the whole transit network. The system performances characterized by transit services (e.g., Airport Express stations, transit system transfers, feeder bus lines, and station spacing) would affect the locational patterns of job and labor markets around the 77 MTR stations.

- **Railway and Property Development**: Transit investments and transit-oriented developments are a set of interventions supposed to guide the spatial transformation of a city-region. The different types of MTRC's property developments would lead to unique job and labor market formations accompanied by the new MTR extensions after 1998.

This empirical study attempts to capture the net impacts of MTRC's place-making practices by controlling for 6 sets of variables in the regression models. Table 3.3 lists the 6 key attributes and candidate variables for model entry. Since synergetic effects are expected among these variables, several interaction terms are also tested in the regression models. All the independent variables are compiled for each of the 77 MTR station areas.

Data Sources:

The job and labor location models are analyzed for the period between 2001 and 2006 due largely to the availability and consistency of governmental databases in these two years. Hong Kong's territorial job data in 2001 and 2006 were derived from the "Number of Establishments and Persons Engaged (Other than Those in the Civil Service) Analysed by Industry Sector and Tertiary Planning Unit (TPU)" (HKSAR, 2007a; 2007b). In the same way, Hong Kong's territorial labor data in 2001 and 2006 were extracted from the "Hong Kong 2001 Population Census" and "Hong Kong 2006 Population By-Census" (HKSAR, 2007c; 2002). These public sources cover disaggregate data across the 5 industrial sectors and 8 occupational categories defined by the HKSAR Census and Statistics Department (Table 3.4).

The governmental databases were originally constructed on a specific geographical demarcation system: "Tertiary Planning Units" (TPUs). The 282 TPUs are spatially matched up to and clipped by the 77 MTR station areas, using geographic information systems (GIS) techniques. Job and labor densities in each of the 282 TPUs are assigned proportionally to the clipped areas, so that the approximate numbers of jobs and labors can be counted for each of the 77 MTR station areas. The job and labor data on the 282 TPUs are also applied to compute isochronic accessibility measures, representing the cumulative count of urban activities that can be reached within a given travel time (Wachs and Kumagai, 1973; Cervero, 2005; Levinson and Krizek, 2005). This study assumes that job and labor markets at the 282 TPU points are the potential destinations accessed from each of the 77 MTR station areas within 30 minutes by the railway system under average operating conditions (travel speeds at 60 km per hour on the MTR network and 4 km per hour in the catchment areas).

Table 3.3 Candidate Variables for Entry into the Absolute Number (AN), Mixture Index (MI), and Balance Index (BI) Models

Attributes	Variables
Urban Agglomeration Pattern in 2001 :	• Number of Total Jobs • Number of Total Labors Jobs • Job Mixture Index in Industrial Sector i • Labor Mixture Index in Industrial Sector i • Labor Mixture Index in Occupational Category j • Housing Mixture Index* • Job-Labor Balance Index in Industrial Sector i • Job Location Quotient in Industrial Sector i** • Labor Location Quotient in Industrial Sector i** • Labor Location Quotient in Occupational Category j**
Job and Labor Access in 2001:	• Number of Jobs within 30 minutes by MTR • Number of Labors within 30 minutes by MTR
Territorial Location:	• Average Travel Time Distance to CBD [minutes] • Average Travel Time Distance to HKIA [minutes]*** • 1/Average Travel Time Distance to CBD [minutes] • 1/Average Travel Time Distance to HKIA [minutes]***
Urban Amenity and Regional Institute:	• Area of Leisure Park [hectare] • Area of Public Open Space owned by Private [hectare] • Area of the Ocean [hectare] • Number of Graded Historic Buildings • Number of Universities
Transit Service:	• Airport Express Line Station Dummy [0/1] • MTR Transfer Station Dummy [0/1] • Light Rail Transit Transfer Station Dummy [0/1] • Number of MTR Feeder Bus Lines • Average Track Distance to Next Stations [km]
Railway and Property Development:	• New MTR Station after 1998 Dummy [0/1] • Newly Connected MTR Station after 1998 Dummy [0/1] • R+P Programme Type Dummies [0/1]

Notes: i = industrial sectors (1~5); j = occupational categories (1~9).
*Housing Mixture Index = $\{-\Sigma k\ [(p_h)\ (\ln p_h)]\}/(\ln k)$ wherein: $(0 \leq MI \leq 1)$ and k = # of housing types (in this case, k=3); p_h: proportion of housing units in type h; and h: housing type (public rental housing, subsidized sale flats, and private housing).
**Location Quotient = [(jobs or labors in sector i in MTR station area)/(total jobs or labors in MTR station area)]/[(jobs or labors in sector i in the Hong Kong territory)/(total jobs or labors in the Hong Kong territory)]
***HKIA: Hong Kong International Airport.

Table 3.4 Industrial Sectors and Occupational Categories in Hong Kong

5 Industrial Sectors:	• Financing, Insurance, Real Estate and Business Services (FIRE+) • Community, Social and Personal Services (CSSV) • Wholesale, Retail and Import/Export Trades, Restaurants and Hotels (WHRE) • Transport, Storage and Communications (TRCM) • Manufacturing (MANU)
8 Occupational Categories:	• Managers and Administrators (MNGR) • Professionals (PROF) • Associate Professionals (APROF) • Clerks (CLRK) • Service Workers and Shop Sales Workers (SVWK) • Craft and Related Workers (CRWK) • Plant and Machine Operators and Assemblers (PLNT) • Elementary Occupations (ELMT)

Sources: HKSAR (2007a; 2007b; 2007c; 2002).

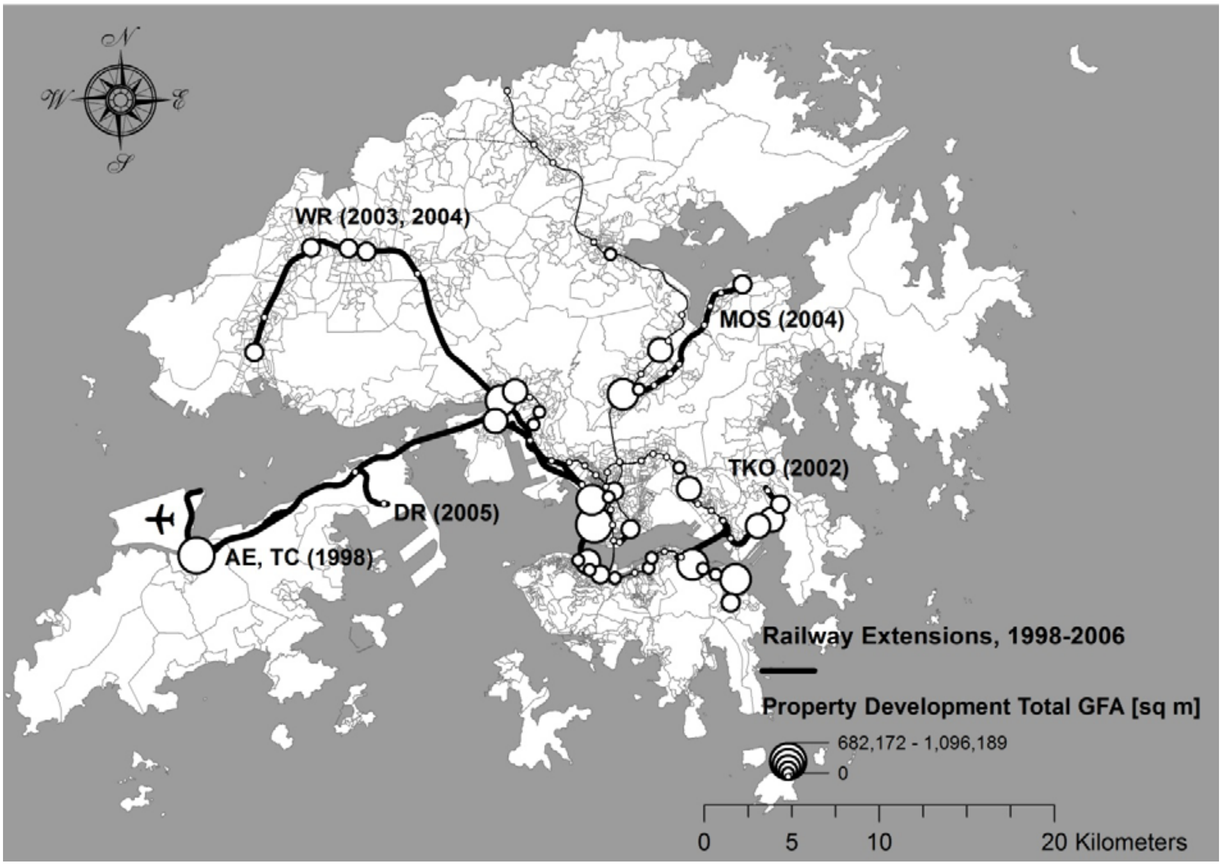
The quantitative data and locational information for urban amenity and regional institute attributes were collected from the HKSAR Leisure and Cultural Services Department and the HKSAR Lands Department (HKSAR; 2009c; 2009d; 2009e) and spatially related to GIS shapefiles, applying online satellite imagery techniques (HKSAR, 2007d; Monkkonen, 2008). The data for transit service and territorial location attributes were extracted from the MTRC website or provided by MTRC's managers (MTRC, 2009). Due to the geographical uniqueness and statistical fitness, Hong Kong's territorial location attributes are indicated by average travel time distances after the MTR extensions rather than physical straight-line distances.

"MTR Corporation Annual Reports" have documented the profiles of MTRC's property development packages except some of the small-scale property towers constructed in the 1980s (MTRC, 2009). These missing data were filled by MTRC's property managers, so that all the built-environment variables listed in Table 3.2 can be compiled for a typology of MTRC's property development practices between 1980 and 2008.

3.3 State Strategies: A Typology

Over the past 30 years, MTRC's R+P programme has been a core instrument of Hong Kong's transit-oriented development strategies. However, the functions of those property packages vary by development generations, territorial locations, and operating organizations. This section attempts to conceptualize the different types of MTRC's development practices based upon statistical figures.

Figure 3.3 shows recent railway extensions with property developments in Hong Kong. From 1998 to 2006, 6 railway extension projects were completed as large sections of the whole MTR network, but MTRC had been two different entities until the merger of 2007. The former MTRC developed Airport Express (AE), Tung Chung (TC) Line, Tseung Kwan O (TKO) Line, and Disneyland Resort (DR) Line with mixed-use, pedestrian-friendly property packages (Cervero and Murakami, 2009; McCarthy, 1996), whereas the former KCRC extended West Rail (WR) Line and Ma On Shan (MOS) Line with the "Linear City" town planning concept (Tang et al., 2004; Yeung, 2003; 2002).



Sources: Author, with data from MTRC (2009), MTRC's internal data, and HKSAR (2002).
Notes: AE: Airport Express; TC: Tung Chung Line; TKO: Tseung Kwan O Line; WR: West Rail Line; MOS: Ma On Shan Line; DR: Disneyland Resort Line; (Open Year).

Figure 3.3 MTRC's Railway Extensions, 1998-2006 and Property Development Total Gross Floor Area (GFA) Distribution, 1980-2008

Through MTRC's property development practices, the large volumes and different functions of activity spaces have been placed over the whole Hong Kong territory. Table 3.5 highlights the territorial distribution of MTRC's property developments by floor use types. Although MTRC's property packages contain multiple commercial uses, their chief function centers on housing. Over 70% of the total gross floor area (GFA) is dedicated to residential uses. This floor use pattern is more so in the outlaying areas. The fourth column of Table 3.5 shows GFA-weighted average Distances (GFA-Ds) from CBD. These figures indicate that office and hotel functions have been highly concentrated in Hong Kong Island and Kowloon, while residential and retail spaces have been largely decentralized to the New Territories.

Table 3.5 MTRC's Property Development Gross Floor Area (GFA) Distribution, 1980-2008

Floor Use	GFA (sq m)	GFA Share (%)	*GFA-D from CBD (km)
Office	935,010	9.4	2.7
Residential	7,246,427	73.2	11.1
Retail	997,652	10.1	8.2
Hotel	448,647	4.5	4.8
Others	281,114	2.8	7.1
Total	9,905,250	100.0	9.6

Sources: MTRC (2009) and MTRC's internal data.
Notes: GFA-D (GFA-weighted average Distance) from CBD i = $\{\Sigma_j [(GFA_{ij}) (CBD\_D_j)]\}/(\Sigma_j GFA_{ij})$
wherein: GFA_{ij}: GFA in type i at R+P station j; CBD_D_j: straight-line distance between CBD and R+P station j (km); i: land use type (office, residential, retail, hotel and others) and j: R+P stations (j=1~38).

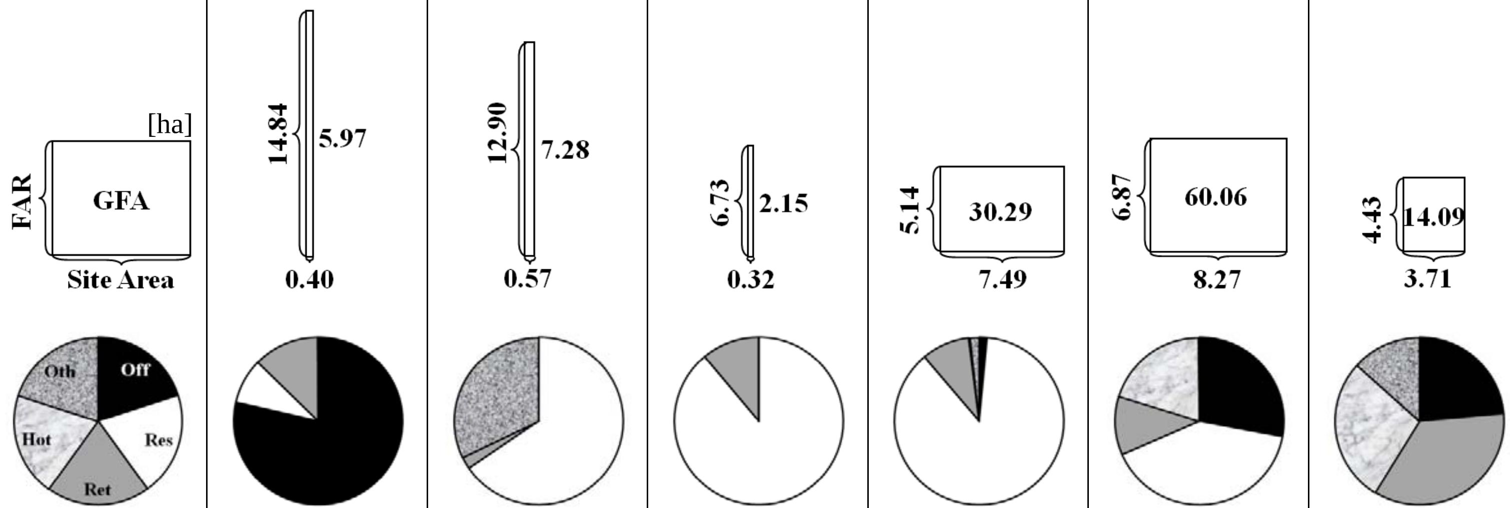
A typology illustrates more details. Cervero and Murakami (2009) identified 5 types of property developments among the former MTRC's 25 R+P stations, using cluster analysis techniques. This dissertation extends their analytical approach to the former KCRC's 13 property development stations. As a result of cluster analysis, 6 types of property developments are re-established among the 38 R+P stations. The titles are also re-named for these six types of property developments based on their built-environment attributes and town planning concepts:

- **High-rise Office (HO)**: high-rise office towers on small sites
- **High-rise Residential (HR)**: high-rise residential towers on small sites
- **Mid-rise Residential (MR)**: mid-rise residential towers on small sites with large parking spaces
- **Large-scale Residential (LR)**: residential towns on large sites with comparatively low floor area ratio
- **Large-scale Mixed (LM)**: mixed-use global centers on large sites with medium floor area ratio
- **Linear-city Commercial (LC)**: dominantly commercial complexes on medium sites with comparatively low floor area ratio

Table 3.6 summarizes the built-environment features of each property development type by presenting statistical averages for the variables used to form clusters. The table also lists the numbers of stations counted by three generations and two operators which belong to each property development type. These statistical figures reflect that MTRC's property development practices have taken four different strategies over the past three decades.

During the 1980s, the former MTRC constructed single-use towers above MTR stations for financial motives (e.g., 9 development cases in the High-rise Office, High-rise Residential, and Mid-rise Residential types). In the early stage of railway development, the young transit corporation needed to moderate incurred net losses (based on differences between revenues and combined operating and depreciated capital cost as well as debt service) by generating additional corporate revenues from the given small sites. In short, those small-scale property development practices were not strongly intended to form business clusters and local communities around the stations and guide Hong Kong's larger territorial developments along the new railway corridors.

Table 3.6 R+P Stations in Each Built-Environment Type and Statistical Mean Statistics for Key Clustering Variables



Development Type	HO: High-rise Office	HR: High-rise Residential	MR: Mid-rise Residential	LR: Large-scale Residential	LM: Large-scale Mixed	LC: Linear-city Commercial
Land Use GFA [%]						
Office	78.7	0.0	0.0	1.5	28.0	23.6
Residential	8.7	65.5	88.9	87.6	40.5	0.0
Retail	12.6	2.4	11.1	9.2	11.4	35.2
Hotel	0.0	0.0	0.0	0.3	20.0	27.9
Others	0.1	32.1	0.0	1.7	0.2	13.3
Mixture [0~1]	0.301	0.421	0.217	0.247	0.624	0.759
Parking Lots /10K GFA sq m	0	20	234	30	36	57
Number of Stations	4	4	1	24	3	2
Before 1998	4	4	1	10	0	0
1998-2006	0	0	0	5	2	2
After 2006	0	0	0	9	1	0
By the Former MTRC	4	4	1	13	3	0
By the Former KCRC	0	0	0	11	0	2

Sources: Author, with data from MTRC (2009) and MTRC's internal documents.

Throughout the 1990s, the concept of railway and property developments shifted from profit-seeking within small plots to place-making over the Hong Kong territory. A number of large-scale housing projects were widely practiced along the new railway extensions (e.g., 24 station development cases in the Large-scale Residential type: LR). In those residential development practices, the former MTRC proactively integrated pedestrian-friendly "new town" property packages with the Airport Express, Tung Chung and Tseung Kwan O Lines. In the case of Tung Chung station, for example, residential towers were intermixed with multiple commercial properties, community service facilities, and spacious amenity settings to offer a sense of livability along the international airport corridor (Figure 3.4).

Source: idsucks (http://www.flickr.com/photos/55533180@N00/2641040858/).

Figure 3.4 Large-scale Residential (LR): Tung Chung Station as a "New Town"

The former MTRC's place-making approach has not been limited to new town developments. Since the late 1990s, 3 Large-scale Mixed (LM) type property packages have been developed to form "global centers" around the main stations. In the cases of Hong Kong and Kowloon stations, the towering International Financial Centre and International Commerce Centre are highly integrated with luxury residential condominiums, modern shopping malls, a five-star deluxe hotel, and regional transit terminals. Projected as part of a state-led urban regeneration initiative, these international property development packages also contain generous urban amenity settings and well-designed pedestrian circulation systems along Victoria Habour (Figure 3.5).

Source: Sun Hung Kai Properties Limited (http://www.shkp-icc.com/index.html).

Figure 3.5 Large-scale Mixed (LM): Kowloon Station as a "Global Center"

On the other hand, the former KCRC has applied the idea of "Linear Cities" for property developments. This town planning attempts to promote competitiveness and livability by separating the different functions of activity spaces (e.g., housing, retail, business and leisure) along the railway corridors rather than mixing those functions together around the station nodes (Yeung, 2003; 2002). The 2 Linear-city Commercial (LC) type property developments implemented by the former KCRC represent one end of the Linear City strategy. In the cases of Hung Hom and Mong Kok East stations, the floor uses of property developments are dominantly commercial. Another part of the Linear City strategy can be seen as housing properties along the new West Rail and Ma On Shan Lines. A number of the new town developments practiced by the former KCRC were classified into the Larges-scale Residential (LR) type. It has generally been recognized that the former KCRC's property developments were physically less integrated with the railway stations than the former MTRC's place-making packages, yet these qualitative differences could not be captured by the cluster analysis. Therefore, the former KCRC's property developments are distinguished from the former MTRC's place-making practices, incorporating dummy variables into the following regression models.

3.4 Market Responses: Job and Labor Location Models

This section examines Hong Kong's job and labor market responses to MTRC's railway and property (R+P) developments based upon empirical figures. Table 3.7 illustrates the large picture of Hong Kong's job and labor markets between 2001 and 2006. More than 50% of Hong Kong's total jobs concentrated in the 77 MTR station areas that covered only 5% of the whole Hong Kong territory. Especially FIRE+ jobs (the finance, insurance, real estate and business service sector) in the 77 MTR station areas accounted for over 70% of all FIRE+ jobs. This suggests that the MTR station areas are highly advantageous locations for knowledge-based economic production. Among the 5 industrial sectors, CSSV (the community and social service sector) had the lowest job proportion (less than 40% in the station areas) but the highest growth rate of proportion (+3.7% between 2001 and 2006). These figures imply that the 77 MTR station areas recently became more attractive locations for living consumption too. Indeed, about 28% of Hong Kong's total labors lived in the station areas and this proportion was not much different across the 5 sectors and the 8 categories. Over the period, however, the proportion of knowledge-based labors (FIRE+) in the station areas increased 0.7%, whereas that of non-knowledge-based labors (WHRE, SVWK, CRWK, and ELMT) decreased more than 1%. It can be assumed that more knowledge-based labors preferred living around MTR stations.

In order to grasp more details, determinants of the job and labor location changes between 2001 and 2006 were estimated as the absolute number (AN), mixture index (MI), and balance index (BI) models across the 77 MTR station areas. Descriptive statistics for the entire variables are attached as appendices because of their large volume. The empirical results are presented from Table 3.8 through 3.13. Weighted least-squares (WLS) regression was used to cope with the problems of heteroscedasticity that were detected when applying ordinary least-squares (OLS) regression (Cervero and Duncan, 2002; Duncan, 2008). In order to deal with the problems of heteroscedasticity, the OLS natural log models and multilevel models were also tested, yet the WLS linear regression models yielded more reasonable estimates with relatively high R-squared ranging from 0.278 to 0.887. All variables in the regression models were significant at the 10% probability level, and most variables were significant at the 5% probability level. These empirical results could cover a wide range of academic topics, yet the coefficients on territorial location, urban amenity, and property development attributes are our primary focus.

Territorial Location:

One important trend across Table 3.9, 3.10, and 3.11 is that the coefficients on "Average Travel Time (ATT) Distance to CBD" are negative especially in the service-based sectors. This means that service-based labors lived closer to CBD over the period. Table 3.8 also shows that community and social service jobs shifted closer to CBD, while financial, insurance, real estate and business service jobs decentralized to the New Territories (the coefficients on ATT Distance to CBD = -35 in CSSV and +34 in FIRE+). The same table, however, presents that financial, insurance, real estate, and business service jobs and manufacturing jobs agglomerated but wholesale and retail jobs declined with proximity to CBD (the coefficients on "1/ATT Distance to CBD" = 3,061 in FIRE+, 826 in MANU, and -2,220 in WHRE). Consequently, job-labor balances in the knowledge-based and manufacturing sectors increased with proximity to CBD (FIRE+ and MANU in Table 3.13).

Hong Kong International Airport (HKIA) is another center influencing economic production and living consumption patterns on the territorial scale. In Table 3.8, the coefficients on "Average Travel Time (ATT) Distance to HKIA" have negative values (-16 in FIRE+ and -28 in WHRE), indicating that Hong Kong's knowledge-based production and retail activities located closer to HKIA. Contrarily, the knowledge-based and service-related labors have shifted away from HKIA, having positive coefficients in Table 3.9 (+21.0 in FIRE+) and Table 3.10 (+10.2 in SVWK). In addition, the coefficients on proximity to HKIA (1/ATT Distance to HKIA) are almost all negative across the location models. These locational disadvantages were probably due to the negative externalities of airport proximity or the geographical idiosyncrasies of Lantau Island. The coefficients in Table 3.12 and 3.13 suggest that these location shifts in turn increased Hong Kong's job mixture and job-labor balance but decreased its labor mixture in accordance with proximity to HKIA.

Urban Amenity:

A set of independent variables shed light on how urban amenity settings attracted Hong Kong's jobs and labors in 500 meters of MTR station. The location models, however, show mixed results. The coefficient on "Area of Leisure Park" has a positive value in transportation and communication jobs (TRCM), while showing negative signs in community and social service jobs (CSSV) and managerial labors (MNGR) (Table 3.8; Table 3.10). This variable may represent the characteristics of suburban amenities rather than those of urban amenities. In Table 3.8, "Area of Public Open Space (POS) owned by Private" attains positive coefficients especially in wholesale and retail, transportation and communication, and manufacturing jobs (WHRE, TRCM, and MANU), but "Number of Graded Historic Buildings (GHBs)" has negative impacts on knowledge-based, community and social service, and wholesale and retail jobs (FIRE+, CSSV, and WHRE). Table 3.9, 3.10, and 3.11 imply that urban amenity settings have weak impacts on Hong Kong's labor market formations or urban amenity impacts are captured largely by MTRC's place-making property development variables.

Property Development:

Incorporating control variables, the WLS regression models estimate the net impacts of MTRC's different property packages on Hong Kong's job and labor market locations. These empirical results are visualized by creating bar charts. Figure 3.6 shows that the new Large-scale Residential (LR) and Large-scale Mixed (LM) type packages developed between 1998 and 2006 gained both knowledge-based and manufacturing jobs (FIRE+ and MANU); on the other hand, the old High-rise Office (HO) and LR type properties constructed between 1980 and 1998 lost knowledge-based and community service jobs (FIRE+ and CSSV). These opposite trends suggest that the locational advantages of Hong Kong's business production shifted from the old properties to the new packages. Yet, both the old LR type property and new LM type package increased wholesale and retail jobs (WHRE). It can be assumed that Hong Kong's retail businesses were polarized between suburban necessary and urban luxury markets.

The new LM type package reduced the number of labors particularly in the non-knowledge-based sectors (CSSV, WHRE, and TRCM), whereas the new LR type package gained more labors in all industrial sectors (Figure 3.7). Figure 3.8 also presents that the new LM type

Table 3.7 Job and Labor Markets over the Hong Kong Territory and in the 77 MTR Station Areas, 2001-2006

	2001			2006			Change		
	HKT	77 SA	Share %	HKT	77 SA	Share %	HKT	77 SA	Share %
LA [sq km]	1,099	55	5.0	1,104	55	5.0	5	0	0.0
Job									
Total	2,220,307	1,155,047	52.0	2,325,800	1,209,656	52.0	105,493	54,609	0.0
FIRE+	428,878	302,850	70.6	479,090	335,800	70.1	50,212	32,951	-0.5
CSSV	360,453	118,360	32.8	454,760	164,637	36.2	94,307	46,277	+3.4
WHRE	1,031,481	557,088	54.0	1,038,050	559,249	53.9	6,569	2,161	-0.1
TRCM	181,829	91,062	50.1	185,290	85,559	46.2	3,461	-5,504	-3.9
MANU	209,329	80,971	38.7	160,500	59,351	37.0	-48,829	-21,620	-1.7
Labor I.									
Total	3,237,252	918,962	28.4	3,335,736	929,917	27.9	98,484	10,955	-0.5
FIRE+	523,983	150,017	28.6	565,591	165,819	29.3	41,608	15,801	+0.7
CSSV	827,599	221,484	26.8	896,566	240,213	26.8	68,967	18,729	0.0
WHRE	850,389	259,606	30.5	908,760	264,764	29.1	58,371	5,158	-1.4
TRCM	366,389	98,637	26.9	388,443	102,030	26.3	22,054	3,393	-0.7
MANU	401,620	112,123	27.9	322,633	89,770	27.8	-78,987	-22,353	-0.1
Labor O.									
MNGR	349,637	103,810	29.7	355,922	103,483	29.1	6,285	-327	-0.6
PROF	179,825	51,487	28.6	202,251	57,648	28.5	22,426	6,161	-0.1
APROF	498,671	144,687	29.0	537,624	153,129	28.5	38,953	8,442	-0.5
CLRK	529,992	153,456	29.0	563,980	159,337	28.3	33,988	5,881	-0.7
SVWK	488,961	145,276	29.7	547,398	155,084	28.3	58,437	9,808	-1.4
CRWK	321,000	91,076	28.4	284,812	76,058	26.7	-36,188	-15,018	-1.7
PLNT	238,666	62,628	26.2	207,695	52,944	25.5	-30,971	-9,684	-0.7
ELMT	635,393	180,642	28.4	626,437	169,319	27.0	-8,956	-11,323	-1.4

Sources: Author, with data from HKSAR (2009a; 2007a; 2007b; 2007c; 2002) and NBSC (2009).

Notes: HKT: Hong Kong Territory; 77 SA: 77 MTR Station Areas; Share: Share of 77 SA in HKT; LA: Land Area; I.: Industrial Sectors; FIRE+: Financing, Insurance, Real Estate and Business Services; CSSV: Community, Social and Personal Services; WHRE: Wholesale, Retail and Import/Export Trades, Restaurants and Hotels; TRCM: Transport, Storage and Communications; MANU: Manufacturing; O.: Occupational Categories; MNGR: Managers and Administrators; PROF: Professionals; APROF: Associate Professionals; CLRK: Clerks; SVWK: Service Workers and Shop Sales Workers; CRWK: Craft and Related Workers; PLNT: Plant and Machine Operators and Assemblers; ELMT: Elementary Occupations.

Table 3.8 Weighted Least Squares (WLS) Regression Results: Determinants of Job Absolute Number (AN) Changes by Industrial Sector, 2001-2006

Sector i	Total		FIRE+		CSSV		WHRE		TRCM		MANU	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
Urban Agglomeration in 2001												
Total Jobs [1,000]	44	0.000	42	0.000	44	0.000	30	0.000	-39	0.000	-17	0.000
Total Labors [1,000]					27	0.041					-9	0.050
Job Mixture Index [0~1]			2,746	0.000	2,376	0.014			-5,755	0.001		
Labor Mixture Index [0~1]			8,660	0.001	11,310	0.017	9,586	0.006				
Balance Index in Sector i [0~1]									2,190	0.000		
Job Location Quotient in Sector i							634	0.090	-511	0.035	-209	0.000
Labor Location Quotient in Sector i			1,985	0.000	1,361	0.014			1,238	0.000	-798	0.000
Territorial Location												
ATT Distance to CBD [min.]			34	0.002	-35	0.000						
ATT Distance to HKIA [min.]			-16	0.061	31	0.000			-28	0.008		
1 / ATT Distance to CBD [min.]			3,061	0.003			-2,220	0.049			826	0.059
1 / ATT Distance to HKIA [min.]	-20,623	0.000	-9,027	0.009	5,744	0.069	-11,287	0.003	-31,155	0.001	-5,473	0.000
Urban Amenity and Regional Institute												
Area of Leisure Park [ha]					-40	0.092			157	0.000		
Area of POS owned by Private [ha]	1,741	0.002					739	0.030	1,527	0.004	227	0.082
Area of the Ocean [ha]			-22	0.014							6	0.073
Number of GHBs			-104	0.006	-78	0.082	-71	0.075			30	0.073
Number of Universities							755	0.039	999	0.057		
Transit Service												
Ave. Distance to Next Stations [km]					103	0.058					30	0.093
LRT Transfer Station [1/0]											299	0.034
Railway and Property Development												
HO by F.MTRC 1980-1998 [1/0]					-1,765	0.027						
LR by F.MTRC 1980-1998 [1/0]			-558	0.004	-421	0.060	594	0.002				
LR by F.MTRC 1998-2006 [1/0]	897	0.015	556	0.027							162	0.042
LM by F.MTRC 1998-2006 [1/0]	1,157	0.009	848	0.002			862	0.000			193	0.033
(Constant)	252	0.143	-12,212	0.000	-14,846	0.002	-9,685	0.005	4,883	0.000	933	0.000
R-Squared	0.478		0.785		0.648		0.417		0.577		0.858	
Number of Observations	77		77		77		77		77		77	

Notes: ATT: Average Travel Time; HKIA: Hong Kong International Airport; POS: Public Open Space; GHBs: Graded Historic Buildings; HO: High-rise Office; LR: Large-scale Residential; LM: Large-scale Mixed; F. MTRC: Former Mass Transit Railway Corporation; FIRE+: Financing, Insurance, Real Estate and Business Services; CSSV: Community, Social and Personal Services; WHRE: Wholesale, Retail and Import/Export Trades, Restaurants and Hotels; TRCM: Transport, Storage and Communications; MANU: Manufacturing.

Table 3.9 Weighted Least Squares (WLS) Regression Results: Determinants of Labor Absolute Number (AN) Changes by Industrial Sector, 2001-2006

Sector i	Total		FIRE+		CSSV		WHRE		TRCM		MANU	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
Urban Agglomeration in 2001												
Total Jobs [1,000]												
Total Labors [1,000]	-202	0.001					-49	0.001	-12	0.056	-37	0.000
Job Mixture Index [0~1]	-8,977	0.064										
Labor Mixture Index [0~1]			6,218	0.013					4,803	0.013		
Housing Mixture Index [0~1]	3,102	0.002			789	0.001	1,023	0.000			399	0.006
Balance Index in Sector i [0~1]	5,680	0.000	559	0.008	1,736	0.000	1,113	0.000			233	0.078
Labor Location Quotient in Sector i									-438	0.000	-869	0.002
Job Access in 2001												
Jobs within 30 min. in Sector i [10K]					-39	0.001						
Territorial Location												
ATT Distance to CBD [min.]	-136	0.000	-19	0.000	-31	0.001	-19	0.004				
ATT Distance to HKIA [min.]	113	0.000	21	0.000								
1 / ATT Distance to HKIA [min.]					-8,201	0.000	-11,421	0.000			-4,620	0.000
Railway and Property Development												
MR by F.MTRC 1980-1998 [1/0]							-1,318	0.050				
LR by F.MTRC 1998-2006 [1/0]	3,114	0.001	861	0.000	804	0.010	891	0.001	434	0.000	583	0.000
LM by F.MTRC 1998-2006 [1/0]	-3,244	0.009			-1,006	0.007	-979	0.002	-258	0.071		
(Constant)	2,816	0.431	-6,455	0.008	580	0.176	291	0.346	-3,981	0.022	738	0.006
R-Squared	0.469		0.439		0.492		0.492		0.278		0.536	
Number of Observations	77		77		77		77		77		77	

Notes: ATT: Average Travel Time; HKIA: Hong Kong International Airport; MR: Mid-rise Residential; LR: Large-scale Residential; LM: Large-scale Mixed; F. MTRC: Former Mass Transit Railway Corporation; FIRE+: Financing, Insurance, Real Estate and Business Services; CSSV: Community, Social and Personal Services; WHRE: Wholesale, Retail and Import/Export Trades, Restaurants and Hotels; TRCM: Transport, Storage and Communications; MANU: Manufacturing.

Table 3.10 Weighted Least Squares (WLS) Regression Results: Determinants of Labor Absolute Number (AN) Changes by Service-based Occupational Category, 2001-2006

Category i	MNGR		PROF		APROF		CLRK		SVWK	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
Urban Agglomeration in 2001										
Total Jobs [1,000]									-8.2	0.074
Total Labors [1,000]	-25	0.000	-12	0.001	-28	0.002	-23	0.008		
Job Mixture Index [0~1]	-2,653	0.000	-1,075	0.001	-2,482	0.002	-1,856	0.031		
Housing Mixture Index [0~1]	403	0.000	238	0.000	522	0.002	528	0.002	408	0.007
Total Balance Index [0~1]	746	0.000	357	0.000	968	0.000	1,350	0.000	869	0.000
Labor Location Quotient in Category i			-85	0.021					-685	0.031
Territorial Location										
ATT Distance to CBD [min.]			-3.1	0.041	-6.9	0.080			-11.0	0.039
ATT Distance to HKIA [min.]									10.2	0.000
1 / ATT Distance to HKIA [min.]	-7,749	0.000	-3,946	0.000	-7,750	0.000	-6,462	0.000		
Urban Amenity and Regional Institute										
Area of Leisure Park [ha]	-37	0.002								
Number of GHBs	46	0.018								
Transit Service										
MTR Feeder Bus Lines									90	0.004
Railway and Property Development										
MR by F.MTRC 1980-1998 [1/0]									-987	0.035
LR by F.MTRC 1980-1998 [1/0]	-215	0.050					-317	0.098	-506	0.011
LR by F.MTRC 1998-2006 [1/0]	1,003	0.000	490	0.000	940	0.000	821	0.000	415	0.012
LM by F.MTRC 1998-2006 [1/0]	219	0.060							-494	0.035
(Constant)	1,758	0.000	930	0.000	1,783	0.004	807	0.181	97	0.795
R-Squared	0.745		0.665		0.489		0.414		0.458	
Number of Observations	77		77		77		77		77	

Notes: ATT: Average Travel Time; HKIA: Hong Kong International Airport; GHBs: Graded Historic Buildings; MR: Mid-rise Residential; LR: Large-scale Residential; LM: Large-scale Mixed; F. MTRC: Former Mass Transit Railway Corporation; MNGR: Managers and Administrators; PROF: Professionals; APROF: Associate Professionals; CLRK: Clerks; SVWK: Service Workers and Shop Sales Workers.

Table 3.11 Weighted Least Squares (WLS) Regression Results: Determinants of Labor Absolute Number (AN) Changes by Manufacturing-related Occupational Category, 2001-2006

Category i	CRWK		PLNT		ELMT	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
Urban Agglomeration in 2001						
Total Labors [1,000]	-24	0.000	-24	0.000	-34	0.000
Job Mixture Index [0~1]					-1,484	0.057
Housing Mixture Index [0~1]	228	0.032	159	0.030	501	0.002
Total Balance Index [0~1]	418	0.003	462	0.000	856	0.001
Labor Location Quotient in Category i	-294	0.009	-137	0.024	-294	0.009
Job Access in 2001						
Total Jobs within 30 min. [100K]	-14	0.036	-13	0.002		
Territorial Location						
ATT Distance to CBD [min.]	-6.3	0.070	-6.1	0.004		
1 / ATT Distance to HKIA [min.]	-2,836	0.000	-1,182	0.002	-6,717	0.000
Railway and Property Development						
LR by F.MTRC 1998-2006 [1/0]	281	0.029			933	0.000
LM by F.MTRC 1998-2006 [1/0]	-319	0.028	-313	0.001		
(Constant)	457	0.033	289	0.013	747	0.168
R-Squared	0.489		0.561		0.485	
Number of Observations	77		77		77	

Notes: ATT: Average Travel Time; HKIA: Hong Kong International Airport; LR: Large-scale Residential; LM: Large-scale Mixed; F. MTRC: Former Mass Transit Railway Corporation; CRWK: Craft and Related Workers; PLNT: Plant and Machine Operators and Assemblers; ELMT: Elementary Occupations.

Table 3.12 Weighted Least Squares (WLS) Regression Results: Determinants of Job and Labor Mixture Index (MI) Changes, 2001-2006

	Job		Labor I.		Labor O.	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
Urban Agglomeration in 2001						
Total Jobs [100K]					-0.018	0.003
Total Labors [100K]	0.237	0.016	0.052	0.001	0.048	0.000
Labor Mixture Index [0~1]	-0.694	0.012	-0.518	0.000	-0.213	0.000
Housing Mixture Index [0~1]			0.006	0.086		
Job and Labor Access in 2001						
Total Jobs within 30 min. [1M]					-0.005	0.005
Total Labors within 30 min. [1M]	-0.032	0.015				
Territorial Location						
ATT Distance to CBD [min.]			0.001	0.000		
ATT Distance to HKIA [min.]			-0.001	0.000	0.000	0.009
1 / ATT Distance to CBD [min.]			-0.033	0.006		
1 / ATT Distance to HKIA [min.]	1.210	0.000	-0.135	0.031	-0.256	0.000
Urban Amenity and Regional Institute						
Area of the Ocean [ha]			0.000	0.060		
Number of Universities	0.052	0.084				
Transit Service						
Ave. Distance to Next Stations [km]	-0.018	0.000	-0.001	0.056	0.001	0.081
Airport Express Line Station [1/0]	0.163	0.000	-0.013	0.092	-0.012	0.038
Railway and Property Development						
New MTR Station 1998-2006 [1/0]	0.042	0.007			-0.005	0.008
Newly Connected MTR Station 1998-2006 [1/0]	0.082	0.000			-0.019	0.006
LR by F.MTRC 1980-1998 [1/0]	0.041	0.024				
LR by F.MTRC 1998-2006 [1/0]	-0.078	0.000	0.013	0.000	0.021	0.000
LM by F.MTRC 1998-2006 [1/0]	-0.136	0.000	0.022	0.000	0.023	0.000
LC by F.KCRC 1998-2006 [1/0]					-0.019	0.006
(Constant)	0.639	0.015	0.489	0.000	0.208	0.000
R-Squared	0.634		0.786		0.861	
Number of Observations	77		77		77	

Notes: ATT: Average Travel Time; HKIA: Hong Kong International Airport; LR: Large-scale Residential; LM: Large-scale Mixed; LC: Linear-city Commercial: F. MTRC: Former Mass Transit Railway Corporation; F. KCRC: Former Kowloon-Canton Railway Corporation; I.: Industrial Sectors; O.: Occupational Categories.

Table 3.13 Weighted Least Squares (WLS) Regression Results: Determinants of Job-Labor Balance Index (BI) *100 Changes by Industrial Sector, 2001-2006

Sector i	Total		FIRE+		CSSV		WHRE		TRCM		MANU	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
Urban Agglomeration in 2001												
Total Jobs [1,000]	-0.18	0.021					-0.47	0.000			-0.16	0.055
Total Labors [1,000]									0.53	0.015	0.28	0.082
Job Mixture Index [0~1]	30.54	0.056			65.97	0.001	55.25	0.002				
Labor Mixture Index [0~1]			-264.50	0.000	-241.91	0.001						
Housing Mixture Index [0~1]	-6.08	0.072							16.82	0.000	-6.37	0.037
Job-Labor BI in Sector i [0~1]	-27.65	0.000	-35.70	0.000	-30.10	0.000	-32.53	0.000			-12.64	0.003
Job Location Quotient in Sector i							-17.26	0.020			5.61	0.000
Labor Location Quotient in Sector i					-26.01	0.003	39.96	0.000	-30.40	0.000		
Job Access in 2001												
Jobs within 30 min. in Sector i							-0.10	0.045				
Territorial Location												
ATT Distance to CBD [min.]			0.30	0.036							0.56	0.000
ATT Distance to HKIA [min.]			-0.57	0.001			-0.20	0.030			-0.17	0.043
1 / ATT Distance to CBD [min.]							32.66	0.069				
1 / ATT Distance to HKIA [min.]	78.77	0.045	-225.82	0.000	44.69	0.011			444.41	0.000		
Urban Amenity and Regional Institute												
Area of Leisure Park [ha]			1.43	0.001			0.83	0.028				
Area of the Ocean [ha]			-0.52	0.011			0.31	0.062	0.47	0.013	0.34	0.010
Number of GHBs			-1.46	0.045							1.35	0.016
Transit Service												
Ave. Distance to Next Stations [km]	-1.55	0.042							-3.24	0.002	-1.86	0.002
Airport Express Line Station [1/0]			-17.66	0.072			-37.95	0.000				
LRT Transfer Station [1/0]									12.91	0.090		
Number of MTR Feeder Bus Lines							1.22	0.028				
Railway and Property Development												
New Station 1998-2006 [1/0]	-5.99	0.030					-7.59	0.037			-9.47	0.000
Connected Station 1998-2006 [1/0]							-12.44	0.009			-6.21	0.097
MR by F.MTRC 1980-1998 [1/0]											-25.57	0.001
LR by F.MTRC 1980-1998 [1/0]			15.83	0.000							-6.98	0.035
LR by F.MTRC 1998-2006 [1/0]							-9.98	0.008			9.84	0.001
LM by F.MTRC 1998-2006 [1/0]	27.05	0.000	34.68	0.000			37.68	0.000			13.75	0.000
LC by F.KCRC 1998-2006 [1/0]											-23.65	0.005
(Constant)	-0.76	0.950	290.86	0.000	224.44	0.004	-24.89	0.234	7.55	0.193	-0.90	0.893
R-Squared	0.644		0.765		0.439		0.887		0.676		0.762	
Number of Observations	77		77		77		77		77		77	

Notes: ATT: Average Travel Time; HKIA: Hong Kong International Airport; GHBs: Graded Historic Buildings; MR: Mid-rise Residential; LR: Large-scale Residential; LM: Large-scale Mixed; LC: Linear-city Commercial; F. MTRC: Former Mass Transit Railway Corporation; F. KCRC: Former Kowloon-Canton Railway Corporation; FIRE+: Financing, Insurance, Real Estate and Business Services; CSSV: Community, Social and Personal Services; WHRE: Wholesale, Retail and Import/Export Trades, Restaurants and Hotels; TRCM: Transport, Storage and Communications; MANU: Manufacturing.

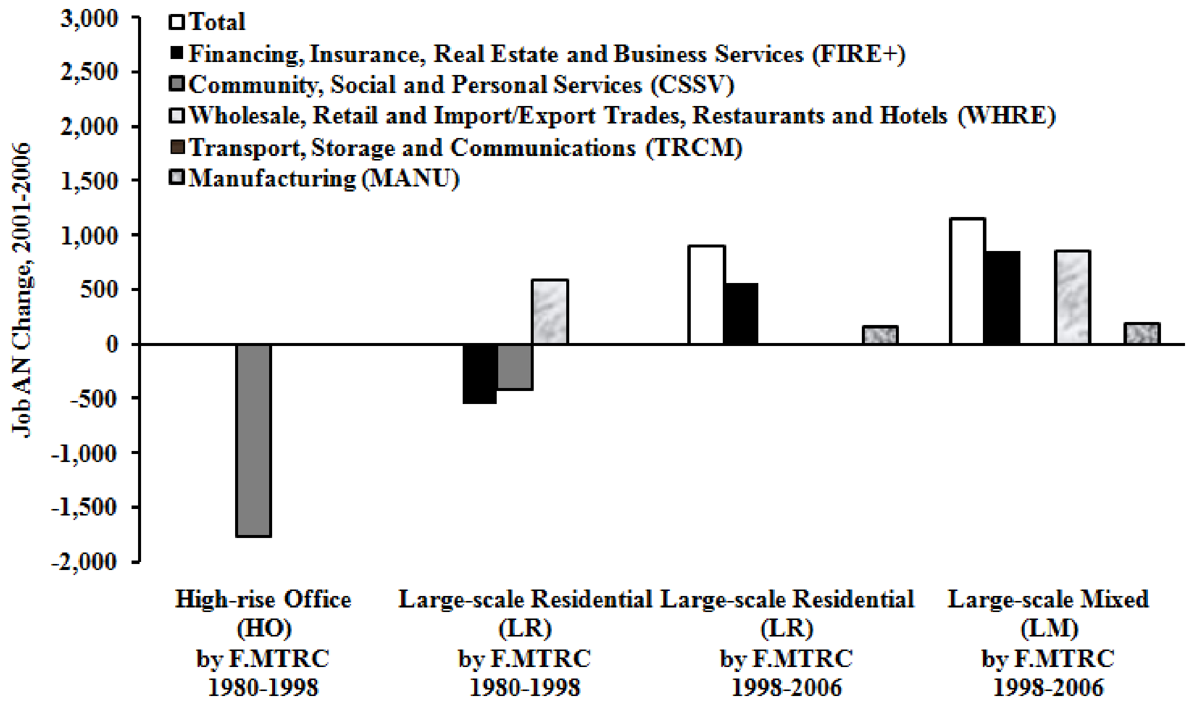


Figure 3.6 Impacts of MTRC's Property Packages on Job Absolute Number (AN), 2001-2006

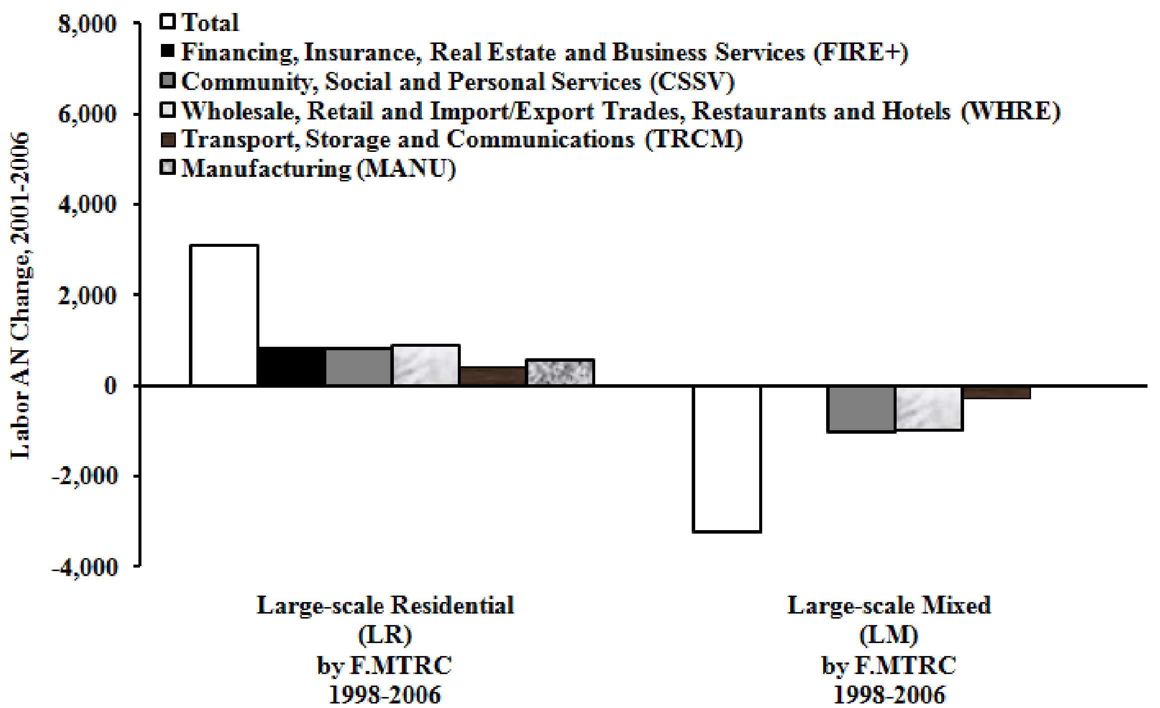


Figure 3.7 Impacts of MTRC's Property Packages on Labor Absolute Number (AN) by Industrial Sector, 2001-2006

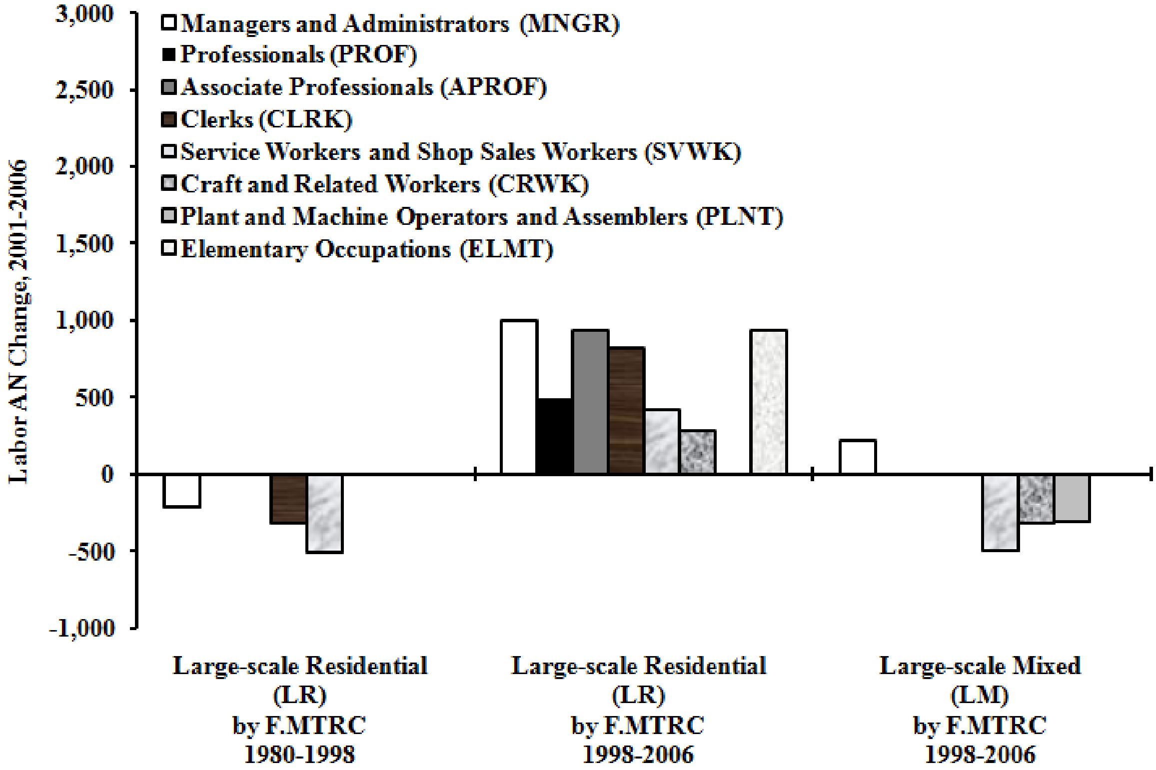


Figure 3.8 Impacts of MTRC's Property Packages on Labor Absolute Number (AN) by Occupational Category, 2001-2006

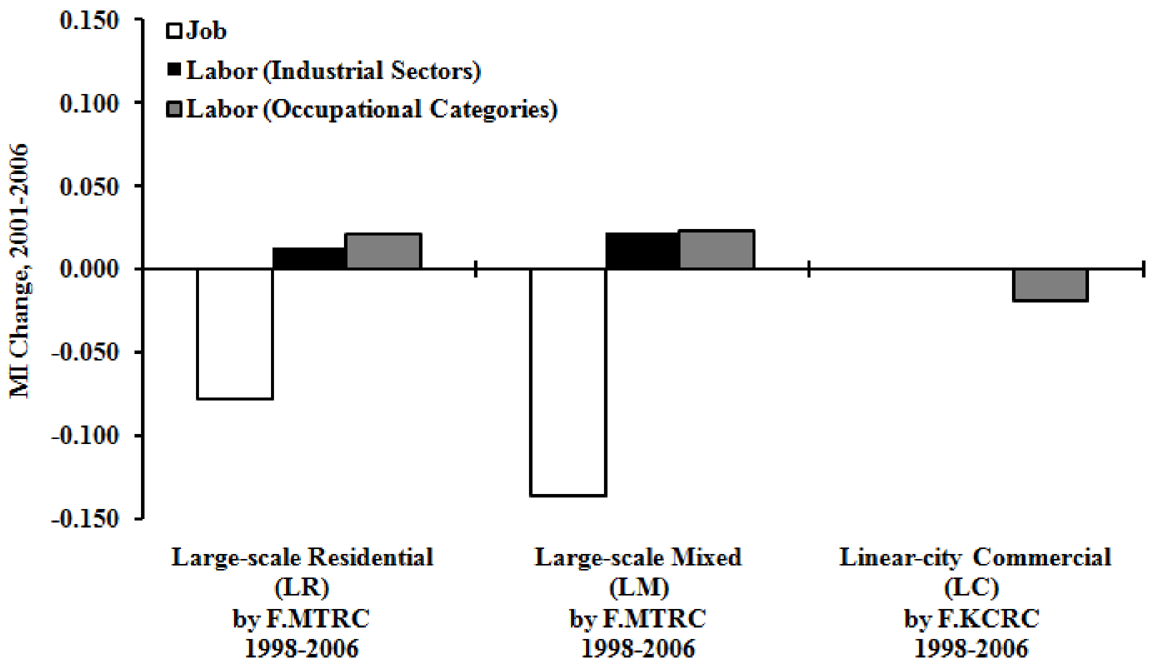


Figure 3.9 Impacts of MTRC's Property Packages on Job and Labor Mixture Index (MI), 2001-2006

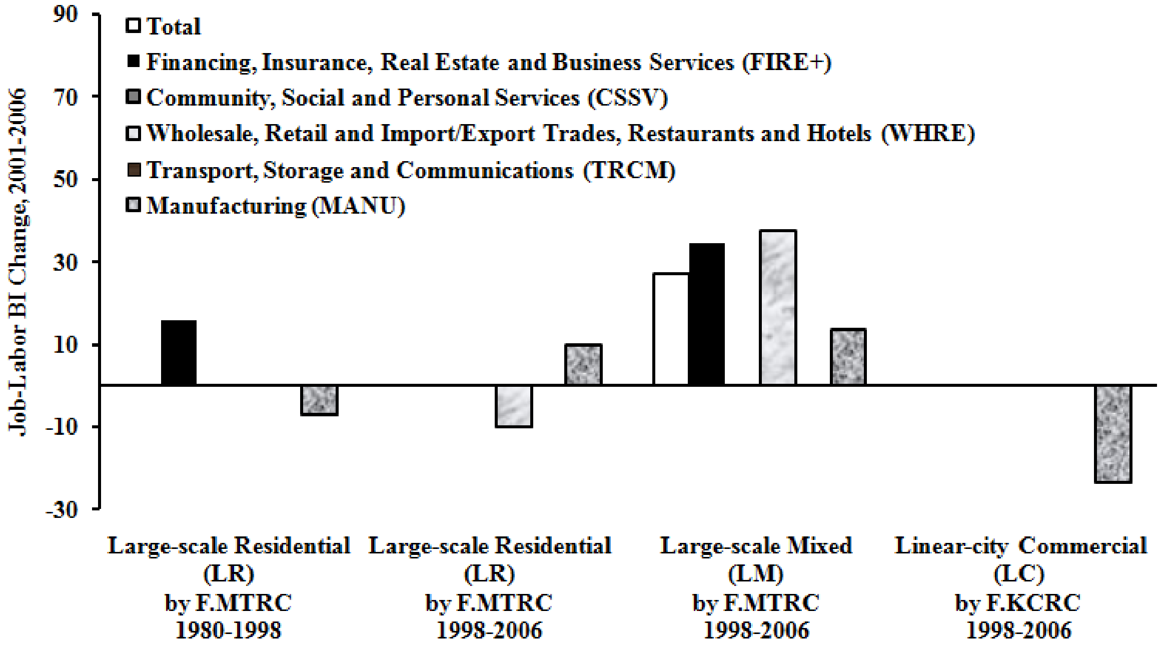


Figure 3.10 Impacts of MTRC's Property Packages on Job-Labor Balance Index (BI), 2001-2006

package accommodated more manager type labors (MNGR), while decreasing non-knowledge type labors (CRWK, PLNT, and ELMT). The new LR type package increased almost all categories of labors; however, the old LR type property decreased the number of labors in the non-knowledge type labor categories (CLRK and SVWK).

Figure 3.9 illustrates that the former MTRC's new LR and LM type packages moderately increased both the industrial and occupational labor mixtures but considerably decreased the job mixture (-0.136). Instead, the new LM type package significantly improved the job-labor balances in the knowledge-based, retail, and manufacturing sectors (FIRE+, WHRE, and MANU in Figure 3.10). To the contrary, the new Linear-city Commercial (LC) type property between 1998 and 2006 largely decreased the job-labor balance in the manufacturing sector (MANU: -0.237) and slightly reduced the occupational labor mixture. The old LR type property also lost the job-labor balance in the manufacturing sector, but the new LR type package balanced it in the same sector.

3.5 Findings

As a core part of HKSAR's development strategy, MTRC's Railway and Property development programme has been applied to guide Hong Kong's densest urban agglomerations over the decades. Yet, its development practices have not been a monolith. This chapter found 6 types of property developments and explained their planning concepts on the basis of location, generation, and organization. In recent generation, the former MTRC's "place-making" approach has widely been practiced across the Hong Kong territory. Large-scale mixed use property packages have been developed with urban amenity settings to form "competitive" global centers in Hong Kong Island and Kowloon, whereas large-scale residual property packages have been delivered with social service settings to create "livable" local communities in the New Territories.

In response to these state interventions, Hong Kong's job and labor markets have reformed their locations, intensifications, and compositions around MTR stations. One of the important findings from the empirical analyses is that Hong Kong's service-based labors and community service jobs have shifted towards the traditional central business district (CBD). This empirical finding partially supports other researchers who claim that central locations should be more advantageous in living consumption (Florida, 2003; Glaeser et al., 2006; 2001; Hinshaw, 2007). At the same time, this empirical study presents that the core location of Hong Kong has been more dedicated to knowledge production in the international business finance and high-tech manufacturing sectors, which is consistent with the "Global City" theory (Sassen, 2001).

This chapter also emphasizes the increasing importance of the world-class airport express investment and airport-linked developments in forming Hong Kong's urban agglomerations. The empirical results suggest that time-sensitive global business activities enjoy the locational advantages of airport access, while amenity-sensitive local living activities avoid the negative externalities of airport proximity. In the case of Hong Kong, however, a number of residential properties have been provided along the new airport access corridor. As Kasarda argued (2009; 2004), commercial property packages would offer higher locational advantages along the airport access corridor. Yet it is too early to conclude the locational impacts of airport-linked developments from this empirical study because a number of commercial properties are still being developed around Hong Kong International Airport (e.g., SkyCity). To assess post-project location shifts, another empirical research should be conducted after the next Hong Kong Population Census 2011.

The chief question investigated by this chapter is whether MTRC's place-making property development practices have actually formed competitive global centers and create livable local communities around the MTR stations. The empirical results reveal that the new large-scale mixed use packages (e.g., Hong Kong and Kowloon stations) accommodated more global businesses, luxury retailers, and managerial labors by relocating less-skilled labors and decreasing job mixture along Victoria Harbour. This composition change, however, resulted in higher job-labor balances particularly in the global business finance and high-tech manufacturing sectors. On the other hand, the new large-scale residential packages gained almost all kinds of labors and increased labor mixtures along the new railway corridors. Yet these gains were likely to come from the losses in MTRC's older properties and replacements in the Victoria Harbour waterfront. In sum, the impacts of the former MTRC's place-making practices were locationally and intergenerationally redistributive on the MTR network.

Finally, this empirical study examines Hong Kong's job and labor market changes during the period 2001 to 2006, which was just one phase of the dynamic interactions between state strategies and market shifts. In response to the previous market profiles, the city-state of Hong Kong would revise the territorial development strategy for the next generation. The latest state strategy "Hong Kong 2030" (HKSAR, 2007e) emphasizes three inter-dependent outcomes: linkage with mainland China; global business competitiveness; and urban living quality. The first outcome is importantly related to Hong Kong's demographic projection because the population growth needs to be sustained largely by the inflows from mainland China. For the next few decades, however, the growth rate is expected to slow down and elderly people will become a larger share of its total population. These demographic trends call for a shift of the development strategy from massive constructions in the New Territories to quality improvements in Hong Kong Island and Kowloon. MTRC's "place-making" property programme will have a next phase and play more an important role in harnessing Hong Kong's densest urban agglomerations for global competitiveness and local livability in coming years.

Chapter Four
Singapore:
Government Land Sales as the Modern Environment Shaper

4.1 Background

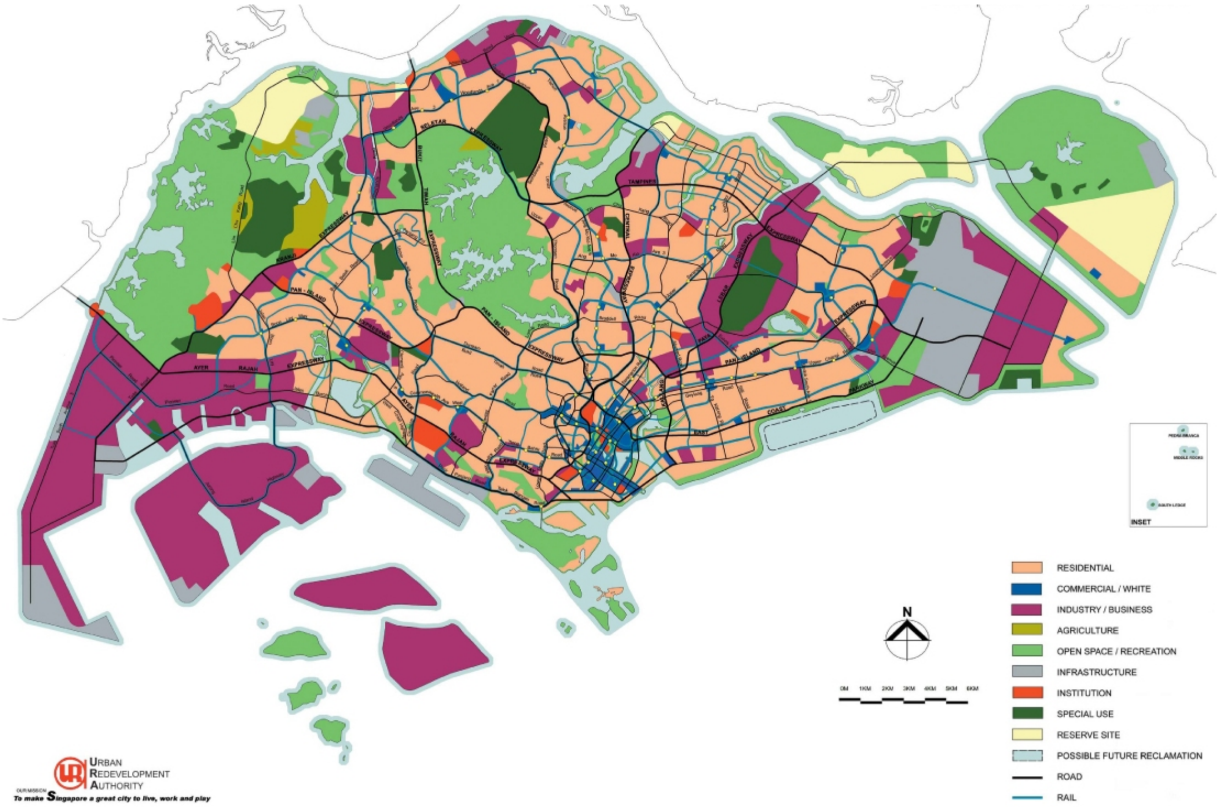
Singapore is an icon of "Modern Asia" known for its global business and green living environments, containing nearly 3 million employments and 5 million populations in a 710 sq km island (Table 4.1). Since the 1990s Singapore's economy has drastically oriented from low-cost manufacturing to knowledge-based global services (e.g., finance, real estate, information, and business service), and its gross domestic product (GDP) has rapidly rose annual average 9.7% between 2003 and 2008. The influx of foreign workers has expanded the size of business and living activities, yet the main concern for Singapore has been about the scarcity of land. As global capital has flown into the small island, the demand for land development has increased over the decades. Under its limited land supply, the city-state of Singapore has proactively guided the spatial transformation of the island by integrating a "World Class Land Transport System" with comprehensive land use planning (LTA, 1996; Lui and Tan, 2001; Yang and Lew, 2009).

Table 4.1 Background Information on Singapore, 2008

Population		4,839,400
Total Land Area [sq km]		710
Total Land Population Density [people sq km]		6,814
Average Annual Population Growth Rate, 2003-08 [%]		+3.3
Gross Domestic Product (GDP) [SG$ Million Current Market Price]		257,419
GDP per Capita [SG$ Current Market Price]		53,192
Average Annual GDP Growth Rate, 2003-08 [%]		+9.7
Number of Jobs		2,952,400
	Primary Sector %	0.7
	Secondary Sector %	32.0
	Tertiary Sector %	67.3
Number of Labors		2,939,900

Sources: GOS (2009a; 2009b).
Note: 1 SG$ = 0.710 US$ in 2008.

Singapore's transportation and land use integration has been conceived largely by its long-term strategic plan. The first "Concept Plan" in 1971 provided a blueprint for configuring new towns, industrial parks, and urban centers in a ring around the Central Area, interconnected by a mass rapid transit (MRT) network. This prototype plan resulted in the massive relocation of residents from overcrowded urban slums to standardized suburban housing units along MRT corridors, yet most the satellite new towns were not self-containable. Therefore, a large number of cross-haul travels generated between those satellite new towns and the Central Area as well as among the satellite new towns (Cervero, 1998). The revised Concept Plan in 1991 and 2001 encouraged the formation of new back-office employment centers in the North, North-East and East regions for more self-sufficiency, while promoting the intensification of global finance and producer service activities in the Central Area for greater synergy and critical mass. The latest revision also addressed the creation of a more livable city with a wide choice of housing types, locations, and amenities over the MRT network (Figure 4.1; URA, 2001).



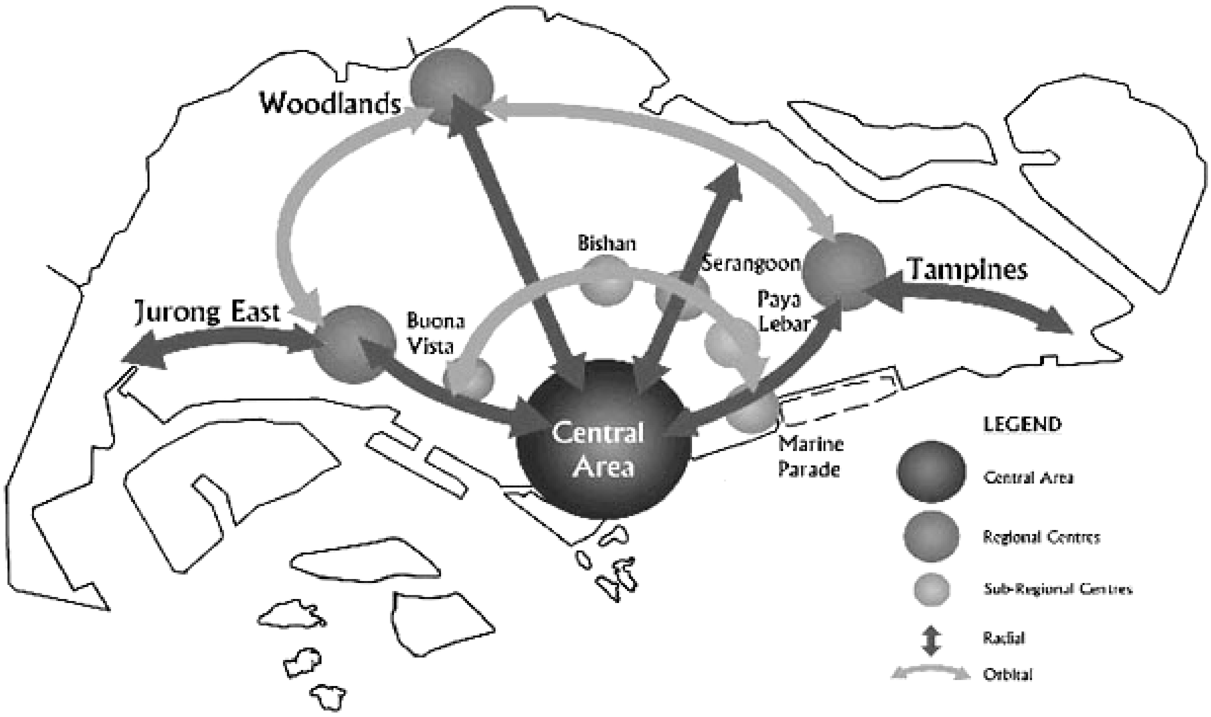
Source: URA (2001).

Figure 4.1 Singapore's Concept Plan 2001

The MRT network has been a critical component of the Concept Plan. New radial and orbital MRT lines are being developed as part of the long term "Constellation Plan" (Figure 4.2). The radial lines would enable people to travel to the Central Area directly, whereas the orbital lines would enable people to get from one place to another outside the Central Area more quickly. This network pattern has been intended to shape a viable core of the island's economy and culture, orbiting regional and sub-regional centers around high-access MRT interchanges, a variety of housing units along MRT corridors, and an equal distribution of jobs and housing throughout the island (Cervero, 1998; LTA, 1996). In addition, Singapore Changi Airport (CGIA) was directly connected by the new MRT line in 2002, expected to form Singapore's regional node that would accommodate industrial, office, hotel, and exhibition spaces (Kasarda, 2009; 2004). Supplementing the MRT network, light rail transit (LRT) systems were recently developed with an extensive bus network and park & ride (P&R) facilities. These multi-modal transit systems have been physically integrated with commercial, residential, and industrial properties around MRT stations (Ibrahim, 2003; Lam and Toan, 2006).

Many international transportation researchers have repeatedly reviewed Singapore's public transit integration and private automobile restriction policies, yet most of them have paid little attention to its transit-oriented urban regeneration projects. The Housing and Development Board

(HDB) and Urban Redevelopment Authority (URA) are the two government entities involved with large-scale property developments and responsible for implementing the long-term Concept Plan and short-term Master Plan. One of the most important public policy instruments practiced by both HDB and URA is the "Government Land Sales" (GLS) programme, in which development rights of land parcels are sold to private or government-linked real estate companies through public auctions on the basis of location, property type, site area, floor area ratio (FAR), and public space requirements. HDB and URA have over the years strategically sold large amounts of development space to form urban agglomerations along the high access MRT corridors and to raise development funds as one kind of "value capture" techniques. Since the early 1990s, the two entities have received about $SG28.7 billion largely from residential and commercial property developments (Table 4.2).



Source: URA (2001).

Figure 4.2 Singapore's Long-Term Rail Transit Plan: the Constellation Plan

As a planning instrument, the basic function of property development rights is to internalize externalities in the competitive use of land resources. Thus, the GLS programme also has had direct impacts on built environment, economic efficiency, and distributive equity in and around target locations (Zhu et al., 2007). Especially since the 1990s, the state entities of HDB and URA have attempted to ensure place-making principles (e.g., high-density, mixed-use, and pedestrian-friendly) in private property developments around MRT stations (Yang and Lew, 2009). However, a critical question is whether these transit-oriented urban intensification strategies have properly guided Singapore's property markets. Existing studies pointed out market signals indicating that Singapore's entrepreneurial state interventions would result in unintended consequences such as spatial recentralization, land fragmentation, lifestyle limitation, and economic recession (Han, 2004; Han et al., 2002; Lum et al., 2004; Richmond, 2008; Zhu et al., 2007). Yet, the diverse types of property development practices around MRT stations and the dynamic impacts of them on Singapore's property markets are still poorly understood.

Table 4.2 Government Land Sales (GLS) awarded by the Housing and Development Board (HDB) and Urban Redevelopment Authority (URA)

Land Use	Site Area sq m	%	Price SG$M	%	# of Sites	Lease Years
HDB*						
Residential	4,346,353	92.5	10,603.7	78.5	103	99, 103
Commercial	228,028	4.9	1,826.3	13.5	33	99
Mixed	125,744	2.7	1,082.2	8.0	7	99
HDB Total	4,700,125	100.0	13,512.2	100.0	143	
URA**						
Business	73,505	1.6	22.9	0.2	3	30, 60
Commercial	144,822	3.1	2,659.0	17.4	51	60, 99
Industrial	2,180,679	46.1	2,119.5	13.9	36	30, 60
Residential	1,695,402	35.8	10,117.9	66.4	380	99
Heavy Vehicle Park	248,504	5.3	45.0	0.3	22	10, 15, 99
Transitional Office	10,444	0.2	37.0	0.2	1	15
White (Flexible)	132,322	2.8	0.1	0.0	13	99
Others	244,715	5.2	243.3	1.6	12	15, 30, 45, 99
URA Total	4,730,394	100.0	15,244.7	100.0	518	
HDB & URA Total	**9,430,519**		**28,756.9**		**661**	

Sources: Author, which data from HDB (2007) and URA (2007).
Notes: *Except Ancillary Developments and Interim Use, Feb.1990-Oct.2007.
** Vacant Lands Only, Feb.1993-Oct.2007.

4.2 Methodologies

This chapter classifies the types of the Government Land Sales (GLS) development practices around MRT/LRT stations awarded by the Housing and Development Board (HDB) and Urban Redevelopment Authority (URA) between 1997 and 2007 and estimates the price impacts of the MRT/LRT extensions and GLS developments on residential, commercial, and industrial property markets between 1997 and 2007. This longitudinal research design enables us to examine the causal relationships between state interventions and market responses on the basis of competitive advantages and lifestyle preferences in the island of Singapore. Before presenting the empirical results, this section explains the analytical units, modeling approaches, and data sources.

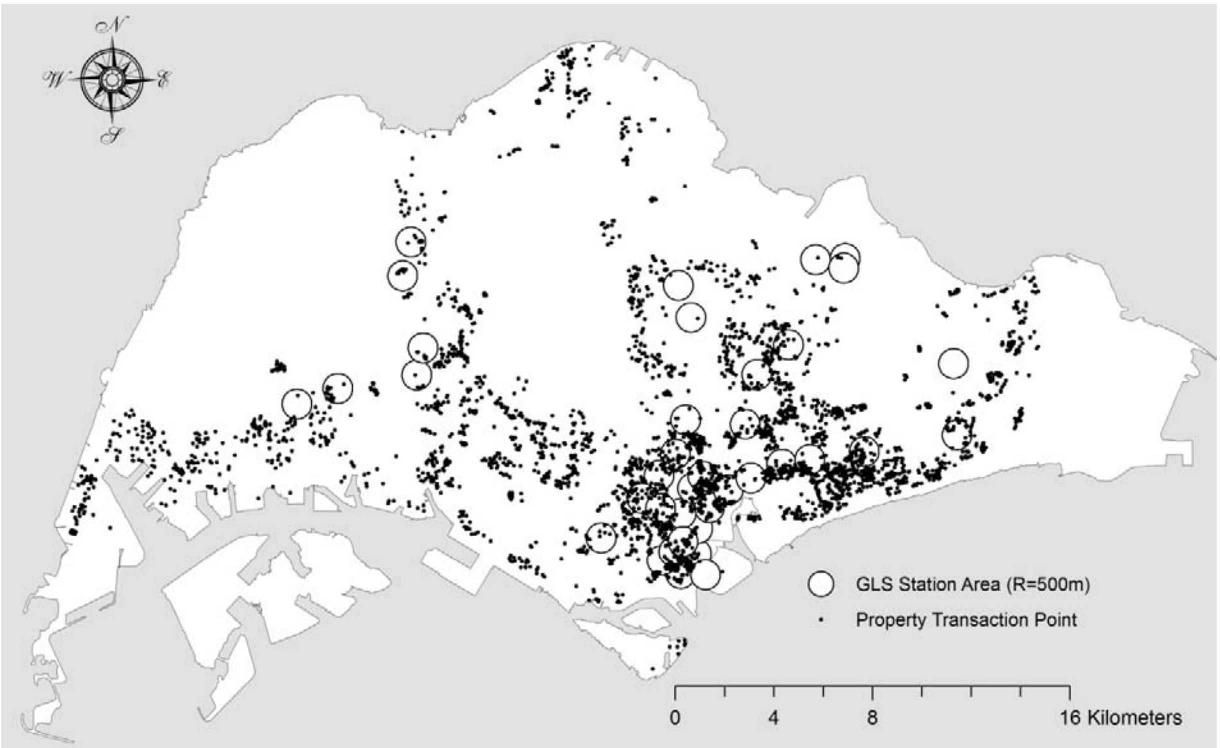
Analytical Units:

In the year 2007, Singapore had 94 stations on the whole MRT/LRT network. Between 1997 and 2007, HDB and URA awarded total 221 site area hectares (635 gross floor area hectares) through the GLS programme, and about 39.7% of the total GLS site areas (65.4% of the total GLS gross floor areas) were granted within 500 meters of 38 MRT/LRT stations. This study aggregates the built-environment variables of GLS parcels by each of the 38 MRT/LRT stations and constructs a typology of the 38 GLS development packages. In response to these state interventions, 10,822 residential, commercial, and industrial property sales transactions are sampled from the pre-project year 1997/98/99 and post-project year 2007 (Table 4.3). These sample points sufficiently cover most the 37 GLS station, 57 MRT/LRT station, and other non-station areas of the island (Figure 4.3).

Table 4.3 Sampled Property Sales Transactions (Residential, Commercial, and Industrial) in Singapore, 1997/98/99 and 2007

Property Market	Pre-Project Year 1997/98/99	Post-Project Year 2007	Property Market Total
Residential	2,085	2,214	4,299
Commercial	1,085	1,851	2,936
Industrial	1,889	1,698	3,587
Year Total	5,059	5,763	10,822

Source: URA (2009a).



Source: Author, with data from HDB (2009) and URA (2009a; 2009b).

Figure 4.3 Analytical Units: 38 Government Land Sales (GLS) Station Areas, 1997-2007 and 10,822 Property Sales Transaction Points (Residential, Commercial, and Industrial), 1997/98/99 and 2007

Modeling Approach 1:

A typology is established on the 38 GLS development packages with regard to built-environment attributes, reflecting the transit-oriented urban intensification strategies of HDB and URA. Cluster analysis is applied to construct a typology. The technique of agglomerative hierarchical clustering systematically combines a number of different cases into a reasonable set of clusters on the basis of their nearness across built-environment variables when expressed as squared Euclidean distances (Aldenderfer and Blashfield; 1984; Cervero and Murakami, 2009). Table 4.4 presents the built-environment attributes and variables investigated for each of the 38 GLS stations. The various property types given by HDB and URA are re-categorized into 6 land use types.

Table 4.4 Government Land Sales (GLS) Built-Environment Attributes and Variables for a Typology

Attributes	Variables
Land Use:	Gross Floor Area (GFA)
	by Use (residential, commercial, white, hotel, industrial, and community)
Scale:	Site Area and Total GFA
Density:	Floor Area Ratio (FAR = Total GFA/Site Area)
Mixture:	Mixture Index*
	(ranging from 0 for single-use to 1 for maximally mixed-use)

Notes: *Mixture Index is based on the measurement of an Entropy Index = $\{-\Sigma k\,[(p_i)\,(\ln p_i)]\}/(\ln k)$ wherein: ($0 \leq$ Entropy Index ≤ 1) and k = # of land use types (in this case, k=6); p_i: GFA-based proportion of land use in type i; and i: land use type (residential, commercial, white, hotel, industrial, and community).

Modeling Approach 2:

In general, property market prices absorb the influences of state interventions, such as rail transit investment, land use coordination, and urban amenity creation (Freeman III, 1993; Rosen, 1974). In order to capture the net impacts brought by the MRT/LRT extensions and GLS developments between 1997 and 2007, hedonic price models are estimated. As experienced in many developed countries, the combinations of railway extensions and property developments might cause the spatial redistribution of property values as a result of shifting competitive advantages and lifestyle attractions within the island of Singapore. Yet, these net effects would not be a zero sum game. The aggregate consequences of changes in property market prices are likely to reflect agglomeration benefits, such as higher productivity, creativity, and synergy associated with increased face-to-face interactions, access to labor markets and urban services, and external transactions made possible by the MRT/LRT extension and GLS development projects (Banister and Berechman, 2000; Cervero and Aschauer, 1998; Weisbrod and Weisbrod; 1997).

The majority of existing transit capitalization studies looked at residential properties only. Also the few studies being conducted to investigate commercial properties took use of rental or assessed prices due largely to data limitations. However, both rental and assessed price data are generally disadvantageous to measure the full array of effects received by property tenants and land owners. In the case of Singapore, property market data are fairly comprehensive; therefore, this study estimates residential, commercial, and industrial property price models comparatively, using property sales transaction data. In order to deal with the interactive relationships between development actions and market prices, longitudinal modeling is statistically more suitable for establishing unilateral causality than cross-sectional modeling (Giuliano, 2004; Giuliano and Golob, 1990). Property sales transactions in the pre-project year 1997/98/99 and post-project year 2007 are distinguished by incorporating dummy variables into each of the three property price regression models.

Modeling Approach 3:

Hedonic price theory assumes that consumer goods comprise a bundle of attributes and that one transaction price can be decomposed into the component prices of each attribute. Thus, hedonic price models allow researchers to extract the marginal impacts of state interventions by controlling for other endogenous and exogenous factors that influence property market prices. In the case of Singapore, sales transaction prices can be estimated as a function of 6 key attributes.

- **Property Type**: Each property transaction includes unique physical regulations and contract conditions determined by the Housing and Development Board (HDB) and Urban Redevelopment Authority (URA). The market values of properties would be dependent upon property size, floor use, leasing period, tenure type, and sales organization.

- **Island Location**: Competitive advantages and living attractions are highly associated with the centralities of locations in the whole island. The price distributions of the three property markets would uniquely be characterized by access to the central business district (CBD) and Singapore Changi Airport (CGIA).

- **Urban Amenity and Public Institute**: The economic and social values of urban amenity settings (e.g., open spaces, national parks and coastlines) would be capitalized on nearby property sales transactions. Also public institutes (e.g., government services and universities) might increase property values around their offices and facilities.

- **Intermodal Transit Service**: Each MRT/LRT station provides different transit access services in the catchment area. The inter-modalities characterized by the numbers of feeder bus lines and park & ride facilities would affect the market value of properties around the 94 MRT/LRT stations.

- **Railway and Roadway Proximity**: The accessibility improvements generated by transportation investments are revealed as the price premiums of nearby properties. The influences of proximity to transportation facilities on property prices would be estimated as a function of distance from each transaction point to the nearest stations and ramps.

- **GLS Development Package**: The property developments granted by HDB and URA are a set of state interventions expected to generate agglomeration benefits. The different types of the GLS development arrangements would have unique price impacts on property sales transactions accompanied by the new MRT/LRT extensions.

Table 4.5 lists the 6 key attributes and candidate variables for model entry. In order to reveal synergetic effects among these independent variables, several interaction terms are also tested in the three property price regression models. All the independent variables are compiled for each of the 10,822 property sales transactions.

Property sales transactions are likely to be clustered within neighborhoods; therefore, ordinary least square (OLS) regression does not guarantee the quality of parameter estimates due to the prevalence of unit heterogeneity. Multilevel modeling (MLM) is suitable for parameter estimates when units of observation fall into groups (Rabe-Hesketh and Skrondal, 2008). Singapore's three hedonic price models are assumed to have a two-level structure and formulated as the following semi-log random intercept function:

$$\ln Y_{ij} = \beta_{00} + \sum_k \beta_k X_{kij} + \zeta_{0j} + \varepsilon_{ij}$$

Wherein
Y_{ij}: property price adjusted by CPI in 2007 [SG$/sq ft]
X_{kij}: independent variable attribute k
β_{00}: constant
β_k: coefficient for the attribute k
ζ_{0j}: random intercept
ε_{ij}: level-1 error
i: property sales transactions (level-1 observations)
j: postal sectors (level-2 districts)
k: 6 attributes (k= 1~6)

Data Sources:

Singapore's property sales transaction data in 1997/98/99 and 2007 were extracted from "REALIS: Real Estate Information System" (URA, 2009a). This government property database includes information on unit price, project name, address, area, floor use type, leasing period, tenure, completion date, postal sector, and sales organization. The license of official geographic information systems (GIS) data is presently limited to Singapore's domestic entities. Thus, all the transportation and land use shapefiles used in this empirical study are originally generated, using online satellite imagery (OSI) techniques (Monkkonen, 2008). The locational information on transportation facilities, urban amenities, and public institutes relied upon the "Singapore Land Authority Map Services and Street Directory" (SLA, 2009). The Land Transport Authority (LTA) "PublicTransport@SG" provided the latest information on intermodal transit services over the MRT/LRT network (LTA, 2009). These transportation and land use data were spatially related to the generated GIS shapefiles and the nearest Euclidian distances were computed for each of the 10,822 property sales transaction points. Both HDB and URA have updated the results of GLS auctions since the early 1990s (HDB, 2009; URA, 2009b). The official records cover street address, GFA, floor uses, site area, and FAR (all the built-environment variables listed in Table 4.4). This study aggregated these figures by each of the 38 MRT/LRT station areas for establishing a typology.

4.3 State Strategies: A Typology

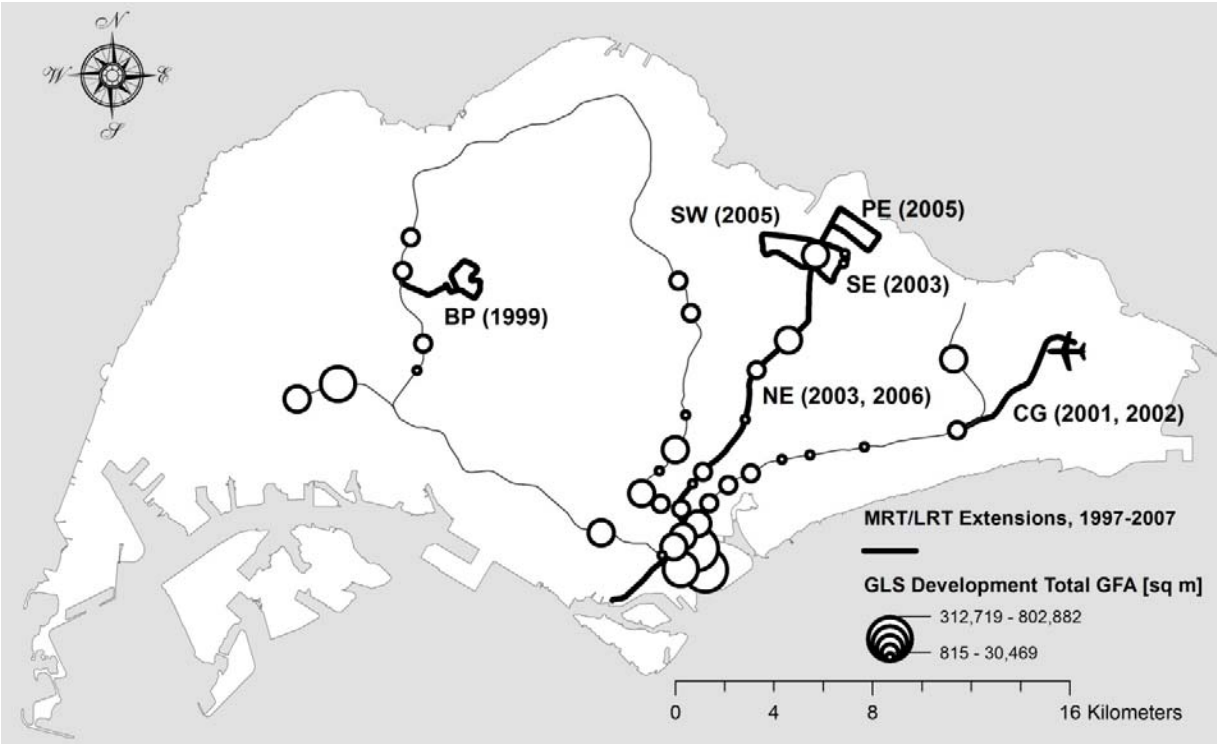
Since the late 1990s the Singapore Land Transport Authority (LTA) has subsequently completed new railway constructions. Figure 4.4 presents the recent MRT/LRT extensions and Government Land Sales (GLS) developments over the island. From 1997 to 2007, 2 MRT Lines and 4 LRT Loops were opened and the operating concessions of the multi-modal transit systems including bus and taxi services were granted to two major transit corporations: SMRT Corporation and SBS Transit Limited. SMRT took over the Bukit Panjang LRT Line (BP) in 1999 and Changi Airport MRT Extension (CG) in 2001 and 2002, whereas SBS embarked on the North East MRT

Line (NE) in 2003 and 2006, Sengkang LRT East Loop (SE) in 2003, Sengkang LRT West Loop (SW) in 2005, and Punggol LRT East Loop (PE) in 2005.

Table 4.5 Candidate Variables for Entry into the Residential, Commercial, and Industrial Property Price Models

Attributes	Variables
Property Type:	• Property Area [sq ft] • Condominium Dummy [1/0] • Terrace House Dummy [1/0] • Detached House Dummy [1/0] • Office Use Dummy [1/0] • Retail Use Dummy [1/0] • Factory Use Dummy [1/0] • Land Leasing 999 years Dummy [1/0] • Land Leasing 99 years Dummy [1/0] • Land Leasing 60 years Dummy [1/0] • Freehold Dummy [1/0] • New Sale Dummy [1/0] • Sub Sale Dummy [1/0] • HDB Award Dummy [1/0]
Island Location:	• Distance to CBD [m] • Distance to CGIA [m] • 1/Distance to CBD [m] • 1/Distance to CGIA [m]
Urban Amenity and Public Institute:	• 1/Distance to the Nearest Green Space [m] • 1/Distance to the Nearest Coastline [m] • 1/Distance to the Nearest Monumental Building [m] • 1/Distance to the Nearest University [m]
Intermodal Transit Service:	• Number of Bus Lines to MRT Stations* • Number of MRT Park & Ride Facilities* • Number of Bus Lines to New MRT Stations* • Number of New MRT Park & Ride Facilities*
Railway and Roadway Proximity:	• 1/Distance to the Nearest Highway Interchange [m] • 1/Distance to the Nearest Local Arterial [m] • 1/Distance to the Nearest MRT Station before 1997 [m] • 1/Distance to the Nearest New MRT Station in 2007 [m] • 1/Distance to the Nearest New LRT Station in 2007 [m] • 1/Distance to the Nearest Projected MRT Station in 2007 [m]**
GLS Development Package:	• Government Land Sales (GLS) Development Package Type Dummies [0/1]***

Notes: HDB: Housing & Development Board; CGIA: Singapore Changi Airport.
*This study assumes that these transit services affect the values of properties within 2 km of the MRT station.
** Many land parcels were already awarded for the future MRT stations.
***This study assumes that the GLS development arrangements affect the values of properties within 500 m of the GLS station in 2007.



Sources: Author, with data from HDB (2009) and URA (2009b).
Notes: BP: Bukit Panjang LRT Line; CG: Changi Airport MRT Extension; NE: North East MRT Line; SE: Sengkang LRT East Loop; SW: Sengkang LRT West Loop; PE: Punggol LRT East Loop; (Open Year).

Figure 4.4 MRT/LRT Extensions and Government Land Sales (GLS) Development Package Total Gross Floor Area (GFA) Distribution, 1997-2007

Table 4.6 Government Land Sales (GLS) Development Package Gross Floor Area (GFA) Distribution, 1997-2007

Floor Use	GFA (sq m)	GFA Share (%)	GFA-D from CBD (km)
Residential	1,367,603	33.0	9.6
Commercial	1,308,417	31.5	1.3
White	1,032,809	24.9	1.2
Hotel	170,557	4.1	1.4
Industrial	12,577	0.3	3.8
Community	258,216	6.2	15.1
Total	4,150,179	100.0	4.9

Sources: Author, with data from HDB (2009) and URA (2009b).
Notes: GFA-D (GFA-Weighted Average Distance) from CBD i = $\{\Sigma_j [(GFA_{ij}) (CBD\_D_j)]\}/(\Sigma_j GFA_{ij})$ wherein: GFA_{ij}: GFA in type i at GLS station j; CBD_D_j: straight-line distance between CBD and GLS station j (km); i: land use type (residential, commercial, white, hotel, industrial, and community) and j: GLS stations (j=1~38).

In parallel, HDB and URA have promoted urban intensification strategies by implementing the GLS programme. During the period 1997 to 2007, the large capacities and diverse uses of GLS properties have been allocated on the whole MRT/LRT network. Table 4.6 indicates the spatial distribution of GLS properties by floor use. About 90% of the total GFA is split largely into residential (33.0%), commercial (31.5%) and white (24.9%) uses. The spatial distribution patterns are clearly different across the floor use types. The fourth column presents Gross Floor Area-weighted average Distances (GFA-Ds) from CBD. Commercial, white, and hotel floor uses have much shorter GFA-Ds than residential and community floor uses. This suggests that global business production has been highly concentrated in the Central Area; on the other hand, local living consumption has been widely located along the suburban corridors.

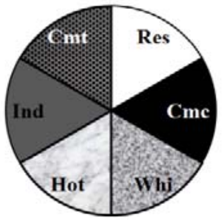
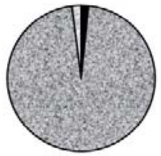
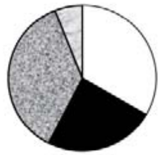
A typology describes the GLS development practices in a systematic way. Applying cluster analysis techniques, this study figures out 7 types of the GLS development packages from the 38 MRT/LRT station areas. The titles and abbreviations given to the seven types of the GLS development packages based on their built environment attributes are as follows:

- **Small-scale Residential (SR)**: residential plus commercial use development package on small site with relatively low FAR (small-scale GFA)
- **Mid-scale Residential (MR)**: residential plus industrial office use development package on medium site with medium FAR (mid-scale GFA)
- **Mid-scale Community (MC)**: dominantly community use development package on medium site with medium FAR (mid-scale GFA)
- **Small-scale White (SW)**: white (flexible) use development package on small site with relatively low FAR (small-scale GFA)
- **Mid-scale Mixed (MM)**: mixed use development package on medium site with medium FAR (mid-scale GFA)
- **Large-scale Mixed (LM)**: mixed-use development package on large site with high FAR (large-scale GFA)
- **Large-scale Global (LG)**: commercial plus white (flexible) use development package on large site with high FAR (large-scale GFA)

Table 4.6 highlights the built-environment features of each GLS development package type by presenting statistical averages for the variables used to form clusters. This table also summarizes the numbers of stations and GLS cases which belong to each of the 7 GLS types. This classification captures the city-state's key strategies aiming to make Singapore "a livable city", "a vibrant playground", and "a global business hub" (Lee, 2007).

One of the chief strategies promoted by HDB and URA is to enhance Singapore's local living environments. According to this cluster analysis, 24 of the 38 GLS development packages are classified as residential types: 23 Small-scale Residential (SR) type and 1 Mid-scale Residential (MR) type development packages. These housing development practices are intended not only to establish self-sufficient green townships with commercial and industrial properties in the suburban areas but also to offer diverse lifestyle options across the island (Lim, 2005; Seah, 2006; Seik, 2001). In recent years, high-quality urban living packages have increasingly been launched mainly by URA. One symbolic example can be observed on the Orchard MRT station (Figure 4.5). A residential condominium is being developed with a deluxe shopping mall and pedestrian-friendly amenities in the Central Region. On the other hand, HDB has continuously supported suburban living in the North East and West Regions. 2 Mid-scale Community (MC) type development packages were awarded around the Sengkang MRT/LRT station and Boon Lay MRT station.

Table 4.7 Government Land Sales (GLS) Stations in Each Built-Environment Type and Statistical Mean Statistics for Key Clustering Variables

Development Type	SR: Small-scale Residential	MR: Mid-scale Residential	MC: Mid-scale Community	SW: Small-scale White	MM: Mid-scale Mixed	LM: Large-scale Mixed	LG: Large-scale Global
[ha] FAR	3.33	4.38	3.85	2.88	3.97	9.54	8.09
GFA	6.34	10.23	11.55	5.11	10.13	31.27	69.32
Site Area	1.84	2.33	3.03	1.31	2.48	3.28	8.68
							
Land Use GFA [%]							
Residential	68.0	88.0	0.0	0.0	11.3	33.0	0.0
Commercial	30.7	0.0	0.0	1.6	18.0	24.0	66.0
White	0.0	0.0	0.0	96.4	37.7	36.0	34.0
Hotel	0.0	0.0	0.0	2.0	32.8	6.0	0.0
Industrial	0.0	12.0	0.0	0.0	0.0	0.0	0.0
Community	1.3	0.0	100.0	0.0	0.0	0.0	0.0
Mixture [0~1]	0.044	0.205	0.000	0.071	0.464	0.695	0.343
Number of Stations	23	1	2	5	4	1	2
Number of GLS Cases	33	3	2	10	16	8	9

Sources: Author, with data from HDB (2009) and URA (2009b).

Source: William Cho (http://www.flickr.com/photos/adforce1/3950991438/).

Figure 4.5 Small-scale Residential (SR): Orchard MRT Station as an "Urban Living Option"

Another important strategy is to facilitate a diversity of urban activities by placing mixed use properties in target locations. 5 of the 38 GLS development packages are granted as mixed use types (4 Mid-scale Mixed and 1 Large-scale Mixed type development packages), accommodating office spaces, shopping malls, café and restaurant streets, residential towers and apartments, luxury and boutique hotels, community facilities, and amenity settings. The Central at the Clarke Quay MRT Station, for example, contains regular office functions, small office home office units, retail complexes, and recreational spaces along the Singapore River to offer vibrant live-work-play experiences in the context of historical urban neighborhoods, authentic night lights, and memorable social events (Figure 4.6; URA, 2005). In addition, this cluster analysis figures out 5 Small-scale White (SW) type development packages along the new North East (NE) Line and South East (SE) Loop. These "white" land grants encourage more flexible and organic site uses on the basis of their marketability and suitability in both traditional urban neighborhoods and new suburban towns (URA, 2009b).

The other key strategy calls for further refinement of Singapore's global competitive edge in the Central Area. URA has envisioned the seamless expansion of the existing CBD at Raffles Place to the strategic Business and Financial Centre (BFC) at Marina Bay, accompanied by the future MRT Downtown Line and pedestrian network development. This cluster analysis identifies 2 Large-scale Global (LG) type development packages within the walkable distances from the existing Raffles Place and Marina Bay MRT stations. These office-based GLS programme practices set up a large share of the total GFA for flexible "white" zones to meet the specific and complex needs of global businesses and their employees (Tay, 2004). In accordance with the unique sales terms, two of the successful tenders, the City Developments Limited and AIG Global Real Estate recently completed "The Sail @ Marina Bay," iconic residential towers with distinctive waterfront amenities and workplace proximity between the existing CBD and new BFC district (Figure 4.7).

Source: The Central© (http://www.thecentral.com.sg).

Figure 4.6 Mid-scale Mixed (MM): Clarke Quay MRT Station as a "Vibrant Live-Work-Play Ground"

4.4 Market Responses: Hedonic Price Models

This section examines Singapore's property market responses to the MRT/LRT extensions and GLS developments between 1997 and 2007. Table 4.8 presents the empirical results of three hedonic price models. Descriptive statistics for the entire variables are attached as appendices due to their large volume. Multilevel modeling (MLM) estimated the between-district standard deviation of the random intercepts of districts $\sum \zeta$ as well as the within-district correlation standard deviation $\sum \varepsilon$. The intra-class correlation ρ was calculated as follows:

$$\boldsymbol{\rho} = \frac{\sum \zeta}{\sum \zeta + \sum \boldsymbol{\varepsilon}}$$

The three hedonic price models yielded acceptable ρ values ranging from 0.384 to 0.404. All variables in the three models were significant at the 10% probability level, and most variables were significant at the 5% and 1% probability levels. Although the empirical results of control variables include a range of issues, this research pays special attention to the marginal impacts of key determinants between 1997 and 2007, referred to as "Year 2007 Dummy [1/0]" in the variable names.

Source: Tim Griffith (http://www.inhabitat.com).

Figure 4.7 Large-scale Global (LG): Marina Bay as a "Global Business and Financial Centre"

Table 4.8 Multilevel Modeling (MLM) Results: Determinants of ln Property Price adjusted by Consumer Price Index (CPI) in 2007 [SG$/sq ft], 1997/98/99 and 2007

Property Markets	Residential		Commercial		Industrial	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
Fixed Effects						
Property Type						
Property Area [10K sq ft]	-0.188	0.003			-0.209	0.000
Condominium Dummy [1/0]	0.138	0.000				
Terrace House Dummy [1/0]	0.083	0.000				
Detached House Dummy [1/0]	-0.053	0.004				
Office Use Dummy [1/0]			-0.171	0.000		
Shop Use Dummy [1/0]			0.142	0.000		
Factory Use Dummy [1/0]					-0.159	0.000
Leasing 999 years Dummy [1/0]					0.625	0.000
Leasing 99 years Dummy [1/0]	-0.158	0.000	-0.207	0.000	0.140	0.001
Leasing 60 years Dummy [1/0]					0.278	0.000
Freehold Dummy [1/0]					0.999	0.000
New Sale Dummy [1/0]	0.249	0.000	0.264	0.000	0.263	0.000
Sub Sale Dummy [1/0]	0.229	0.000	0.308	0.000	0.274	0.000
HDB Award Dummy [1/0]	-0.020	0.017				
Island Location						
Distance to CBD [10K m]	-0.338	0.000	-0.305	0.020	-0.484	0.000
Distance to CGIA [10K m]	0.059	0.022			0.192	0.004
Distance to CBD [10K m] *Year 2007 Dummy [1/0]	-0.107	0.000	-0.360	0.000	-0.242	0.000
Distance to CGIA [10K m] *Year 2007 Dummy [1/0]	0.019	0.093	0.177	0.000		
Urban Amenity and Public Institute						
1/Distance to Green Space [m]	-88.3	0.000			-338.0	0.000
1/Distance to Coastline [m]			170.0	0.001	-83.3	0.000
1/Distance to Monumental Building [m]	-27.7	0.000				
1/Distance to University [m]	-132.9	0.000	-156.4	0.000		
1/Distance to Green Space [m] *Year 2007 Dummy [1/0]	48.1	0.000	-31.5	0.000		
1/Distance to Coastline [m] *Year 2007 Dummy [1/0]	33.3	0.000			47.9	0.000
1/Distance to Monumental Building [m] *Year 2007 Dummy [1/0]	40.3	0.000			-144.8	0.031
1/Distance to University [m] *Year 2007 Dummy [1/0]	136.4	0.000				
Intermodal Transit Service						
# of Bus Lines to MRT in 2km [10]	0.003	0.037			0.004	0.000
# of MRT Park & Ride Facilities in 2km	-0.022	0.009	-0.149	0.014		
# of Bus Lines to New MRT in 2km [10]	-0.041	0.000			-0.015	0.000
# of New MRT Park & Ride Facilities in 2km			-0.283	0.000	0.160	0.006

(Continued)

Table 4.8 (Continued)

Property Markets	Residential		Commercial		Industrial	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
Railway and Roadway Proximity						
1/Distance to Highway Interchange [m]	23.1	0.000	26.9	0.001		
1/Distance to Local Arterial [m]					0.486	0.004
1/Distance to Highway Interchange [m] * Year 2007 Dummy [1/0]					34.4	0.058
1/Distance to Local Arterial [m] * Year 2007 Dummy [1/0]	0.607	0.000	0.492	0.003		
1/Distance to MRT Station [m]	41.8	0.000	23.9	0.002		
1/Distance to New MRT Station [m] * Year 2007 Dummy [1/0]			14.6	0.000		
1/Distance to New LRT Station [m] * Year 2007 Dummy [1/0]	19.1	0.075			175.8	0.031
1/Distance to Projected MRT Station [m] * Year 2007 Dummy [1/0]			-23.0	0.000	-36.5	0.005
1/Distance to MRT Station [m] * Year 2007 Dummy [1/0]	-36.2	0.000				
GLS Development Package						
SR Type in Year 2007 Dummy [1/0]	0.123	0.000	-0.214	0.000	0.202	0.009
MR Type in Year 2007 Dummy [1/0]					0.446	0.059
MC Type in Year 2007 Dummy [1/0]	0.141	0.030				
SW Type in Year 2007 Dummy [1/0]	-0.145	0.001	-0.166	0.000	0.933	0.084
MM Type in Year 2007 Dummy [1/0]	0.155	0.022				
LM Type in Year 2007 Dummy [1/0]	0.297	0.000	0.160	0.011		
LG Type in Year 2007 Dummy [1/0]	0.144	0.004				
Interaction Terms						
1/Distance to MRT Station [m] * SR Type in Year 2007 Dummy [1/0]			52.3	0.003		
1/Distance to MRT Station [m] * MM Type in Year 2007 Dummy [1/0]	29.9	0.043				
1/Distance to MRT Station [m] * # of MRT Park & Ride Facilities in 2km			-54.6	0.012		
(Constant)	6.72	0.000	7.15	0.000	5.54	0.000
Random Effects						
∑ ζ	0.189		0.350		0.319	
∑ ε	0.299		0.443		0.399	
ρ	0.404		0.384		0.390	
# of Property Sales Transactions (Level-1 Observations)	4,299		2,936		3,587	
# of Postal Sectors (Level-2 Districts)	68		51		35	

Notes: HDB: Housing and Development Board; CGIA: Singapore Changi Airport; GLS: Government Land Sales; SR: Small-scale Residential; MR: Mid-scale Residential; MC: Mid-scale Commercial; SW: Small-scale White; MM: Mid-scale Mixed; LM: Large-scale Mixed; LG: Large-scale Global.

Island Location:

All the three hedonic price models have the negative coefficients on "Distance to CBD [10K m] * Year 2007 Dummy [1/0]." This means that the price gradients of the whole island's residential, commercial, and industrial property markets became steeper with distance to CBD over the period 1997 to 2007. Especially the commercial property market (-0.360) showed larger gradient shifts than the residential and industrial property markets (-0.107 and -0.242). On the other hand, the coefficients on "Distance to CGIA [10K m] * Year 2007 Dummy [1/0]" have positive values especially in the residential and commercial market models (+0.019 and +0.177), which indicate that the price gradients of Singapore's residential and commercial properties got flatter with distance to Singapore Changi Airport during the same period.

MRT/LRT Station Proximity:

The three hedonic price models capture the property price premiums of proximity to new MRT/LRT stations. In the commercial market model, the coefficient on proximity to a new MRT station has a positive value (+14.6), meaning that commercial property prices increased with proximity to a new MRT station between 1997 and 2007. Figure 4.8 presents the accessibility benefits (or agglomeration benefits) of new MRT investments on nearby commercial properties by 50-meter distances, wherein all other variables are fixed with their statistical averages.

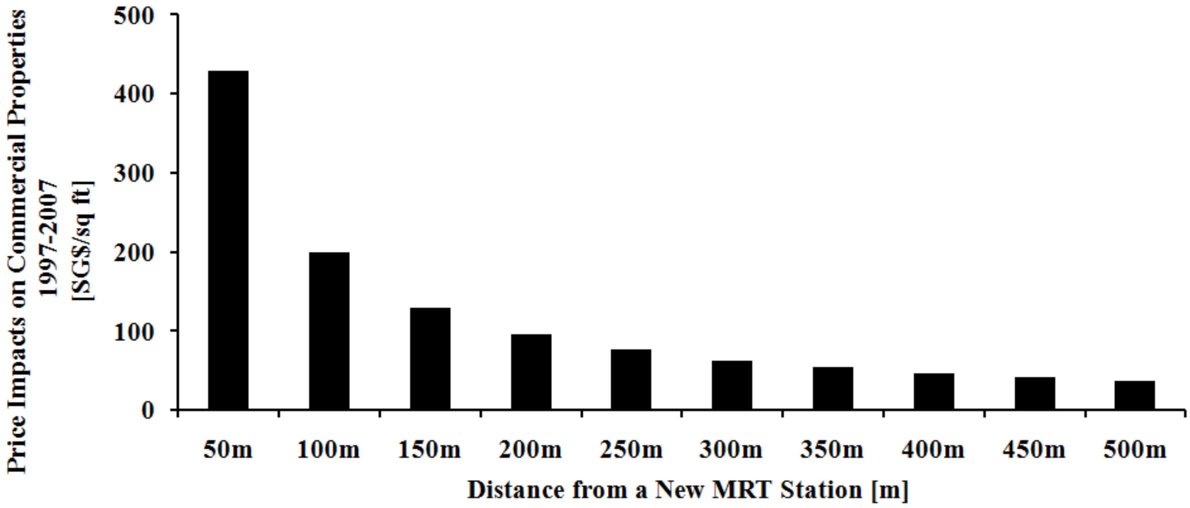


Figure 4.8 Price Impacts of a New MRT Station on Commercial Properties by 50-meter Distances, 1997-2007

The residential and industrial market models have the positive coefficients on proximity to a new LRT station (+19.1 and +175.8), which indicate that residential and industrial properties gained the price premiums for proximity to a new LRT station between 1997 and 2007. Figure 4.9 shows the price gains of residential and industrial properties from a new LRT station by 50-meter distances, wherein all other variables are fixed with their statistical averages. In reality, there was no industrial property sales transaction within 150 meters of LRT stations between 1997 and 2007. Thus, the price impacts of a new LRT station on industrial properties were illustrated in the range 200 to 500 meter distances.

These price gains (accessibility benefits or agglomeration benefits), however, might come from other stations on the MRT network. In the residential market model, proximity to an old MRT station (constructed before 1997) is negatively associated with changes in property prices between 1997 and 2007 (-36.2). Figure 4.10 shows the estimates of price drops in residential properties around an old MRT station by 50-meter distances, wherein all other variables are fixed with their statistical averages. Similarly, the price discounts for being closer to a future MRT station are observed in the commercial and industrial market models (-23.0 and -36.5). It can be assumed that these negative price effects were temporary generated by the relocations of old economic activities and constructions of new station facilities.

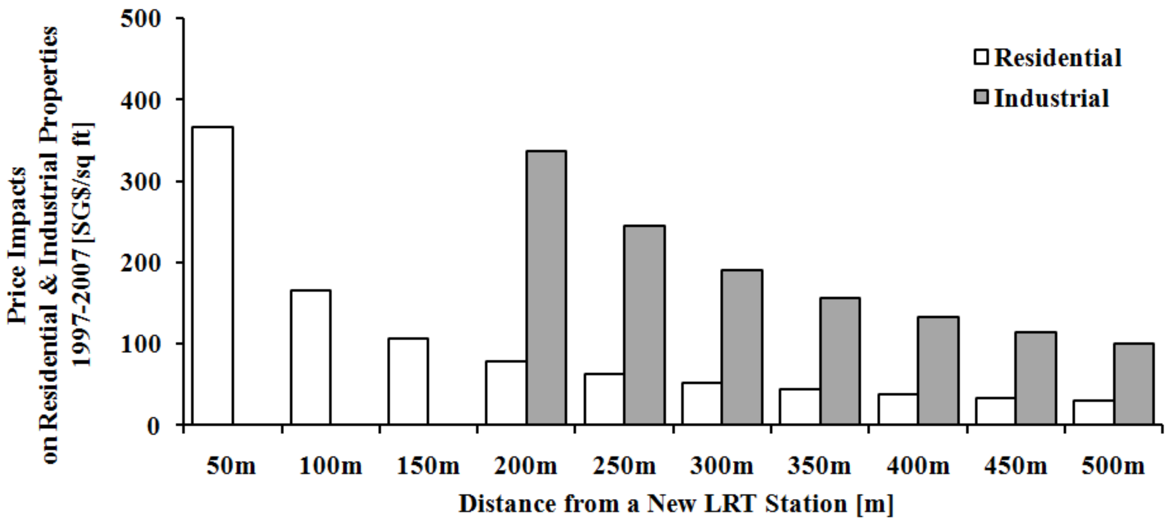


Figure 4.9 Price Impacts of a New LRT Station on Residential and Industrial Properties by 50-meter Distances, 1997-2007

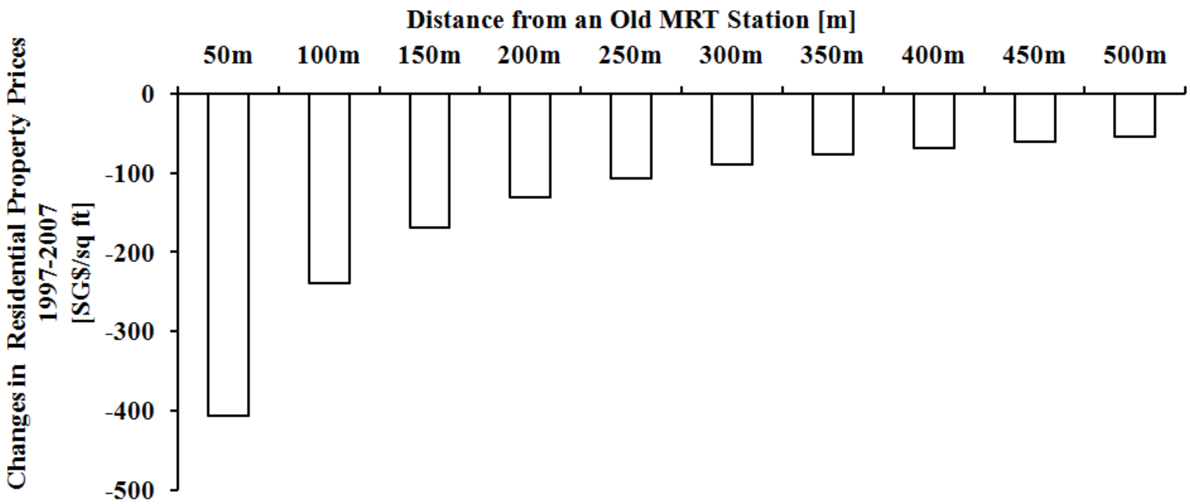
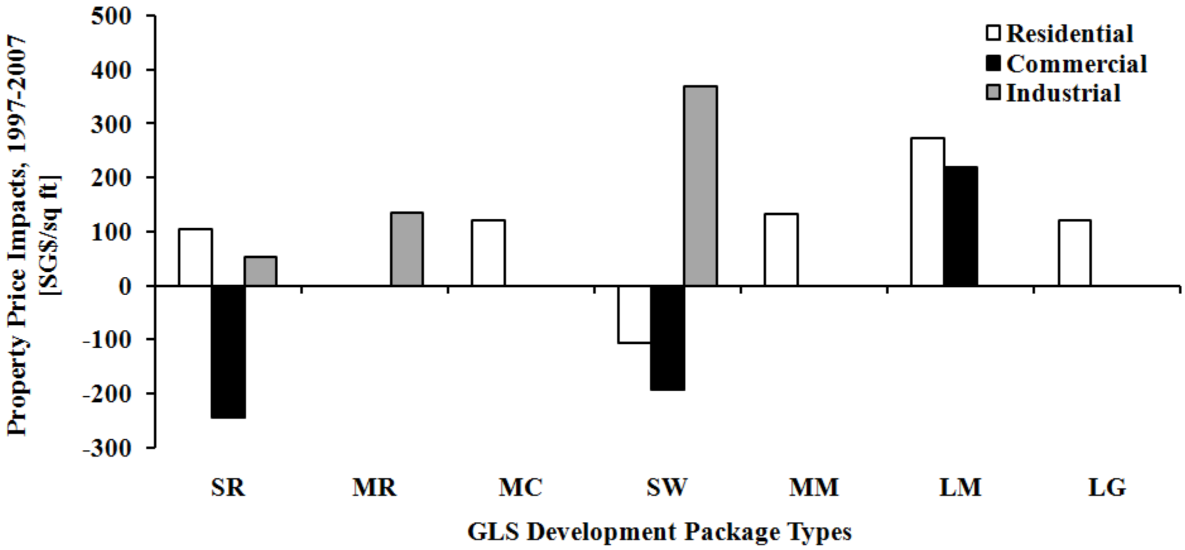


Figure 4.10 Changes in Residential Property Prices around an Old MRT Station by 50-meter Distances, 1997-2007

GLS Development Package:

The three property market models also reveal the price premiums and discounts for the Government Land Sales (GLS) programme. Figure 4.11 presents the price impacts of the 7 GLS types on residential, commercial, and industrial properties in 500 meters of a MRT/LRT station between 1997 and 2007, wherein all other variables are fixed with their statistical averages.



Notes: SR: Small-scale Residential; MR: Mid-scale Residential; MC: Mid-scale Community; SW: Small-scale White; MM: Mid-scale Mixed; LM: Large-scale Mixed; LG: Large-scale Global.

Figure 4.11 Price Impacts on Residential, Commercial, and Industrial Properties in 500 meters of a MRT/LRT Station by Government Land Sales (GLS) Development Package Types, 1997-2007

The Small-scale Residential (SR) type development package increased residential and industrial property prices (+SG$104/sq ft and +SG$54/sq ft); however, at the same time, it decreased commercial property prices (-SG$244/sq ft) within 500 meters of a MRT/LRT station. The Mid-scale Residential (MR) type development package had no price impact on residential and commercial properties but generated price appreciation of industrial properties around a MRT station (+SG$135/sq ft). On the contrary, the Mid-scale Community (MC) type development package increased residential property prices (+SG$120/sq ft) and had no price impact on commercial and industrial properties.

The Small-scale White (SW) type development package significantly raised industrial property prices (+SG$370/sq ft) but reduced both residential and commercial property prices (-SG$107/sq ft and -SG$193/sq ft). It can be assumed that the flexible white sites were converted into parking lots or local factories for profits and these industrial uses generated negative externalities in the MRT/LRT station area. The Mid-scale Mixed (MM) type development package showed positive price impacts on residential properties (+SG132/sq ft) rather than commercial properties, whereas the Large-scale Mixed (LM) type development package generated large price increases in both residential and commercial properties (+SG273/sq ft and +SG220/sq ft).

The Large-scale Global (LG) type development package showed price gains in residential properties (+SG122/sq ft) yet had no price impact on commercial properties in the existing CBD and new Business and Financial Centre (BFC) district. This is because most of the office tower projects at Marina Bay are still under construction, while some residential condominiums (e.g., The Sail @ Marina Bay) were already opened in the marketplace. The large-scale GLS programme contracts in the Central Area allowed a flexible payment scheme and a longer project period to lower upfront costs and project risks (Tay, 2004).

Interaction Effects:

The residential market model includes the interaction effects between proximity to an old MRT station and the Mid-scale Mixed (MM) development package. Figure 4.12 shows the estimates of price increases in residential properties within 500 meters of an old MRT station that has the MM type development package, wherein all other variables are fixed with their statistical averages. This bar chart suggests that the MM type development package was very effective to offer high-quality urban living options in already developed urban districts and add high price premiums to transit-joint residential properties (+SG$753/sq ft).

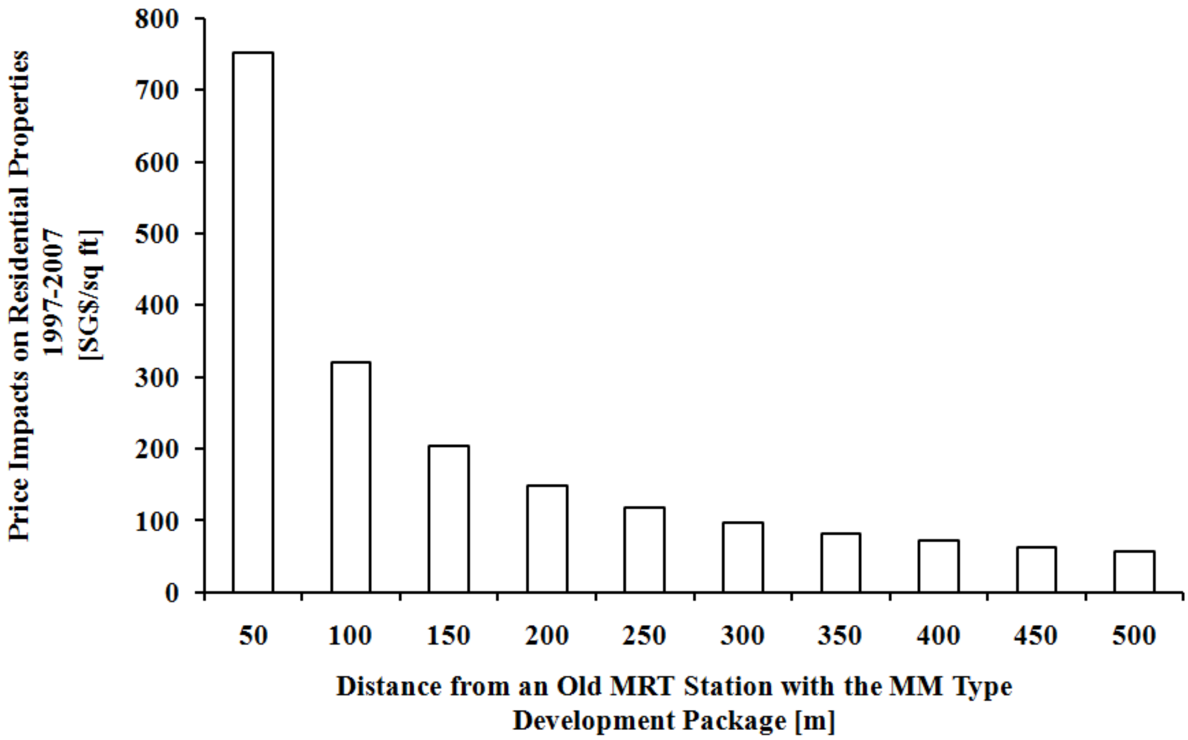


Figure 4.12 Price Impacts of the Mid-scale Mixed (MM) Type Development Package on Residential Properties in 500 meters of an Old MRT Station, 1997-2007

The interaction effects between proximity to an old MRT station and the Small-scale Residential (SR) type development package are captured by the commercial market model. Figure 4.13 illustrates the price impacts of the SR type development package on commercial properties within 500 meters of an old MRT station, where all other variables are fixed with their statistical averages. Figure 4.11 simply indicates that the SR type development package decreased commercial property prices as a whole; however, Figure 4.13 further suggests that local economic activities shifted closer to transit-joint commercial properties around an old MRT station. In short, the effects of the SR type development package on commercial properties were highly redistributive within 500 meters of an old MRT station.

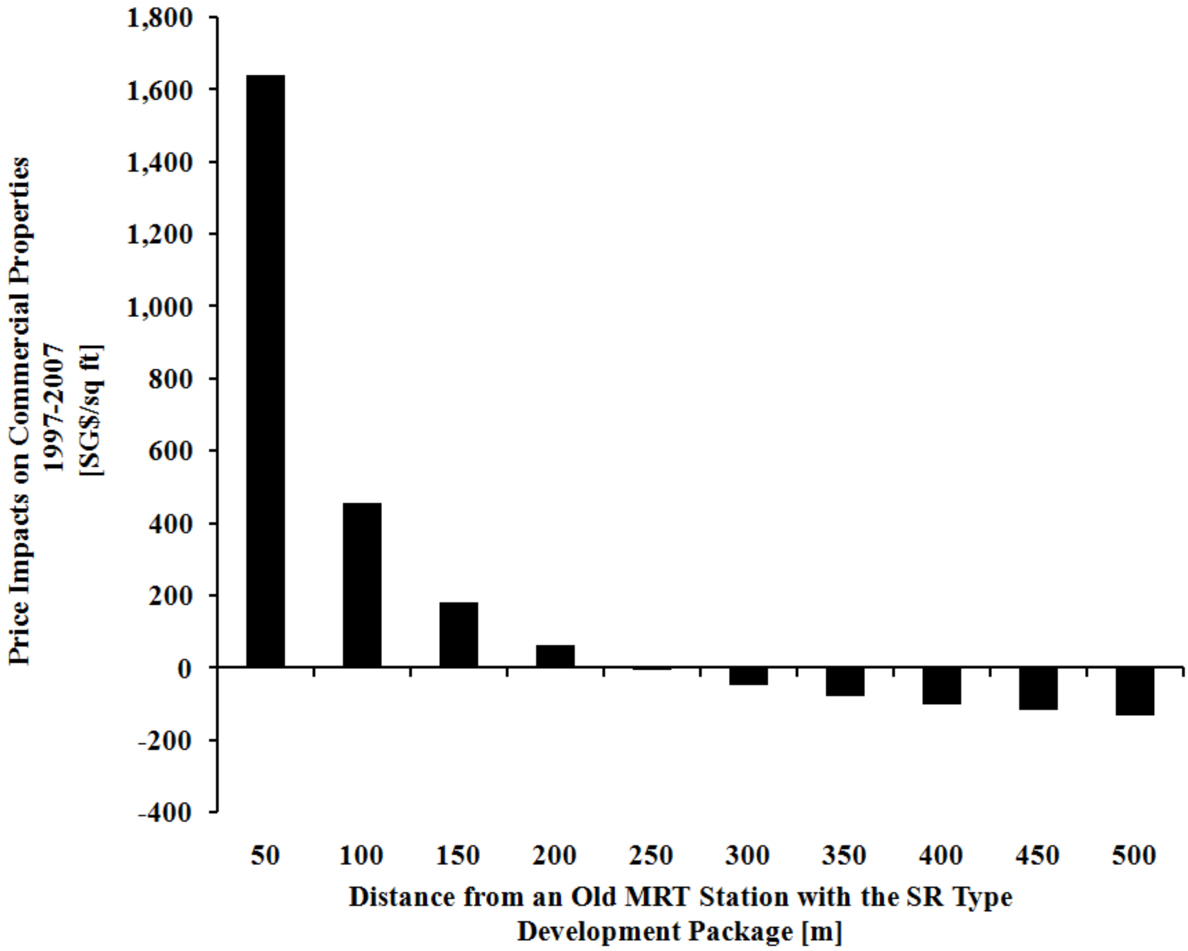


Figure 4.13 Price Impacts of the Small-scale Residential (SR) Type Development Package on Commercial Properties in 500 meters of an Old MRT Station, 1997-2007

4.5 Findings

The Government Land Sales (GLS) programme is one of the main planning instruments to shape Singapore's modern business and living environments, accompanied by the new MRT/LRT investments. This study finds 7 types of the GLS development packages, reflecting Singapore's larger strategic development outcomes. Many housing development packages were widely placed with non-residential properties to shape self-sufficient suburban towns as well as high-quality urban neighborhoods. Mixed and white use development packages were increasingly applied to promote the creative economy around target stations. In enhancing Singapore's global competitiveness, large-scale office development packages were recently awarded with high amenity settings and flexible white sites to meet the dynamic and specific needs of international businesses and skilled professionals in the existing Raffle Place CBD and new Marina Bay Business and Financial Centre (BFC) district.

This chapter empirically examines Singapore's property market responses to these state development strategies in the past decade. The empirical findings suggest that the island's business advantages and living preferences largely shifted towards CBD, while gradually leaving from Singapore Changi Airport (CGIA). It can be assumed that property developments along the recent Changi Airport MRT extension have not effectively supported new industrial business activities in the East Region; the diseconomies of airport proximity have been larger than the economies of airport accessibility in the East Region; and/or the small island has offered more advantageous business climates and attractive living environments in the Central Area, having relatively high rail transit access to/from CGIA.

The hedonic price models illustrate the details of property price changes (agglomeration benefits) around the old, new, and future MRT/LRT stations. The new MRT extensions generated agglomeration benefits in nearby commercial properties; on the other hand, the agglomeration benefits of the new LRT developments were capitalized into nearby residential and industrial property prices in the suburban regions. It seems that the recent MRT/LRT extensions have gradually framed the island's "polycentric" urban agglomerations. Yet, the statistical figures also imply that these price gains were likely to come from the price losses around the old and future MRT stations. As experienced in other developed countries, the agglomeration benefits of rail transit investments in Singapore were not continuously accumulative in each of the station areas but rather spatiotemporally redistributive over the railway network.

As a key planning instrument, the GLS programme has been playing a significant role in stimulating Singapore's economic development and balancing the island's urban agglomerations on the extending MRT/LRT network. The hedonic price models, however, reveal both interactive and counteractive price effects across the 7 GLS development package types. The mixed use development packages, for instance, added high price premiums to residential and commercial properties around the existing MRT stations. On the other hand, many commercial malls included in the housing development packages did not generate net price growth in the suburban regions but rather caused highly localized price redistribution effects within each of the existing station areas. Also the small white site development packages awarded for market-oriented flexible uses resulted in negative price impacts on nearby residential and commercial properties due probably to the wild and unruly aspects of the creative economy (Ho, 2009). These unanticipated impacts indicate that too flexible and piecemealed white site grants do not assure local public interests and socioeconomic diversities in profit-based private property development packages, while too strict and super-blocked zoning codes do not support complex interactions and dynamic innovations in the emerging new economy.

Singapore's transit-oriented urban regeneration projects are on-going experiences; thus, many things are still unknown for building effective public-private partnerships in the context of globalization. Learning the current market profiles, the city-state of Singapore would take the GLS programme to the next phase. This chapter presents Singapore's progressive approaches to offering modern business and living environments in the global marketplace.

Chapter Five
Tokyo:
Urban Renaissance in the Shrinking Megalopolis

5.1 Background

Tokyo is a megalopolis with about 35 million inhabitants and 17 million workers in a land area of over 13,000 sq km (Table 5.1). Despite its modest population growth rate in recent years, the Asian megalopolis will remain the world's largest urban agglomeration for the next decades (UN, 2007). Tokyo also has the highest gross domestic product (GDP) among the world's city-regions. Today's political, financial, commercial, industrial, educational, and cultural capital flows are highly concentrated in the central locations of Tokyo for the many benefits derived from greater agglomeration economies (Sassen, 2001; Figure 5.1). This global capital intensification has offered appreciable opportunities to make profits from the synergetic impacts of rail transit investment and real estate development. Conversely, Tokyo's leading position in the global economy could not have been maintained without the integration of rail network development and land use management (Cervero, 1998).

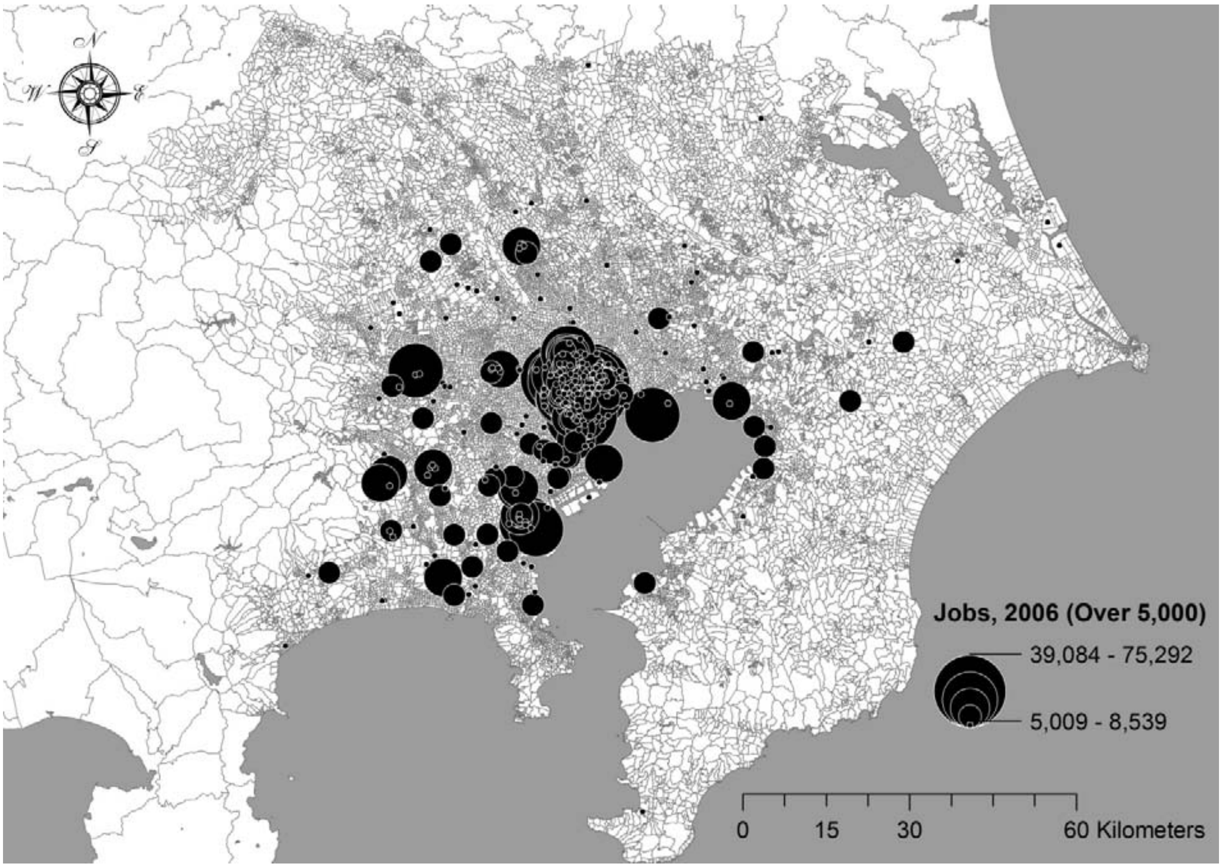
Table 5.1 Background Information on Tokyo*, 2006

Population		34,633,957
Total Land Area [sq km]		13,368
Total Land Population Density [people sq km]		2,591
Average Annual Population Growth Rate, 2001-06 [%]		+0.6
Gross Domestic Product (GDP) [JPY Billion]		164,169
GDP per Capita [JPY]		474,011
Average Annual GDP Growth Rate, 2001-06 [%]		+0.7
Number of Jobs		15,324,528
	Primary Sector %	0.1
	Secondary Sector %	19.5
	Tertiary Sector %	80.4
Number of Labors		17,042,785

Sources: GOJ (2009a; 2009b; 2009c).
Notes: 1 JPY = 0.0097 US$ in 2008.
*The Tokyo Megalopolis Region includes Tokyo and the three neighboring prefectures of Saitama, Kanagawa, and Chiba (TMG, 2009).

In the case of Tokyo, a mix of transit systems of varying sizes, technologies, and ownerships builds up the world's largest railway network, having over 3,000 directional km of track and 1,500 stations that expand over 90 km from central Tokyo. In the early 20th century, the basic sections of Tokyo's railway network were already developed by the national government, local municipalities, and several entrepreneurs (Cervero, 1998). Since then, Tokyo's major private railway companies have widely practiced an integrated model of suburban rail investment and new town development based upon the value capture principle (Hayashi, 1989; World Bank, 2002). On the other hand, the former Japanese National Railways (JNR) and municipal transit bureaus have developed and managed the central loop and terminals, intercity commuter rail and high-speed rail lines, subways, and light rail transit systems by raising debt finance (JSCE, 1991;

Kasai, 2001). Despite the existence of a regional-scale railway network, the megalopolis spread out development and its monocentric structure inflated commuting times (Cervero, 1998).



Sources: Author, with data from GOJ (2009b; 2009d).

Figure 5.1 Job Agglomerations in Tokyo, 2006

During the period of rapid economic growth, Tokyo drastically transformed into a "monocentric" megalopolis in the absence of regional planning systems and local development controls (Sorensen, 2003; 2001a). This spatial development pattern caused serious urban problems such as overcrowded central locations, haphazard housing settlements, wasteful commuting, traffic congestion, air pollution, and amenity losses. The National Capital Region Development Plan, thus, has envisioned a "polycentric" megalopolis, placing satellite business centers around the high speed rail (HSR) stations, Narita International Airport (NIA), and regional belt highway interchanges to mitigate the excessive concentration of economic activities in central Tokyo and to support the formation of self-sufficient sub-regions in the outlaying areas. In the 1980s and 1990s, public administration, international trade, and academic institute functions were partially decentralized from downtown Tokyo to new business districts in Yokohama, Saitama, Chiba, and Tsukuba, accompanied by mega transportation projects (GOJ, 1999; Sorensen, 2001b; Yamashita et al., 1996). Since the 1990s, however, it has increasingly been recognized that the massive decentralization model would not be suitable for Japan's shrinking demographic structure and sluggish real estate market.

Japan's fanatic real estate boom in the 1980s considerably undermined the viability of small businesses and urban communities in central Tokyo and its massive bad property loans seriously damaged the nation's economic system. Since the crash of 1991, Tokyo has gradually lost its competitive positions against Hong Kong, Singapore, and Shanghai due partly to disadvantageous business regulations and unattractive urban environments in central Tokyo (Rowe, 2005). At the turn of the 21st century, the nation-state's economic stimulus policies drastically shifted towards urban intensification using property market deregulations and private finance initiatives (PFI) in central Tokyo. Since the year 2002, the Cabinet Office has coordinated "Urban Renaissance Areas," wherein larger floor area ratio (FAR) bonuses and faster project approvals can be granted for high-amenity property redevelopment packages, typically around the former JNR's central terminals, Haneda Airport (HNA), and waterfront business centers (GOJ, 2009e; Saito, 2003; Sorensen, 2003). Notably, the privatized Japan Railway Companies (the former JNR) aggressively embarked on large-scale transit-joint redevelopment projects, converting the former JNR's railway yards into more profitable global office towers, luxury shopping malls, and five-star hotels (Chorus, 2009; Waley, 2007).

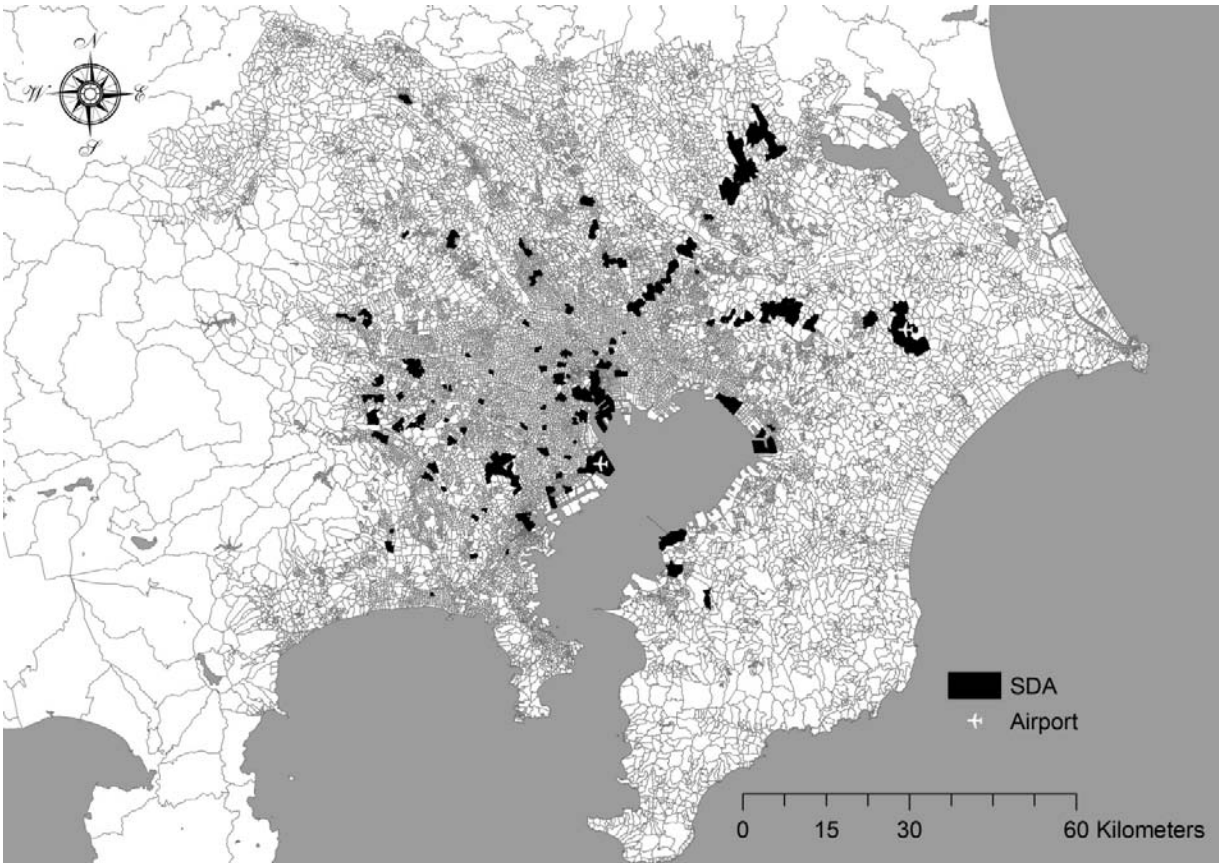
Several researchers in international political economy have argued that Tokyo's spatial transformation has been guided importantly by Japan's "developmental state" policies rather than global capitalist's resource allocation criteria (Fujita, 2003; Hill and Kim, 2000; Jacobs, 2005; Saito, 2003; Waley, 2007). Also, a large number of local development projects, implemented by the Tokyo Metropolitan Government (TMG), neighboring prefectures, city governments, railway companies, highway agencies, and other public corporations in the megalopolis, have been embedded in the nation-state's larger regional development strategies. In the domestic context of institutional conflicts over Tokyo's developable space, however, the nation-state's Urban Renaissance Program in the 2000s was likely to promote the global competitiveness of urban business entities at the expense of regional equity and local livability (Machimura, 1998; Sorensen, 2003). Yet, there has been little empirical work analyzing the relationships between the state's comprehensive development strategies and the megalopolis' urban agglomeration patterns in the past decade.

5.2 Methodologies

This chapter analyzes the types of the region's strategic Joint Development (JD) packages between 2000 and 2006 and estimates the locational impacts of transportation investments and JD packages on the Tokyo Megalopolis Region's job, labor, and land markets between 2000/01 and 2005/06/07. This longitudinal research framework is useful to capture a critical phase of the dynamic interactions between developmental state interventions and spatial transformation processes with a focus on urban resurgence, regional balance, and local viability. This section specifies the analytical units, modeling approaches, and data sources.

Analytical Units:

The Tokyo Megalopolis Region contains a numerous number of transportation and urban development activities. Yet, its major development areas in the 2000s were strategized largely by: (i) the Urban Renaissance Program; (ii) National Capital Region Development Plan (NCRDP); (iii) Tokyo Metropolitan Government (TMG) and 4 prefectural governments; (iv) 4 ordinance-designated city governments; (v) Urban Renaissance Agency; and (vi) Special Measures Act for the Integration of Housing Development and Railway Investment. According to their official planning definitions, this research identifies original 107 Strategic Development Areas (SDAs) as analytical units (Figure 5.2). These analytical units cover a wide range of Joint Development (JD) packages as well as without-development cases across the Megalopolis Region so that the statistical analyses can sufficiently examine marginal changes in Tokyo's job and labor market agglomeration patterns on the basis of regional locations, transportation systems, and built environments.



Sources: Author, with data from GOJ (2009e; 1999), TMG (2008), CPG, (2009), SPG (2009), IPG (2009), COY (2009a; 2009b), COK (2009), COS (2009), COA (2009), and UR (2009).

Figure 5.2 Analytical Units: 107 Strategic Development Areas (SDAs), 2000-2006

In order to estimate Tokyo's real estate market responses, 8,237 residential, commercial, mixed, and industrial land prices were sampled from within 2 km of the 107 SDAs' main transportation facilities (e.g., railway station, highway interchange, and airport terminal) in the pre-project year 2000 and post-project year 2007 (Table 5.3). This sampling, however, cannot cover the 2 international airport districts and 5 of the new suburban station areas, which did not have enough property transactions in the marketplace (Figure 5.2). This hedonic price study assumes that the sampled 8,237 land prices sufficiently represent the values of most SDAs by including a variety of similar and different cases in 2001 and 2007.

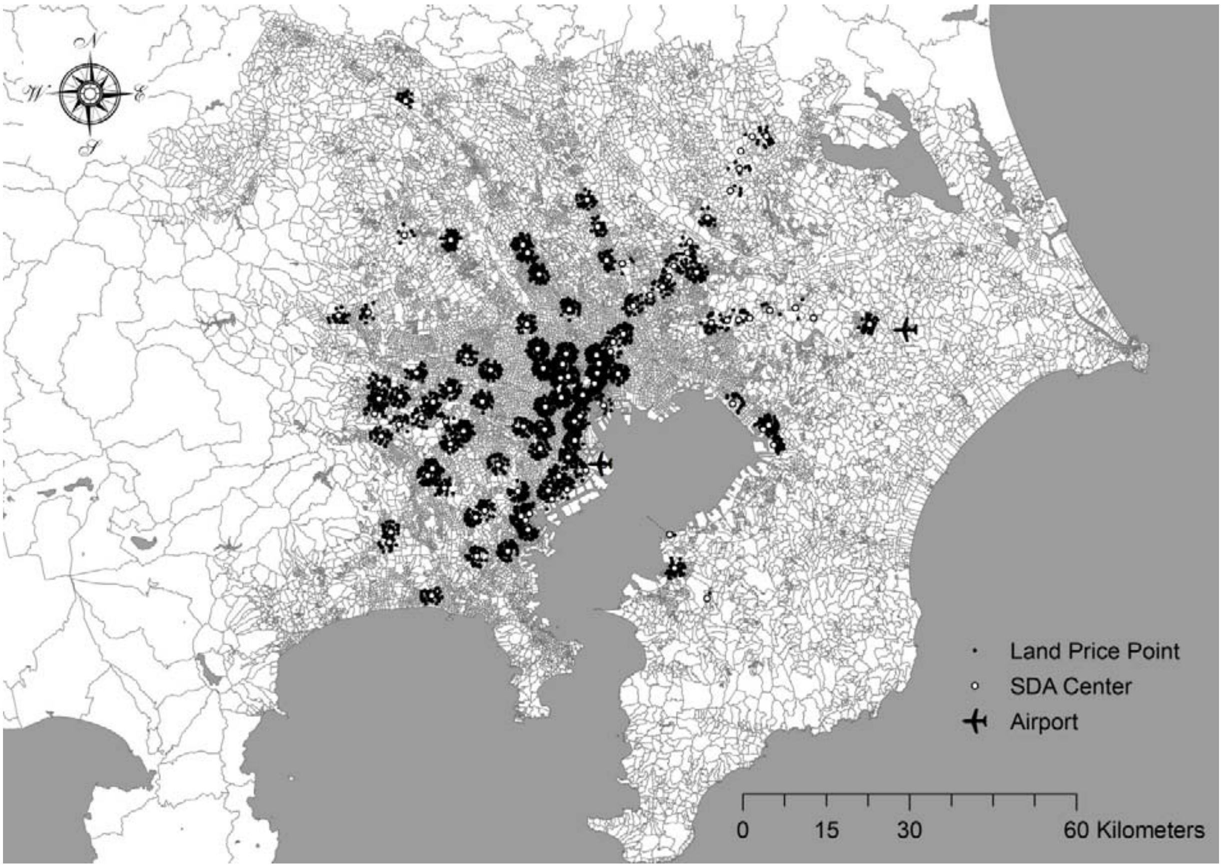
Modeling Approach 1:

This chapter statistically classifies the different "types" of Joint Development (JD) packages completed in 62 of the 107 Strategic Development Areas (SDAs) between 2000 and 2006. A typology is constructed with respect to key built-environment attributes, indicating the development strategies of the region's different entities. Cluster analysis is applied to build a typology. The technique of agglomerative hierarchical clustering systematically combines a number of different cases into a reasonable set of clusters on the basis of their nearness across built-environment variables when expressed as squared Euclidean distances (Aldenderfer and Blashfield; 1984; Cervero and Murakami, 2009). Table 5.3 lists the built-environment variables complied for each of the 62 JD packages.

Table 5.2 Sampled Land Price Points in Tokyo, 2000 and 2007

Property Market	Pre-Project Year 2000	Post-Project Year 2007	Property Market Total
Residential	2,248	2,156	4,404
Commercial	805	997	1,802
Mixed	760	880	1,640
Industrial	202	189	391
Year Total	4,015	4,222	8,237

Source: GOJ (2009f).



Sources: Author, with data from GOJ (2009d; 2009f).

Figure 5.3 Analytical Units: 8,237 Land Price Points (Residential, Commercial, Mixed and Industrial), 2000 and 2007

Table 5.3 Joint Development (JD) Built-Environment Attributes and Variables for a Typology

Attributes	Variables
Land Use:	Gross Floor Area (GFA) by Use (office, residential, retail, hotel, mixed, and others) and Parking Lots (per Total GFA)
Scale:	Site Area and Total GFA
Density:	Floor Area Ratio (FAR =Total GFA/Site Area)
Mixture:	Mixture Index* (ranging from 0 for single-use to 1 for maximally mixed-use)

Notes: *This is based on the measurement of an Entropy Index = $\{-\Sigma k\ [(p_i)\ (\ln p_i)]\}/(\ln k)$ wherein: ($0 \leq$ Entropy Index ≤ 1) and k = # of land use types (in this case, k=6); p_i: GFA-based proportion of land use in type i; and i: land use type (office, residential, retail, hotel, mixed, and others).

Modeling Approach 2:

This empirical research estimates the impacts of the different Joint Development (JD) package types by modeling job and labor market locations across the 107 Strategic Development Areas (SDAs). In the context of Japan's stagnating economy and shrinking population, it is more likely that the combinations of transportation investments and JDs have had highly redistributive and "re-centralized" effects on the locations of business production and living consumption as a result of shifting competitive advantages and lifestyle preferences within the megalopolis region. Knowledge-based businesses and skilled professionals who move closer to central Tokyo could produce and consume better services or same services at lower cost (Weisbrod and Weisbrod; 1997). In order to cope with the two-way interactions between state interventions and market responses, Tokyo's job and labor market changes between 2001 and 2006 are directly explained by the several JD package types and other state intervention variables because longitudinal modeling is more suitable for seeing causality than cross-sectional modeling (Giuliano, 2004; Giuliano and Golob, 1990).

Tokyo's urban agglomeration patterns can be expressed by three interrelated measurements: the 107 SDAs' job and labor densities (DN); location quotients (LQ); and shift-shares (SS). However, the empirical results suggest that the LQ and SS measurements were less appropriate for this city-region case because "change rates" in the new suburban and waterfront development areas are much more overly indicated than those in the urban regeneration areas. The job and labor DN models enable us to have a sense of "physical intensification" across the 107 SDAs. Being informative, the empirical results of the LQ and SS models are attached as appendices. Tokyo's job and labor markets are disaggregated into the 6 workplace and 7 occupational categories defined by the Statistics Bureau. The category specific models yielded greater explanatory powers than the aggregate models. Besides the density models, this chapter estimates the "socioeconomic mixture" and "job-labor balance" models. Mixture Index (MI) and Balance Index (BI) are measured for each of the 107 SDAs in 2000/01 and 2005/06 as follows:

$$\mathbf{MI} = \{-\Sigma k\ [(p_i)\ (\ln p_i)]\}/(\ln k)$$
$$\mathbf{BI} = 1 - |\text{Job-Labor}|/(\text{Job+Labor})$$

Wherein
MI (Mixture Index): ranging from 0 for specialized to 1 for mixed

BI (Balance Index): ranging from 0 for polarized to 1 for balanced
p_i: proportion of jobs or labors in category i
Job: number of total jobs in SDA (Strategic Development Area)
Labor: number of labors in SDA
i: workplace or occupational category
k: # of the industrial sectors or occupational categories (in this case, k=6 or 7)

The aggregate consequences of changes in land prices include agglomeration benefits, such as higher productivity, creativity, and synergy, derived from the face-to-face interactions, labor and service accesses, and external market transactions increased by transportation investments and JD package arrangements (Banister and Berechman, 2000; Cervero and Aschauer, 1998; Weisbrod and Weisbrod; 1997). Hedonic regression decomposes land prices into the marginal effects of transportation investments, joint development packages, and bundles of neighborhood attributes (Freeman III, 1993; Rosen, 1974). In general, hedonic price models are estimated by using market sales transactions or publicly assessed values. Market sales transactions are advantageous to capture the full array of effects received by land owners. In the case of the Tokyo Megalopolis Region, however, the database of publicly assessed values are spatially and temporarily more comprehensive and consistent than those of market sales transactions (GOJ, 2009g). Thus, this study estimates residential, commercial, mixed, and industrial land price changes based upon publicly assessed values in the pre-project year 2000 and post-project year 2007.

Modeling Approach 3:

Urban agglomeration patterns are attributed to several different factors that affect competitive advantages and lifestyle preferences in a city-region (Giuliano, 2004; Giuliano and Small, 1999; Ingram, 1998; OECD, 2006). The Tokyo Megalopolis Region's job and labor location changes can be formulated as a function of the following 7 key attributes.

- **Urban Agglomeration Pattern in Base Year (2000/01)**: The spatial evolution of a city-region is path-dependent. The future job and labor market formations would be affected by the given agglomeration patterns such as density, specialization, diversity, and balance in each of the 107 Strategic Development Areas (SDAs).

- **Job and Labor Market Access in Base Year (2000/01)**: The redistributions of job and labor markets are dependent on given job-labor distribution and transportation network patterns. Access to given labor markets would be a factor of job location decisions, whereas access to given job opportunities would be a determinant of labor location choices.

- **Megalopolis Location**: Competitive advantages and lifestyle preferences are importantly characterized by the centralities of locations in the overall Megalopolis Region. In the case of Tokyo, job and labor market agglomerations would shift in accordance with distances to the central business district (CBD), Narita International Airport (NIA), and Haneda Airport (HNA).

- **Public Institute**: Government offices, research facilities, university campuses, and cultural centers are likely to form knowledge-based business clusters and labor markets. The distributions of public institute functions would be associated with the Megalopolis Region's urban agglomeration patterns.

- **Transportation Infrastructure in Base Year (2000/01)**: The 107 SDAs have different transportation performances over the city-region. The availability of transportation facilities in each of the 107 SDAs (e.g., railway stations and highway interchanges) would be a strong determinant of job and labor market locations.

- **Transportation Investment**: Railway, highway, and walkway investments are intensively made in the 107 SDAs to offer better transportation access. The availability of new transportation facilities in each of the 107 SDAs would influence the locational shifts of job and labor markets.

- **Joint Development**: Property development coordination around transportation facilities characterizes business competitiveness and living attractiveness. The different types of JD packages would have unique impacts on Tokyo's job and labor agglomeration patterns accompanied by railway, highway, and walkway investments.

Table 5.4 lists the 7 key attributes and candidate variables for the job and labor location models. All the independent variables are collected for each of the 107 SDAs. In the same way, one land price can be decomposed into the component prices of each attribute. Land market changes can be explained by the above 7 key attributes and the following attribute.

- **Land Parcel**: Each land parcel is publicly assessed on the basis of unique physical conditions, development regulations, and market transaction records. The fundamental value of each land parcel would be determined by its land parcel size, maximum floor area ratio (FAR) regulation, SDA size, and proximity to waterfront.

Table 5.5 presents the 8 key attributes and candidate variables for the hedonic price models. In order to grasp synergetic effects among the independent variables, several interaction terms are tested in the four regression models. All the independent variables are compiled for each of the 8,237 land price points. The land price data are clustered within districts; thus, ordinary least square (OLS) regression would not provide reliable parameters due to the prevalence of unit heterogeneity. Multilevel modeling (MLM) is useful when units of observation fall into groups (Rabe-Hesketh and Skrondal, 2008). Tokyo's four land market models are assumed to have a two-level structure and formulated as the following semi-log random intercept function:

$$\ln Y_{ij} = \beta_{00} + \sum_k \beta_k X_{kij} + \zeta_{0j} + \varepsilon_{ij}$$

Wherein
Y_{ij}: property price adjusted by Consumer Price Index (CPI) in 2007 [JPY/sq m]
X_{kij}: independent variable attribute k
β_{00}: constant
β_k: coefficient for the attribute k
ζ_{0j}: random intercept

ε_{ij}: level-1 error
i: land price points (level-1 observations)
j: wards/cities/towns/villages (level-2 districts)
k: 8 attributes (k= 1~8)

Table 5.4 Candidate Variables for Entry into the Density (DN), Mixture Index (MI), and Balance Index (BI) Models

Attributes	Variables
Urban Agglomeration Pattern in 2000/01 :	• Strategic Development Area (SDA) Size [sq km] • Number of Total Jobs • Number of Total Labors Jobs • Density of Total Jobs [sq km] • Density Total Labors [sq km] • Job Mixture Index (MI) in Workplace Category i (i=1~6) • Labor Mixture Index (MI) in Occupational Category j (j=1~7) • Job-Labor Balance Index • Job Location Quotient (LQ) in Workplace Category i (i=1~6)* • Labor Location Quotient (LQ) in Occupational Category j (j=1~7)*
Job and Labor Access in 2000/01:	• Number of Jobs within 30 minutes by Rail • Number of Labors within 30 minutes by Rail • Number of Jobs within 30 minutes by Road • Number of Labors within 30 minutes by Road
Megalopolis Location:	• Average Travel Time Distance to CBD [minutes] • Average Travel Time Distance to NIA [minutes] • Average Travel Time Distance to HNA [minutes] • 1/Average Travel Time Distance to CBD [minutes] • 1/Average Travel Time Distance to NIA [minutes] • 1/Average Travel Time Distance to HNA [minutes]
Public Institute:	• Number of National Government Offices • Number of Local Government Offices • Number of Public Research Institutes • Number of University Departments • Number of Public Cultural Facilities
Transportation Infrastructure in 2000/01:	• Density of Highway [km/100ha] • Density of National Roadway [km/100ha] • Density of Local Roadway [km/100ha] • Number of High Speed Rail (HSR) Stations • Number of Commuter Rail Transit (CRT) Stations • Number of Subway Stations • Number of Light Rail Transit (LRT) Stations
Transportation Investment between 2000/01 and 2005/06	• Number of New HSR Stations • Number of New CRT Stations • Number of New Subway Stations • Number of New LRT Stations • Proportion of New Pedestrian Space in SDA [%]
Joint Development:	• JD Package Type Dummies [0/1]

Notes: *Location Quotient (LQ) = [(jobs or labors in the category in SDA)/(total jobs or labors in SDA)]/[(jobs or labors in the category in Tokyo)/(total jobs or labors in Tokyo)].
NIA: Narita International Airport; HNA: Haneda Airport.

Table 5.5 Candidate Variables for Entry into the Residential, Commercial, Mixed and Industrial Land Price Models

Attributes	Variables
Land Parcel:	• Land Area [sq m] • Maximum FAR [%] • Strategic Development Area (SDA) Size [sq km] • 1/Distance to Coastline [m] • 1/Distance to River [m]
Urban Agglomeration Pattern in 2000/01:	• Number of Total Jobs • Number of Total Labors • Density of Total Jobs [sq km] • Density of Total Labors [sq km] • Job Mixture Index (MI) in Workplace Category i (i=1~6) • Labor Mixture Index (MI) in Occupational Category j (j=1~7) • Job-Labor Balance Index (BI) • Job Location Quotient (LQ) in Workplace Category i (i=1~6) • Labor Location Quotient (LQ) in Occupational Category j (j=1~7)
Job and Labor Access in 2000/01:	• Number of Jobs within 30 minutes by Rail + Road • Number of Labors within 30 minutes by Rail + Road • Job Modal Accessibility Gap (MAG) Index [-1~+1]* • Labor Modal Accessibility Gap (MAG) Index [-1~+1]*
Megalopolis Location:	• Average Travel Time Distance to CBD [minutes] • Average Travel Time Distance to NIA [minutes] • Average Travel Time Distance to HNA [minutes] • 1/Average Travel Time Distance to CBD [minutes] • 1/Average Travel Time Distance to NIA [minutes] • 1/Average Travel Time Distance to HNA [minutes]
Public Institute:	• Number of National Government Offices • Number of Local Government Offices • Number of Public Research Institutes • Number of University Departments • Number of Public Cultural Facilities
Transportation Infrastructure in 2000/01:	• 1/Distance to the Nearest Highway Interchange [m] • 1/Distance to the Nearest National Roadway [m] • 1/Distance to the Nearest Local Roadway [m] • 1/Distance to the Nearest High Speed Rail (HSR) Station [m] • 1/Distance to the Nearest Commuter Rail Transit (CRT) Station [m] • 1/Distance to the Nearest Subway Station [m] • 1/Distance to the Nearest Light Rail Transit (LRT) Station [m]
Transportation Investment between 2000/01 and 2005/06:	• 1/Distance to the Nearest New HSR Station [m] • 1/Distance to the Nearest New CRT Station [m] • 1/Distance to the Nearest New Subway Station [m] • 1/Distance to the Nearest New LRT Station [m] • Proportion of New Pedestrian Space in SDA [%]**
Joint Development:	• Joint Development (JD) Package Type Dummies [0/1]**

Notes: *Modal Accessibility Gap (MAG) Index = (jobs or labors within 30 min. by rail - jobs or labors within 30 min. by road) / (jobs or labors within 30 min. by rail + jobs or labors within 30 min. by road) [-1~+1] (Kwok and Yeh, 2004).**This empirical study assumes that JD arrangements affect the values of land parcels within 2 km of the SDA's main transportation facilities.
NIA: Narita International Airport; HNA: Haneda Airport.

Data Sources:

The GOJ Statistics Bureau surveyed Japan's employments and populations in 2000/01 and 2005/06. The Tokyo Megalopolis Region's job data were extracted from the "Establishment and Enterprise Census of Japan 2001 and 2006" (GOJ, 2009b; 2009d). In the same way, The Tokyo Megalopolis Region's labor data were obtained from the "Population Census of Japan 2000 and 2005" (GOJ, 2009d). These public sources provide disaggregate data by the major economic sectors (such as finance & insurance, real estate, information, transformation, manufacturing); however, these major economic sector categories were drastically changed between the two survey periods. In order to keep the comparability of panel data, this empirical study instead looks at the 6 workplace and 7 occupational categories consistently given by the Statistics Bureau (Table 5.6).

The census data were collected on a small district scale. The census small districts were spatially matched up to the 107 Strategic Development Areas (SDAs), using geographic information systems (GIS) shapefiles (GOJ, 2009d). The job and labor density (DN), Mixture Index (MI), Location Quotient (LQ), and Balance Index (BI) measurements were computed for each of the 107 SDAs. The job and labor data on the census small district scale were also applied to calculate isochronic accessibility measures, representing the cumulative count of urban activities that can be reached within a given travel time (Wachs and Kumagai, 1973; Cervero, 2005; Levinson and Krizek, 2005). In this case study, it is assumed that job and labor markets in the census small districts are the potential destinations reached from each of the 107 SDAs' main transportation facilities within 30 minutes by the roadway network or railway network under average operating conditions. Average travel times extracted from railway companies' timetable and highway agencies' traffic information were assigned to each of the railway and roadway corridors (Jorudan, 2009; MEX, 2009; NEXCO, 2009). Due to its geographic characteristics and statistical fitness, the megalopolis location attributes are indicated by the average travel time distances after transportation investments rather than physical straight-line distances.

Table 5.6 Workplace and Occupational Categories in Tokyo

6 Workplace Categories:	• Office (OFFC) • Home Office (HOME) • Social and Community Service (SCSV) • Retail and Restaurant (RETL) • Factory (FCTY) • Logistics and Storage (LGSG)
7 Occupational Categories:	• Skilled Professional (SKPR) • Manager (MNGR) • Administrator (ADMN) • Sales Worker (SALE) • Service Worker (SVLB) • Transportation and Communication Worker (TRCM) • Factory Labor (FCLB)

Sources: GOJ (2009b; 2009d).

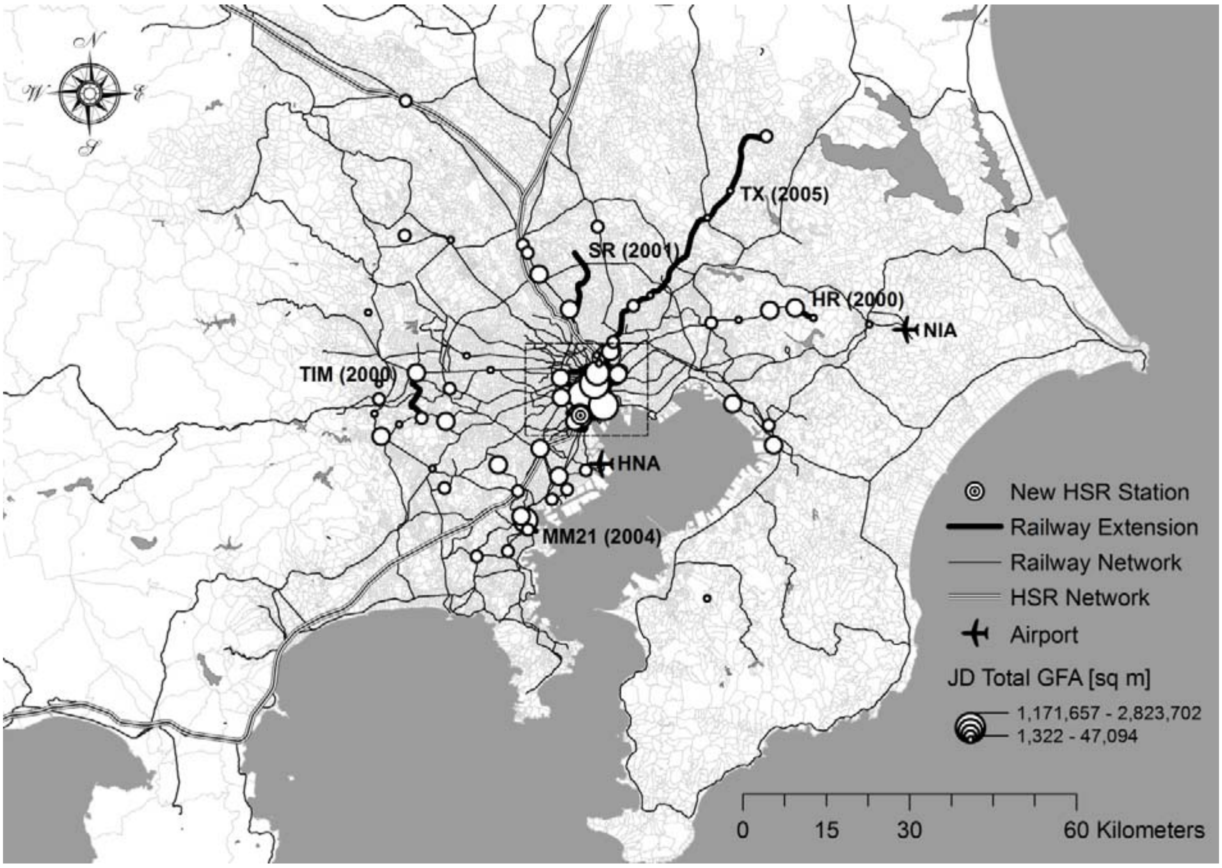
The geographic points of public institutes were obtained from the "Geographic Information Systems Download Service" (GOJ, 2009f) and counted for each of the 107 SDAs. This public GIS download service also provides the Tokyo Megalopolis Region's railway network and stations in 2006, national-based and prefectural-based land price points in 2000 and 2007, and other natural built-environment features. The GIS shapefiles for the highway, national roadway, and local roadway networks were covered by the JMC Map CD-ROM (JMC, 2005) and the recent roadway investments were updated by using online satellite imagery (OSI) techniques (Monkkonen, 2008). The areas of new pedestrian spaces were extracted from the local governments' neighborhood plans ("chiku keikaku" in Japanese) and compiled for each of the 107 SDAs.

In the case of the Tokyo Megalopolis Region, there is no comprehensive database on Joint Development (JD) projects across the SDAs. Thus, for establishing a typology, this study compiled the JD built-environment variables gathered from several different sources: (i) the Urban Renaissance Program's property development projects; (ii) the metropolitan and prefectural governments' master plans and land readjustment projects; (iii) the municipal governments' master plans and land readjustment projects; (iv) the railway companies' annual reports and internal documents; (v) the Urban Renaissance Agency's new town plans and land readjustment projects; (vi) the local commercial associates' land readjustment projects; and (vii) the real estate developers' press releases.

5.3 State Strategies: A Typology

Despite its stagnating economy and shrinking population, the Tokyo Megalopolis Region's large railway network is still being developed in both urban and suburban areas. Figure 5.4 illustrates railway extension projects and joint development distributions on the regional scale. From 2000 to 2006, 5 railway systems were opened by several joint public-private entities in the outlaying areas. In the west side of Tokyo, Tama Intercity Monorail (TIM) was built by one joint public-private corporation to encourage the suburban interactions between Tama Newtown Center and Tachikawa Business Core City. In the east side of Chiba, one private railway company was extending the Hokuso Railway (HR) corridor to Narita International Airport, accompanied by the Urban Renaissance Agency's Chiba Newtown projects. In the north area, another joint public-private corporation completed Saitama Railway (SR) to connect between central Tokyo and Saitama Stadium just before the 2002 FIFA World Cup. Minato Mirai 21 Line (MM21) is a new joint public-private metro link to promote Yokohama's central business districts with direct transit access to/from Tokyo's cultural centers (e.g., Shibuya). The region's latest suburban transit project was Tsukuba Express (TX), which was developed under the Special Measures Act to form a new science corridor with local land readjustment projects between central Tokyo and Tsukuba Academic City.

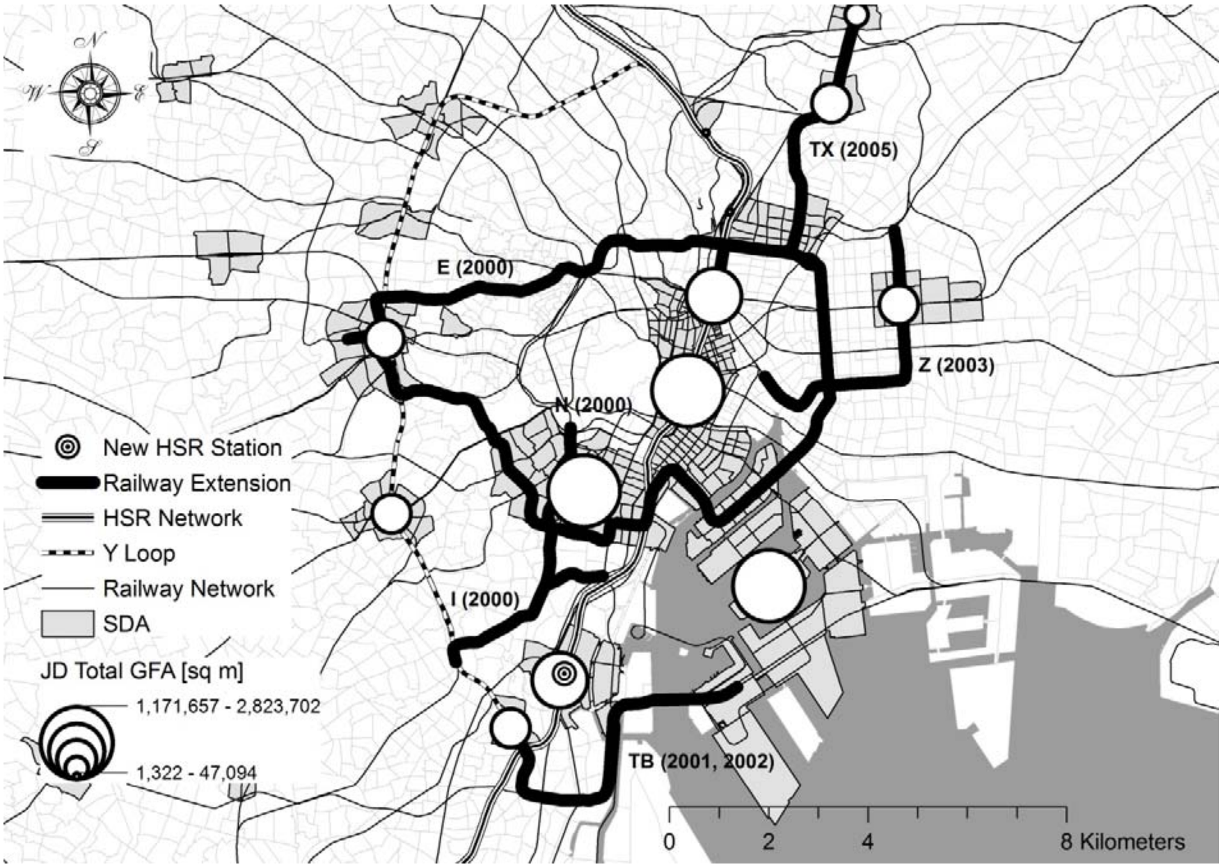
Figure 5.5 focuses upon central Tokyo. In the period 2000 to 2006, 4 subway lines were built by the privatized Tokyo Metro Corporation and the Tokyo Metropolitan Government (TMG)'s public transit bureau, while 2 urban lines were developed by joint public-private corporations. TMG Ohedo Line (E) is a new underground loop passing across the several urban regeneration areas, such as Shinjyuku, Roppongi, Akasaka, Shiodome, and Ueno. Tokyo Metro North-South Line (N) and Hanzomon Line (Z) penetrate the E loop to connect between the inside and outside urban regeneration areas. In the south part of central Tokyo, TMG Mita Line (N) and Tokyo Bay Railway (TB) were developed to link between the existing Y Loop and developing waterfront districts. On the HSR network, the privatized Central Japan Railway Company newly opened Shinagawa HSR Station with the former Japanese National Railways' (JNR) railway yard redevelopment projects. In central Tokyo, the Tsukuba Express (TX) science corridor, having an underground structure, were directly connected to the Akihabara business district, well-known for its electronics and subculture retail agglomeration.



Sources: Author, with data from GOJ (2009d; 2009f) and ITPS (2007; 2001).
Notes: TIM: Tama Intercity Monorail; HR: Hokuso Railway; SR: Saitama Railway; MM21: Minato Mirai 21 Line; TX: Tsukuba Express; (Open Year); NIA: Narita International Airport. HNA: Haneda Airport; HSR: High Speed Rail; JD: Joint Development.

Figure 5.4 Regional Railway Extensions and Joint Development (JD) Total Gross Floor Area (GFA) Distribution, 2000-2006

Along with these railway extensions, the 62 Joint Development (JD) practices distributed large and different activity spaces over the Tokyo Megalopolis Region. Table 5.7 presents the functional proportion of property developments by floor use types. Among the 6 floor use types, office has the highest GFA share (34.7%) and the shortest GFA-weighted average Distance (GFA-D) from CBD (6.2 km). This indicates that Tokyo's business function was highly concentrated in central Tokyo through the recent Urban Renaissance Program. Residential and mixed uses have large shares (29.1%; 11.9%) and modest GFA-Ds (12.7km; 11.1km). These figures suggest that large amounts of urban work-live space were added to central Tokyo, whereas new towns were still developed along the suburban railway corridors. On the other hand, retail and other floor uses have relatively long GFA-Ds because large shopping malls and small community facilities were widely placed to meet the demand for suburban living consumption.



Sources: Author, with data from GOJ (2009d; 2009f) and ITPS (2007; 2001).
Notes: E: TMG Ohedo Line; I: TMG Mita Line; N: Tokyo Metro North-South Line; Z: Tokyo Metro Hanzomon Line; TB: Tokyo Bay Railway; TX: Tsukuba Express; (Open Year); SDA; Strategic Development Area; HSR: High Speed Rail; JD: Joint Development.

Figure 5.5 Urban Railway Extensions and Joint Development (JD) Total Gross Floor Area (GFA) Distribution, 2000-2006

Table 5.7 Joint Development (JD) Gross Floor Area (GFA) Distribution, 2000-2006

Floor Use	GFA (sq m)	GFA Share (%)	*GFA-D from CBD (km)
Office	5,261,298	34.7	6.2
Residential	4,405,731	29.1	12.7
Retail	2,764,534	18.3	22.8
Hotel	235,798	1.6	10.3
Mixed	1,798,943	11.9	11.1
Others	532,721	3.5	23.9
Total	15,144,853	100.0	12.6

Notes: *GFA-weighted average Distance (GFA-D) from CBD i = $\{\Sigma_j [(GFA_{ij}) (CBD\_D_j)]\}/(\Sigma_j GFA_{ij})$
wherein: GFA_{ij}: GFA in type i at Strategic Development Area (SDA) j; CBD_D_j: straight-line distance between CBD and SDA j (km); i: land use type (office, residential, retail, hotel, mixed, and others) and j: SDA (j=1~62).

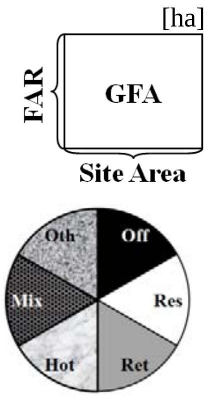
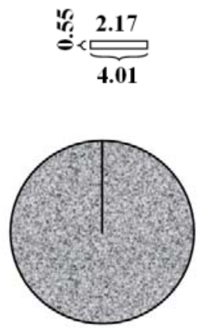
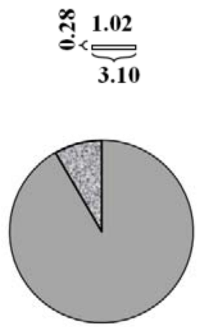
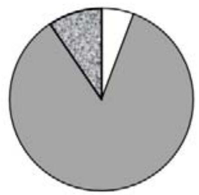
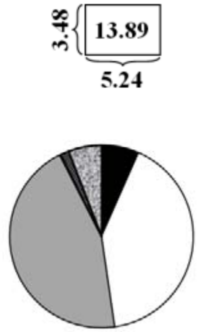
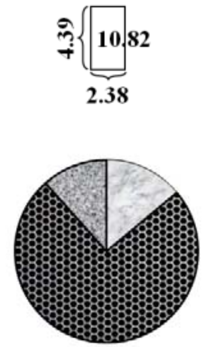
A typology grasps the functional features of Joint Development (JD) practices on the Strategic Development Area (SDA) scale. Cluster analysis statistically yielded 10 types of JD packages among the 62 SDAs. The titles and abbreviations are decided to represent the built-environment attributes of the 10 JD package types as follows:

- **Small-scale Pubic (SP)**: public and community facilities on small site with low Floor Area Ratio (FAR) (small-scale Gross Floor Area: GFA)
- **Small-scale Shopping (SS)**: dominantly shopping malls on small site with low FAR (small-scale GFA)
- **Large-scale Shopping (LS)**: dominantly shopping malls on huge site with low FAR (relatively large-scale GFA)
- **Mid-scale Residential (MR)**: residential towers plus shopping malls on small sites with medium FAR (mid-scale GFA)
- **Mid-scale Mixed (MM)**: mixed-use (residential and commercial) towers on small sites with medium FAR (mid-scale GFA)
- **Large-scale Mixed (LM)**: mixed use complexes (residential, office, retail, hotel, and recreational) on large site with medium FAR (relatively large-scale GFA)
- **Large-scale Waterfront (LW)**: mixed use complexes (residential, office, retail, hotel, and recreational) on huge waterfront site with medium FAR (large-scale GFA)
- **Large-scale Office (LO)**: dominantly office complexes on large site with medium FAR (relatively large-scale GFA)
- **High-rise Commercial (HC)**: commercial towers (office, retail, and hotel) on small site with high FAR (relatively large-scale GFA)
- **Large-scale Commercial (LC)**: commercial complexes (office, retail, and hotel) on large site with high FAR (large-scale GFA)

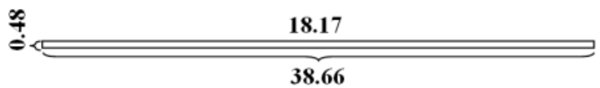
Table 5.8 summarizes the built-environment characteristics of each property development type by presenting statistical averages for the variables used to form clusters. This table also lists the numbers of SDAs which belong to each JD package type. Looking at these statistical figures, this study discusses large development strategies taken place across the megalopolis region.

One of the important strategies can be seen as the Small-scale Public (SP), Small-scale Shopping (SS), and Large-scale Shopping (LS) type packages along the new suburban corridors, particularly in the eastern outskirts of Tokyo. Historically, the eastern outskirts have long been less developed than the western outskirts of Tokyo for political, cultural and geographical reasons; therefore, throughout the 1980s and 1990s, a number of developable parcels were assembled through land readjustment projects. After the crash of 1991, however, the former public housing corporations and local governments struggled with Tokyo's slumping suburban real estate markets. In order to fill vacant lots, their new town projects have increasingly turned to publicly financed community facilities or more profitable big box stores with huge car parking spaces not only around the regional belt highway interchanges but also near the new suburban railway stations.

Table 5.8 Joint Developments (JDs) in Each Built-Environment Type and Statistical Mean Statistics for Key Clustering Variables

Development Type	SP: Small-scale Public	SS: Small-scale Shopping	LS: Large-scale Shopping	MR: Mid-scale Residential	MM: Mid-scale Mixed
			* 		
Land Use GFA [%]					
Office	0.0	0.0	0.0	6.6	10.8
Residential	0.0	0.0	5.7	41.1	1.9
Retail	0.0	91.6	84.9	44.8	1.2
Hotel	0.0	0.0	0.0	0.1	0.0
Mixed	0.0	0.0	0.0	1.5	74.5
Others	100.0	8.4	9.5	5.9	11.6
Mixture [0~1]	0.000	0.089	0.234	0.239	0.300
Parking Lots /GFA [ha]	291	961	401	109	78
# of Strategic Development Areas	3	4	2	34	6

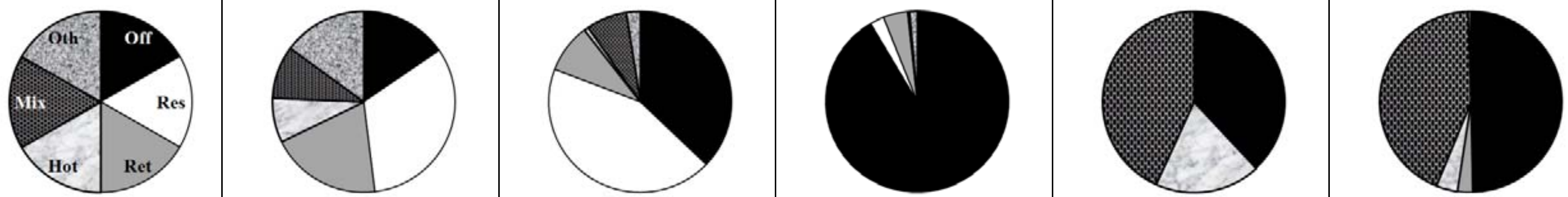
***LS: Large-scale Shopping**



(Continued)

Table 5.8 (Continued)

Development Type	LM: Large-scale Mixed	LW: Large-scale Waterfront	LO: Large-scale Office	HC: High-rise Commercial	LC: Large-scale Commercial
[ha] FAR / GFA / Site Area	4.50 / 41.94 / 9.37	**	3.64 / 32.13 / 8.65	10.30 / 24.55 / 2.38	14.72 / 55.82 / 10.59
Land Use GFA [%]					
Office	15.4	37.2	91.5	38.1	49.7
Residential	32.6	43.7	2.5	0.0	0.0
Retail	19.7	8.7	4.3	0.0	2.7
Hotel	7.9	0.8	0.3	18.7	3.8
Mixed	9.4	7.2	0.0	43.2	43.3
Others	14.9	2.5	1.4	0.0	0.5
Mixture [0~1]	0.788	0.612	0.156	0.583	0.536
Parking Lots /GFA [ha]	85	39	140	34	28
# of Strategic Development Areas	2	2	7	1	1



****LW: Large-scale Waterfront**

5.73 / 220.60 / 41.35

In response to the slowing economies and changing lifestyles, denser and more mixed property redevelopments with fewer car parking lots have increasingly been practiced around suburban and inner-city terminal stations: 34 Mid-scale Residential (MR) and 6 Mid-scale Mixed (MM) type packages. In the case of Minamisenjyu Station, for example, the former Japan National Railways' (JNR) freight yard was awarded to public housing corporations and private real estate developers and its large developable site is being converted into public housing units and residential condominium towers with retail stores, community facilities, and urban amenities (Figure 5.6). Served by three different railway systems (East Japan Railway, Tokyo Metro, and Tsukuba Express), this inner-city residential redevelopment package offers more urban living-working options with high transit access not only to business, shopping, and cultural districts in central Tokyo but also to Tsukuba Academic City in the eastern outskirts of Tokyo.

Source: BLUE STYLE COM (http://bluestyle.livedoor.biz/archives/51131645.html).
Figure 5.6 Mid-scale Residential (MR): Minamisenjyu Station as an "Urban Living Option"

In the 1990s, as a result of project feasibility studies, the local governments' waterfront development strategies were largely revised from massive office constructions to mixed commercial, residential, and recreational space creations: 1 Large-scale Mixed (LM) and 1 Large-scale Waterfront (LW) type packages. Yokohama Minato Mirai 21 is a typical example of the recent large reclamation sites filled with not only high-rise office towers but also with high-end residential condominiums, governmental subsidiary facilities, deluxe leisure hotels, international convention centers, professional sports clubs, amusement and theme parks, and public green spaces (Figure 5.7). These new waterfront development settings are well-connected by modern transit systems as well as pleasant pedestrian networks to encourage spatial integrations and social interactions with the existing business, retail and cultural districts.

On the other hand, large amounts of business space have been provided intensively around regional transportation facilities, such as central terminals, HSR stations, intercity highways and international airports: 7 Large-scale Office (LO), 1 High-rise Commercial (HC), and 1 Large-scale Commercial (LC) type packages. In the case of Shinagawa HSR Station, for instance, the former JNR's train depot site was converted into a large office complex that contains well-designed pedestrian networks and a generous green courtyard to attract the time-sensitive headquarter functions of leading corporations in the high-tech manufacturing and telecommunication sectors (Figure 5.8). In a similar way, the former JNR's railway yard around Tokyo Station was granted for prestigious office complex, luxury shopping mall, and deluxe hotel redevelopment projects with the Urban Renaissance Program's special FAR bonuses (maximum 1600 %), aiming to form a global business center (Figure 5.9).

Source: BLUE STYLE COM (http://bluestyle.livedoor.biz/archives/51264389.html).

Figure 5.7 Large-scale Mixed (LM): Yokohama Minato Mirai 21 as a "Multi-functional Center"

5.4 Market Responses

5.4.1 Job and Labor Location Models

This section examines Tokyo's job and labor market responses to the above developmental state strategies, using statistical analyses. Table 5.10 presents Tokyo's aggregate job and labor figures across the 107 Strategic Development Areas (SDAs). During the period 2000/01 to 2005/06, the 107 SDAs gained 321,381 jobs and 40,682 labors, while the overall Tokyo Megalopolis Region lost 87,133 jobs and 291,364 labors. In 2005/06, about 17% of the total jobs located within the 107 SDAs that account for only 2% of the Tokyo Megalopolis Region's land area. Notably office jobs (OFFC) in the 107 SDAs reached more than 27% of all office jobs; on the other hand, home office and retail jobs (HOME and RETL) in the 107 SDAs decreased about 0.3% of their proportions. This implies that the 107 SDAs gave more locational advantages particularly to the knowledge-based business sector, while replacing the small home-based business and factory-based manufacturing sectors. The locational shifts of labor markets were consistent with those of job markets. Among the 8 occupational categories, skilled professionals and managers (SKPR and MNGR) in the 107 SDAs had the highest proportions (4.4% and 4.8%) in 2005/06 and the highest growth rates of the proportions (+0.7% and +0.5%) from 2000/01 to 2005/06. These figures suggest that the 107 SDAs became more attractive locations for knowledge-based labors to have living consumption as well.

Source: World City Tower (http://www.tower-2000.com/location/index.html).

Figure 5.8 Large-scale Office (LO): Shinagawa HSR Station as a "High-tech and Informational Center"

In order to grasp further details, the determinants of job and labor location shifts between 2000/01 and 2005/06 were estimated across the 107 Strategic Development Areas (SDAs). The empirical results of the job and labor density (DN), Mixture Index (MI), and Balance Index (BI) models are shown in Table 5.10, 5.11, and 5.12. Ordinary least-squares (OLS) regression yielded reasonable models with the relatively high R-squared ranging between 0.278 and 0.691. All variables in the regression models were significant at the 10% probability level, and most variables were significant at the 5% and 1% probability levels. Due to their large volume, descriptive statistics for the entire variables are reported as appendices. This chapter looks particularly at the coefficients on megalopolis location, transportation infrastructure, transportation investment, and joint development attributes.

Source: Keibun Suzuki (http://jm1dvi.cocolog-nifty.com/).

Figure 5.9 Large-scale Commercial (LC): Tokyo Station as a "Global Business Center"

Megalopolis Location:

One of the important discussions is whether the megalopolis region's competitive advantages and lifestyle preferences have locationally shifted to central Tokyo in the past decade. The coefficients on "Average Travel Time (ATT) Distance to CBD" show mixed results. In Table 5.10, the retail job density (RETL) change has a negative slope in accordance with the ATT distance to CBD (about -19 jobs per minute), while the other categories' density changes show weak and no slope effects with distance to CBD. This table also presents that office, retail and factory job density changes were negatively associated with proximity to CBD (the coefficients on "1/ATT Distance to CBD" = -53,049 in OFFC, -18,046 in RETL, and -2,506 in FCTY). In Table 5.11, labor density changes especially in the sales, service, transportation and communication, and factory labor categories (SALE, SVLB, TRCM and FCLB) have positive

Table 5.9 Job and Labor Markets over the Tokyo Megalopolis Region and in the 107 Strategic Development Areas (SDAs), 2000/01-2005/06

	2000/01			2005/06			Change		
	TMR	**107 SDA**	**Share %**	**TMR**	**107 SDA**	**Share %**	**TMR**	**107 SDA**	**Share %**
LA [sq km]	16,004	328	2.0						
Job									
Total	22,063,740	3,457,905	15.7	21,976,607	3,779,286	17.2	-87,133	321,381	+1.5
OFFC	8,698,928	2,257,002	25.9	9,012,617	2,506,129	27.8	313,689	249,127	+1.9
HOME	733,077	26,009	3.5	588,712	18,596	3.2	-144,365	-7,413	-0.4
SCSV	2,214,342	196,150	8.9	2,649,364	244,245	9.2	435,022	48,095	+0.4
RETL	5,729,819	820,371	14.3	5,707,851	881,927	15.5	-21,968	61,556	+1.1
FCTY	4,089,968	131,405	3.2	3,516,079	100,364	2.9	-573,889	-31,041	-0.4
LGSG	597,606	26,968	4.5	501,984	28,036	5.6	-95,622	1,068	+1.1
Labor									
Total	18,711,411	624,296	3.3	18,420,047	664,978	3.6	-291,364	40,682	+0.3
SKPR	2,952,281	116,702	4.0	2,972,325	131,437	4.4	20,044	14,735	+0.5
MNGR	603,537	24,558	4.1	492,914	23,693	4.8	-110,623	-865	+0.7
ADMN	4,301,171	149,089	3.5	4,327,934	167,947	3.9	26,763	18,858	+0.4
SALE	3,201,764	120,198	3.8	3,038,867	122,334	4.0	-162,897	2,136	+0.3
SVLB	1,751,273	67,317	3.8	1,912,856	71,496	3.7	161,583	4,179	-0.1
SCRY	317,793	10,634	3.3	338,758	11,054	3.3	20,965	420	-0.1
TRCM	677,652	15,731	2.3	637,376	15,557	2.4	-40,276	-174	+0.1
FCLB	4,905,940	120,068	2.4	4,699,017	121,456	2.6	-206,923	1,388	+0.1

Source: Author, with data from GOJ (2009d).

Notes: TMR: Tokyo Megalopolis Region; 107 SDA: 107 Strategic Development Areas; Share: Share of 107 SDA in TMR; LA: Land Area; OFFC: Office; HOME: Home Office; SCSV: Social and Community Service; RETL: Retail and Restaurant; FCTY: Factory; LGSG: Logistics and Storage; SKPR: Skilled Professional; MNGR: Manager; ADMN: Administrator; SALE: Sales Worker; SVLB: Service Worker; TRCM: Transportation and Communication Worker; FCLB: Factory Labor.

Table 5.10 Ordinary Least Squares (OLS) Regression Results: Determinants of Job Density (DN) Changes by Workplace Category, 2000/01-2005/06

Category i	Total		OFFC		HOME		SCSV		RETL		FCTY		LGSG	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
Urban Agglomeration, 2000/01														
Total Jobs [10,000]									-162	0.005				
Total Job Density [1,000]	107	0.000	42	0.006			7	0.002	29	0.003			1	0.054
Total Labor Density [1,000]			160	0.060					-134	0.010				
Labor Mixture Index [0~1]	15,212	0.065	15,679	0.033					5,832	0.098				
Job Location Quotient in Category i							-75	0.033			-559	0.000	57	0.000
SKPR Location Quotient							297	0.001						
MNGR Location Quotient			1,574	0.001			-118	0.077						
SVLB Location Quotient					-147	0.000	-260	0.031						
FCLB Location Quotient											542	0.042		
Megalopolis Location														
ATT Distance to CBD [min.]					1.3	0.055			-18.7	0.058			-2.0	0.003
ATT Distance to NIA [min.]			33.7	0.002							-6.4	0.033		
ATT Distance to HNA [min.]			-26.8	0.028							8.3	0.011		
1/ATT Distance to CBD [min.]	-68,338	0.000	-53,049	0.001	401	0.006			-18,046	0.010	-2,506	0.015		
1/ATT Distance to NIA [min.]			5,110	0.051										
1/ATT Distance to HNA [min.]	16,723	0.031	16,688	0.021					6,445	0.053				
Regional Institute														
# of National Gov. Offices	-214	0.003	-142	0.018					-104	0.002			5	0.044
# of Public Research Institutes	456	0.000	325	0.001					87	0.069			-8	0.094
# of University Departments	-295	0.038												
Transportation Infrastructure, 2000/01														
National Roadway Density [km/100ha]							128	0.030						
Local Roadway Density [km/100ha]							70	0.013	274	0.014				
# of HSR Stations			-1,750	0.093							1,018	0.002		
# of Subway Stations	-603	0.027	-766	0.001			56	0.022					28	0.000
Transportation Investment, 2000-2006														
# of New HSR Stations	10,548	0.000	7,098	0.007									221	0.046
# of New CRT Stations	1,326	0.064	2,009	0.003									-77	0.004
# of New Subway Stations			1,583	0.002			-155	0.004					-37	0.051

(Continued)

Table 5.10 (Continued)

Category i	Total		OFFC		HOME		SCSV		RETL		FCTY		LGSG	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
Joint Development, 2000-2006														
MR Type Dummy [1/0]	1,733	0.004							976	0.001				
MM Type Dummy [1/0]			2,975	0.009	89	0.078					-1,726	0.000		
LM Type Dummy [1/0]	4,503	0.034	5,008	0.014										
LW Type Dummy [1/0]	7,586	0.022							3,137	0.034				
LO Type Dummy [1/0]			1,744	0.103										
HC Type Dummy [1/0]	10,503	0.000	10,720	0.000	-489	0.000								
LC Type Dummy [1/0]	65,955	0.000	67,193	0.000			-2,112	0.001	19,728	0.001				
(Constant)	-12,183	0.085	-16,456	0.017	51	0.360	38	0.819	-3,737	0.222	-83	0.812	112	0.004
R-Squared	0.637		0.691		0.384		0.399		0.329		0.421		0.675	
Number of Observations*	106		106		106		106		106		106		106	

Notes:*One of the 107 Strategic Development Areas (SDAs) had no job in 2000/01 and 2005/06.

OFFC: Office; HOME: Home Office; SCSV: Social and Community Service; RETL: Retail and Restaurant; FCTY: Factory; LGSG: Logistics and Storage; SKPR: Skilled Professional; MNGR: Manager; SVLB: Service Worker; FCLB: Factory Labor; NIA: Narita International Airport; HNA: Haneda Airport; ATT: Average Travel Time; MR: Mid-scale Residential; MM: Mid-scale Mixed; LM: Large-scale Mixed; LW: Large-scale Waterfront; LO: Large-scale Office; HC: High-rise Commercial; LC: Large-scale Commercial.

Table 5.11 Ordinary Least Squares (OLS) Regression Results: Determinants of Labor Density (DN) Changes by Occupational Category, 2000/01-2005/06

Category i	Total		SKPR		MNGR		ADMN	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
Urban Agglomeration in 2000/01								
Total Job Density [1,000]					-0.79	0.000		
Total Labor Density [1,000]	-38.97	0.060			-5.45	0.000		
Job Mixture Index [0~1]					-91.31	0.002		
Labor Location Quotient in Category i					-24.82	0.000		
OFFC Location Quotient					23.05	0.008		
Megalopolis Location								
ATT Distance to CBD [min.]	10.08	0.021						
ATT Distance to HNA [min.]	-6.73	0.044	-1.30	0.044			-1.25	0.072
1/ATT Distance to HNA [min.]					-88.70	0.027		
Transportation Infrastructure in 2000/01								
National Roadway Density [km/100ha]					0.01	0.053		
# of Subway Stations					3.46	0.009		
Transportation Investment between 2000 and 2006								
Proportion of New Pedestrian Space [%]	46.38	0.000	15.47	0.000	2.72	0.001	15.04	0.000
Joint Development between 2000 and 2006								
MR Type Dummy [1/0]	461.03	0.000	99.48	0.004	14.26	0.050	149.43	0.000
MM Type Dummy [1/0]	1,079.04	0.000	185.91	0.008	28.50	0.061	229.97	0.003
(Constant)	-96.87	0.625	67.31	0.129	59.55	0.020	73.80	0.125
R-Squared	0.376		0.278		0.564		0.300	
Number of Observations*	102		102		102		102	

(Continued)

Table 5.11 (Continued)

Variables / Category i	SALE		SVLB		TRCM		FCLB	
	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Urban Agglomeration in 2000/01								
Total Labor Density [1,000]	-24.11	0.000	-9.69	0.000			-12.08	0.001
Job and Labor Access in 2000/2001								
Total Jobs within 30 min. by Rail [100K]	1.30	0.097						
Megalopolis Location								
ATT Distance to CBD [min.]	2.31	0.030	1.63	0.000	0.28	0.005	2.24	0.001
ATT Distance to NIA [min.]					-0.27	0.000	-1.20	0.007
1/ATT Distance to HNA [min.]					-30.31	0.091		
Transportation Infrastructure in 2000/01								
Local Roadway Density [km/100ha]					0.00	0.012		
# of Subway Stations					0.76	0.095		
# of LRT Stations					-2.67	0.016		
Transportation Investment between 2000 and 2006								
Proportion of New Pedestrian Space [%]	8.08	0.004						
Joint Development between 2000 and 2006								
MR Type Dummy [1/0]	64.65	0.018	52.55	0.001	10.25	0.002	53.35	0.022
MM Type Dummy [1/0]	172.67	0.002	93.13	0.004	23.81	0.000	195.78	0.000
HC Type Dummy [1/0]			-137.69	0.066				
(Constant)	-123.91	0.054	-64.47	0.007	15.65	0.024	14.40	0.747
R-Squared	0.417		0.424		0.335		0.380	
Number of Observations*	102		102		102		102	

Notes:*5 of the 107 Strategic Development Areas (SDAs) had no labor in 2000/01 and 2005/06.

OFFC: Office; SKPR: Skilled Professional; MNGR: Manager; ADMN: Administrator; SALE: Sales Worker; SVLB: Service Worker; TRCM: Transportation and Communication Worker; FCLB: Factory Labor; NIA: Narita International Airport; HNA: Haneda Airport; ATT: Average Travel Time; MR: Mid-scale Residential; MM: Mid-scale Mixed; HC: High-rise Commercial.

Table 5.12 Ordinary Least Squares (OLS) Regression Results: Determinants of ln Job Mixture Index (MI), Labor Mixture Index (MI), and Job-Labor Balance Index (BI) Changes, 2000/01-2005/06

Category i	Job Mixture MI		Labor MI		Job-Labor BI	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
Urban Agglomeration in 2000/01						
ln Total Labors	0.037	0.001			0.225	0.000
ln Total Labor Density			-0.007	0.001		
ln Job Mixture Index [0~1]	-0.625	0.000			-0.749	0.000
ln Labor Mixture Index [0~1]	-0.102	0.002				
ln Job-Labor Balance Index [0~1]					-0.366	0.000
Job and Labor Access in 2000/2001						
ln Total Labors within 30 min. by Rail	-0.025	0.003				
ln Total Jobs within 30 min. by Rail			-0.004	0.027		
Megalopolis Location						
ln Average Travel Time Distance to CBD [min.]			-0.018	0.000		
ln Average Travel Time Distance to NIA [min.]			0.008	0.078		
ln Average Travel Time Distance to HNA [min.]	0.094	0.015	0.008	0.048	0.170	0.082
Public Institute						
ln # of National Government Offices					-0.366	0.000
ln # of Local Government Offices			-0.002	0.063		
Transportation Infrastructure in 2000/01						
ln # of HSR Stations			-0.005	0.027	-0.161	0.002
ln # of CRT Stations			0.004	0.012		
ln # of Subway Stations					-0.062	0.023
ln # of LRT Stations	-0.028	0.010			-0.080	0.035
Transportation Investment between 2000 and 2006						
ln # of New CRT Stations					0.069	0.013
Joint Development between 2000 and 2006						
SS Type Dummy [1/0]	-0.150	0.062				
MM Type Dummy [1/0]	-0.112	0.081				
LM Type Dummy [1/0]			0.091	0.000	2.150	0.000
LO Type Dummy [1/0]	-0.170	0.006			-0.874	0.000
LC Type Dummy [1/0]	-0.290	0.062				
(Constant)	4.411	0.000	0.087	0.008	3.790	0.001
R-Squared	0.633		0.475		0.570	
Number of Observations*	106		102		107	

Notes:*One of the 107 Strategic Development Areas (SDAs) had no job and 5 of them had no labor in 2000/01 and 2005/06.

NIA: Narita International Airport; HNA: Haneda Airport; SS: Small-scale Shopping; MM: Mid-scale Mixed; LM: Large-scale Mixed; LO: Large-scale Office; LC: Large-scale Commercial.

slopes to the ATT distance to CBD; however, these labor market decentralizations consequently increased labor Mixture Index (MI) near central Tokyo (elasticity = +0.018 in Table 5.12).

The empirical results of the regression models suggest that Narita International Airport (NIA) and Haneda Airport (HNA) differently influenced on the megalopolis region's economic production and living consumption patterns. In the job density change models (Table 5.10), the coefficient on "Average Travel Time (ATT) Distance to NIA" has a positive value in the office job category (OFFC = 33.7) and a negative value in the factory job category (FCTY = -6.4); contrarily, "ATT Distance to HNA" has a negative coefficient in the office job category (OFFC = -26.8) and a positive coefficient in the factory job category (FCTY = 8.3). These figures indicate that business production activities located closer to the urban domestic airport (HNA), while industrial production activities moved towards the suburban international airport (NIA). In the same table, however, office job density changes (OFFC) were positively related to proximity to both NIA and HNA (5,110 and 16,688), which implies that time-sensitive business production increasingly agglomerated around the suburban international and urban domestic airports. Table 5.11 shows that Tokyo's skilled professional and administrator labor markets (SKPR and ADMN) also shifted towards the urban domestic airport (the coefficients on ATT Distance to HNA: -1.30 and -1.25) and its transportation and communication and factory labors (TRCM and FCLB) resided closer to the suburban international airport (the coefficients on ATT Distance to NIA: -0.28 and -1.20). However, manager and transportation and communication labor densities (MNGR and TRCM) decreased in the immediate vicinity of the urban domestic airport (the coefficients on 1/ATT Distance to HNA: -88.70 and -30.31). As a result, Tokyo's job mixture, labor mixture, and job-labor balance increased with distance to the urban domestic airport (HNA) (elasticity = + 0.094, +0.008, and + 0.170 in Table 5.12).

Transportation Infrastructure and Investment:

A set of independent variables shed light on the agglomeration effects of different transit systems. The empirical results in Table 5.10, 5.11 and 5.12 are visualized by drawing bar charts. Figure 5.10 presents that the new HSR, CRT, and Subway stations developed between 2000 and 2006 increased office type job densities (OFFC); however, the old HSR and Subway stations constructed before 2000 decreased the office type job densities (OFFC) in the Strategic Development Areas (SDAs). These empirical results suggest that the locational advantages of knowledge-based economic production shifted from the old station catchment areas to the new station catchment areas. On the other hand, the new LRT investment between 2000 and 2006 did not have significant impacts on job densities in the SDAs.

The agglomeration impacts of new transit investments between 2000 and 2006 on labor densities are statistically insignificant. Figure 5.11 shows that the old Subway and LRT stations also had very small influences on labor densities, but new pedestrian space investments between 2000 and 2006 increased labor densities particularly in the skilled professional, manager, administrator and sales worker categories (SKPR, MNGR, ADMN, and SALE). For example, about 16 skilled professionals per sq km would be added to the SDA where new pedestrian space created between 2000 and 2006 accounts for 1% of its total land area. These empirical results support the assumption that the location choices of knowledge-based labors have importantly been affected by urban amenity improvements rather than massive infrastructure constructions.

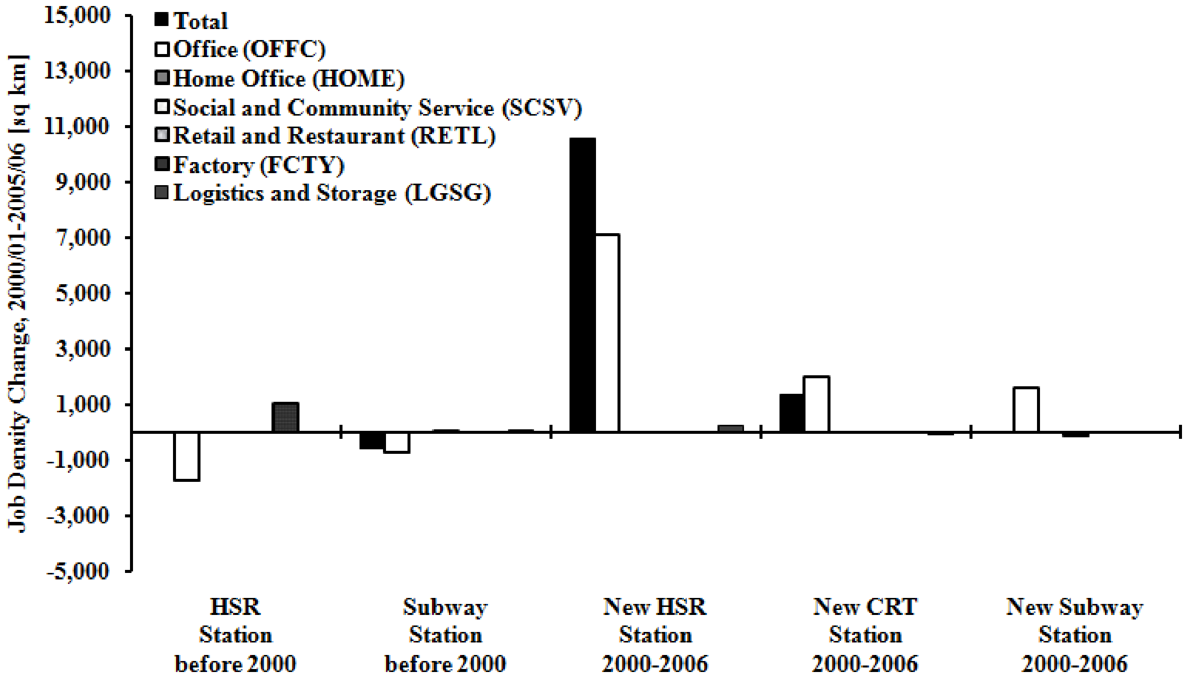


Figure 5.10 Impacts of Rail Transit Stations on Job Density (DN) Changes, 2000/01-2005/06

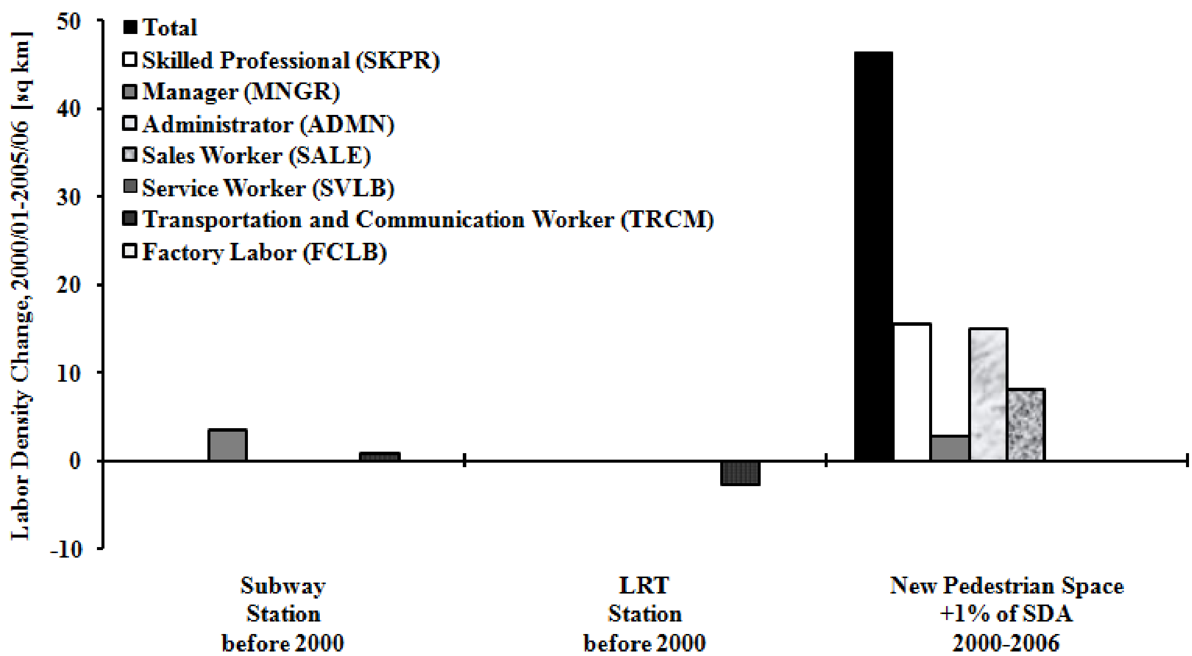


Figure 5.11 Impacts of Rail Transit Stations and New Pedestrian Space (+1 of the SDA Land Area) on Labor Density (DN) Changes, 2000/01-2005/06

The locational shifts of job and labor markets caused by rail transit investments resulted in changes in job and labor compositions within each of the 107 SDAs. Figure 5.12 reveals that the old HSR, Subway, and LRT stations developed before 2000 significantly decreased job-labor balances (elasticity = -0.161, -0.062, and -0.080), whereas the new CRT station largely increased a job-labor balance (elasticity = 0.069). Yet, the impacts of rail transit investment and pedestrian space creation on both job mixture and labor mixture are statistically insignificant.

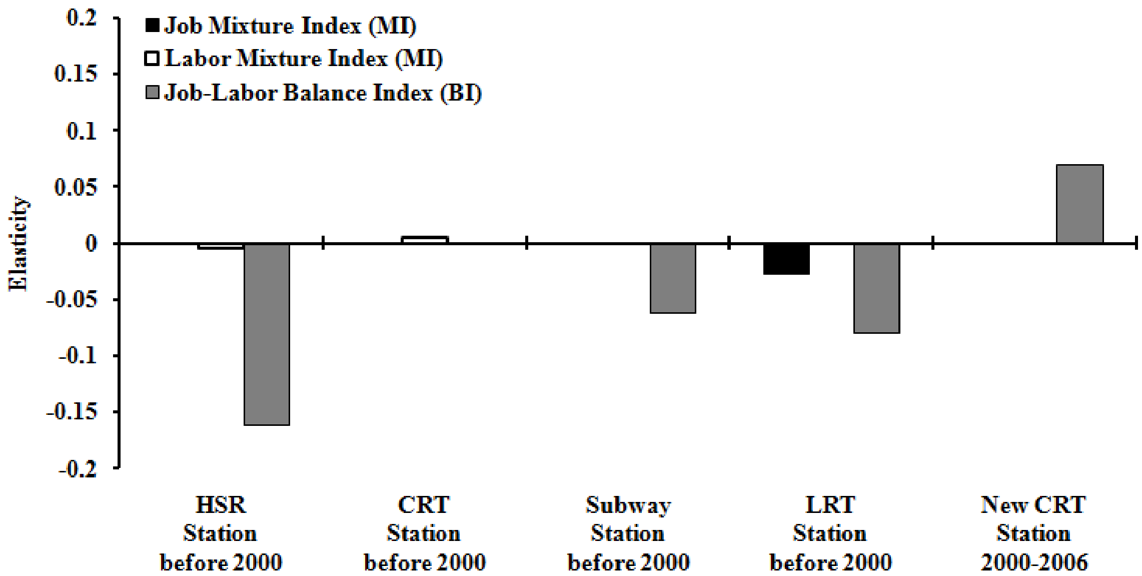
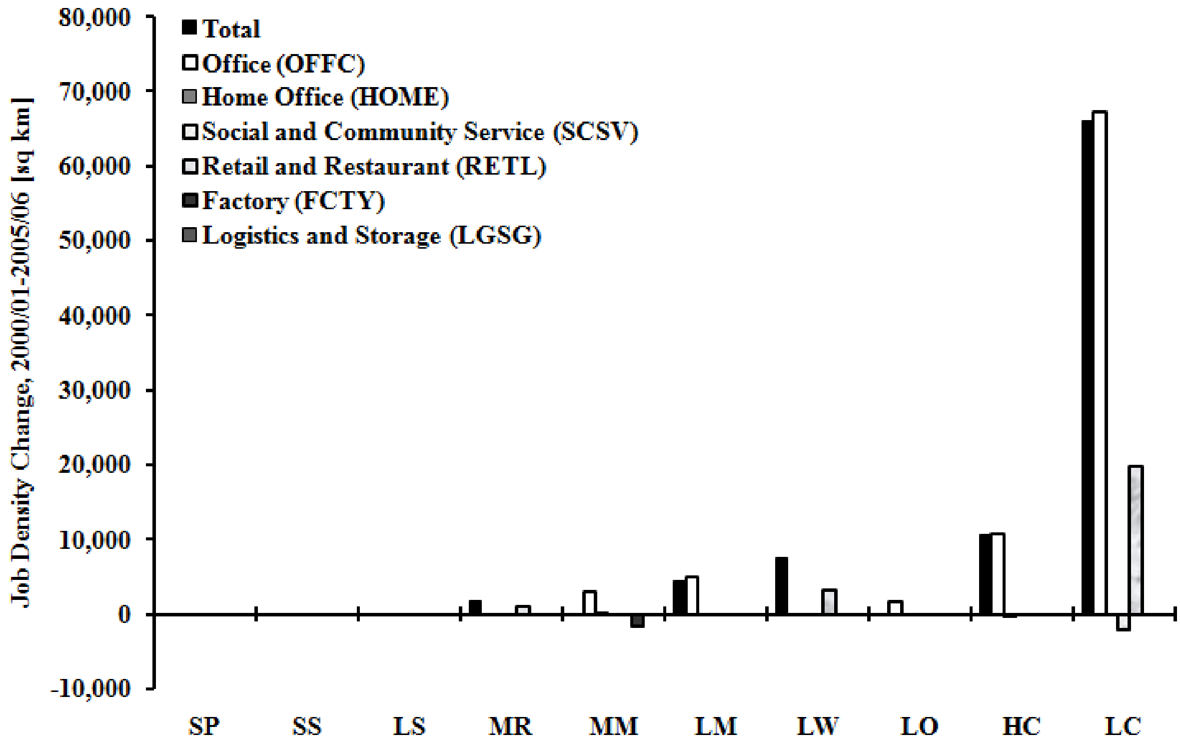


Figure 5.12 Impacts of Rail Transit Stations on Job Mixture Index (MI), Labor Mixture Index (MI), and Job-Labor Balance Index (BI) Changes, 2000/01-2005/06

Joint Development:

The estimates of Joint Development (JD) package impacts in Table 5.10, 5.11 and 5.12 are also illustrated by using bar charts. Figure 5.13 presents that the Small-scale Public (SP), Small-scale Shopping (SS), and Large-scale Shopping (LS) type packages did not have any impact on job densities, while the other JD packages generated various effects on job densities across the 6 workplace categories. The Large-scale Commercial (LC) type package around Tokyo Station led to considerable job density increases especially in the office and retail workplace categories (OFFC = +67,193 and RETL = +19,728 sq km) with a slight job density decrease in the social and community service job category (SCSV = -2,112 sq km); on the other hand, the Large-scale Office (LO) type package caused a modest density increase in the office type workplace category (OFFC = +1,744 sq km). The Large-scale Mixed (LM) and High-rise Commercial (HC) type packages gained large job densities in the office type job category (OFFC: LM = +5,008 and HC = +10,720 sq km), but the Large-scale Waterfront (LW) type package increased job densities in the retail workplace category (RETL = +3,137 sq km) rather than the office workplace category (OFFC). The Mid-scale Residential (MR) and Mid-scale Mixed (MM) type packages moderately influenced job densities in the office, retail and factory workplace categories (OFFC = +2,975, RETL = +976, and FCTY = -1,726 sq km).

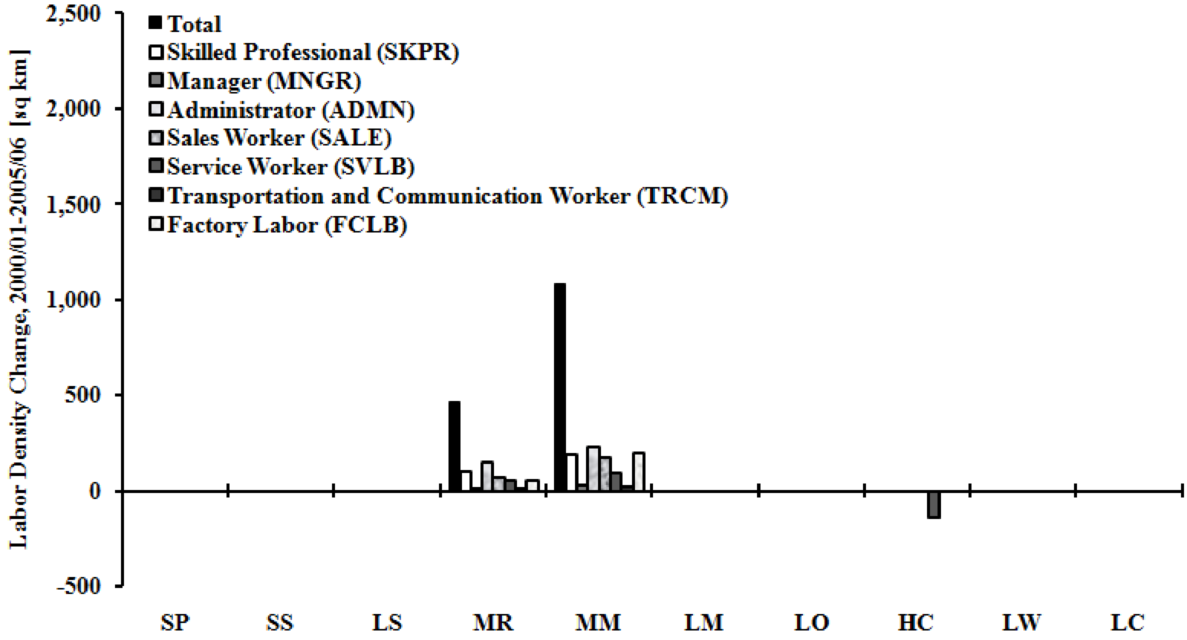


Notes: SP: Small-scale Public; SS: Small-scale Shopping; LS: Large-scale Shopping; MR: Mid-scale Residential; MM: Mid-scale Mixed; LM: Large-scale Mixed; LW: Large-scale Waterfront; LO: Large-scale Office; HC: High-rise Commercial; LC: Large-scale Commercial.

Figure 5.13 Impacts of Joint Development (JD) Packages on Job Density (DN) Changes, 2000/01-2005/06

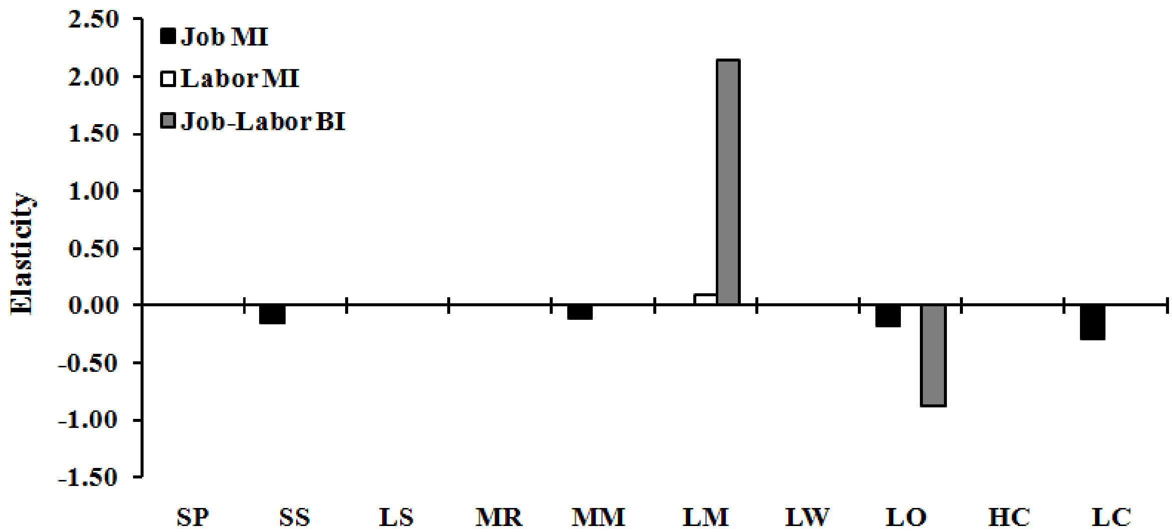
The Joint Development (JD) packages had much weaker impacts on labor densities. Figure 5.14 indicates that only the Mid-scale Residential (MR) and Mid-scale Mixed (MM) type packages increased labor densities in all the occupational categories, while the other JD packages did not intensify labor densities at all. Notably, the MM type package showed larger impacts on labor densities than the MR type package in all the occupational categories. This bar chart also suggests that the High-rise Commercial (HC) type package replaced service labors (SVLB = -138 sq km), whereas intensifying office type jobs (OFFC = +10,720 sq km) in the same SDA.

Figure 5.15 describes the impacts of Joint Development (JD) packages on job mixture, labor mixture and job-labor balance indices. The Small-scale Shopping (SS), Mid-scale Mixed (MM), Large-scale Office (LO), and Large-scale Commercial (LC) type packages, which were basically commercial property developments, decreased job mixtures (elasticity = -0.150, -0.112, -0.170, and -0.290). The models also captures that the Large-scale Mixed (LM) type package slightly raises a labor mixture (elasticity = +0.091) and drastically increased a job-labor balance (elasticity = +2.150). This exceptional figure makes sense because Yokohama's waterfront sites were rapidly filled with tall residential properties during the period. In an opposite way, the Large-scale Office (LO) type package significantly decreased a job-labor balance (elasticity = -0.874) since Tokyo's large vacant sites were converted into massive office complexes.



Notes: SP: Small-scale Public; SS: Small-scale Shopping; LS: Large-scale Shopping; MR: Mid-scale Residential; MM: Mid-scale Mixed; LM: Large-scale Mixed; LW: Large-scale Waterfront; LO: Large-scale Office; HC: High-rise Commercial; LC: Large-scale Commercial.

Figure 5.14 Impacts of Joint Development (JD) Packages on Labor Density (DN) Changes, 2000/01-2005/06



Notes: SP: Small-scale Public; SS: Small-scale Shopping; LS: Large-scale Shopping; MR: Mid-scale Residential; MM: Mid-scale Mixed; LM: Large-scale Mixed; LW: Large-scale Waterfront; LO: Large-scale Office; HC: High-rise Commercial; LC: Large-scale Commercial.

Figure 5.15 Impacts of Joint Development (JD) Packages on Job Mixture Index (MI), Labor Mixture Index (MI), and Job-Labor Balance Index (BI) Changes, 2000/01-2005/06

Table 5.13 Multilevel Modeling (MLM) Results: Determinants of ln Land Price adjusted by Consumer Price Index (CPI) in 2007 [JPY/sq m], 2000 and 2007

Land Markets	Residential		Commercial		Mixed		Industrial	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
Fixed Effects								
Land Parcel								
Land Area [sq m]	9.12E-05	0.000	7.64E-05	0.000	2.31E-04	0.000	-9.53E-06	0.000
Maximum FAR [%]	4.45E-04	0.000	3.18E-03	0.000	2.42E-03	0.000	2.02E-03	0.000
SDA Size [sq km]	0.015	0.000			-0.015	0.036	-0.024	0.012
1/Distance to Coastline [m]	-31.078	0.003						
1/Distance to River [m]	-1.180	0.007	-8.034	0.002	1.826	0.000		
Urban Agglomeration Pattern, 2000/01								
Total Job Density [sq km]	-1.20E-06	0.000			-1.65E-06	0.002		
Total Labor Density [sq km]	3.52E-06	0.076	2.07E-05	0.002			1.40E-05	0.058
Job Mixture Index [0~1]			-0.510	0.002	-0.186	0.081		
Labor Mixture Index [0~1]	-1.399	0.000			-0.508	0.009		
OFFC Location Quotient							0.247	0.017
RETL Location Quotient					0.084	0.016	0.195	0.008
FCTY Location Quotient							0.118	0.015
SKPR Location Quotient	0.211	0.000						
MNGR Location Quotient	0.050	0.000						
ADMN Location Quotient	0.229	0.000			0.219	0.017		
SALE Location Quotient	0.153	0.000						
SVLB Location Quotient	0.163	0.000			0.120	0.001		
TRCM Location Quotient	0.078	0.002						
FCLB Location Quotient					-0.146	0.010		
Job and Labor Access, 2000/01								
Total Jobs in 30 minutes by Rail + Road	2.05E-08	0.000			3.17E-08	0.000		
Job MAG Index [-1~+1]					-0.207	0.001		
Total Labors in 30 minutes by Rail + Road			5.23E-08	0.000				
Labor MAG Index [-1~+1]			-0.300	0.006			-0.197	0.000
Megalopolis Location								
ATT Distance to CBD [hours]	0.107	0.000						
ATT Distance to NIA [hours]					0.232	0.000		
ATT Distance to HNA [hours]					-0.291	0.000	-0.456	0.000
ATT Distance to CBD [hours] *Year 2007 Dummy [1/0]	-0.007	0.000	-0.006	0.000	-0.008	0.000	-0.013	0.000
ATT Distance to HNA [hours] *Year 2007 Dummy [1/0]	0.002	0.000			0.003	0.000	0.003	0.000
Public Institute								
# of National Government Offices	0.004	0.000	-0.010	0.008			0.011	0.046
# of Local Government Office	0.018	0.000						
# of Public Research Institutes	-0.006	0.000						
# of Public Cultural Facilities			0.045	0.000			0.026	0.094
# of University Departments			-0.020	0.000			-0.013	0.028
Transportation Infrastructure, 2000/01								
1/Distance to Highway [m]	-4.357	0.003	-2.613	0.048			8.838	0.000
1/Distance to National Road [m]					-0.524	0.027	423.535	0.026
1/Distance to HSR Station [m]	295.848	0.000	175.967	0.000	200.404	0.000		
1/Distance to CRT Station [m]	17.971	0.000	19.784	0.000	6.656	0.001		
1/Distance to MRT Station [m]	19.842	0.000	13.940	0.000	8.295	0.000	-70.868	0.010
1/Distance to LRT Station [m]							423.535	0.026

(Continued)

Table 5.13 (Continued)

Property Markets	Residential		Commercial		Mixed		Industrial	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
Transportation Infrastructure								
1/Distance to Highway [m] * Year 2007 Dummy [1/0]			3.140	0.037				
1/Distance to Local Road [m] * Year 2007 Dummy [1/0]			0.277	0.092	0.227	0.003		
1/Distance to HSR Station [m] * Year 2007 Dummy [1/0]	-58.973	0.082	-125.014	0.000	-211.298	0.000	-500.710	0.001
1/Distance to CRT Station [m] * Year 2007 Dummy [1/0]	12.739	0.000						
1/Distance to Subway Station [m] * Year 2007 Dummy [1/0]							44.235	0.009
1/Distance to LRT Station [m] * Year 2007 Dummy [1/0]							49.208	0.089
Transportation Investment, 2000-2006								
1/Distance to New Highway [m]					-73.165	0.073		
1/Distance to New HSR Station [m]	387.039	0.000	242.102	0.000			306.717	0.050
1/Distance to New CRT Station [m]	-44.501	0.002						
1/Distance to New Subway Station [m]	28.521	0.000	16.815	0.021	17.313	0.001		
1/Distance to New LRT Station [m]			123.496	0.027	89.166	0.011	512.297	0.024
New Pedestrian Space [%]	-0.032	0.000					0.023	0.058
Joint Development, 2000- 2006								
SP Type Dummy [1/0]					-0.240	0.017		
LS Type Dummy [1/0]	-0.564	0.000			-0.474	0.011		
MR Type Dummy [1/0]							-0.085	0.026
MM Type Dummy [1/0]	-0.149	0.000	-0.136	0.041			-0.318	0.000
LM Type Dummy [1/0]	-0.081	0.024						
LW Type Dummy [1/0]	0.413	0.000	0.285	0.000	0.407	0.000		
LO Type Dummy [1/0]	0.260	0.000	0.700	0.000	0.348	0.000		
HC Type Dummy [1/0]							-0.161	0.018
LC Type Dummy [1/0]	0.804	0.001					-0.507	0.001
Interaction Terms								
1/Distance to CRT Station [m] * MM Type Dummy [1/0]	40.024	0.001						
1/Distance to New Subway Station [m] * MM Type Dummy [1/0]	59.861	0.097						
New Pedestrian Space [%] * 1/Distance to HSR Station [m]			61.266	0.002	41.961	0.007		
New Pedestrian Space [%] * 1/Distance to New CRT Station [m]	9.821	0.001						
New Pedestrian Space [%] * 1/Distance to New LRT Station [m]	43.031	0.001						
New Pedestrian Space [%] * Total Labor Density [sq km]	5.51E-06	0.000						
(Constant)	12.147	0.000	11.626	0.000	12.036	0.000	11.488	0.000
Random Effects								
∑ ζ	0.555		0.317		0.288		0.464	
∑ ε	0.166		0.428		0.265		0.167	
ρ	0.918		0.354		0.542		0.885	
Level-1 Observations	4,404		1,802		1,640		391	
Level-2 Districts	113		77		84		53	

Notes: SDA: Strategic Development Area; OFFC: Office; RETL: Retail and Restaurant; FCTY: Factory; SKPR: Skilled Professional; MNGR: Manager; ADMN: Administrator; SALE: Sales Worker; SVLB: Service Worker; TRCM: Transportation and Communication Worker; FCLB: Factory Labor; MAG: Modal Accessibility Gap; ATT: Average Travel Time; NIA: Narita International Airport; HNA: Haneda Airport; SP: Small-scale Public; SS: Small-scale Shopping; LS: Large-scale Shopping; MR: Mid-scale Residential; MM: Mid-scale Mixed; LM: Large-scale Mixed; LW: Large-scale Waterfront; LO: Large-scale Office; HC: High-rise Commercial; LC: Large-scale Commercial.

5.4.2 Hedonic Price Models

This section examines Tokyo's land market responses to the above developmental state strategies. Table 5.13 presents the empirical results of four hedonic price models. Descriptive statistics for the entire variables are also attached as appendices due to their large volume. Multilevel modeling (MLM) estimated the between-district standard deviation of the random intercepts of districts $\sum \zeta$ as well as the within-district correlation standard deviation $\sum \varepsilon$. The intra-class correlation ρ was calculated as follows:

$$\rho = \frac{\sum \zeta}{\sum \zeta + \sum \varepsilon}$$

The four hedonic price models were estimated with the relatively high ρ values ranging between 0.354 and 0.918. All variables in the four regression models were significant at the 10% probability level, and most variables were significant at the 5% and 1% probability levels. This section also focuses upon the marginal impacts of key attributes: megalopolis location, transportation infrastructure, transportation investment, and joint development.

Megalopolis Location:

All the four hedonic price models have the negative coefficients on "Average Travel Time (ATT) Distance to CBD [hours] * Year 2007 Dummy [1/0]" (-0.007, -0.006, -0.008, and -0.013), which means that the price gradients of residential, commercial, and industrial land markets across the 107 SDAs got steeper with proximity to CBD during the period 2000 to 2007. The coefficients on "ATT Distance to Haneda Airport (HNA) [hours] * Year 2007 Dummy [1/0]" have positive values in the residential, mixed, and industrial market models (+0.002, +0.003, and +0.003), which suggests that the price gradients of residential, mixed, and industrial land markets across the 107 Strategic Development Areas (SDAs) became flatter with proximity to the urban domestic airport (HNA) in the same period. These empirical results are not consistent with the estimates of job and labor location changes as discussed in the previous section. Additionally, the price impacts of "ATT Distance to Narita International Airport (NIA) [hours] * Year 2007 Dummy [1/0]" was statistically insignificant in all the four hedonic price models.

Transportation Infrastructure and Investment:

This empirical study investigates the land price premiums and discounts for proximity to rail transit stations. Figure 5.16 presents the estimates of the impacts of both new and old HSR stations on residential, commercial, mixed and industrial land prices within 2 km of the stations by 250-meter distances, wherein all other variables are fixed with their statistical averages. Since there was no residential land point within 500 meters of a new HSR station in 2000 and 2007, the impacts of a new HSR station on residential land prices are drawn in the range 500 to 2000 meter distances. Commercial, industrial, and residential land prices increased with proximity to a new HSR station between 2000 and 2007. This bar chart also illustrates that commercial, mixed, industrial, and residential land prices decreased according to proximity to an old HSR station between 2000 and 2007. It can be assumed that the new HSR station's price gains in central Tokyo came from the old HSR stations' price losses in suburban Tokyo.

In a similar manner, Figure 5.17 shows the effects of proximity to both new and old CRT stations on residential land price changes within 500 meters of the stations by 50-meter distances, wherein all other variables are fixed with their statistical averages. Residential land prices moderately rise with proximity to an old CRT station, while dropping with proximity to a new CRT station between 2000 and 2007. It is likely that the relocation of previous dwellers temporarily led to the price discounts for proximity to a new CRT station; on the other hand, the existing CRT station developed before 2000 gradually formed more attractive living environments and added the price premiums for transit access to nearby residential land parcels. Thus, new subway stations immediately generated much higher price premiums without the large relocation of urban activities in central Tokyo and downtown Yokohama. Figure 5.18 reveals that commercial, mixed, and residential land prices substantially increased with proximity to a new subway station.

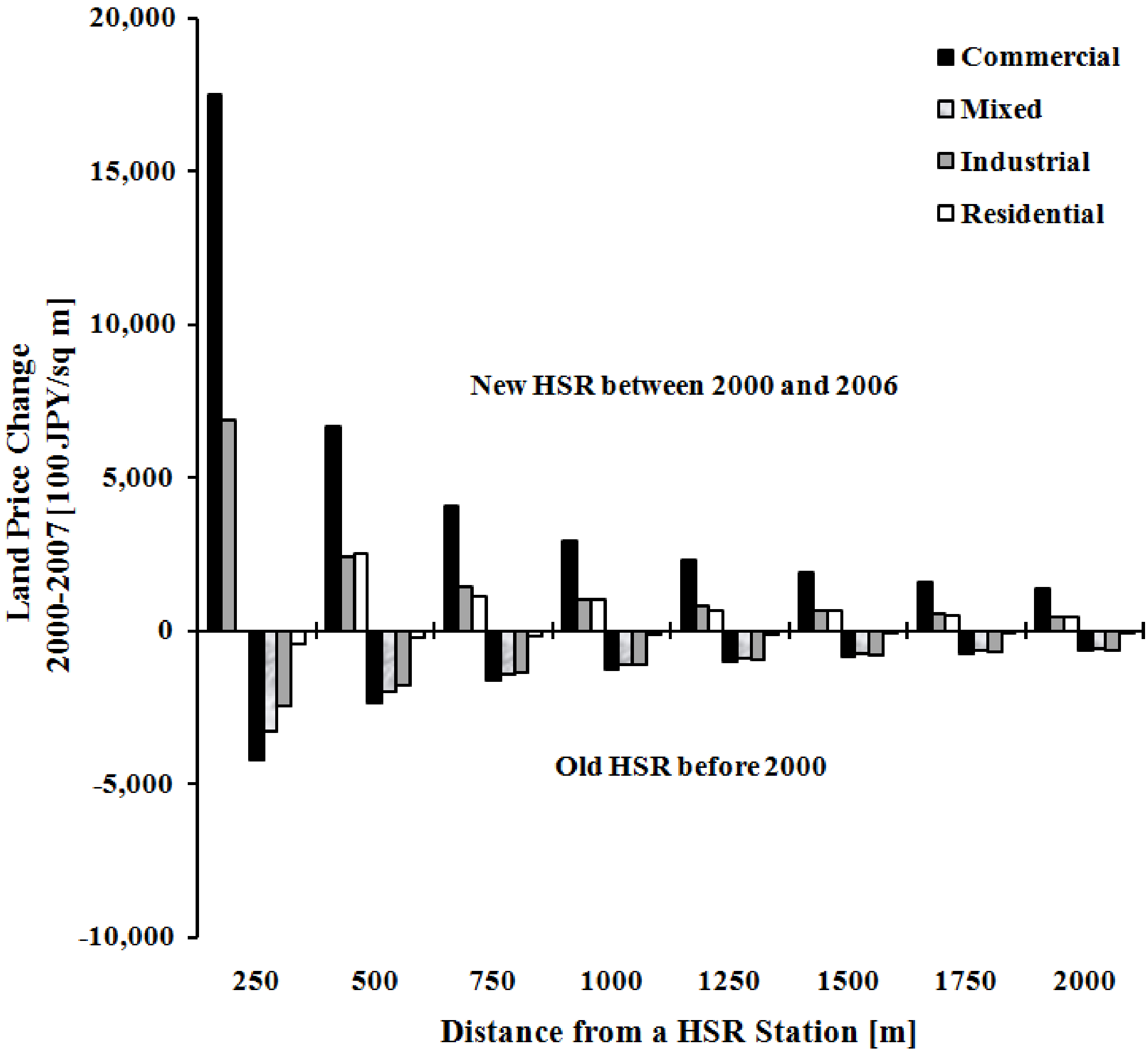


Figure 5.16 Impacts of New and Old HSR Stations on Land Price Changes by 250-meter Distances, 2000-2007

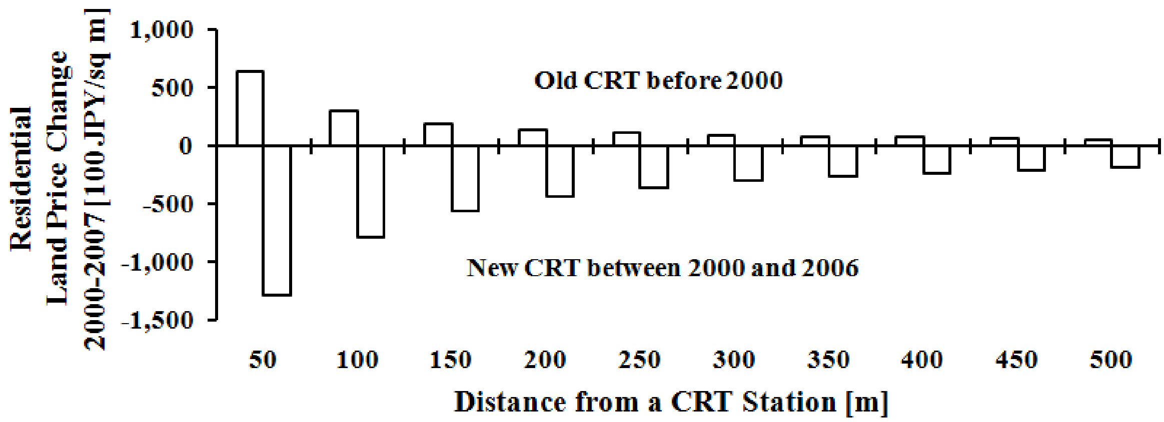


Figure 5.17 Impacts of New and Old CRT Stations on Land Price Changes by 50-meter Distances, 2000-2007

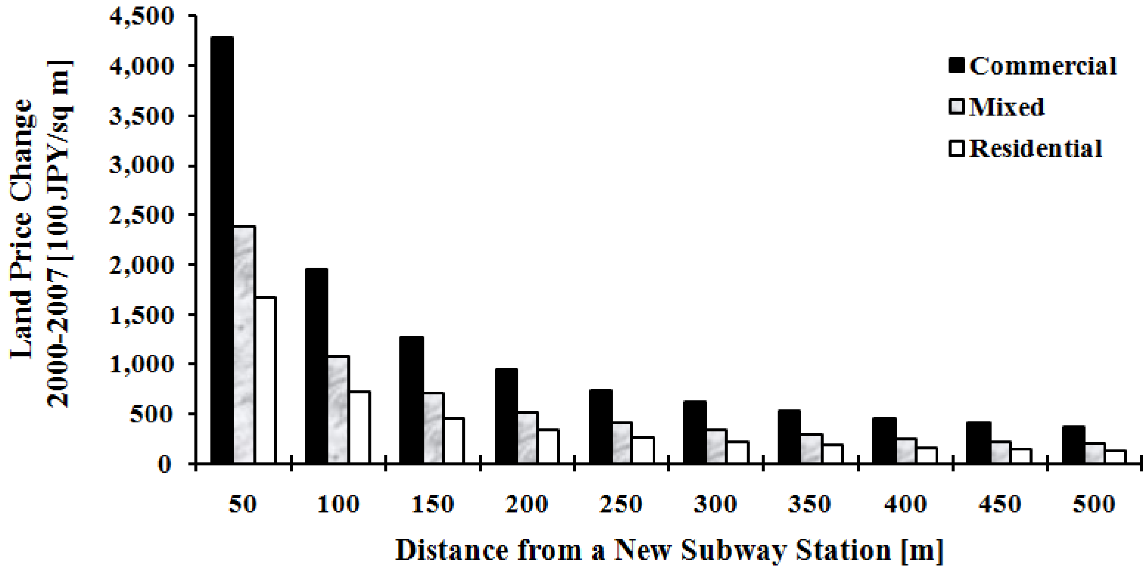


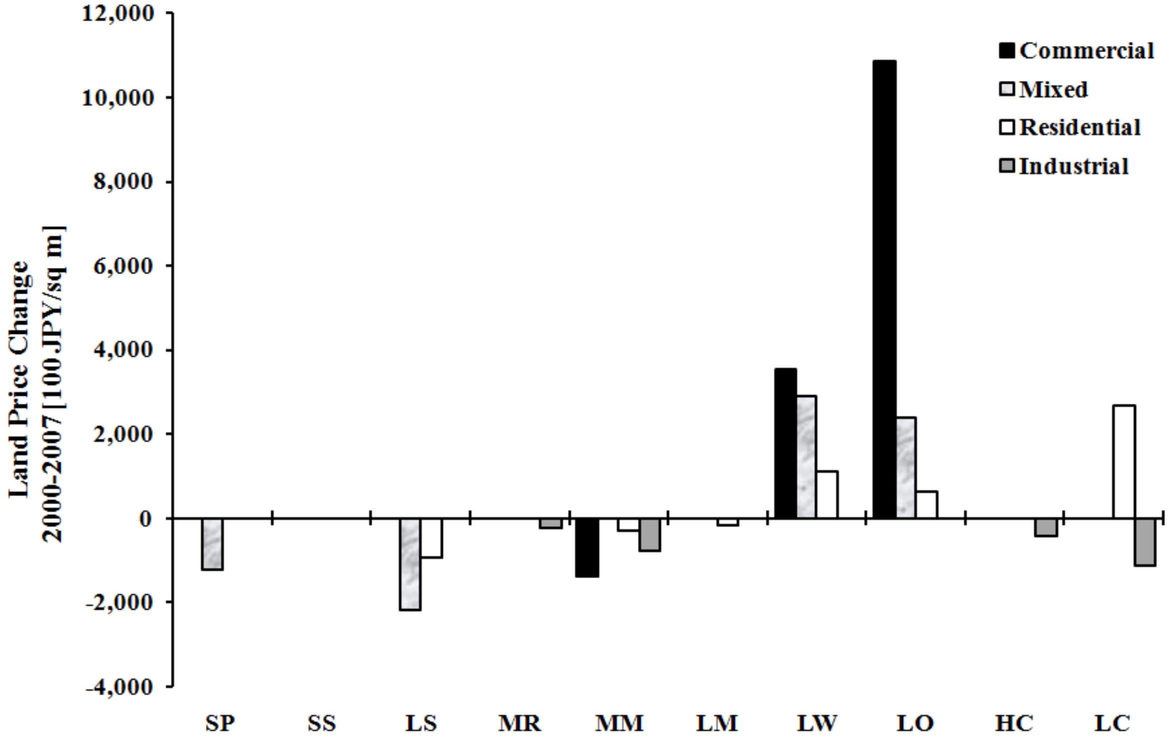
Figure 5.18 Impacts of a New Subway Station on Land Price Changes by 50-meter Distances, 2000-2007

Table 5.13 also indicates that the price premiums for proximity to a new LRT station were significant in the commercial, mixed, and industrial land models (the coefficients on "1/Distance to New LRT Station" = +123.496, +89.166, and +512.297). For estimating the three hedonic price models, however, very few land price points were sampled from within 500 meters of the new LRT stations in 2000 and 2007. The effects of new LRT investments on nearby land prices are still inconclusive.

Joint Development:

The price premiums and discounts for Joint Development (JD) practices are also captured by the hedonic price models. Figure 5.19 illustrates the estimates of the 10 JD types' impacts on commercial, mixed, residential and industrial land prices within 2 km from of the Strategic

Development Area's main transportation facilities between 2000 and 2007, wherein all other variables are fixed with their statistical averages. The Small-scale Public (SP) and Large-scale Shopping (LS) type packages, due probably to the negative externalities of automobile-oriented shopping malls, largely decreased mixed and residential land prices in suburban Tokyo; on the other hand, the Large-scale Waterfront (LW) and Large-scale Office (LO) type packages, encouraged by the Urban Renaissance Program, considerably increased commercial, mixed, and residential land values in central Tokyo. The High-rise Commercial (HC) and Large-scale Commercial (LC) type packages did not add price premiums to commercial land parcels but rather discounted industrial land values and raised residential land values within 2 km from the main transportation facilities, where urban districts were already well-developed. Notably, the Mid-scale Mixed (MM) type package had negative impacts on commercial and residential land prices, which are inconsistent with the empirical results of job and labor location changes between 2000/01 and 2005/06 as discussed in the previous section.



Notes: SP: Small-scale Public; SS: Small-scale Shopping; LS: Large-scale Shopping; MR: Mid-scale Residential; MM: Mid-scale Mixed; LM: Large-scale Mixed; LW: Large-scale Waterfront; LO: Large-scale Office; HC: High-rise Commercial; LC: Large-scale Commercial.

Figure 5.19 Impacts of Joint Development (JD) Packages on Land Price Changes, 2000-2007

Interaction Terms:

This empirical study finds the interaction effects between proximity to a rail transit station, the Mid-scale Mixed (MM) type package, and new pedestrian space. Figure 5.20 presents the estimates of residential land price changes in 500 meters of new subway and old CRT stations with the MM type package by 50-meter distances, wherein all other variables are fixed with their statistical averages. Figure 5.19 indicated that the MM type package merely decreased land prices in 2 km from the main transportation facilities; however, Figure 5.20 depicts that residential land prices increased in the immediate proximity of new subway and old CRT stations with the MM type package. In other words, the impacts of the MM type package on residential land prices were highly redistributive within the Strategic Development Area (SDA) where urban neighborhoods were already well-developed.

Similarly, Figure 5.21 describes the estimates of commercial and mixed land price changes in 2 km of an old HSR station by 250-meter distances, wherein 1% of the SDA land area was converted into new pedestrian space and all other variables are fixed with their statistical averages. The large price premiums indicate that urban amenity improvements around the existing HSR station effectively encouraged the economic competitiveness of the SDA. New pedestrian space investments, however, had different impacts on residential land prices near a new CRT station. Figure 5.22 shows the estimates of residential land price changes in 500 meters of a new CRT station by 50-meter distances, wherein 1% of the SDA land area was converted into new pedestrian space and all other variables are fixed with their statistical averages. Residential land prices intensively increased in the immediate proximity of a new CRT station, while modestly decreasing in the range 350 to 500 meter distances from a new CRT station. The new pedestrian space creations also had redistributive price impacts within the SDA, accompanied by the new CRT development in suburban Tokyo.

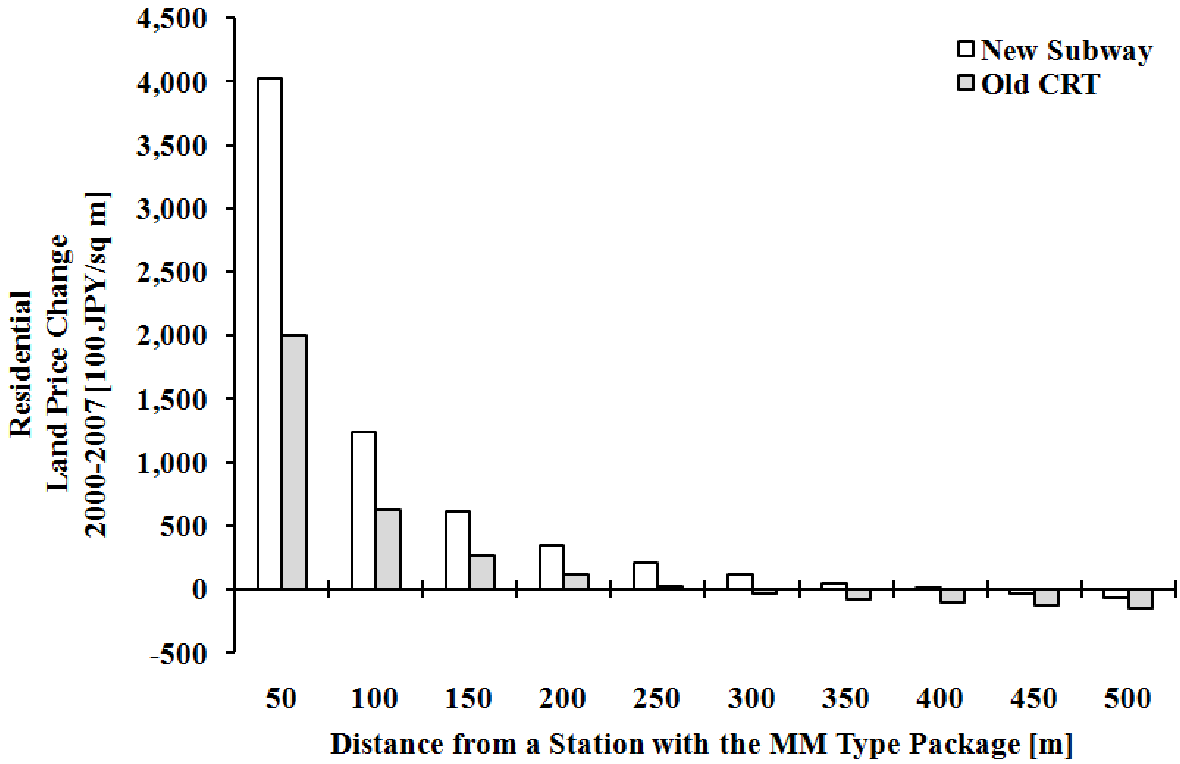


Figure 5.20 Impacts of the Mid-scale Mixed (MM) Type Package on Land Price Changes in 500 meters of New Subway and Old CRT Stations, 2000-2007

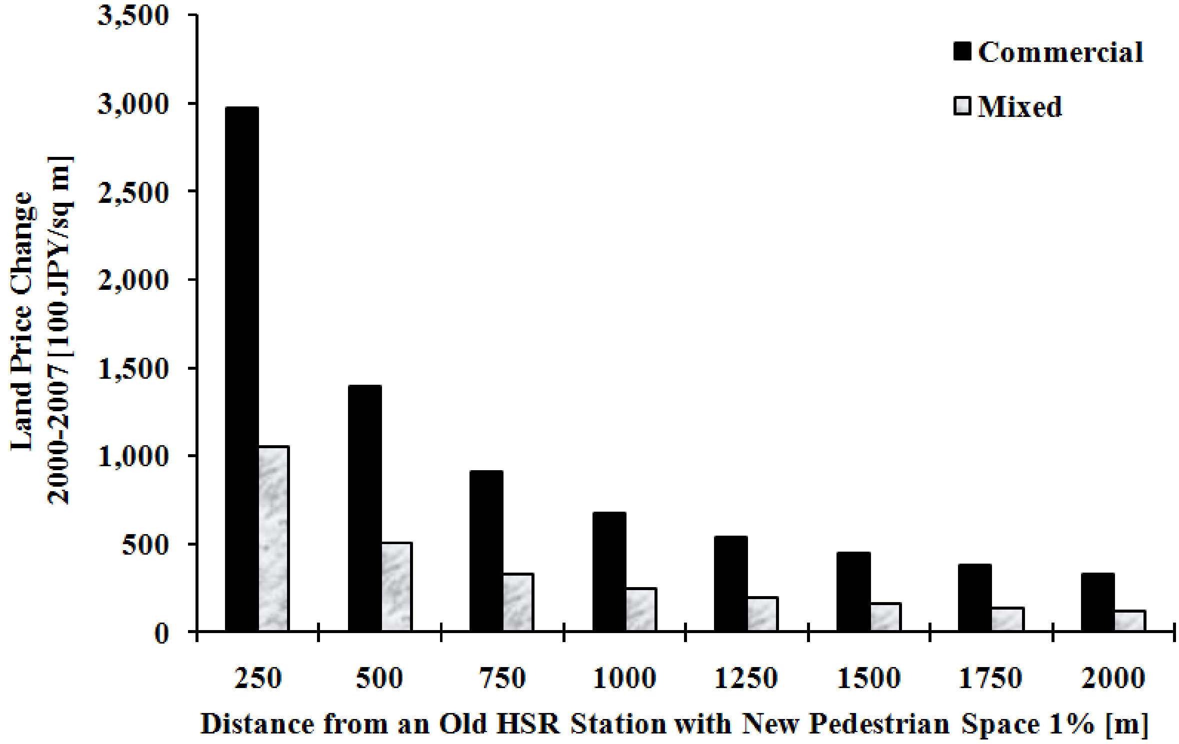


Figure 5.21 Impacts of New Pedestrian Space (+1% of the SDA Land Area) on Land Price Changes in 2 kilometers of an Old HSR Station, 2000-2007

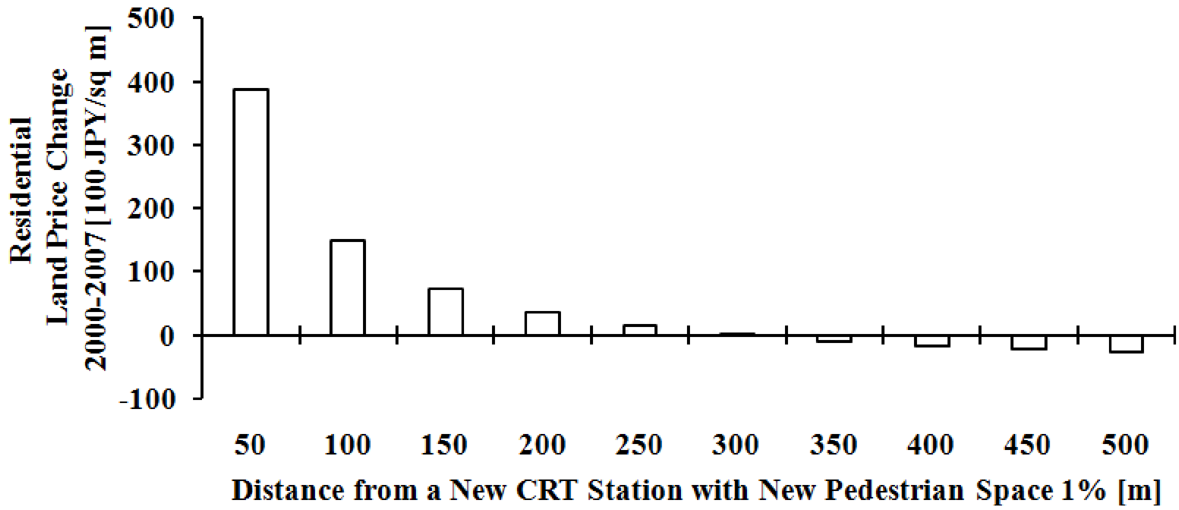


Figure 5.22 Impacts of New Pedestrian Space (+1% of the SDA Land Area) on Land Price Changes in 500 meters of a New CRT Station, 2000-2007

5.5 Findings

Japan's slowing economy and aging society have called for the drastic transformation of Tokyo; however, several development strategies have institutionally conflicted within the Megalopolis Region. Throughout the 2000s, the nation-state's urban regeneration projects have intensively been practiced in central Tokyo, even though the satellite business centers have continuously been promoted by local entities in suburban Tokyo. The privatized railway companies and real estate developers jointly converted the former Japanese National Railways' (JNR) railway yards into large-scale office complexes, high-end shopping malls, residential condominium towers, and deluxe hotels with special floor area ratio (FAR) bonuses and exceptional project approvals, accompanied by the new HSR, CRT, and subway investments. This chapter classifies 10 types of Joint Development (JD) packages and discussed their development strategies on the basis of built-environment characteristics, intra-regional locations, and public-private partnerships.

The empirical analyses were conducted to examine Tokyo's job, labor, and land market responses to these state-led developments. One of the main findings drawn from the statistical figures is that the Tokyo Megalopolis Region's job and labor markets have highly concentrated in the 107 Strategic Development Areas (SDAs). Especially Haneda Airport (HNA) has increasingly attracted office-based jobs and knowledge-based labors due to its higher accessibility from central Tokyo, while Narita International Airport (NIA) has gradually formed industrial job and labor clusters because of its lower land costs in suburban Tokyo. It is currently a political argument whether Tokyo's international aviation hub functions should be reallocated from NIA to HNA to compete with other international airports in the Asian-Pacific region. Giving higher priority to the global competitiveness of HNA, the Nation's recent airport improvement proposal has faced protests from the Chiba Prefectural Government and NIA's political bodies that would lose their local interests. It is important for policymakers to take a strategic approach to making airport access investments and promoting airport-linked developments based upon the Tokyo Megalopolis Region's market profiles.

The location models clearly reveal that the large rail transit investments between 2000 and 2006 have generated considerable agglomeration effects on office-based business activities especially around central terminal stations. The empirical evidence also suggest that the new rail transit developments have largely redistributed office-based business activities from the old HSR and CRT station areas to the new HSR, CRT, and subway station areas, while not significantly relocating labor markets. Instead, skilled professionals, managers and administrators have more sensitively reacted to the new pedestrian space investments in the SDAs. These empirical results are consistent with the hypotheses that the locational choices of knowledge-based labors have importantly been influenced by pedestrian-friendly environment creations. The hedonic price models further reveal that the benefits of the new HSR and subway investments were largely capitalized into nearby commercial, mixed, residential and industrial land prices in central Tokyo; however, the impacts of the new CRT investments on nearby residential land prices were slightly negative or redistributive with the new pedestrian space investments in suburban Tokyo.

The empirical results of the job and labor location models also indicate that the Urban Renaissance Program has played an important role in concentrating the Megalopolis Region's economic development in central Tokyo. While low-density shopping mall packages have struggled with creating office jobs and attracting skilled labors along the suburban railway corridors, high-rise office and mixed commercial tower packages have significantly intensified knowledge-based job and labor markets around the central terminals. The hedonic price models, however, imply that the price premiums of large-scale office development packages are speculative particularly in the waterfront districts and the price impacts of mixed commercial development packages are redistributive around the existing terminal stations. Critics argue that new, modern shopping malls in and around stations largely redistribute sales transactions and seriously undermine the viability of traditional retail streets away from stations. In October 2007, the Tokyo Metropolitan Government (TMG) surcharged a JPY 2.2 billion property tax on the private railway companies' commercial businesses at 83 stations in central Tokyo (TMG, 2007). Yet, the hedonic price estimates suggest that the redistributive effects of mixed use development packages were largely capitalized into residential land values.

In short, the Tokyo Megalopolis Region's urban footprint is shrinking as its economy is slowing and society is maturing. Additionally, the nation-state's urban deregulation policies during the early 2000s accelerated the recentralization of knowledge-based job and labor markets around central terminals. In this context, Tokyo's recent transit-oriented urban regeneration strategies are controversial due largely to their redistributive consequences: the Urban Renaissance Program resulted in the enhancement of global competitiveness in central Tokyo at the expense of social welfare over the Megalopolis Region or even the nation. The current market failure temporarily calls for radical state interventions in correcting social fairness and improving local livability, yet the previous experiences have poorly been reviewed for the next generation. This chapter, thus, sheds light on the complex and dynamic nature of postindustrial market responses and on-going transit-oriented urban regeneration strategies aimed at increasing Tokyo's global competitiveness, local livability and intra-regional balance.

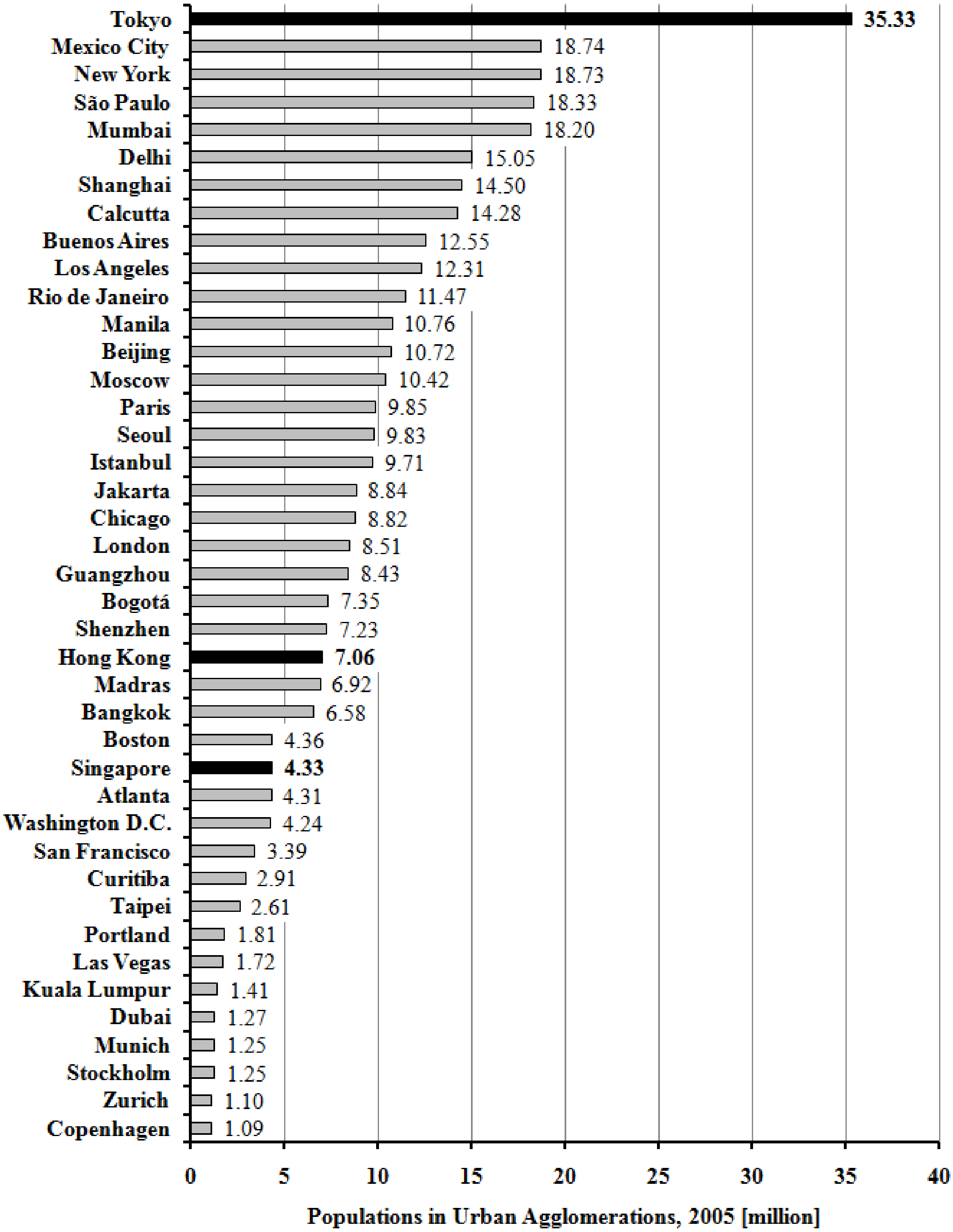
Chapter Six
Global Comparisons:
Moving Towards Transit-Oriented Urban Regeneration

6.1 The Comparative Approach

The third, fourth and fifth chapters examines Hong Kong, Singapore and Tokyo as transit-oriented global center models, in which the integration of rail transit investments and urban regeneration projects has been playing a major role in forming very dense urban agglomerations in global city-regions. As discussed in the second chapter, entrepreneurial city-states have increasingly applied transit-oriented urban regeneration projects to increase global competitiveness and local livability. Yet, it is difficult to generalize the evidence on transit-oriented urban regeneration as being derived from the three Asian models in a global context. The normative Asian city-regions have kept extremely dense urban agglomerations with strong city centers, which fit well into rail transit investments and urban regeneration projects. However, global city-regions in North America, Europe, and developing countries have taken their own evolutional pathways being featured by the interactive relationships between transportation investment policies and urban development patterns. Before drawing key lessons from the three Asian models, this dissertation attempts to identify common characteristics as well as specific issues across the global city-regions moving towards transit-oriented urban regeneration. The following three sections compare the selected global city-regions' population sizes and growth trends, transit investments and urban agglomerations, and transit-oriented urban regeneration projects based upon recent international statistics and case reviews.

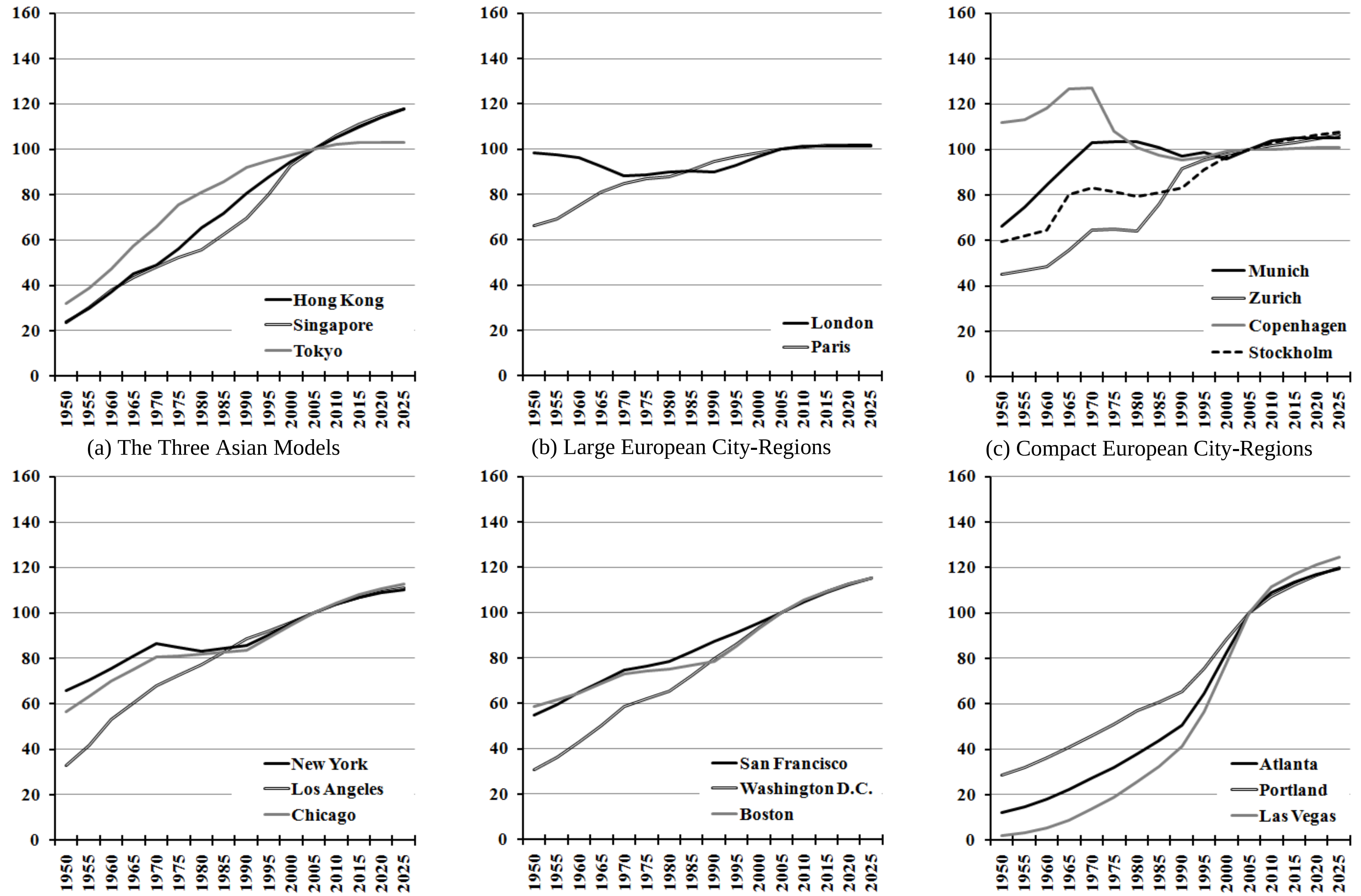
6.2 Population Sizes and Growth Trends in Urban Agglomerations

The world's major city-regions are seen as the economic engines for attracting human capital flows and generating urban agglomeration benefits. Thus, it is important to grasp global city-regions' population sizes and growth projections in urban agglomerations, which critically influence entrepreneurial states' long-term spatial development strategies. One of the most comprehensive sources of data on urban population trends across global city-regions is "World Urbanization Prospects" issued by the United Nations (UN, 2007), providing estimates of the population of urban agglomerations with 750,000 inhabitants or more in 2007 for the period 1950 to 2025. According to the latest edition of this UN report, "mega" city-regions are defined as urban agglomerations with at least 10 million inhabitants and there are today 19 mega city-regions over the world. Asia contains 11 of the 19 mega city-regions and Tokyo is the world's largest urban agglomeration with 35.33 million inhabitants, followed by Mexico City (18.74 million), New York (18.73 million), São Paulo (18.33 million) and Mumbai (18.20 million) (Figure 6.1). On the other hand, Hong Kong and Singapore are more compact urban agglomerations with 7.06 million and 4.33 million inhabitants, which are internationally sizable between "large" and "medium" city-regions such as Chicago (8.82 million), London (8.51 million), Bogotá (7.35 million), Boston (4.36 million), Atlanta (4.31 million), and Washington D.C. (4.24 million). Notably, the European "transit metropolises" such as Munich, Stockholm, Zurich, and Copenhagen (Cervero, 1998) have smaller urban population sizes than the three Asian models and newly developing city-regions such as Shenzhen (7.23 million), Las Vegas (1.72 million), and Dubai (1.27 million).



Source: Author, with data from UN (2007).

Figure 6.1 Urban Population Sizes across the Selected Global City-Regions, 2005



(a) The Three Asian Models

(b) Large European City-Regions

(c) Compact European City-Regions

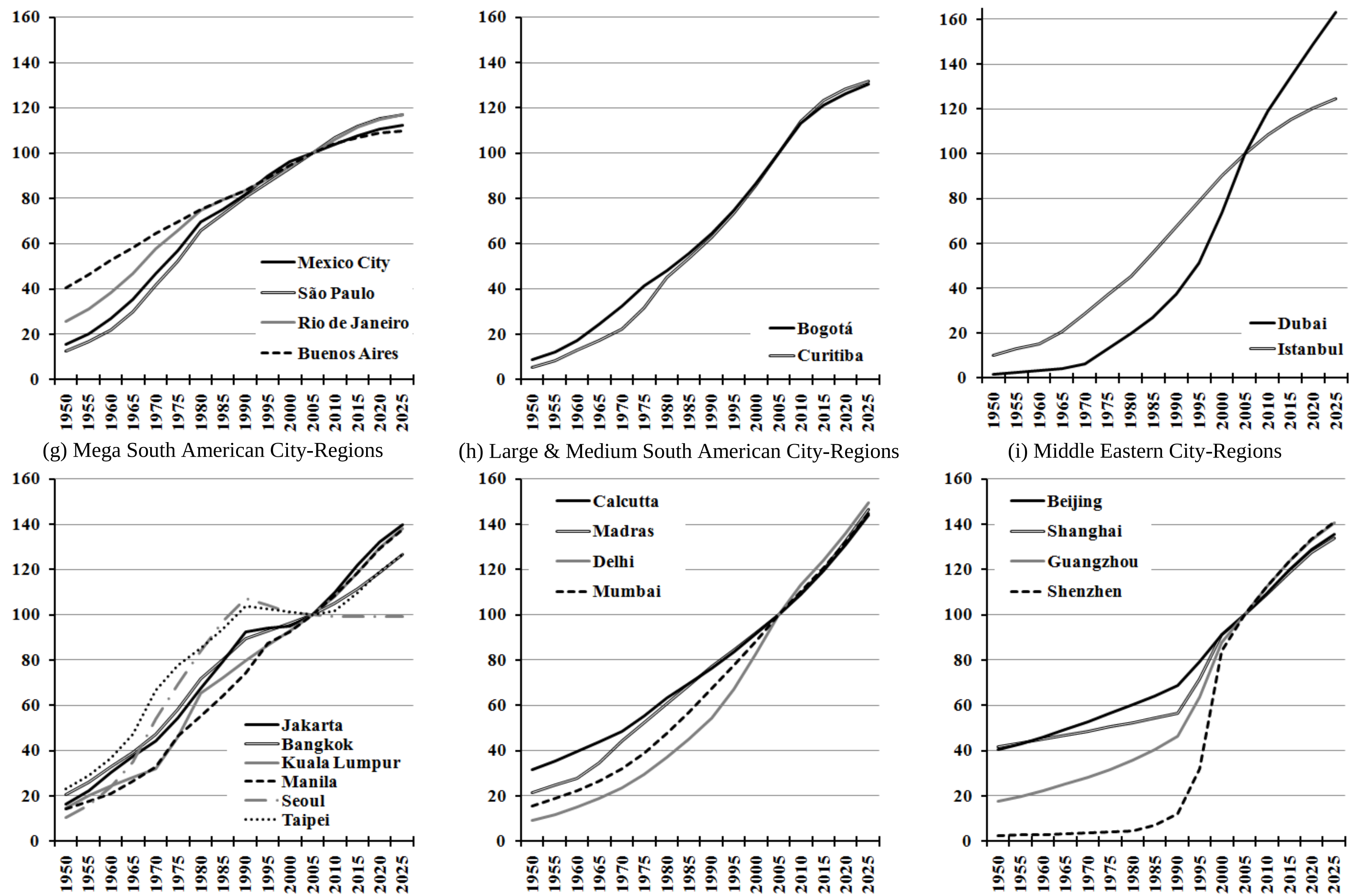
(d) Mega & Large American City-Regions

(e) Medium American City-Regions

(f) Rapidly Growing American City-Regions

(Continued)

Figure 6.2 Urban Population Growth Estimates across the Selected Global City-Regions, 1950-2025 (Year 2005 = 100)



(g) Mega South American City-Regions

(h) Large & Medium South American City-Regions

(i) Middle Eastern City-Regions

(j) East Asian City-Regions

(k) Indian City-Regions

(l) Chinese City-Regions

Source: Author, with data from UN (2007).

Figure 6.2 (Continued)

Figure 6.2 presents population growth trends in urban agglomerations from 1950 to 2025 by the selected global city-regions, wherein each city-region's past and future population sizes are normalized by the city-region's present population size (Year 2005 = 100). The trajectories of urban population growth considerably vary across the three Asian models, Europe, North and South America, Middle East, East Asia, India, and China. Of the three Asian Models (Figure 6.2.a), Hong Kong and Singapore have continuously gained urban populations since 1950 and will have more than 17% increases by 2025. Tokyo's urban population growth, on the other hand, has been slowing down since the 1990s and it will have only a 3% increase by 2025. The selected European city-regions (London, Paris, Munich, Zurich, Stockholm, and Copenhagen) also show low population growth rates. The growth curves of the "large" and "compact" European city-regions from 1950 to 2005 are flatter than those of other global city-regions and their urban populations will increase less than 10% from 2005 to 2025 (Figure 6.2.b and 6.2.c).

The selected "mega", "large" and "medium" American city-regions (New York, Los Angeles, Chicago, San Francisco, Washington D.C., and Boston) have experienced substantial population growth since the 1980s and 1990s and will have about 10 to 15% increases in urban populations by 2025 (Figure 6.2.d and 6.2.e). Atlanta, Portland, and Las Vegas are selected as "growing" American city-regions that have rapidly increased populations in urban agglomerations since the early 1990s and will see about 20 to 24% growth of urban populations by 2025 (Figure 6.2.f). These growth rate differences are also observed across South American city-regions. The selected "mega" city-regions such as Mexico City, São Paulo, Rio de Janeiro, and Buenos Aires will increase urban populations from 9 to 16% by 2025 (Figure 6.2.g); on the other hand, the "transit metropolises" in South America such as Bogotá and Curitiba (Cervero, 1998) have rapidly been growing since the 1950s and will become sizable city-regions with 30% increases of urban populations for the period 2005 to 2025 (Figure 6.2.h).

Other parts of the world record remarkable population growth in urban agglomerations. In the Middle East, the urban populations of Istanbul and Dubai have grown more than ten times during the past decades and are expected to increase about 25% and 63% by 2025 (Figure 6.2.i). In Figure 6.2.j, the selected East Asian city-regions (Jakarta, Bangkok, Kuala Lumpur, Manila, and Taipei) are also expected to experience 27 to 40% population growth in urban agglomerations by 2025 (except Seoul). Furthermore, the selected "mega" and "large" city-regions in China and India (Beijing, Shanghai, Guangzhou, Shenzhen, Calcutta, Madras, Delhi, and Mumbai) will face unprecedented growth phenomena, having 34 to 49% increases of urban populations by 2025 (Figure 6.2.k and 6.2.l), which would put enormous pressure on transportation infrastructure and suburban development. Indeed, the mega city-regions in China and India are already suffering from severe transportation problems that resulted from continuing population growth, expanding urban sprawl, rising household incomes, and increasing automobile dependency (Kenworthy and Townsend, 2002; Pucher et al., 2007; Shen, 1997; Zhao, 2010).

6.3 Transit Investments and Urban Agglomerations

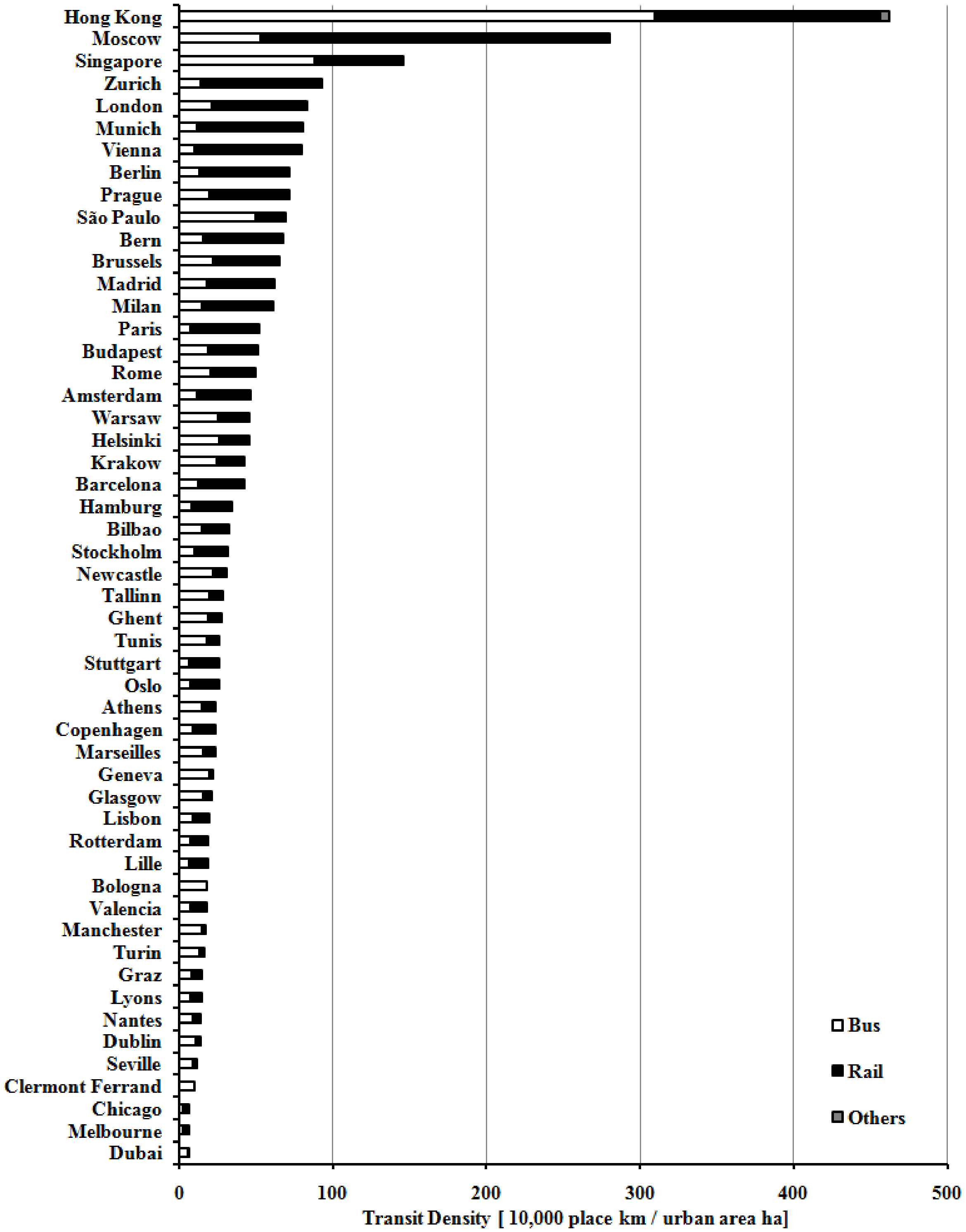
6.3.1 The Asian Models and Global City-Regions

Over the past decades, American types of roadway investment and suburban development have widely been ill-adapted to cope with the growing demands for urban mobility in an international context (Cervero, 2005a; 2003; Muller, 2004; Newman and Kenworthy, 1999; Stubbs and Clarke, 1996; World Bank, 2002). As a consequence of worsening traffic congestion, urban sprawl, and environmental problems, an increasing number of entrepreneurial city-states are today turning to rail transit investments in an attempt to guide competitive and livable forms of urban development accompanied by global real estate markets, even though the long-term impacts of contemporary transit investments on forming urban agglomerations is still questionable with uncertainties and risks in the rapidly developing world (Bagaeen, 2007; Loo and Li, 2006; Figure 6.3). Therefore, this section discusses the linkage between transit investments and urban agglomerations across the Asian models and selected global city-regions by using the recent international statistics extracted from "Mobility in Cities Database" (UITP, 2006).

Source: Parsons (http://brochure.parsons.com/infra-dubaimetro.html).

Figure 6.3 "The Dubai Metro": the First Mass Rail Transit Line in the United Arab Emirates, 2009

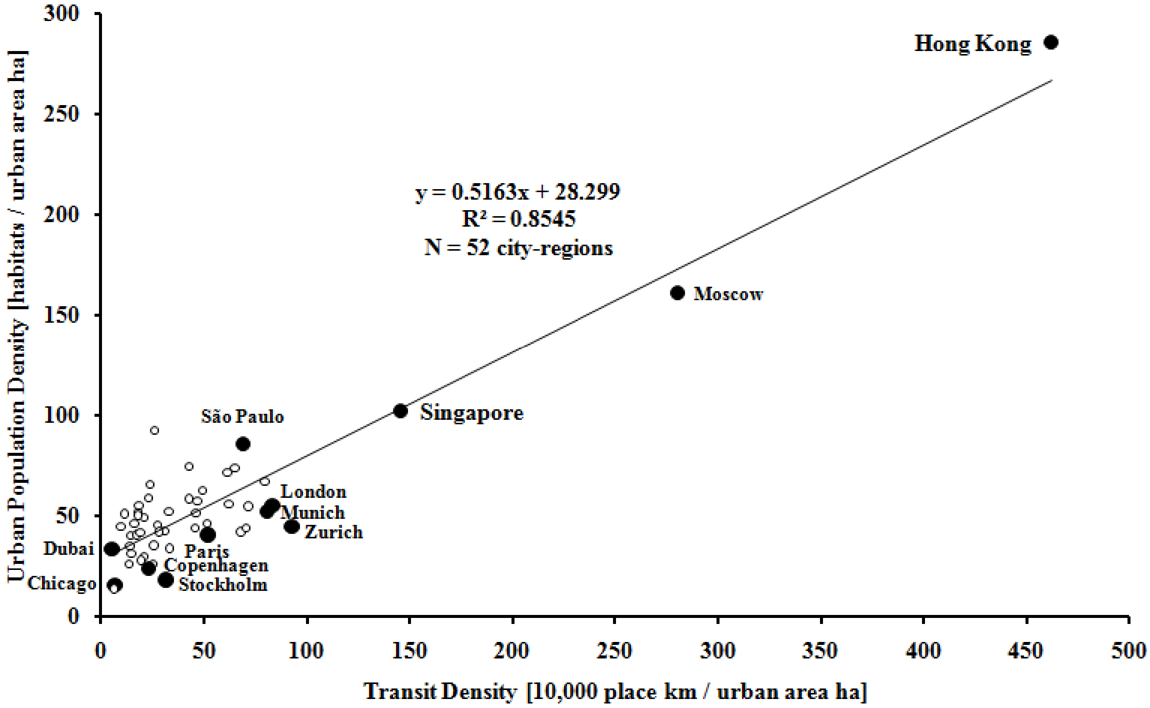
Figure 6.4 presents the density of urban transit systems across the selected 52 global city-regions. Hong Kong, Moscow and Singapore have developed much denser urban transit networks than European city-regions such as Zurich, London, Munich, Paris, Stockholm and Copenhagen. Notably, the urban transit networks of Hong Kong and Singapore are formed mostly by both bus and rail transit systems, while those of Moscow and European city-regions are built up mainly by rail transit systems. In South America, the urban transit network of São Paulo is covered largely by bus systems. Among the selected 52 global city-regions, Dubai has the lowest urban transit density (without any mass rail transit line in 2001), which would importantly influence its long-term spatial development pattern.



Source: Author, with data from UITP (2006).

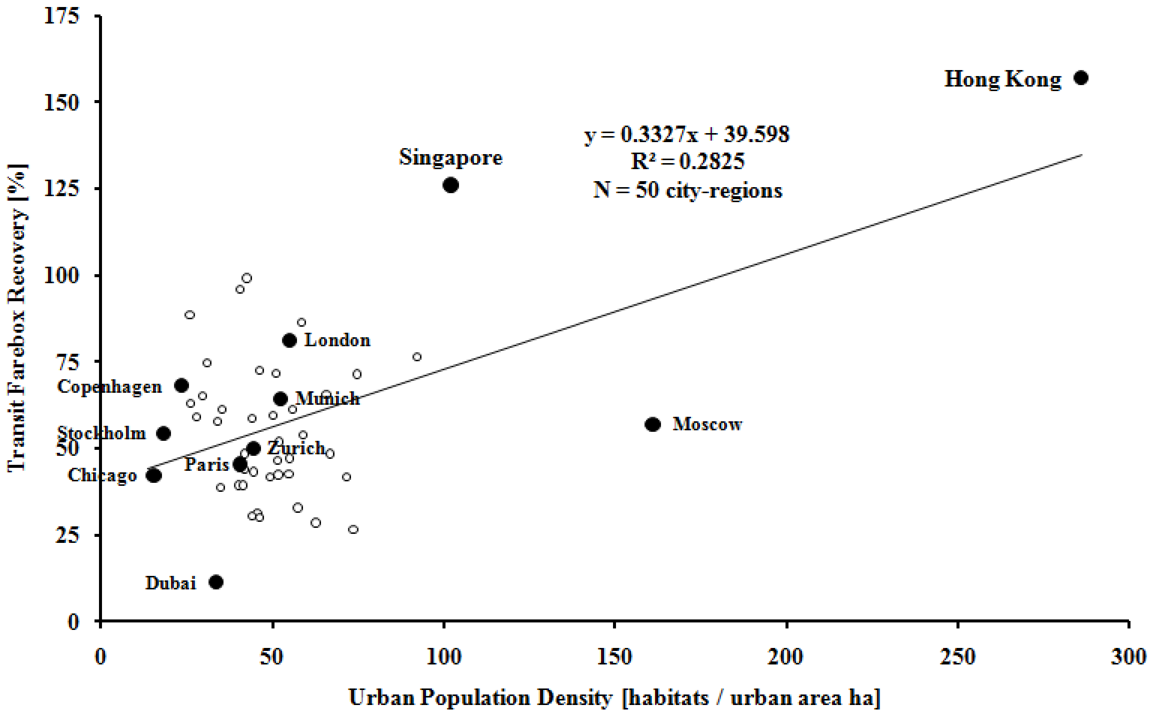
Notes: UITP Mobility in Cities Database does not cover Tokyo and many American city-regions.

Figure 6.4 Transit Densities across the Selected 52 Global City-Regions, 2001



Source: Author, with data from UITP (2006).

Figure 6.5 Transit Investments and Urban Population Densities across the Selected 52 Global City-Regions, 2001



Source: Author, with data from UITP (2006).

Figure 6.6 Urban Population Densities and Transit Farebox Recovery Percentages across the Selected 50 Global City-Regions, 2001

As a matter of fact, transit investment levels are strongly associated with urban agglomeration patterns in a global context. Figure 6.5 presents the positive relationship between urban transit densities and urban population densities across the selected 52 global city-regions (R-squared = 0.854). Yet, this correlation does not mean one-way causation. Larger transit investments have greater impacts on intensifying urban agglomerations; conversely, denser urban agglomerations justify larger transit investments (Cervero, 1998; VAN Loben Sels et al., 1996). Hong Kong is an extreme example of this co-dependency. The world's densest urban agglomerations could not have been maintained without the world-class mass transit railway (MTR) system. Also the world-class MTR system could not have made an appreciable profit without the world's densest marketplace (Cervero and Murakami, 2009).

Having dense urban agglomerations is a prerequisite to making mega transit investments in global city-regions; however, the presence of high urban densities does not alone grantee successful transit financing. Figure 6.6 shows the relatively modest association between urban population densities and transit farebox recovery percentages across the selected 50 global city-regions (R-squared = 0.282). Moscow, for instance, has the second highest urban population density among the selected global city-regions; however, it records lower farebox recovery (58%) than Singapore (126%), London (81%), Munich (64%), and Copenhagen (68%). Dubai also contains denser urban populations in its skyscrapers than Copenhagen, Stockholm, and Chicago; nonetheless, it leads to the lowest farebox recovery (11%) among the selected global city-regions. On the other hand, Hong Kong and Singapore are two of the few marketplaces in the world where transit agencies generate substantial profits from railway operation. These financial performance gaps are due in large part to differences in built-environment integrations, transit-supportive policies, public-private partnerships, regional economic structures, and local lifestyle preferences between the Asian models and selected global city-regions.

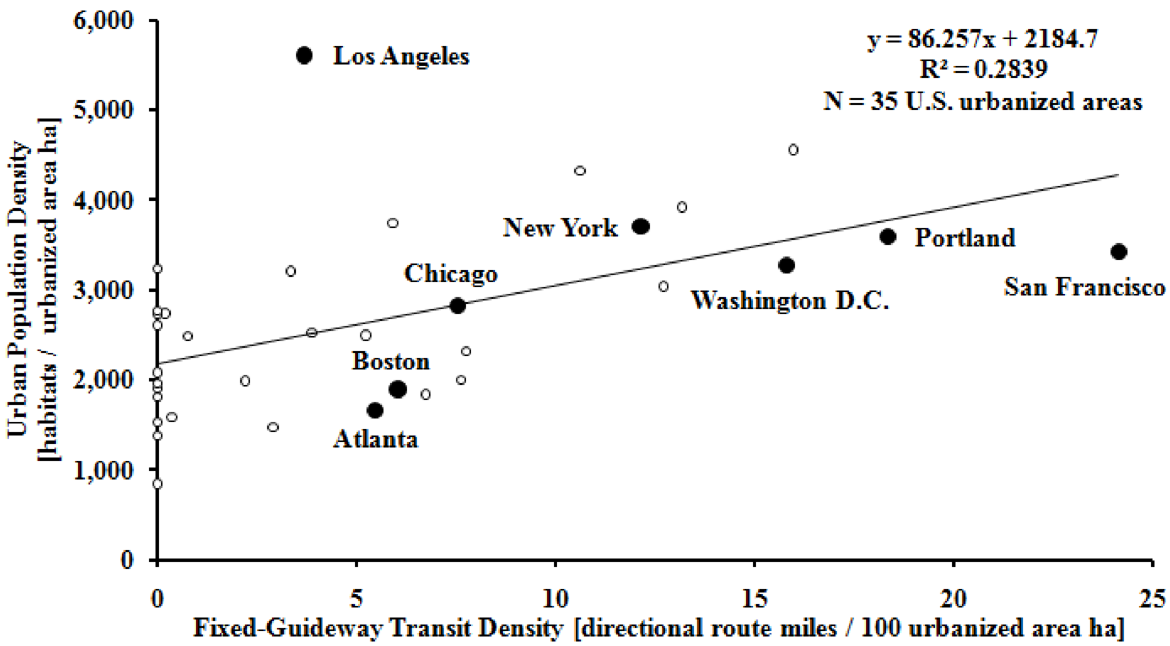
6.3.2 The Asian Models and American City-Regions

As shown in the previous section, the magnitude of transit investments on forcing denser urban agglomerations in Hong Kong, Singapore, and European city-regions has historically been much more significant than that in Chicago and Dubai. This international statistics raises the question of whether contemporary transit investments will make differences in guiding the long-term spatial development patterns of rapidly growing city-regions, especially where have already been moving towards automobile-dependent urban sprawl. This section, thus, attempts to suggest the potential of contemporary transit investments in the rapidly growing world by looking at the relationships between fixed-guideway transit systems and urban agglomeration patterns across the selected American city-regions.

According to U.S. Department of Transportation's definition, 48 fixed-guideway transit systems are operated across 54 U.S. urbanized areas (Figure 6.7). New York has the largest fixed-guideway transit network with 581 directional route miles, followed by San Francisco (291 miles), Washington D.C. (207 miles) and Chicago (206 miles) (APTA, 2005). Figure 6.8 presents the positive association between fixed-guideway transit densities and urban population densities across the 35 U.S. urbanized areas with populations over 1 million in 2003, whose ordinary least squares (OLS) regression fitness (R-squared = 0.284) is lower than that across the 52 global city-regions shown in Figure 6.5 (R-squared = 0.855). This means that transit investment alone does not significantly determine the large spatial development patterns of American city-regions.

Sources: U.S. DOC (2009a) and U.S. DOT (2009a).

Figure 6.7 Fixed-Guideway Transit Systems and U.S. Urbanized Areas, 2000



Sources: Author, with data from APTA (2005) and U.S. DOT (2009b).
Notes: In this figure, "fixed-guideway transit" includes heavy, light and other transit systems.

Figure 6.8 Fixed-Guideway Transit Densities and Urban Population Densities across the 35 U.S. Urbanized Area with Populations over 1 million, 2003

In order to grasp the details of the linkages between transit investments and urban agglomerations, this chapter focuses on the selected 9 mega, large, medium and compact American city-regions that have different sets of transportation investment and urban agglomeration attributes (Table 6.1). New York and Chicago have dense commuter and heavy rail transit systems in the large and dense urban areas, whereas Los Angeles's urban mobility depends mainly upon a massive freeway infrastructure network that covers the large and dense urban areas. The urban mobility of Washington D.C. and San Francisco relies more upon heavy rail transit systems with the dense urban areas; on the other hand, Boston and Atlanta contain sparser transportation infrastructures in the large urbanized areas. Of the rapidly growing compact American city-regions, Portland has already developed dense light rail transit systems within the urban growth boundaries, while Las Vegas has recently provided new monorail and bus rapid transit services in the central area.

It can be assumed that the urban agglomeration effects of fixed-guide transit investments have been localized within each of the American city-regions in a specific way. This study, therefore, compares the "intraregional" development patterns of the selected 9 American city-regions with those of Tokyo and Hong Kong that have largely been guided by the world-class rail transit systems. Figure 6.9 illustrates the spatial distribution patterns of jobs by 5 km ring distances from the central business districts (CBDs) in New York, Los Angeles, Chicago, and Tokyo. Given the large commuter and heavy rail transit systems, New York and Chicago keep strong city centers in 5-10 km of the CBDs with the large urban territories. In contrast, developing the large freeway infrastructure networks, Los Angeles shows a massive job decentralization pattern with sub-regional centers around 20-25 km of the CBD. In the case of Tokyo, a majority of jobs massively agglomerates along its heavy rail transit corridors in the range 15 to 40 km of the CBD. In the same manner, Figure 6.10 illustrates the spatial distribution patterns of populations by 5 km ring distances. New York and Chicago have a sharp peak point of urban populations around 15 km from the CBD, whereas Los Angeles forms contiguously populated suburban areas around 20 km from the CBD. Tokyo shows mixed spatial development patterns, having a sharp center of urban populations within 15 km and continuously populated suburban areas from 20 to 40 km of the CBD.

Figure 6.11 also reveals that the heavy rail transit networks in Washington D.C., San Francisco, and Boston have shaped multi-centric metropolises that have strong city centers in 5 km of the CBDs and sub-regional job centers in the outlaying areas. Compared to these transit-oriented city-regions, Atlanta has formed a weaker city center and edgeless suburban territories. Portland and Las Vegas still contain most of their regional jobs within 25 km of the CBDs; on the other hand, Hong Kong presents a large sub-regional job center around 25 km from the CBD in addition to an extremely dense job center within 10 km of the CBD, which suggests the importance of Hong Kong International Airport (HKIA) in forming large industrial clusters accompanied by airport access transit investments. In response to these job distribution patterns, Figure 6.12 describes that the spatial distribution patterns of populations in Boston has two sharp peak points around 10 and 40 km from the CBD, while those of populations in the other American city-regions do not shape clear edges over the urbanized areas. In both Las Vegas and Hong Kong, a large number of urban populations live around 10-15 km of the CBDs for high access to its strong central locations. In the case of Hong Kong, urban populations also agglomerate around 25 km from the CBD due partly to the existence of HKIA.

Table 6.1 Transportation Investments and Urban Agglomerations across the Selected 9 American City-Regions, 2003

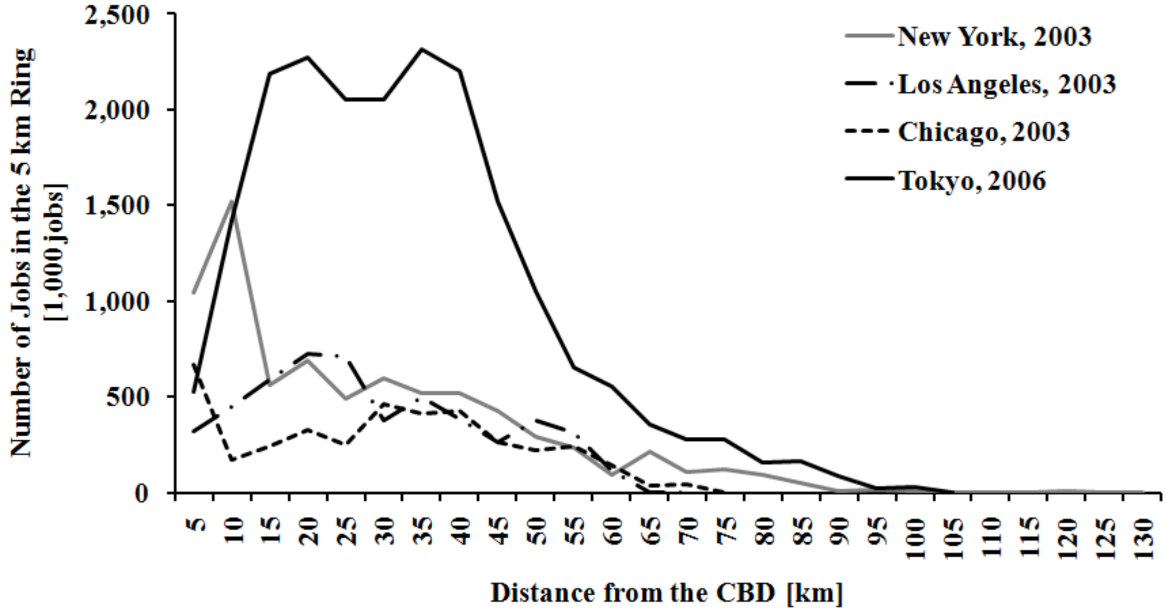
	Mega		Large	Medium	
City-Region	New York	Los Angeles	Chicago	Washington D.C.	San Francisco
Urban Population	17.72	12.52	7.70	4.28	4.12
Transportation Investments					
Rail Transit Density					
Commuter	47.2	34.9	41.0	12.4	12.8
Heavy	11.5	0.0	7.6	15.8	17.4
Light	0.6	3.7	0.0	0.0	6.1
Other	0.0	0.0	0.0	0.0	0.7
Freeway Density	150.1	261.9	97.7	156.6	201.0
Urban Agglomerations					
Urbanized Area	4,778	2,231	2,730	1,305	1,203
Population Density	3,708	5,612	2,821	3,277	3,425
Job Density	622	1,440	880	899	785

(Continued)

Table 6.1 (Continued)

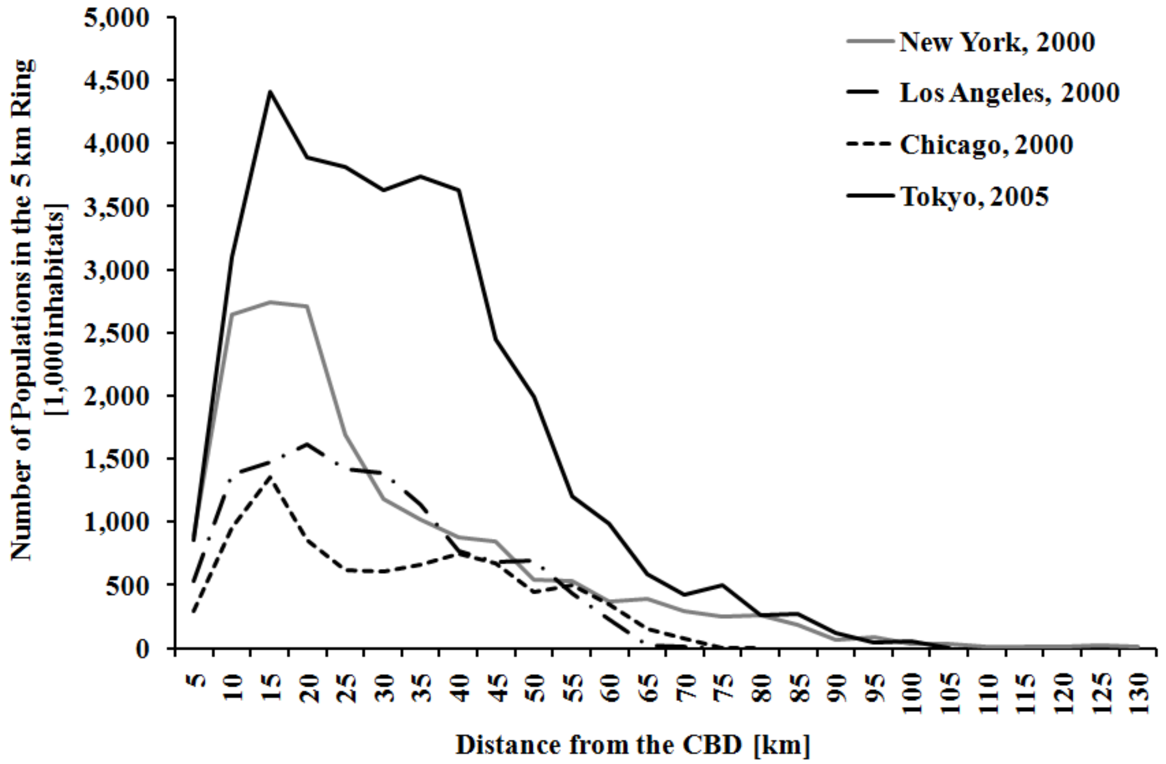
	Medium		Compact		Notes
City-Region	Boston	Atlanta	Portland	Las Vegas	
Urban Population	3.99	2.92	1.69	0.88	[million habitats]
Transportation Investments					
Rail Transit Density					
Commuter	33.4	0.0	0.0	0.0	[route miles/100ha]
Heavy	3.6	5.5	0.0	0.0	[route miles/100ha]
Light	2.4	0.0	18.4	0.0	[route miles/100ha]
Other	0.0	0.0	0.0	0.0	[route miles/100ha]
Freeway Density	112.9	127.1	152.2	177.8	[lane miles/100ha]
Urban Agglomerations					
Urbanized Area	2,104	1,757	469	270	[ha]
Population Density	1,895	1,664	3,593	3,244	[habitats/100ha]
Job Density	550	655	1,003	1,185	[base jobs/100ha]

Sources: APTA (2005); U.S. DOT (2009b); U.S. DOC (2009b).



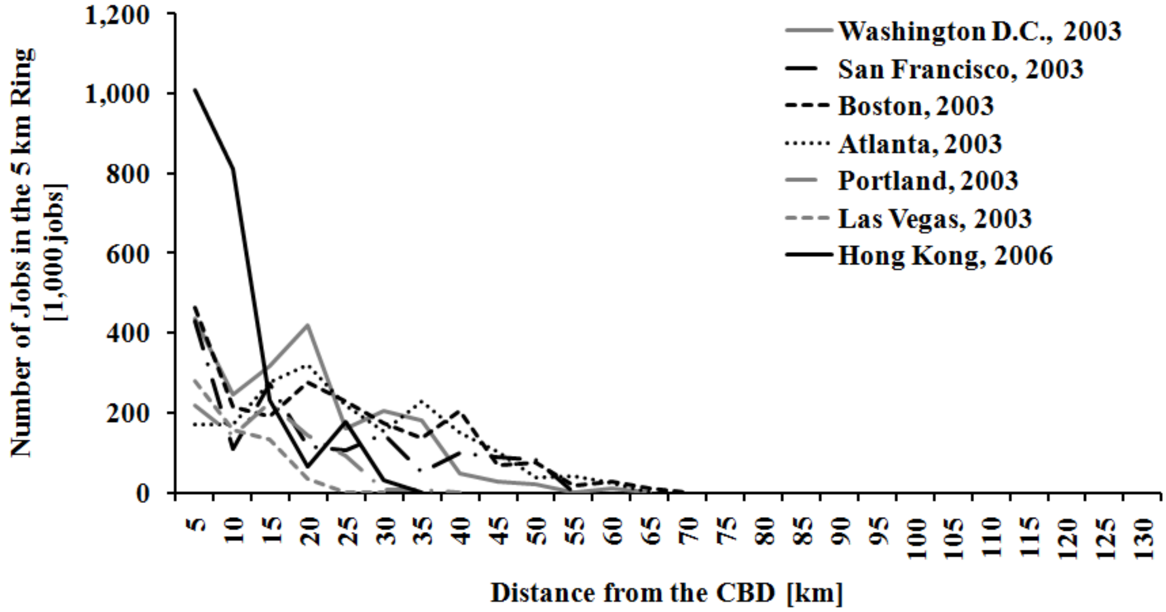
Sources: Author, with data from U.S. DOC (2009b) and GOJ (2009b).

Figure 6.9 Urban Agglomeration Patterns of Jobs in Tokyo, 2006 and 3 American City-Regions, 2003



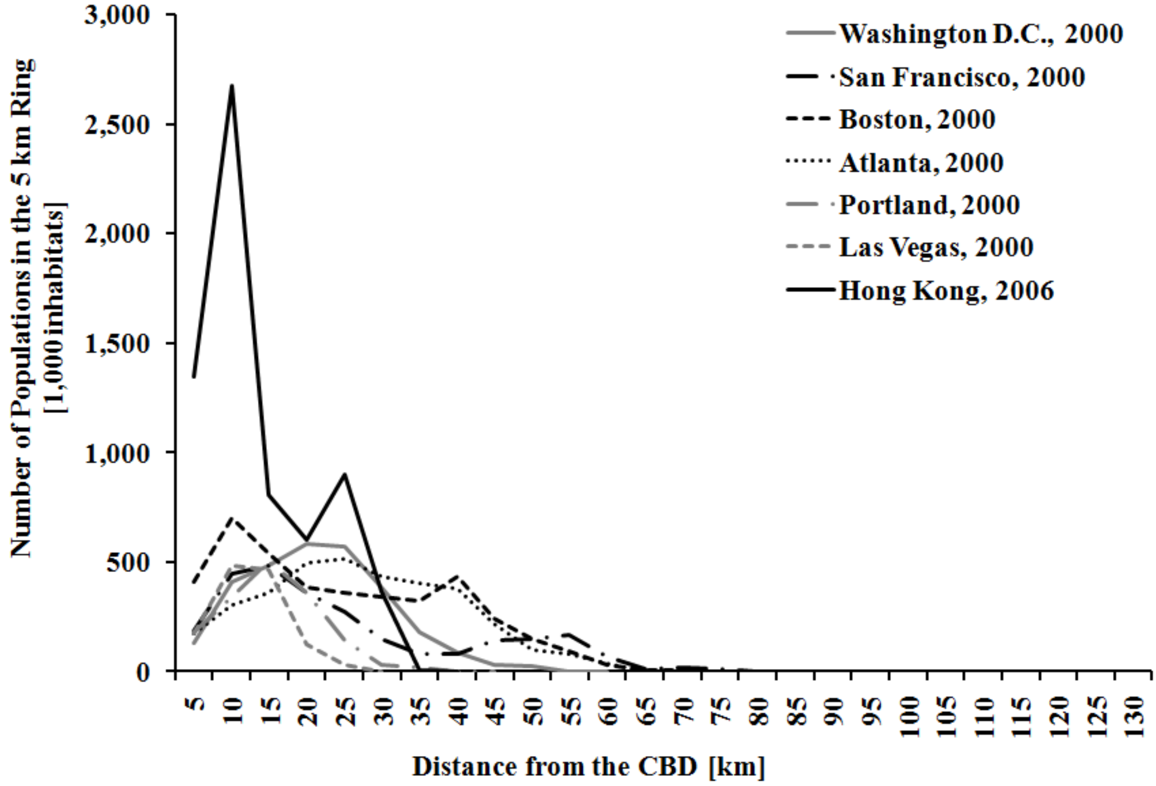
Sources: Author, with data from U.S. DOC (2009a) and GOJ (2009d).

Figure 6.10 Urban Agglomeration Patterns of Populations in Tokyo, 2005 and 3 American City-Regions, 2000



Sources: Author, with data from U.S. DOC (2009b) and HKSAR (2007a).

Figure 6.11 Urban Agglomeration Patterns of Jobs in Hong Kong, 2006 and 6 American City-Regions, 2003



Sources: Author, with data from U.S. DOC (2009a) and HKSAR (2007c).

Figure 6.12 Urban Agglomeration Patterns of Populations in Hong Kong, 2006 and 6 American City-Regions, 2000

Table 6.2 Urban Agglomeration Patterns within 5 km of the Central Business Districts (CBDs) across Hong Kong, 2006, Tokyo, 2006/2005, and 9 American City-Regions, 2003/2000

City-Regions	Jobs			Populations		Data [Year]
	Total [1,000]	Finance & Business [1,000]	[%]	Inhabitants [1,000]	Balance [Jobs/Populations]	
New York	1,047	433	41.4	887	1.18	2003/2000
Los Angeles	317	86	27.3	297	1.07	
Chicago	665	317	47.7	528	1.26	
Washington D.C.	437	180	41.1	133	3.28	
San Francisco	431	166	38.6	187	2.30	
Boston	465	178	38.2	410	1.13	
Atlanta	170	66	38.9	171	1.00	
Portland	219	66	30.0	182	1.20	
Las Vegas	279	57	20.3	175	1.59	
Tokyo	526	20	3.8	858	0.61	2006/2005
Hong Kong	1,009	322	31.9	1,349	0.75	2006

Sources: Author, with data from U.S. DOC (2009a; 2009b), GOJ (2009b; 2009d), and HKSAR (2007a; 2007c).

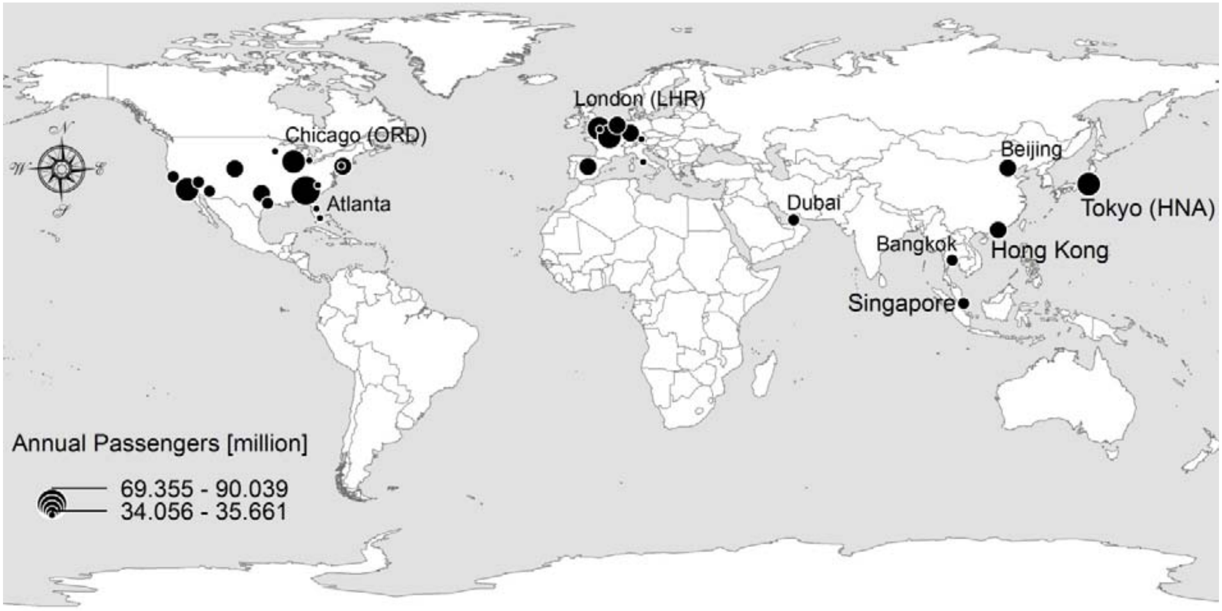
As existing transportation studies point out (Giuliano, 2004; Cervero and Landis, 1997), the Asian models and selected 9 American city-regions shows that the urban agglomeration impacts of rail transit investments are localized and tend to occur in the dense core areas. Thus, this section further looks into the compositions of jobs and populations within 5 km of the CBDs that reflect the characteristics of transit-oriented urban regeneration. Table 6.2 presents how the urban agglomeration patterns in the central locations are similar and different across the Asian Models and selected 9 American city-regions. Supported by the world-class rail transit systems, the central areas of New York, Chicago, Boston, Tokyo, and Hong Kong sustain much more jobs than those of the other American city-regions. New York, Chicago, Boston, and Hong Kong form global finance and business districts in the central locations, while Tokyo places a mix of high-tech manufacturing, information, biotechnologies, and research & development activities around the CBDs. This suggests that the existence of global finance and business clusters is not always a prerequisite to making mega transit investments in global city-regions.

The same table also reveals that New York, Chicago, Boston, Tokyo, and Hong Kong contain a larger number of urban populations in the central locations than the other selected American city-regions. Especially the two Asian models demonstrate that the numbers of urban populations exceed those of jobs within 5 km of the CBDs. The lower job-population ratios imply that the transit-oriented global centers are not only competitive for global business production but also attractive for local living consumption, though there are two exceptions among the selected 9 American city-regions. Washington D.C. and San Francisco keep relatively strong city centers with the heavy rail transit systems; however, the central locations are more dedicated to economic production activities with less urban residents. Expanding the suburban job centers and bedroom communities along with the massive freeway networks, Los Angeles and Atlanta keep a smaller number of business employments and urban dwellers in the core areas. With a focus on global competitiveness and local livability, these urban agglomerations would have been intensified by the combinations of rail transit investments and urban regeneration projects in the rapidly growing periods.

6.4 Contemporary Transit Investments and Urban Regeneration Projects

6.4.1 Airport Access Development

In the context of globalization, international airports are seen as an important catalyst for local economic development by forming time-sensitive, multi-national business clusters along ground transportation systems (Kasarda, 2004). The potential benefits of airport-linked developments can be larger than those of urban regeneration projects in the CBDs (Kasarda, 2009); however, the locational advantages of airport access have been largely cancelled out by the negative externalities of airport proximity, such as traffic congestion, air pollution, and noise (McMillen, 2004; Tomkins et al., 1998; Nelson, 1980). Thus, there has been common emphasis on airport access rail transit investments across global city-regions.



Source: Author, with data from ACI (2009).
Notes: ORD: O'Hare International Airport; LHR: Heathrow Airport; HNA: Haneda Airport.

Figure 6.13 The World's 30 Busiest Airports, 2008

From East Asia, Hong Kong International Airport, Singapore Changi Airport and Tokyo Haneda Airport, Beijing Capital International Airport, and Bangkok Suvarnabhumi Airport are ranked in the world's 30 busiest airports (Figure 6.13). Especially Tokyo Haneda Airport (HNA) is the world's 4th busiest airport, handling nearly 67 million domestic and international passengers in the urban waterfront district where can take advantage of high access to and from central Tokyo (Figure 6.14). Haneda's world-class air passenger flows would considerably affect Tokyo's long-term urban development pattern. The empirical findings in the fifth chapter reveal that the agglomerations of office-type businesses and knowledge-based professionals have significantly shifted towards this urban waterfront airport in the last decade, which have proactively been guided by the national government's airport expansion plan, private railway companies' airport access investments, and local municipalities' urban regeneration initiatives. This Asian model suggests that successful airport access development requires strong coordination among multiple public and private stakeholders in a city-region.

Source: Tokyo Bay Funabashi Vivit 2009 (http://image.blog.livedoor.jp/vivit2009/imgs/0/5/054c5d39.jpg).

Figure 6.14 Tokyo Haneda Airport (HNA) Expansion in the Urban Waterfront District

Airport ground access congestion has increasingly been seen as one of the major sources jeopardizing the global competitiveness and local livability of American city-regions in the 21st century (RPA, 2006). In 2008, 16 of the world's 30 busiest airports (53.3%) are concentrated in the United States. Especially Hartsfield-Jackson Atlanta International Airport and Chicago O'Hare International Airport (ORD) are the world's 1st and 2nd busiest airports with about 90 and 69 million annual passengers (Figure 6.13). Some of the selected American city-regions such as New York, Los Angeles, Chicago, Washington D.C., San Francisco, Atlanta, and Portland have already invested in direct rail transit access to their major international airports (APTA, 2008); however, airport-linked developments in the United States have incrementally been driven by different property owners in absence of any common strategic vision (Kasarda, 2009). In addition, neighborhood opponents and environmental activists have typically blocked airport capacity expansion, whereas business interests and public officials have politically pressed airport capital improvements in the federal, state, and local arenas (Altshuler and Luberoff, 2003).

The recent federal funding policies empower local initiatives in progressing airport expansion projects, ground access investments, and economic development programs. In the case of Chicago, for instance, the O'Hare Modernization Program (OMP) has been implemented by the city-state to meet the region's growing aviation needs. The US$6.6 billion program on the basis of airline-backed general airport revenue bonds, passenger facility charges, and federal airport improvement program funds will reconfigure O'Hare International Airport's runways and develop a new world-class intermodal transportation center that would directly connect the existing Metra commuter trains, new intercity railways, a CTA extension of the Blue Line, and future DuPage County bus rapid transit system on the western edge of the airport (Figure 6.15). Around the intermodal transportation center, the local government plans to convert huge car parking areas into tax-paying modern commercial properties and raise improved property-tax revenues from growing businesses (DuPage County, 2006; MHSRA, 2009). The OMP is expected to generate 195,000 jobs and US$18 billion in annual economic activity (COC, 2009). Another empirical study on Chicago's regional growth also presents the potential agglomeration benefits of proximity to O'Hare, wherein employment density is estimated to decline by 0.9 % per mile from the airport in 1990 and 3.4 % per mile in 2020 (McMillen, 2003).

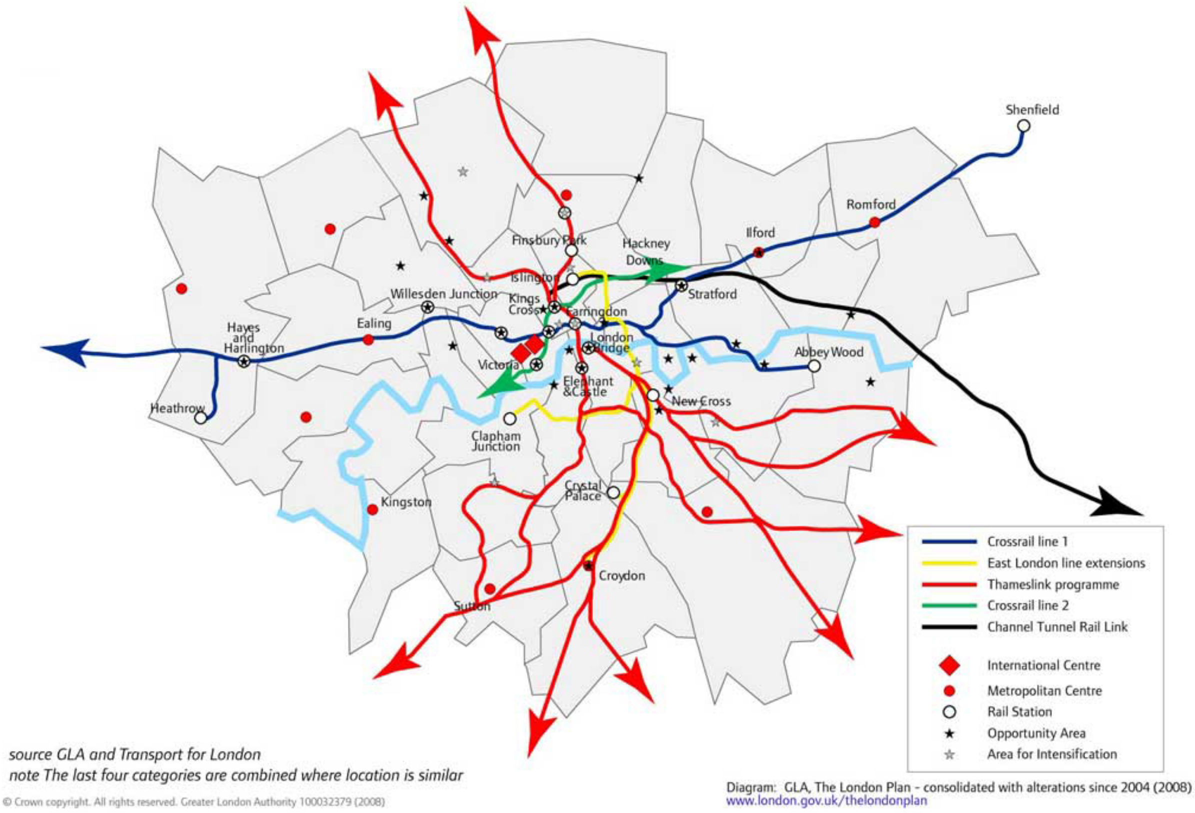
Source: The D-Spot (http://www.dspotblog.com/wp-content/uploads/2009/05/ord.jpg).

Figure 6.15 Chicago O'Hare International Airport and Ground Transportation Systems

6.4.2 High-Speed Rail Terminals

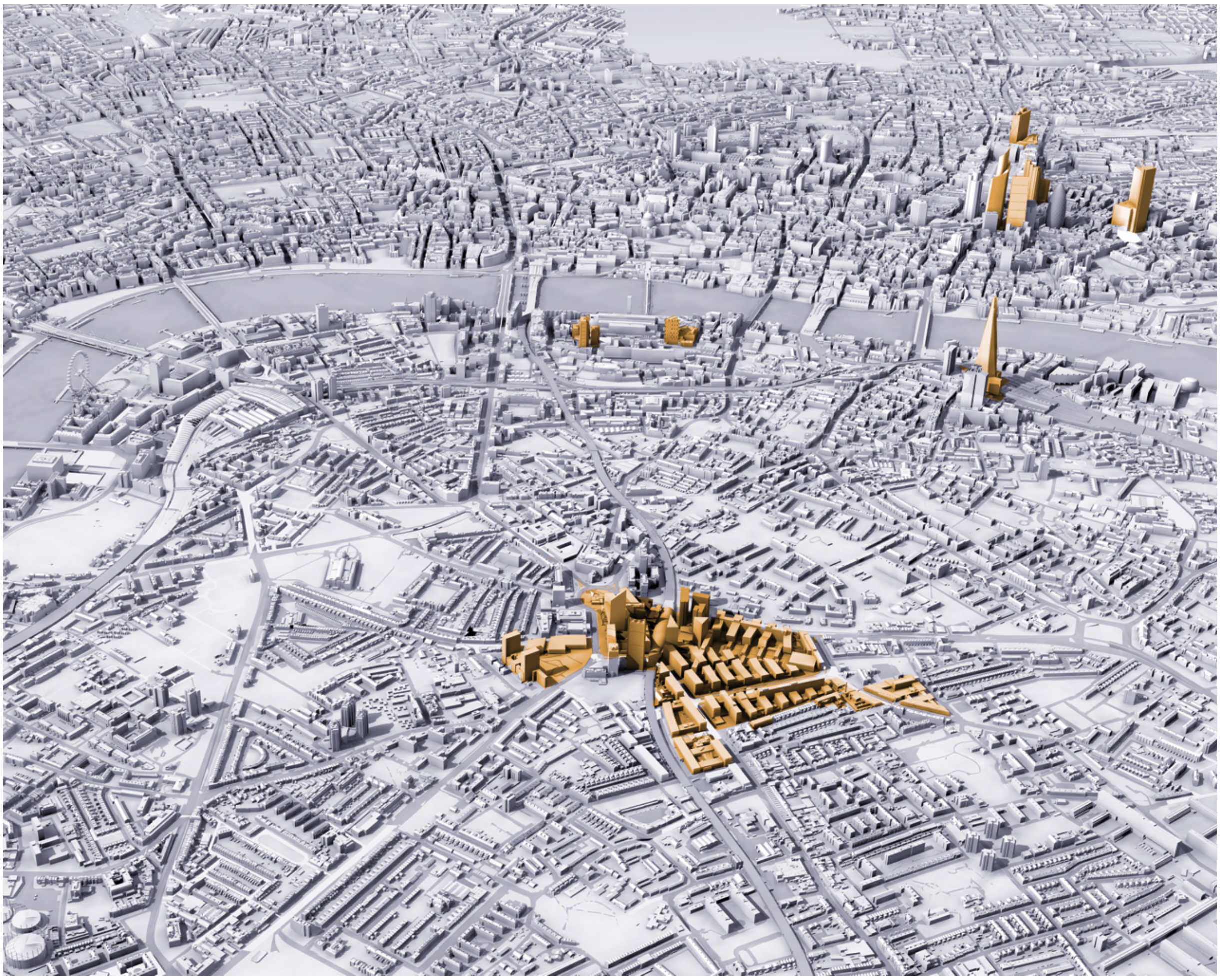
There has been the increasing recognition of the importance of high-speed rail (HSR) investments in relieving traffic congestion around international airports and stimulating economic development near terminal stations (Leinback, 2004). London is a typical case of this transit-oriented urban regeneration model. Among the 8 busiest airports in Europe (Figure 6.13), London Heathrow Airport (LHR) is the world's 3rd busiest airport with over 67 million annual passengers. Having the growing aviation demand, Heathrow is predicted to distribute 12,100-37,600 direct, indirect, induced, and catalytic employments within the airport's catchment area by 2015 (GLA, 2006). It has generally been expected that Heathrow's capacity expansion would have a significant impact on the number of business passengers working in central London; thus, its urban agglomeration benefits are likely to occur around the "in-city terminals" where could offer sizable redevelopment opportunities with the new HSR connections.

The Greater London Authority's spatial development strategy designated the Central Activity Zones and Opportunity Areas that would densely accommodate about 560,000 global finance and business service employments around target transportation centers by 2016 (MOL, 2008; Figure 6.16). The new HSR links are regarded as a catalyst for urban regeneration of the designated zones and areas around King's Cross/St Pancras and Stratford. Crossrail Line 1 is being projected to improve the links between Heathrow's gateway functions and central London's business activities. Thameslink 2000 aims to enhance cross-London interactions with property redevelopment opportunities in the vicinity of King's Cross and London Bridge. Furthermore, Crossrail Line 2 will intensify urban agglomerations at Victoria, King's Cross, Piccadilly Circus, Tottenham Court Road, and Hackney Central. These station areas contain a large share of London's creative businesses, thriving on face-to-face communications for the exchange of knowledge and ideas within dense, compact, and cultural urban settings (Freeman, 2007; GLA, 2008). London's transit-oriented urban regeneration projects, therefore, stresses the role of urban design in harmonizing the existing neighborhoods, new buildings, and revitalized terminals through public-private partnerships (Urban Task Force, 1999; Figure 6.17).



Source: MOL (2008).

Figure 6.16 High-Speed Rail (HSR) Investments and Urban Regeneration Opportunities in London, 2004



Source: GMJ (http://www.gmj.co.uk).

Figure 6.17 GMJ CityModel: London Victoria Station, 2012

In the United States, HSR investments as economic stimulus have recently gained political momentum across the different levels of institutions. In accordance with the American Recovery and Reinvestment Act of 2009, the Federal Railroad Administration has been charged with the distribution of $8 billion for HSR and other transit investments. Involving long-term spatial development strategies, however, only sizable American city-regions can be qualified for HSR investments. One of the potential markets has long been identified in California, having large air passenger flows between Los Angeles and San Francisco (Hagler and Todorovich, 2009). In 2008, California voters approved a US$9.95 billion general obligation bond for building the main segment of the California HSR corridor between Los Angeles/Anaheim and downtown San Francisco with local transit capital improvements (SOC, 2009). In the north end of this corridor, the Transbay Transit Center and Tower development plan has been promoted by the San Francisco Redevelopment Agency. This local urban regeneration plan attempts to transform an outmoded transportation facility and underutilized land parcels into the heart of a new transit-oriented neighborhood with houses, offices, parks, shops, and a modern regional transit hub that would connect the California HSR and 9 transit systems (CCSF, 2009; TJPA, 2009; Figure, 6.18).

Source: TJPA (2009).

Figure 6.18 The Proposed Transbay Transit Center and Tower Development Plan in Downtown San Francisco

Due to the lack of experience in the United States, the HSR investment and urban regeneration plan in downtown San Francisco would face many challenges, which include securing adequate funding resources over the next decades and managing complex implementation processes particularly in the central location (Hess and Lombardi, 2004). In response to the gap in knowledge about HSR development in American city-regions, there is a need to learn advanced experiences from other global city-regions in Europe and Asia that have already practiced the integration of HSR investments with urban regeneration projects. While London's HSR terminal projects are still under development, Tokyo's new Shinagawa HSR station was already completed with a large office property redevelopment package in the early 2000s. The empirical findings in the fifth chapter suggest that the urban agglomeration benefits of HSR investments on knowledge-based business activities are very significant especially in the central locations where entrepreneurial states proactively encourage urban regeneration projects by using financial incentives, floor area ratio bonuses, and urban amenity improvements. Notably, the appreciable windfalls of the new HSR terminal development on nearby commercial properties were captured largely by the privatized Japan Railway Company that aggressively implemented transit joint developments.

6.4.3 LRT and BRT Investments

High-speed rail (HSR) and mass rail transit (MRT) investments are not always adequate options, particularly in the city-regions that have low-density and small-size urban populations. Indeed, many global city-regions have flexibly adapted light rail transit (LRT) technologies to best serve their given urban settlement patterns (Cervero, 1998). In the cases of Singapore and Tokyo, the recent LRT investments were made to support suburban development projects. The hedonic price models in both the fourth and fifth chapters show that the benefits of LRT investments are capitalized into nearby residential and mixed use property prices in the suburban areas of large global city-regions. These Asian models are conceptually different from European city-regions. Zurich, for example, integrated the world-class LRT systems with its traditional urban streetscapes, keeping high shares of regional service businesses and retail sales within the core district (Cervero, 1998). This European model rather presents the ability of LRT investments to revitalize the central locations of more compact global city-regions.

Throughout the 1990s, LRT investments were widely practiced in American city-regions by relying heavily upon the federal subsidy programs. One of the most successful LRT investment cases in the United States is Portland, maintaining a vibrant downtown with the designation of urban growth boundaries (UGBs) and creation of transit-oriented urban villages. 41% of its households are living within a half mile of the local business districts that offer job opportunities as well as social services. As other North American city-regions experienced, the annual growth rate of regional employments in Portland sharply dropped to 0.2% between 2000 and 2006. Yet, the competitive advantages of business activities were unevenly redistributed within the city-region. Central Portland gained about 12,000 jobs from 2000 to 2006, while the rest of the city-region lost 7,000 jobs in the same period (COP, 2009). This economic development study points out that the city-state's proactive actions such as LRT investments, UGB designations and urban regeneration programs have intensified the agglomerations of management and administrative services in central Portland (Figure 6.19).

Source: Wikipedia (http://en.wikipedia.org/wiki/File:PortlandOR-aerial.jpg).

Figure 6.19 Central Portland: Moving Towards Transit-Oriented Urban Regeneration

In recent years, bus rapid transit (BRT) systems have increasingly been considered as a cheaper and more flexible alternative to LRT and other rail transit systems in both developing and developed countries (Hensher and Golob, 2008; Hidalgo and Graftieaux, 2008; Levinson et al., 2003; Polzin and Baltes, 2002). In the case of Las Vegas, for instance, the Federal Transit Administration withdrew funding in 2006 for the Monorail extension project in downtown Las Vegas. The Regional Transportation Commission of Southern Nevada re-evaluated possible transit investment options and selected a high-grade BRT system (MAX: Metropolitan Area Express) as a viable alternative (COLV, 2008). With a new regional transit terminal, the proposed BRT project is regarded as an essential tool for urban regeneration in the city center. Many residential, commercial and mixed-use property development projects have proactively been promoted around the proposed BRT stops. In comparison to other rail transit technologies, however, BRT systems are likely to generate modest urban agglomeration impacts due to the lack of speed advantage, modern image, and practical experience in the central locations of American city-regions (Jarzab, 2002; Levinson et al., 2002; Pucher, 2004).

Source: HIADA (http://www.flickr.com/photos/hiada/814375392/).

Figure 6.20 The TransMilenio Bus Rapid Transit (BRT) Corridor in Central Bogotá

Among several international BRT cases, Bogotá's application is one of the most progressive and iconic models. The TransMilenio BRT system acts as the centerpiece of Bogotá's social improvement strategy that aims to spur urban regeneration by providing new transit stations, creating public open space around the stations, and giving spatial priority to pedestrians along the transit corridors (Cain et al., 2007; Figure 6.20). Such transit capital improvements have already shown initial signs of generating urban agglomeration benefits. One empirical research presents that residential properties closer to the BRT stations and Bogotá's activity centers tend to have higher values (Rodríguez and Targa, 2004). This evidence indicates the potential of applying "betterment taxes" to finance Bogotá's future rail transit investments and urban amenity improvements on the basis of a value capture mechanism (Cervero, 2009b). Another empirical study, however, reveals that the urban agglomeration benefits are unevenly distributed across socioeconomic strata (Munoz-Raskin, 2010). Middle-income residential properties have higher values with proximity to the BRT stations, while low-income housing units show opposite trends. These statistical findings raise the question of whether Bogotá's transit capital improvements make the poor worse off in the city-region. In response to this social inequity concern, the city-state's funding policies have shifted to human capital improvements such affordable housing and social welfare programs along the BRT corridors (Cervero, 2005c).

6.4.4 Pedestrian Space Creations

As shown in the previous section, progressive city-states such as Singapore, Portland and Bogotá attempt to establish modern images of social life that would promote creative business clusters in the global marketplace. In this perspective, urban amenity settings play a key role in attracting creative talents, facilitating cultural mixtures and fostering social identities in target locations. In order to meet these objectives, the three Asian models have created livable pedestrian environments around rail transit stations through joint development programs. In the case of Hong Kong, R+P Programme's well-connected pedestrian networks and high-quality public plazas not only increase rail transit riderships but also add considerable price premiums to nearby residential properties (Cervero and Murakami, 2009). In the fifth chapter, the empirical analysis on Tokyo's Urban Renaissance Program also suggests that pedestrian space creations significantly intensify knowledge-based labor markets and moderately increase residential land values in the immediate vicinity of rail transit stations, though these urban agglomeration effects are spatially redistributive within the target districts.

While the demand for high-rise property redevelopment increases around terminal stations, the ratio of open space areas to urban populations decreases in the central locations of a global city-region. New York City (NYC) is a typical example of this dilemma. In the 2000s, the city-state generated more than 300 acres of new parkland by reclaiming the waterfront districts. However, due largely to its urban resurgence, Manhattan still has fewer acres of green space per urban resident than other large American city-regions. This spatial conflict has called for a paradigm shift in transportation policies from engineering a city for automobile traffic to designing a city for pedestrian circulation. NYC Department of Transportation (DOT) Pedestrian Project Group, being consisted of city planners, transportation engineers and urban designers, has converted underused roadway lanes into new comfortable plazas, green space, and safe travel paths for all street users. In the case of Broadway Boulevard, for instance, people started to gather at newly created public open space that has the colorful collection of chairs, tables, umbrellas, and planters adjacent to shops and cafes (Figure 6.21). According to PlaNYC 2030 (NYC, 2007), each of the city's 59 Community Boards contains at least one opportunity to convert underutilized road space into attractive urban places for social interactions, which would regenerate knowledge spillovers and economic innovations in Manhattan as envisioned by Jane Jacobs.

Source: NYC DOT (2009).

Figure 6.21 New York City Pedestrian Project: Broadway Boulevard in Manhattan

Chapter Seven
Conclusion

7.1 The Three Asian Models

This dissertation examines Hong Kong, Singapore and Tokyo as three transit-oriented global center models, wherein entrepreneurial city-states have largely integrated rail transit investments with urban regeneration projects to guide postindustrial agglomeration and spur economic development in target locations. Over the last decade, these transit-oriented development strategies have made significant progress towards shaping “competitive” and “livable” Asian city-regions in the global marketplace. The case descriptions and empirical analyses in the third, fourth, and fifth chapters cover novel experiences with entrepreneurial state strategies and postindustrial market responses across the three Asian models.

Given the world’s densest urban agglomeration, Hong Kong’s single public-private railway company has developed the world-class mass transit railway network with a variety of high-quality property packages. This joint development model has been very successful not only in co-financing the railway corporation’s large-scale infrastructure investments with private real estate companies but also sustaining Hong Kong’s extremely dense urban agglomeration patterns over the territory. A few mixed commercial property packages have enhanced global business clusters with urban amenity settings around the terminal stations in Hong Kong Island and Kowloon, while many residential property packages have formed local labor markets with social and community services along the suburban corridors in the New Territories.

In an attempt to offer modern business and living environments, Singapore’s entrepreneurial state authorities have proactively leased government-own land parcels with floor use regulations, plot ratio bonuses and public use requirements along the new mass rapid transit lines. This joint development model has raised substantial public funds for Singapore’s future capital investments and would have shaped sub-regional employment centers and new-town communities over the island. In practice, the new rail transit line expansion alone has moderate relocation impacts on commercial activities in the suburban planning areas; on the other hand, the state-led mixed use property packages around the existing stations tend to generate significant re-agglomeration effects on both transnational business clusters and creative labor markets in the central area.

Facing the challenges of shrinking economy and demography, Tokyo’s multiple private railway companies and real estate developers have brought together limited resources into transit-oriented urban regeneration projects in the megalopolis’ key locations. This joint development model has aggressively converted sizable old train yards into profitable global office buildings, luxury shopping malls and high-end hotels around the central terminal stations where the region’s developmental states have offered more generous density bonuses and faster project approvals with public open space requirements. These capitalist investments and liberalized policies have generated considerable agglomeration benefits on knowledge-based business clusters and professional enclaves near the central terminals connecting new urban rail and high-speed rail lines, while raising the issues of geographic inequity in the megalopolis.

7.2 In the Global Marketplace

The three Asian models appeal to other entrepreneurial city-states that seek to tap into the potential benefits of integrating large-scale rail transit investments with urban regeneration projects in the global marketplace. Critics might argue that the Asian models represent a few extreme cases in terms of transit investment levels and urban agglomeration patterns, having very different evolutional pathways and institutional structures from other global city-regions. The international statistics and case reviews in the sixth chapter attempt to illustrate specific experiences and common themes across the three Asian models and selected global city-regions that have been moving towards transit-oriented urban regeneration.

In the global marketplace, Copenhagen and Stockholm are often introduced as another successful model, wherein rail transit investments are made to shape balanced, mixed-use development along radial corridors. This Scandinavian model, however, has been practiced with relatively small population sizes and slow growth rates. The three Asian models, on the other hand, have gone through much larger and faster urban population growth over the last decades, as the emerging global city-regions in North and South America, Middle East, India and China will face for the next decades. These rapidly growing city-regions are well-positioned to consider the potential benefits of applying the three Asian models. Given substantial population growth in dense urban agglomerations, the Asian models have provided much denser and more profitable urban transit systems than the European and other global city-regions.

One of the cross-cutting themes is the ability of contemporary transit investments to shape denser urban agglomerations in the global marketplace. The Asian models along with European and selected global city-regions show a strong correlation between transit investment levels and urban population densities, whereas American city-regions present a weak link. This comparative statistics does not mean that the potential impacts of rail transit investments on shaping urban agglomerations are insignificant in the rapidly growing city-regions that have been moving towards automobile-dependent urban development. Having dense heavy rail transit networks, the central locations of New York, Chicago, Washington D.C. and San Francisco keep fairly sizable urban agglomerations in comparison to those of Tokyo and Hong Kong. The central locations of the selected American city-regions tend to form global finance and business service centers, while those of the Asian models contain a larger number of urban residents with community service activities. These job-population compositions can be reshaped by transit-oriented urban regeneration projects, aiming to balance competitiveness and livability in a strategic manner.

A common strategy across the Asian models and selected large global city-regions is airport access development. The recent airport expansion projects in the large global city-regions are expected to generate significant agglomeration impacts not only near the international airport districts but also along the airport access corridors and around the in-city transit terminals that are associated with high-speed rail (HSR) investments and urban regeneration projects. Tokyo’s experiences suggest that such mega transit projects call for building innovative partnerships among multiple public and private stakeholders. The considerable agglomeration benefits around the in-city transit terminals of Tokyo and Hong Kong also indicate the high potential of financing HSR and mass rail transit (MRT) projects through joint development programs in the central locations of large global city-regions such as central London and downtown San Francisco where entrepreneurial city-states have proactively promoted transit-oriented urban regeneration projects.

More compact global city-regions such as Zurich and Portland have adapted light rail transit (LRT) technologies within the well-defined core districts. This approach also tends to generate urban agglomeration benefits especially for knowledge-based business activities moving closer to the central locations. In rapidly growing global city-regions such as Las Vegas and Bogotá, on the other hand, bus rapid transit (BRT) investments are likely to have moderate agglomeration effects particularly on middle-income labor markets around the BRT stations with pedestrian-friendly built environments. In a similar way, the pedestrian space creation programs across the three Asian models and New York City contribute to making "sense of livable place" that would attract creative people and encourage knowledge spillovers near the MRT stations where the market pressure on developable land parcels is very high for commercial speculation. Yet, these international cases imply that such authentic amenity settings would simply form urban elitist enclaves in the global marketplace unless affordable housing and social welfare programs are properly built in transit-oriented urban regeneration projects.

7.3 Lessons

Despite the recent worldwide economic recession, there is global momentum to put greater public-private resources together into rail transit investments and transit-oriented developments. Contrarily, there is local concern over "wasteful" public spending and "speculative" private financing in such mega transit projects. Several researchers point out that more expensive transit projects bring about larger cost overruns and demand shortfalls, which inadequately place a number of local taxpayers at higher risks (Flyvbjerg, 2007; Flyvbjerg et al., 2003; Pickrell, 1992; Gomez-Ibanez, 1985; Gordon and Richardson, 1997; Wachs, 1987). Inadequate project evaluation and management are a major source of higher risk for mega transit projects. Avoiding "double counting" issues, the conventional cost-benefit analysis framework in the public sector takes into account "internal" user benefits only within a transit system. However, in relation to global private financers, care need to be taken to properly account for "external" spatial impacts generated by mega transit projects in an unconventional manner, such as business location shifts, property price changes and socioeconomic redistribution effects (Banister and Berechman, 2000; Dimitriou, 2006; 2005; Dimitriou and Trueb, 2005; Weisbrod and Weisbrod, 1997).

In conclusion, I argue that the external impacts of large-scale rail transit investments and transit-oriented developments on postindustrial agglomeration processes are too important considerations to be ignored in the project evaluation framework, particularly where entrepreneurial city-states attempt to capture the potential benefits of knowledge spillovers and economic innovations in the global marketplace. The experiences in Hong Kong, Singapore and Tokyo over the last decade support my argument. From the three Asian cases and global comparisons, this final section draws five key lessons for policymakers and planners who make efforts to shape "competitive" and "livable" city-regions by integrating large-scale rail transit investments with urban regeneration projects in the global marketplace.

1. **Evaluating urban agglomeration benefits:** Mega transit investments in large, dense and/or growing global city-regions can generate significant urban agglomeration benefits for knowledge-based businesses and skilled professional communities around the in-city terminal stations and international airport districts especially where entrepreneurial city-states proactively promote transit-oriented urban regeneration projects in the global marketplace.

2. **Choosing adequate transit technologies:** Mega transit investments are not always the best means of triggering transit-oriented urban regeneration, particularly in compact or low-density city-regions. Less expensive technologies such as light rail transit and bus rapid transit systems may be able to generate moderate agglomeration benefits within the well-defined central locations where accommodate mixed use property packages and pedestrian-friendly amenity settings.

3. **Establishing public-private partnerships:** The private sector's long-term commitment is essential to shape postindustrial agglomerations in the global marketplace. In stagnating districts, however, there remain physical, institutional and regulatory barriers to delivering transit-oriented urban regeneration projects. Entrepreneurial city-states need to create favorable opportunities for private developers by arranging land assemblages, density bonuses, financial incentives and approval deregulations around target stations.

4. **Applying value capture techniques:** Urban agglomeration benefits need to be properly shared among multiple public and private stakeholders to recover the costs of mega-projects. In this funding framework, entrepreneurial city-state agencies stand to capture the substantial portion of the land value increases generated by large-scale rail transit investments through local property taxes, special benefit assessment, tax increment financing, impact fees, development rights auctions and/or joint development programs.

5. **Ensuring local community interests:** Authentic mixed use property development packages with sidewalks, cafes, art galleries and public plazas around rail transit stations are likely to not only form creative professional communities but also raise social stratification problems in the global marketplace. Entrepreneurial city-states' property rights arrangements and social welfare programs play a critical role in representing a variety of local community members in transit-oriented urban regeneration projects.

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Appendix A
Background Statistics on Hong Kong

A.1 Dendrogram for a Typology among the 38 Rail + Property Stations

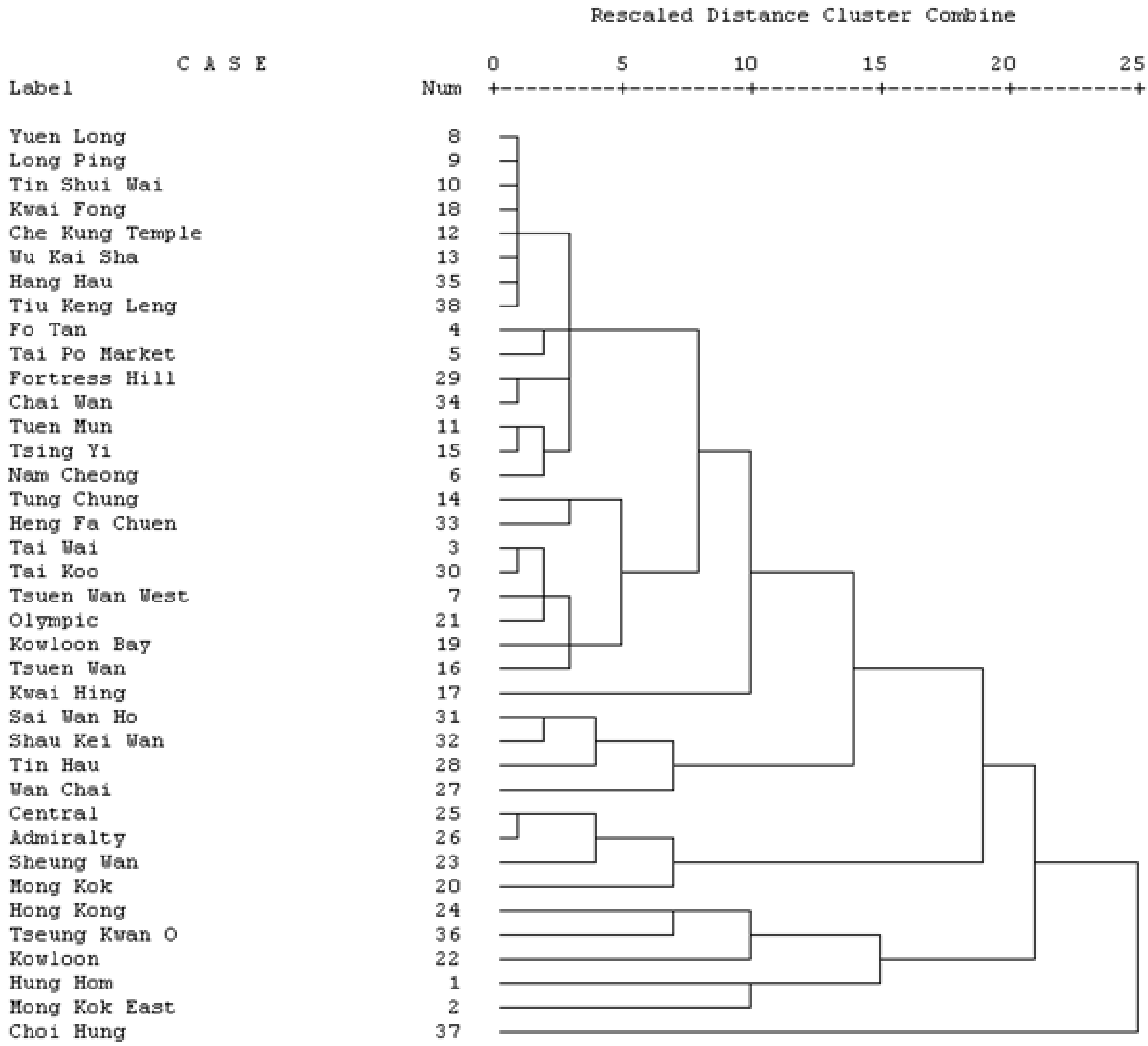

Figure A.1.1 Dendrogram for a Typology among the 38 Rail + Property Stations

A.2 Descriptive Statistics of Variables for the Location Models

Table A.2.1 Descriptive Statistics of Job Absolute Number (AN), 2001 and 2006 (N=77)

Industrial Sectors	Minimum	Maximum	Mean	Std. Deviation
2006				
Total	0	106,154	18,290	24,307
FIRE+	0	69,869	5,391	12,468
CSSV	0	13,037	2,391	2,558
WHRE	0	46,643	8,367	10,358
TRCM	0	9,272	1,243	1,942
MANU	0	6,259	794	1,208
2001				
Total	0	96,892	17,633	23,010
FIRE+	0	63,717	4,874	11,392
CSSV	0	10,733	1,897	2,130
WHRE	0	45,515	8,341	10,241
TRCM	0	13,681	1,338	2,337
MANU	0	8,343	1,070	1,649
Change				
Total	-4,449	10,101	656	2,192
FIRE+	-1,802	6,152	517	1,304
CSSV	-3,105	5,553	495	966
WHRE	-2,154	3,574	27	981
TRCM	-8,163	1,277	-95	1,016
MANU	-2,084	376	-276	495

Notes: FIRE+: Financing, Insurance, Real Estate and Business Services; CSSV: Community, Social and Personal Services; WHRE: Wholesale, Retail and Import/Export Trades, Restaurants and Hotels; TRCM: Transport, Storage and Communications; MANU: Manufacturing.

Table A.2.2 Descriptive Statistics of Job Location Quotient (LQ), 2001 and 2006 (N=77)

Industrial Sectors	Minimum	Maximum	Mean	Std. Deviation
2006				
FIRE+	0.000	3.382	0.802	0.650
CSSV	0.241	4.041	1.143	0.688
WHRE	0.443	1.629	1.098	0.260
TRCM	0.000	6.110	0.747	0.821
MANU	0.000	3.226	0.847	0.863
2001				
FIRE+	0.088	3.567	0.791	0.689
CSSV	0.222	3.568	1.172	0.734
WHRE	0.450	1.635	1.089	0.236
TRCM	0.069	6.698	0.791	0.918
MANU	0.015	3.233	0.828	0.796
Change				
FIRE+	-0.389	0.588	0.022	0.177
CSSV	-1.179	0.535	-0.067	0.278
WHRE	-0.175	0.579	0.017	0.117
TRCM	-1.990	0.962	-0.034	0.461
MANU	-0.525	1.566	0.030	0.278

Notes: FIRE+: Financing, Insurance, Real Estate and Business Services; CSSV: Community, Social and Personal Services; WHRE: Wholesale, Retail and Import/Export Trades, Restaurants and Hotels; TRCM: Transport, Storage and Communications; MANU: Manufacturing.

Table A.2.3 Descriptive Statistics of Job Shift-Share (SS) %, 2001-2006 (N=77)

Industrial Sectors	Minimum	Maximum	Mean	Std. Deviation
Total	-30.18	480.67	8.92	59.39
FIRE+	-111.71	1,028.29	26.17	129.61
CSSV	-69.93	445.77	11.97	70.47
WHRE	-23.11	502.44	9.67	62.72
TRCM	-101.90	331.43	8.43	58.02
MANU	-76.67	96.80	5.52	38.26

Notes: Shift-Share (SS) Analysis: Differential Shift i = (% change in the station area jobs in the sector i) - (% change in the HK territorial jobs in the sector i); FIRE+: Financing, Insurance, Real Estate and Business Services; CSSV: Community, Social and Personal Services; WHRE: Wholesale, Retail and Import/Export Trades, Restaurants and Hotels; TRCM: Transport, Storage and Communications; MANU: Manufacturing.

Table A.2.4 Descriptive Statistics of Labor Absolute Number (AN) by Industrial Sector, 2001 and 2006 (N=77)

Industrial Sectors	Minimum	Maximum	Mean	Std. Deviation
2006				
Total	93	34,267	12,868	8,189
FIRE+	8	8,641	2,316	1,759
CSSV	23	9,185	3,320	2,069
WHRE	28	9,992	3,687	2,426
TRCM	13	3,453	1,396	899
MANU	9	3,165	1,228	833
2001				
Total	102	40,892	12,761	8,747
FIRE+	11	9,045	2,096	1,691
CSSV	27	10,197	3,068	2,031
WHRE	24	11,569	3,642	2,702
TRCM	9	2,983	1,351	906
MANU	6	4,467	1,540	1,096
Change				
Total	-6,625	16,001	108	3,114
FIRE+	-695	3,104	220	555
CSSV	-1,346	4,394	252	827
WHRE	-2,277	3,853	45	929
TRCM	-570	1,806	44	334
MANU	-1,313	1,888	-312	461

Notes: FIRE+: Financing, Insurance, Real Estate and Business Services; CSSV: Community, Social and Personal Services; WHRE: Wholesale, Retail and Import/Export Trades, Restaurants and Hotels; TRCM: Transport, Storage and Communications; MANU: Manufacturing.

Table A.2.5 Descriptive Statistics of Labor Location Quotient (LQ) by Industrial Sector, 2001 and 2006 (N=77)

Industrial Sectors	Minimum	Maximum	Mean	Std. Deviation
2006				
FIRE+	0.506	1.712	1.046	0.270
CSSV	0.765	1.471	0.996	0.147
WHRE	0.610	1.463	1.029	0.145
TRCM	0.496	1.834	0.952	0.233
MANU	0.475	1.360	0.958	0.221
2001				
FIRE+	0.596	1.946	1.000	0.275
CSSV	0.725	1.699	0.989	0.185
WHRE	0.716	1.600	1.044	0.175
TRCM	0.528	2.395	0.959	0.266
MANU	0.417	1.426	0.953	0.231
Change				
FIRE+	-0.264	0.482	0.046	0.121
CSSV	-0.228	0.173	0.006	0.075
WHRE	-0.279	0.195	-0.015	0.091
TRCM	-0.561	0.469	-0.006	0.126
MANU	-0.239	0.249	0.005	0.096

Notes: FIRE+: Financing, Insurance, Real Estate and Business Services; CSSV: Community, Social and Personal Services; WHRE: Wholesale, Retail and Import/Export Trades, Restaurants and Hotels; TRCM: Transport, Storage and Communications; MANU: Manufacturing.

Table A.2.6 Descriptive Statistics of Labor Shift-Share (SS) % by Industrial Sector, 2001-2006 (N=77)

Industrial Sectors	Minimum	Maximum	Mean	Std. Deviation
Total	-47.12	327.28	8.01	48.65
FIRE+	-47.38	394.13	15.75	59.81
CSSV	-44.61	382.24	10.81	56.72
WHRE	-57.73	291.59	6.72	49.44
TRCM	-37.60	329.67	8.91	54.90
MANU	-36.10	311.03	7.51	41.90

Notes: Shift-Share (SS) Analysis: Differential Shift i = (% change in the station area labors in the sector i) - (% change in the HK territorial labors in the sector i); FIRE+: Financing, Insurance, Real Estate and Business Services; CSSV: Community, Social and Personal Services; WHRE: Wholesale, Retail and Import/Export Trades, Restaurants and Hotels; TRCM: Transport, Storage and Communications; MANU: Manufacturing.

Table A.2.7 Descriptive Statistics of Labor Absolute Number (AN) by Occupational Category, 2001 and 2006 (N=77)

	Occupational Categories	Minimum	Maximum	Mean	Std. Deviation
2006					
	Total	93	34,267	12,849	8,186
	MNGR	4	6,961	1,467	1,295
	PROF	3	3,022	807	611
	APROF	10	5,934	2,126	1,384
	CLRK	12	6,103	2,193	1,472
	SVWK	16	5,758	2,141	1,453
	CRWK	6	2,950	1,037	769
	PLNT	4	2,041	718	534
	ELMT	19	5,819	2,335	1,514
2001					
	Total	102	40,892	12,988	8,873
	MNGR	6	7,965	1,472	1,524
	PROF	4	3,733	724	688
	APROF	12	6,410	2,019	1,396
	CLRK	18	6,685	2,117	1,480
	SVWK	17	6,102	2,024	1,477
	CRWK	13	3,990	1,252	981
	PLNT	4	2,194	850	633
	ELMT	16	7,640	2,511	1,763
Change					
	Total	-6,625	16,001	-139	2,890
	MNGR	-1,892	2,180	-5	459
	PROF	-738	1,319	83	245
	APROF	-848	2,941	107	484
	CLRK	-1,246	2,850	76	486
	SVWK	-1,247	2,264	116	566
	CRWK	-1,350	1,362	-215	403
	PLNT	-569	908	-132	228
	ELMT	-2,018	2,324	-176	631

Notes: MNGR: Managers and Administrators; PROF: Professionals; APROF: Associate Professionals; CLRK: Clerks; SVWK: Service Workers and Shop Sales Workers; CRWK: Craft and Related Workers; PLNT: Plant and Machine Operators and Assemblers; ELMT: Elementary Occupations.

Table A.2.8 Descriptive Statistics of Labor Location Quotient (LQ) by Occupational Category, 2001 and 2006 (N=77)

Occupational Categories	Minimum	Maximum	Mean	Std. Deviation
2006				
MNGR	0.376	2.959	1.164	0.649
PROF	0.518	2.660	1.124	0.453
APROF	0.667	1.406	1.036	0.142
CLRK	0.372	1.213	0.968	0.183
SVWK	0.510	1.458	0.982	0.219
CRWK	0.222	1.554	0.907	0.350
PLNT	0.264	1.951	0.879	0.390
ELMT	0.303	1.444	0.968	0.142
2001				
MNGR	0.371	2.531	1.076	0.623
PROF	0.234	2.557	1.043	0.541
APROF	0.731	1.427	1.021	0.151
CLRK	0.557	1.251	0.984	0.169
SVWK	0.494	1.424	1.027	0.213
CRWK	0.169	1.703	0.971	0.376
PLNT	0.255	2.032	0.905	0.405
ELMT	0.718	1.358	0.977	0.110
Change				
MNGR	-0.738	1.612	0.089	0.347
PROF	-0.750	2.036	0.080	0.419
APROF	-0.292	0.384	0.015	0.119
CLRK	-0.729	0.234	-0.017	0.145
SVWK	-0.598	0.708	-0.045	0.167
CRWK	-1.122	0.289	-0.064	0.215
PLNT	-0.494	0.482	-0.026	0.131
ELMT	-0.712	0.369	-0.009	0.128

Notes: MNGR: Managers and Administrators; PROF: Professionals; APROF: Associate Professionals; CLRK: Clerks; SVWK: Service Workers and Shop Sales Workers; CRWK: Craft and Related Workers; PLNT: Plant and Machine Operators and Assemblers; ELMT: Elementary Occupations.

Table A.2.9 Descriptive Statistics of Labor Shift-Share (SS) % by Occupational Category, 2001-2006 (N=77)

Occupational Categories	Minimum	Maximum	Mean	Std. Deviation
Total	-34.7	327.8	6.5	47.8
MNGR	-40.6	631.5	27.9	115.7
PROF	-52.5	762.5	39.2	135.3
APROF	-38.4	344.0	10.1	55.8
CLRK	-41.7	302.4	2.9	41.7
SVWK	-50.9	280.6	3.0	55.7
CRWK	-48.7	254.9	1.4	44.5
PLNT	-46.8	259.0	3.7	40.3
ELMT	-74.7	292.3	6.5	51.2

Notes: Shift-Share (SS) Analysis: Differential Shift j = (% change in the station area labors in the category j) - (% change in the HK territorial labors in the category j); MNGR: Managers and Administrators; PROF: Professionals; APROF: Associate Professionals; CLRK: Clerks; SVWK: Service Workers and Shop Sales Workers; CRWK: Craft and Related Workers; PLNT: Plant and Machine Operators and Assemblers; ELMT: Elementary Occupations.

Table A.2.10 Descriptive Statistics of Job, Labor, and Housing Mixture Indices (MI), 2001 and 2006 (N=77)

	Year	Minimum	Maximum	Mean	Std. Deviation
Job					
	2006	0.338	0.919	0.728	0.096
	2001	0.530	0.898	0.733	0.083
	Change	-0.200	0.080	0.000	0.046
Labor (Industrial)					
	2006	0.871	0.972	0.934	0.026
	2001	0.856	0.985	0.943	0.029
	Change	-0.044	0.025	-0.010	0.011
Labor (Occupational)					
	2006	0.828	0.928	0.894	0.021
	2001	0.848	0.936	0.897	0.019
	Change	-0.047	0.024	-0.003	0.012
Housing					
	2006	0.000	0.999	0.550	0.393
	2001	0.000	0.999	0.559	0.360
	Change	-0.820	0.383	-0.009	0.166

Table A.2.11 Descriptive Statistics of Job-Labor Balance Index (BI), 2001 and 2006 (N=77)

	Industrial Sectors	Minimum	Maximum	Mean	Std. Deviation
2006					
	Total	0.000	0.941	0.537	0.261
	FIRE+	0.000	0.962	0.472	0.295
	CSSV	0.000	0.995	0.583	0.226
	WHRE	0.000	0.989	0.560	0.268
	TRCM	0.000	0.976	0.338	0.299
	MANU	0.000	1.000	0.441	0.312
2001					
	Total	0.000	0.998	0.534	0.280
	FIRE+	0.000	0.993	0.471	0.312
	CSSV	0.000	0.933	0.538	0.223
	WHRE	0.000	0.992	0.565	0.280
	TRCM	0.000	0.991	0.344	0.286
	MANU	0.000	0.999	0.464	0.324
Change					
	Total	-0.338	0.835	0.003	0.134
	FIRE+	-0.352	0.505	0.001	0.130
	CSSV	-0.508	0.452	0.046	0.142
	WHRE	-0.350	0.735	-0.004	0.142
	TRCM	-0.468	0.563	-0.005	0.138
	MANU	-0.401	0.248	-0.023	0.115

Notes: FIRE+: Financing, Insurance, Real Estate and Business Services; CSSV: Community, Social and Personal Services; WHRE: Wholesale, Retail and Import/Export Trades, Restaurants and Hotels; TRCM: Transport, Storage and Communications; MANU: Manufacturing.

Table A.2.12 Descriptive Statistics of Job Accessibility within 30 minutes, 2001 and 2006 (N=77)

Industrial Sectors	Minimum	Maximum	Mean	Std. Deviation
2006				
Total	103,303	1,995,689	1,650,758	511,847
MANU	6,302	114,945	90,817	28,383
WHRE	27,179	918,388	758,662	233,255
TRCM	3,693	158,170	112,466	32,868
FIRE+	8,487	448,077	381,270	120,270
CSSV	8,299	378,102	300,895	99,727
2001				
Total	1,128	1,819,588	1,217,569	737,839
MANU	35	151,077	95,070	59,431
WHRE	684	865,363	574,136	347,472
TRCM	104	157,789	92,675	56,268
FIRE+	34	391,947	266,353	165,159
CSSV	101	273,895	183,943	108,106
Change				
Total	9,275	1,826,875	433,189	567,878
MANU	-37,559	98,669	-4,253	44,608
WHRE	1,311	823,347	184,526	264,317
TRCM	-11,166	125,626	19,791	43,643
FIRE+	287	427,752	114,917	135,062
CSSV	-16,917	344,809	116,952	87,074

Notes: FIRE+: Financing, Insurance, Real Estate and Business Services; CSSV: Community, Social and Personal Services; WHRE: Wholesale, Retail and Import/Export Trades, Restaurants and Hotels; TRCM: Transport, Storage and Communications; MANU: Manufacturing.

Table A.2.13 Descriptive Statistics of Labor Accessibility within 30 minutes by Industrial Sector, 2001 and 2006 (N=77)

Industrial Sectors	Minimum	Maximum	Mean	Std. Deviation
2006				
Total	171,820	2,180,402	1,622,184	491,144
MANU	19,063	214,053	158,458	46,956
WHRE	45,967	609,012	453,660	136,348
TRCM	22,931	239,945	178,721	51,339
FIRE+	28,558	382,325	286,773	92,933
CSSV	42,637	579,857	430,528	133,131
2001				
Total	3,635	1,876,884	1,147,742	669,062
MANU	428	232,708	140,869	81,965
WHRE	835	520,241	317,552	185,608
TRCM	439	201,464	122,960	71,075
FIRE+	400	310,417	192,144	115,147
CSSV	878	463,513	285,626	165,839
Change				
Total	-14,342	1,752,647	474,442	478,841
MANU	-29,528	168,844	17,589	59,846
WHRE	-748	493,090	136,108	133,574
TRCM	1,463	193,062	55,761	51,075
FIRE+	6,931	311,935	94,629	81,255
CSSV	5,189	462,395	144,902	119,315

Notes: FIRE+: Financing, Insurance, Real Estate and Business Services; CSSV: Community, Social and Personal Services; WHRE: Wholesale, Retail and Import/Export Trades, Restaurants and Hotels; TRCM: Transport, Storage and Communications; MANU: Manufacturing.

Table A.2.14 Descriptive Statistics of Labor Accessibility within 30 minutes by Occupational Category, 2001 and 2006 (N=77)

Occupational Categories	Minimum	Maximum	Mean	Std. Deviation
2006				
MNGR	19,685	243,064	181,916	59,850
PROF	12,259	137,704	102,566	33,354
APROF	31,482	358,913	265,158	81,412
CLRK	28,303	372,375	276,093	83,124
SVWK	26,502	356,966	264,863	77,757
CRWK	13,196	177,789	130,752	36,519
PLNT	9,292	124,180	92,197	25,752
ELMT	30,579	405,444	305,401	93,714
2001				
MNGR	288	209,552	133,892	80,886
PROF	28	107,357	67,333	40,387
APROF	462	288,938	176,181	102,837
CLRK	525	311,743	188,335	110,202
SVWK	523	291,179	175,765	101,727
CRWK	687	182,999	108,559	61,929
PLNT	349	127,627	76,442	43,625
ELMT	753	373,544	229,706	134,850
Change				
MNGR	590	197,886	48,024	56,905
PROF	3,610	111,331	35,234	28,529
APROF	3,567	291,319	88,977	74,553
CLRK	5,126	302,046	87,757	79,187
SVWK	7,270	286,041	89,098	73,734
CRWK	-17,704	140,283	22,193	45,587
PLNT	-11,491	97,292	15,755	32,053
ELMT	-12,138	323,144	75,695	95,368

Notes: MNGR: Managers and Administrators; PROF: Professionals; APROF: Associate Professionals; CLRK: Clerks; SVWK: Service Workers and Shop Sales Workers; CRWK: Craft and Related Workers; PLNT: Plant and Machine Operators and Assemblers; ELMT: Elementary Occupations.

Table A.2.15 Descriptive Statistics of Other Candidate Variables for Entry into the Location Models (N=77)

Attributes: Variables	Minimum	Maximum	Mean	Std. Deviation
Territorial Location:				
Ave. Travel Time Distance to CBD [min.]	0.000	61.000	25.208	14.197
Ave. Travel Time Distance to HKIA [min.]	5.000	79.000	45.948	14.704
1/Ave. Travel Time Distance to CBD [min.]	0.016	1.000	0.078	0.134
1/Ave. Travel Time Distance to HKIA [min.]	0.013	0.200	0.026	0.022
Urban Amenity and Regional Institute:				
Area of Leisure Park [ha]	0.000	19.000	1.433	3.904
Area of Public Open Space [ha]	0.000	1.770	0.127	0.357
Area of the Ocean [ha]	0.000	28.763	4.022	7.091
# of Graded Historic Buildings	0.000	27.000	1.909	4.184
Number of Universities	0.000	1.000	0.052	0.223
Transit Service:				
Airport Express Line Station Dummy [0/1]	0.000	1.000	0.039	0.195
LRT Transfer Station Dummy [0/1]	0.000	1.000	0.052	0.223
# of MTR Feeder Bus Lines	0.000	13.000	1.130	2.080
Ave. Distance to Next MTR Stations [km]	0.675	10.455	1.882	1.661

Notes: HKIA: Hong Kong International Airport.

A.3 Location Quotient and Shift-Share Models

Table A.3.1 Weighted Least Squares (WLS) Regression Results: Determinants of Job Location Quotient (LQ) Changes (*100), 2001-2006

Sector i	FIRE+		CSSV		WHRE		TRCM		MANU	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
<u>Urban Agglomeration in 2001</u>										
Total Jobs [1,000]	0.004	0.013			0.002	0.001	-0.009	0.008	-0.008	0.002
Total Labors [1,000]					-0.006	0.000				
Job Mixture Index [0~1]	0.705	0.006								
Labor Mixture Index [0~1]	-2.190	0.011							4.307	0.007
Balance Index in Sector i [0~1]	-0.232	0.004	-0.244	0.003	0.093	0.004	0.479	0.003	0.787	0.000
Job Location Quotient in Sector i			-0.217	0.000	1.221	0.001	-0.468	0.000	0.096	0.016
Labor Location Quotient in Sector i					0.137	0.041	-1.309	0.000	-0.918	0.000
<u>Labor Access in 2001</u>										
Total Labors within 30 min. [10K]	-0.012	0.000	0.007	0.002			0.018	0.007	0.020	0.000
<u>Territorial Location</u>										
ATT Distance to CBD [min.]	0.004	0.090	-0.015	0.000	0.003	0.012	0.019	0.000	0.006	0.017
ATT Distance to HKIA [min.]	-0.008	0.001	0.013	0.000	-0.004	0.001			0.029	0.000
1 / ATT Distance to CBD [min.]									1.139	0.006
1 / ATT Distance to HKIA [min.]			5.638	0.000	-3.948	0.000	20.878	0.000	9.899	0.000
<u>Urban Amenity and Regional Institute</u>										
Area of Leisure Park [ha]									0.061	0.000
Area of POS owned by Private [ha]	-0.322	0.000							-0.254	0.064
Area of the Ocean [ha]	-0.009	0.002	-0.010	0.000					0.013	0.001
Number of GHBs	-0.020	0.064								
Number of Universities			-0.016	0.004					-0.258	0.053
<u>Transit Service</u>										
Ave. Travel Distance to Next MTR Station [km]	-0.040	0.002	0.064	0.000	0.022	0.001	-0.143	0.000		
Airport Express Line Station [1/0]			0.670	0.000	-0.439	0.000			0.351	0.039
LRT Transfer Station [1/0]	-0.264	0.014	0.455	0.000	-0.197	0.000	0.053	0.021		
MTR Feeder Bus Lines									0.057	0.002

(Continued)

Table A.3.1 (Continued)

Sector i	FIRE+		CSSV		WHRE		TRCM		MANU	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
Railway and Property Development										
New MTR Station 1998-2006 [1/0]			0.123	0.022	-0.048	0.006				
Newly Connected MTR Station 1998-2006 [1/0]	0.173	0.009					0.346	0.018		
HO by F.MTRC 1980-1998 [1/0]			-0.319	0.035						
LR by F.MTRC 1980-1998 [1/0]									-0.569	0.000
LR by F.MTRC 1998-2006 [1/0]			-0.385	0.000	0.151	0.000				
LM by F.MTRC 1998-2006 [1/0]	0.113	0.084	-0.914	0.000	0.396	0.000				
(Constant)	2.250	0.009	-0.294	0.067	-1.117	0.003	0.450	0.038	-5.605	0.000
R-Squared	0.857		0.956		0.864		0.829		0.903	
Number of Observations	77		77		77		77		77	

Notes: ATT: Average Travel Time; HKIA: Hong Kong International Airport; POS: Public Open Space; GHBs: Graded Historic Buildings; HO: High-rise Office; MR: Mid-rise Residential; LR: Large-scale Residential; LM: Large-scale Mixed; F. MTRC: Former Mass Transit Railway Corporation; FIRE+: Financing, Insurance, Real Estate and Business Services; CSSV: Community, Social and Personal Services; WHRE: Wholesale, Retail and Import/Export Trades, Restaurants and Hotels; TRCM: Transport, Storage and Communications; MANU: Manufacturing.

Table A.3.2 Weighted Least Squares (WLS) Regression Results: Determinants of Labor Location Quotient (LQ) Changes (*100) by Industrial Sector, 2001-2006

Sector i	FIRE+		CSSV		WHRE		TRCM		MANU	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
Urban Agglomeration in 2001										
Total Jobs [1,000]			-0.001	0.035						
Total Labors [1,000]	0.004	0.001	-0.002	0.014	-0.002	0.032	0.004	0.000		
Labor Mixture Index [0~1]			-1.064	0.006	1.475	0.000	-1.530	0.001		
Housing Mixture Index [0~1]	-0.126	0.000	0.159	0.000	-0.073	0.000	0.119	0.000		
Job Location Quotient in Sector i	0.135	0.000								
Labor Location Quotient in Sector i	-0.397	0.000	-0.345	0.000	-0.211	0.000	-0.330	0.000	-0.384	0.000
Labor Access in 2001										
Total Jobs within 30 min. [10K]			-0.004	0.000	0.001	0.005				
Territorial Location										
ATT Distance to CBD [min.]	-0.006	0.000	-0.002	0.001			0.007	0.000	0.003	0.000
ATT Distance to HKIA [min.]	0.004	0.000	-0.003	0.001	0.002	0.001	-0.006	0.000		
1 / ATT Distance to CBD [min.]	-0.475	0.000			0.211	0.001				
1 / ATT Distance to HKIA [min.]			-1.974	0.000	0.745	0.006	-1.681	0.005		
Urban Amenity and Regional Institute										
Area of Leisure Park [ha]									0.010	0.003
Area of POS owned by Private [ha]			0.053	0.050			-0.060	0.019		
Area of the Ocean [ha]	-0.007	0.000	0.001	0.062						
Number of GHBs									-0.018	0.005
Number of Universities			0.056	0.046	-0.065	0.017	-0.055	0.050	0.161	0.005
Transit Service										
Ave. Travel Distance to Next MTR Station [km]	0.009	0.053			0.017	0.000			-0.021	0.000
LRT Transfer Station [1/0]			-0.116	0.000			0.080	0.006		
MTR Feeder Bus Lines					0.005	0.070				

(Continued)

Table A.3.2 (Continued)

Sector i	FIRE+		CSSV		WHRE		TRCM		MANU	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
Railway and Property Development										
New MTR Station 1998-2006 [1/0]	0.085	0.000	-0.046	0.004					-0.053	0.006
Newly Connected MTR Station 1998-2006 [1/0]	0.093	0.002	0.063	0.002	-0.086	0.000				
LR by F.MTRC 1980-1998 [1/0]	0.054	0.020			-0.029	0.073	0.044	0.019		
LR by F.MTRC 1998-2006 [1/0]	0.077	0.001	-0.039	0.022	-0.063	0.000				
LM by F.MTRC 1998-2006 [1/0]	0.099	0.001			-0.090	0.000	0.096	0.000		
LC by F.KCRC 1998-2006 [1/0]									-0.226	0.034
(Constant)	0.298	0.000	1.627	0.000	-1.283	0.000	1.787	0.000	0.363	0.000
R-Squared	0.895		0.881		0.939		0.985		0.708	
Number of Observations	77		77		77		77		77	

Notes: ATT: Average Travel Time; HKIA: Hong Kong International Airport; POS: Public Open Space; GHBs: Graded Historic Buildings; LR: Large-scale Residential; LM: Large-scale Mixed; LC: Linear-city Commercial; F. MTRC: Former Mass Transit Railway Corporation; F. KCRC: Former Kowloon-Canton Railway Corporation; FIRE+: Financing, Insurance, Real Estate and Business Services; CSSV: Community, Social and Personal Services; WHRE: Wholesale, Retail and Import/Export Trades, Restaurants and Hotels; TRCM: Transport, Storage and Communications; MANU: Manufacturing.

Table A.3.3 Weighted Least Squares (WLS) Regression Results: Determinants of Job Shift-Share (SS) %, 2001-2006

Sector i	Total		FIRE+		CSSV		WHRE		TRCM		MANU	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
Urban Agglomeration in 2001												
Total Jobs [1,000]					3.42	0.001	-2.63	0.000				
Total Labors [1,000]					-3.93	0.009					-2.33	0.002
Job Mixture Index [0~1]	225.68	0.085			720.03	0.000						
Labor Mixture Index [0~1]	-780.16	0.034	-2,714.65	0.005	-1,873.61	0.001			1,281.10	0.000		
Balance Index in Sector i [0~1]	-185.37	0.000	-351.50	0.000	-255.25	0.000	-200.09	0.000	66.32	0.000		
Job Location Quotient in Sector i					50.59	0.002	-95.70	0.008	-30.38	0.000	-13.27	0.045
Labor Location Quotient in Sector i					-141.57	0.042	221.49	0.000	-272.25	0.000	59.68	0.058
Labor Access in 2001												
Total Labors within 30 min. [10K]	-0.54	0.037	-9.37	0.013			-3.21	0.000	1.56	0.054	-4.42	0.000
Territorial Location												
ATT Distance to CBD [min.]							-3.12	0.000				
ATT Distance to HKIA [min.]	-1.79	0.027	-10.03	0.000					3.06	0.000		
1 / ATT Distance to CBD [min.]			-502.24	0.060	-244.85	0.065						
1 / ATT Distance to HKIA [min.]			-4,767.36	0.000	540.18	0.004			4,762.02	0.000		
Urban Amenity and Regional Institute												
Area of Leisure Park [ha]									3.44	0.047		
Area of POS owned by Private [ha]	-64.30	0.013										
Area of the Ocean [ha]			-5.91	0.061	-4.75	0.000					1.44	0.027
Transit Service												
Ave. Travel Distance to Next MTR Station [km]	-12.52	0.018	-29.49	0.054							-15.40	0.000
Airport Express Line Station [1/0]	-121.29	0.037	-293.29	0.066							96.45	0.005
LRT Transfer Station [1/0]									86.53	0.001		

(Continued)

Table A.3.3 (Continued)

Sector i	Total		FIRE+		CSSV		WHRE		TRCM		MANU	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
Railway and Property Development												
New MTR Station 1998-2006 [1/0]	-66.52	0.021	-153.40	0.014			-110.36	0.000			-39.35	0.002
Newly Connected MTR Station 1998-2006 [1/0]							-56.99	0.019				
LR by F.MTRC 1998-2006 [1/0]	291.37	0.000	591.57	0.000	182.36	0.000	208.24	0.000				
LM by F.MTRC 1998-2006 [1/0]	61.98	0.065	194.59	0.016	-96.36	0.014			-49.05	0.003	-69.39	0.000
LC by F.KCRC 1998-2006 [1/0]					-140.75	0.058	-104.26	0.098				
(Constant)	863.87	0.035	3,683.57	0.001	1,486.81	0.008	260.67	0.001	-1,221.13	0.000	78.78	0.026
R-Squared	0.835		0.758		0.917		0.883		0.969		0.811	
Number of Observations	77		77		77		77		77		77	

Notes: ATT: Average Travel Time; HKIA: Hong Kong International Airport; POS: Public Open Space; LR: Large-scale Residential; LM: Large-scale Mixed; LC: Linear-city Commercial; F. MTRC: Former Mass Transit Railway Corporation; F. KCRC: Former Kowloon-Canton Railway Corporation; FIRE+: Financing, Insurance, Real Estate and Business Services; CSSV: Community, Social and Personal Services; WHRE: Wholesale, Retail and Import/Export Trades, Restaurants and Hotels; TRCM: Transport, Storage and Communications; MANU: Manufacturing.

Table A.3.4 Weighted Least Squares (WLS) Regression Results: Determinants of Labor Shift-Share (SS) % by Industrial Sector, 2001-2006

Sector i	Total		FIRE+		CSSV		WHRE		TRCM		MANU	
Variables	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Urban Agglomeration in 2001												
Total Jobs [1,000]							1.94	0.000				
Total Labors [1,000]	-3.06	0.002					-3.18	0.000				
Job Mixture Index [0~1]	-222.89	0.007			-223.40	0.005	-238.52	0.000				
Labor Mixture Index [0~1]											604.03	0.075
Housing Mixture Index [0~1]	57.09	0.001			68.98	0.000	50.16	0.000	38.57	0.018		
Balance Index in Sector i [0~1]	106.98	0.000			165.71	0.000	119.93	0.000				
Labor Location Quotient in Sector i			53.28	0.052			-160.13	0.000	-42.93	0.102	-104.43	0.014
Labor Access in 2001												
Total Jobs within 30 min. [10K]					-2.77	0.000						
Territorial Location												
ATT Distance to CBD [min.]	-2.29	0.001			-2.45	0.000	-1.47	0.012				
ATT Distance to HKIA [min.]	2.16	0.002					1.20	0.018			1.23	0.018
1 / ATT Distance to CBD [min.]							-184.14	0.016				
1 / ATT Distance to HKIA [min.]	892.91	0.001					549.57	0.008	405.45	0.066	1,234.29	0.004
Urban Amenity and Regional Institute												
Area of Leisure Park [ha]							-2.72	0.057				
Area of the Ocean [ha]			-1.52	0.078			-1.70	0.011				
Transit Service												
Ave. Travel Distance to Next MTR Station [km]					5.58	0.004						
Airport Express Line Station [1/0]			-72.64	0.085								
Railway and Property Development												
LR by F.MTRC 1998-2006 [1/0]	79.61	0.000	160.86	0.000			106.18	0.000	92.95	0.000	75.26	0.000
LM by F.MTRC 1998-2006 [1/0]	-47.68	0.028										
LC by F.KCRC 1998-2006 [1/0]							83.62	0.036				
(Constant)	52.01	0.415	-40.28	0.116	147.06	0.019	242.45	0.003	6.93	0.778	-561.44	0.070
R-Squared	0.867		0.795		0.874		0.957		0.662		0.626	
Number of Observations	77		77		77		77		77		77	

Notes: ATT: Average Travel Time; HKIA: Hong Kong International Airport; LR: Large-scale Residential; LM: Large-scale Mixed; LC: Linear-city Commercial; F. MTRC: Former Mass Transit Railway Corporation; F. KCRC: Former Kowloon-Canton Railway Corporation; FIRE+: Financing, Insurance, Real Estate and Business Services; CSSV: Community, Social and Personal Services; WHRE: Wholesale, Retail and Import/Export Trades, Restaurants and Hotels; TRCM: Transport, Storage and Communications; MANU: Manufacturing.

Table A.3.5 Weighted Least Squares (WLS) Regression Results: Determinants of Labor Location Quotient (LQ) Changes (*100) by Occupational Category, 2001-2006

Category i	MNGR		PROF		APROF		CLRK		SVWK	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
Urban Agglomeration in 2001										
Total Jobs [1,000]	0.007	0.000							-0.002	0.090
Total Labors [1,000]	-0.009	0.002					0.003	0.016	0.005	0.049
Job Mixture Index [0~1]	-0.876	0.001								
Labor Mixture Index [0~1]							1.784	0.003		
Total Balance Index [0~1]	-0.249	0.003	-0.384	0.000	-0.144	0.000	0.106	0.004	0.105	0.055
Labor Location Quotient in Category i	-0.113	0.004	-0.309	0.000	-0.234	0.000	-0.458	0.000	-0.157	0.058
Job Access in 2001										
Total Jobs within 30 min. [10K]					-0.001	0.000			-0.001	0.022
Territorial Location										
ATT Distance to CBD [min.]									-0.004	0.014
ATT Distance to HKIA [min.]			-0.007	0.000	-0.008	0.000	-0.003	0.001		
1 / ATT Distance to CBD [min.]					-0.327	0.007				
1 / ATT Distance to HKIA [min.]	-2.846	0.001	-3.797	0.000	-3.114	0.000	-2.320	0.000		
Urban Amenity and Regional Institute										
Area of POS owned by Private [ha]	-0.159	0.067	-0.221	0.013						
Area of the Ocean [ha]	-0.005	0.049					-0.003	0.009		
Number of Universities					0.097	0.043			-0.170	0.023
Transit Service										
Airport Express Line Station [1/0]			-0.417	0.001	-0.303	0.000	0.021	0.000	0.037	0.000
LRT Transfer Station [1/0]					-0.099	0.065				
MTR Feeder Bus Lines			-0.024	0.022	-0.014	0.022				
Railway and Property Development										
New MTR Station 1998-2006 [1/0]							0.086	0.000		
LR by F.MTRC 1980-1998 [1/0]			0.166	0.006	0.059	0.087				
LR by F.MTRC 1998-2006 [1/0]	0.364	0.000	0.414	0.000			-0.146	0.000	-0.189	0.000
LM by F.MTRC 1998-2006 [1/0]	0.339	0.000	0.598	0.000	0.226	0.000			-0.283	0.000
LC by F.KCRC 1998-2006 [1/0]			0.397	0.013						
(Constant)	1.018	0.000	0.964	0.000	0.900	0.000	-1.105	0.021	0.203	0.030
R-Squared	0.851		0.917		0.759		0.879		0.657	
Number of Observations	77		77		77		77		77	

(Continued)

Table A.3.5 (Continued)

Variables / Category i	CRWK		PLNT		ELMT	
	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
Urban Agglomeration in 2001						
Total Jobs [1,000]					0.000	0.024
Total Labors [1,000]	0.005	0.020				
Labor Mixture Index [0~1]	4.655	0.000				
Housing Mixture Index [0~1]	-0.067	0.097	0.117	0.013		
Total Balance Index [0~1]	0.090	0.083	0.194	0.001		
Labor Location Quotient in Category i	-0.193	0.000	-0.229	0.000	-0.603	0.002
Job Access in 2001						
Total Jobs within 30 min. [10K]	0.001	0.001	-0.001	0.000	0.001	0.000
Territorial Location						
ATT Distance to CBD [min.]					0.004	0.059
ATT Distance to HKIA [min.]	0.005	0.000	-0.010	0.000	0.007	0.002
1 / ATT Distance to CBD [min.]					0.352	0.098
1 / ATT Distance to HKIA [min.]	2.974	0.000	-6.290	0.000	5.532	0.000
Urban Amenity and Regional Institute						
Area of POS owned by Private [ha]			0.161	0.023		
Area of the Ocean [ha]					0.007	0.001
Transit Service						
Ave. Travel Distance to Next MTR Station [km]			0.074	0.000	-0.058	0.000
LRT Transfer Station [1/0]	0.228	0.001			0.142	0.077
MTR Feeder Bus Lines					0.018	0.041
Railway and Property Development						
New MTR ST 1998-2006 [1/0]					-0.121	0.004
Newly Connected MTR ST 1998-2006 [1/0]			-0.169	0.001		
LR by F.MTRC 1980-1998 [1/0]					-0.084	0.065
LR by F.MTRC 1998-2006 [1/0]			-0.288	0.000	0.183	0.000
LM by F.MTRC 1998-2006 [1/0]			-0.294	0.000		
(Constant)	-4.530	0.000	0.654	0.000	-0.028	0.911
R-Squared	0.817		0.825		0.857	
Number of Observations	77		77		77	

Notes: ATT: Average Travel Time; HKIA: Hong Kong International Airport; POS: Public Open Space; LR: Large-scale Residential; LM: Large-scale Mixed; F. MTRC: Former Mass Transit Railway Corporation; MNGR: Managers and Administrators; PROF: Professionals; APROF: Associate Professionals; CLRK: Clerks; SVWK: Service Workers and Shop Sales Workers; CRWK: Craft and Related Workers; PLNT: Plant and Machine Operators and Assemblers; ELMT: Elementary Occupations.

Table A.3.6 Weighted Least Squares (WLS) Regression Results: Determinants of Labor Shift-Share (SS) % by Occupational Category, 2001-2006

Category i	MNGR		PROF		APROF		CLRK		SVWK	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
Urban Agglomeration in 2001										
Total Labors [1,000]	-2.6	0.021	-4.0	0.002	-2.7	0.004	-3.0	0.001	0.0	0.041
Job Mixture Index [0~1]	-369.7	0.000	-332.3	0.007	-232.6	0.005	-199.2	0.013	-261.3	0.002
Housing Mixture Index [0~1]	56.2	0.007			56.3	0.001	67.4	0.000	60.7	0.000
Total Balance Index [0~1]	124.5	0.000	105.0	0.006	98.9	0.000	135.9	0.000	169.5	0.000
Labor Location Quotient in Category i	30.0	0.035							-129.5	0.000
Job Access in 2001										
Total Jobs within 30 min. [10K]	0.0	0.020	0.0	0.001						
Territorial Location										
ATT Distance to CBD [min.]	-1.4	0.026	-3.0	0.000	-1.5	0.018	-1.6	0.004	-1.6	0.014
ATT Distance to HKIA [min.]					1.2	0.067	1.1	0.012	2.0	0.004
1 / ATT Distance to HKIA [min.]	-1,175.4	0.000	-1,235.4	0.000	432.5	0.079			1172.5	0.000
Urban Amenity and Regional Institute										
Area of Leisure Park [ha]	-4.4	0.055							-5.1	0.010
Area of the Ocean [ha]	-1.8	0.067	-3.8	0.001			37.5	0.013		
Transit Service										
LRT Transfer Station [1/0]									57.3	0.061
Railway and Property Development										
LR by F.MTRC 1980-1998 [1/0]							-36.2	0.041	-50.8	0.007
LR by F.MTRC 1998-2006 [1/0]	226.3	0.000	238.1	0.000	110.2	0.000	64.4	0.000	95.9	0.000
LM by F.MTRC 1998-2006 [1/0]							-37.6	0.068		
LC by F.KCRC 1998-2006 [1/0]					89.7	0.079				
(Constant)	282.6	0.000	427.8	0.000	89.9	0.161	67.1	0.268	154.9	0.031
R-Squared	0.799		0.782		0.850		0.790		0.916	
Number of Observations	77		77		77		77		77	

(Continued)

Table A.3.6 (Continued)

Category i	CRWK		PLNT		ELMT	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
Urban Agglomeration in 2001						
Total Labors [1,000]	-1.5	0.051	-1.5	0.049	-2.1	0.007
Job Mixture Index [0~1]	-193.2	0.007	-181.1	0.014	-254.3	0.001
Housing Mixture Index [0~1]	49.2	0.001	52.4	0.000	53.7	0.000
Total Balance Index [0~1]	126.0	0.000	125.5	0.000	143.2	0.000
Labor Location Quotient in Category i	-40.7	0.005	-46.8	0.000	-167.1	0.013
Territorial Location						
ATT Distance to CBD [min.]	-1.1	0.047			-2.8	0.000
ATT Distance to HKIA [min.]	1.6	0.008			2.8	0.000
1 / ATT Distance to HKIA [min.]	991.3	0.000			1513.7	0.000
Urban Amenity and Regional Institute						
Area of Leisure Park [ha]	-3.3	0.048	-3.0	0.077	-3.4	0.031
Number of Universities					40.1	0.073
Transit Service						
Ave. Travel Distance to Next MTR Station [km]			7.2	0.000		
LRT Transfer Station [1/0]	48.8	0.062			45.7	0.071
MTR Feeder Bus Lines					4.7	0.096
Railway and Property Development						
LR by F.MTRC 1980-1998 [1/0]	-29.3	0.059	-30.2	0.070	-35.8	0.027
LR by F.MTRC 1998-2006 [1/0]	79.7	0.000	79.2	0.000	73.6	0.000
LM by F.MTRC 1998-2006 [1/0]					-54.9	0.004
(Constant)	41.8	0.485	93.5	0.080	175.4	0.104
R-Squared	0.926		0.883		0.958	
Number of Observations	77		77		77	

Notes: ATT: Average Travel Time; HKIA: Hong Kong International Airport; LR: Large-scale Residential; LM: Large-scale Mixed; F. MTRC: Former Mass Transit Railway Corporation; MNGR: Managers and Administrators; PROF: Professionals; APROF: Associate Professionals; CLRK: Clerks; SVWK: Service Workers and Shop Sales Workers; CRWK: Craft and Related Workers; PLNT: Plant and Machine Operators and Assemblers; ELMT: Elementary Occupations.

Appendix B
Background Statistics on Singapore

B.1 Dendrogram for a Typology among the 38 Government Land Sales Stations

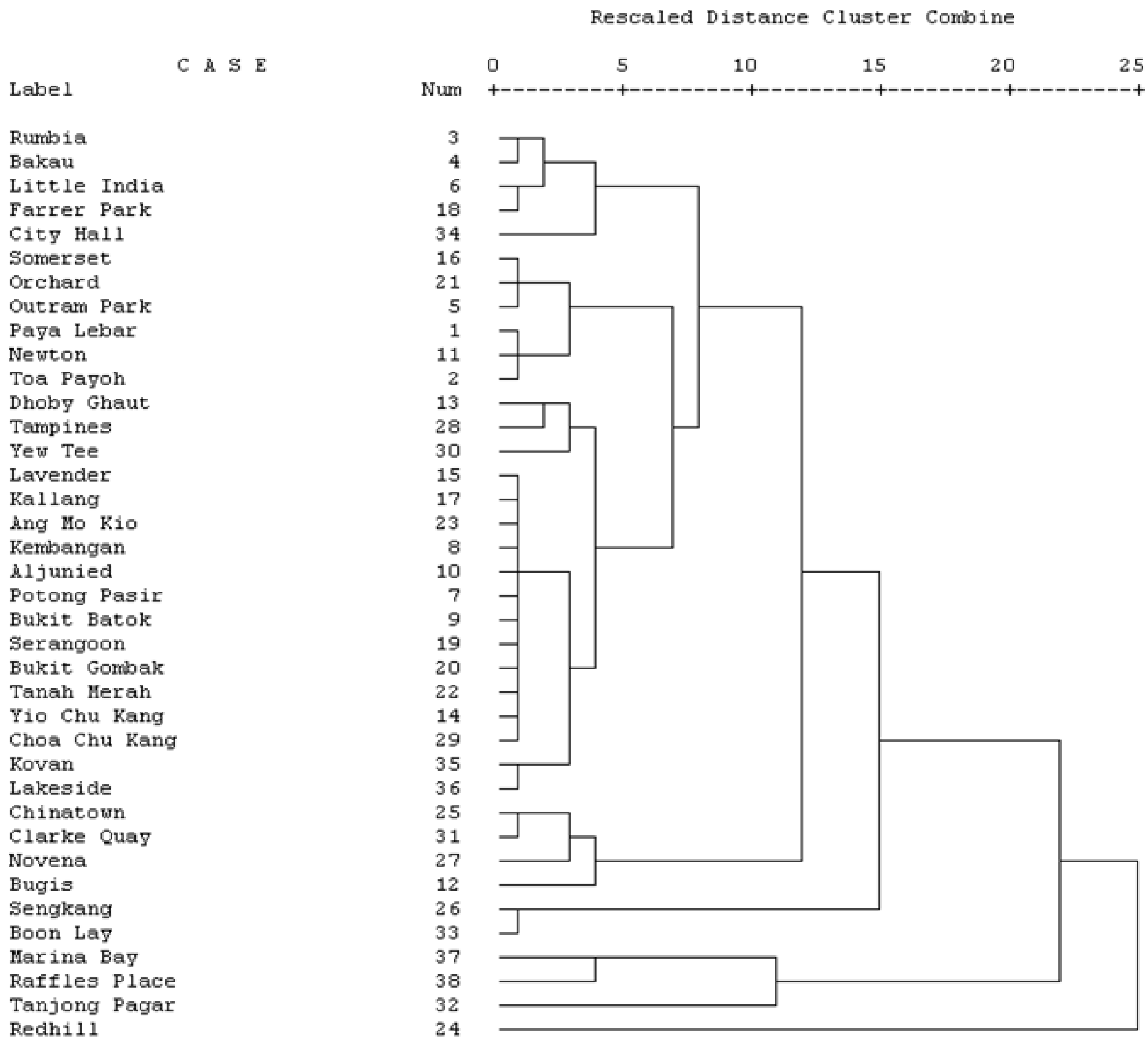

Figure B.1.1 Dendrogram for a Typology among the 38 Government Land Sales Stations

B.2 Descriptive Statistics of Variables for the Hedonic Price Models

Table B.2.1 Descriptive Statistics of Variables for the Residential Property Price Model (N= 4,299)

Attributes: Variables	Minimum	Maximum	Mean	Std. Deviation
Dependent Variable:				
Property Price adjusted by CPI in 2007 [SG$ per sq f]	109	4,515	863	479
ln Property Price adjusted by CPI in 2007 [SG$ per sq f]	4.691	8.415	6.650	0.444
Property Type:				
Property Area [sq f]	31	28,159	173	568
Condominium Dummy [1/0]	0	1	0.598	0.490
Terrace House Dummy [1/0]	0	1	0.088	0.284
Detached House Dummy [1/0]	0	1	0.061	0.239
Land Leasing 999 yrs Dummy [1/0]	0	1	0.080	0.271
Land Leasing 99 yrs Dummy [1/0]	0	1	0.463	0.499
Freehold Dummy [1/0]	0	1	0.455	0.498
New Sale Dummy [1/0]	0	1	0.441	0.497
Sub Sale Dummy [1/0]	0	1	0.127	0.334
HDB Project Dummy [1/0]	0	1	0.346	0.476
Island Location:				
Distance to CBD [m]	354	19,218	8,562	4,402
Distance to CGIA[m]	1,214	32,253	16,067	7,098
Urban Amenity and Public Institute:				
1/Distance to the Nearest Green Space [m]	0.000	0.008	0.001	0.001
1/Distance to the Nearest Coastline [m]	0.000	0.020	0.001	0.002
1/Distance to the Nearest Monumental Building [m]	0.000	0.030	0.001	0.002
1/Distance to the Nearest University [m]	0.000	0.011	0.000	0.001
Intermodal Transit Service:				
Number of Bus Lines to MRT Stations within 2km	0	294	53.238	64.791
Number of MRT Park & Ride Facilities within 2km	0	3	0.645	0.868
Number of Bus Lines to New MRT Stations within 2km	0	66	6.334	15.274
Number of New MRT Park & Ride Facilities within 2km	0	3	0.071	0.376
Railway and Roadway Proximity:				
1/Distance to the Nearest Highway Interchange [m]	0.000	0.015	0.001	0.001
1/Distance to the Nearest Local Arterial [m]	0.000	0.333	0.013	0.028
1/Distance to the Nearest MRT Station before 1997 [m]	0.000	0.125	0.001	0.005
1/Distance to the Nearest New MRT Station in 2007 [m]	0.000	0.008	0.000	0.001
1/Distance to the Nearest New LRT Station in 2007 [m]	0.000	0.011	0.000	0.000
1/Distance to the Nearest Projected MRT Station in 2007 [m]	0.000	0.045	0.000	0.001

Notes: CPI: Consumer Price Index; HDB: Housing and Development Board; CGIA: Singapore Changi Airport.

Table B.2.2 Descriptive Statistics of Variables for the Commercial Property Price Model (N= 2,936)

Attributes: Variables	Minimum	Maximum	Mean	Std. Deviation
Dependent Variable:				
Property Price adjusted by CPI in 2007 [SG$ per sq f]	53	27,702	1,406	1,148
ln Property Price adjusted by CPI in 2007 [SG$ per sq f]	3.968	10.229	7.065	0.578
Property Type:				
Property Area [sq f]	4	50,645	171	1,110
Office Use Dummy [1/0]	0	1	0.365	0.481
Shop Use Dummy [1/0]	0	1	0.414	0.493
Land Leasing 999 yrs Dummy [1/0]	0	1	0.122	0.327
Land Leasing 99 yrs Dummy [1/0]	0	1	0.513	0.500
Freehold Dummy [1/0]	0	1	0.335	0.472
New Sale Dummy [1/0]	0	1	0.067	0.251
Sub Sale Dummy [1/0]	0	1	0.039	0.194
Island Location:				
Distance to CBD [m]	74	16,516	3,470	2,997
Distance to CGIA[m]	1,594	25,300	15,913	3,127
Urban Amenity and Public Institute:				
1/Distance to the Nearest Green Space [m]	0.000	0.013	0.002	0.002
1/Distance to the Nearest Coastline [m]	0.000	0.004	0.001	0.000
1/Distance to the Nearest Monumental Building [m]	0.000	1.000	0.008	0.057
1/Distance to the Nearest University [m]	0.000	0.008	0.001	0.001
Intermodal Transit Service:				
Number of Bus Lines to MRT Stations within 2km	0	294	132.463	82.488
Number of MRT Park & Ride Facilities within 2km	0	2	0.241	0.433
Number of Bus Lines to New MRT Stations within 2km	0	66	22.158	24.718
Number of New MRT Park & Ride Facilities within 2km	0	2	0.017	0.184
Railway and Roadway Proximity:				
1/Distance to the Nearest Highway Interchange [m]	0.000	0.013	0.002	0.001
1/Distance to the Nearest Local Arterial [m]	0.001	1.000	0.032	0.059
1/Distance to the Nearest MRT Station before 1997 [m]	0.000	0.017	0.002	0.003
1/Distance to the Nearest New MRT Station in 2007 [m]	0.000	0.053	0.002	0.005
1/Distance to the Nearest New LRT Station in 2007 [m]	0.000	0.008	0.000	0.000
1/Distance to the Nearest Projected MRT Station in 2007 [m]	0.000	0.025	0.001	0.002

Notes: CPI: Consumer Price Index; HDB: Housing and Development Board; CGIA: Singapore Changi Airport.

Table B.2.3 Descriptive Statistics of Variables for the Industrial Property Price Model (N= 3,587)

Attributes: Variables	Minimum	Maximum	Mean	Std. Deviation
Dependent Variable:				
Property Price adjusted by CPI in 2007 [SG$ per sq f]	1	1,700	278	178
ln Property Price adjusted by CPI in 2007 [SG$ per sq f]	0.076	7.438	5.418	0.702
Property Type:				
Property Area [sq f]	49	138,003	1,170	4,339
Factory Use Dummy [1/0]	0	1	0.922	0.268
Land Leasing 999 yrs Dummy [1/0]	0	1	0.014	0.120
Land Leasing 99 yrs Dummy [1/0]	0	1	0.060	0.237
Land Leasing 60 yrs Dummy [1/0]	0	1	0.580	0.494
Freehold Dummy [1/0]	0	1	0.210	0.408
New Sale Dummy [1/0]	0	1	0.401	0.490
Sub Sale Dummy [1/0]	0	1	0.088	0.283
Island Location:				
Distance to CBD [m]	1,718	25,405	10,865	5,631
Distance to CGIA[m]	1,709	40,398	17,839	8,789
Urban Amenity and Public Institute:				
1/Distance to the Nearest Green Space [m]	0.000	0.003	0.001	0.000
1/Distance to the Nearest Coastline [m]	0.000	0.043	0.001	0.001
1/Distance to the Nearest Monumental Building [m]	0.000	0.004	0.000	0.000
1/Distance to the Nearest University [m]	0.000	0.001	0.000	0.000
Intermodal Transit Service:				
Number of Bus Lines to MRT Stations within 2km	0	288	30.091	24.588
Number of MRT Park & Ride Facilities within 2km	0	3	0.354	0.507
Number of Bus Lines to New MRT Stations within 2km	0	43	1.687	6.165
Number of New MRT Park & Ride Facilities within 2km	0	2	0.031	0.244
Railway and Roadway Proximity:				
1/Distance to the Nearest Highway Interchange [m]	0.000	0.007	0.001	0.001
1/Distance to the Nearest Local Arterial [m]	0.000	1.000	0.004	0.020
1/Distance to the Nearest MRT Station before 1997 [m]	0.000	0.004	0.001	0.000
1/Distance to the Nearest New MRT Station in 2007 [m]	0.000	0.003	0.000	0.000
1/Distance to the Nearest New LRT Station in 2007 [m]	0.000	0.006	0.000	0.000
1/Distance to the Nearest Projected MRT Station in 2007 [m]	0.000	0.012	0.000	0.001

Notes: CPI: Consumer Price Index; HDB: Housing and Development Board; CGIA: Singapore Changi Airport.

Appendix C
Background Statistics on Tokyo

C.1 Dendrogram for a Typology among the 62 Joint Development Areas

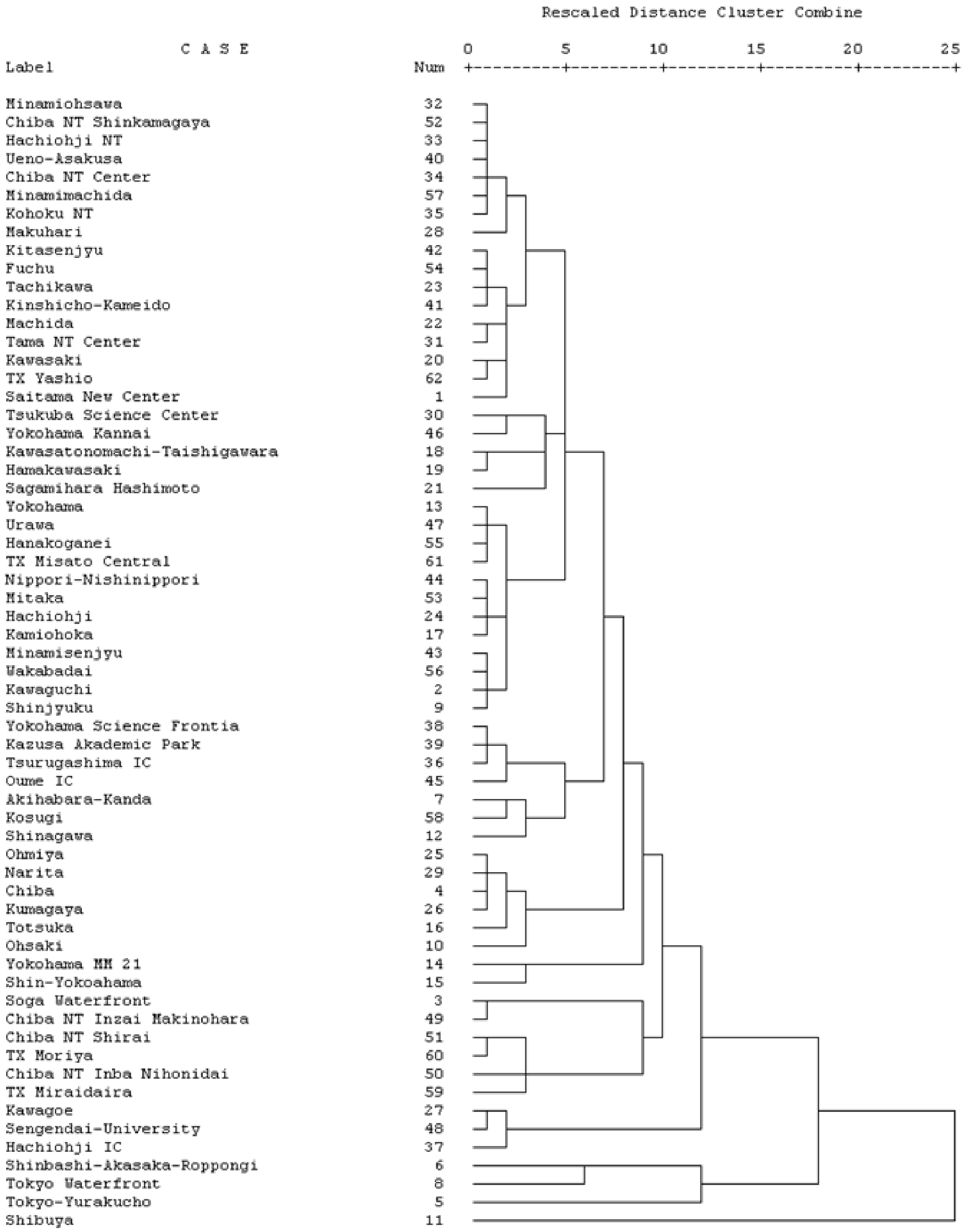

Figure C.1.1 Dendrogram for a Typology among the 62 Joint Development Areas

C.2 Descriptive Statistics of Variables for the Location Models

Table C.2.1 Descriptive Statistics of Job Absolute Number (AN), 2000/01 and 2005/06 (N=107)

Workplace Categories	Minimum	Maximum	Mean	Std. Deviation
2005/06				
Total	65	565,480	3,779,286	35,320
OFFC	31	464,853	2,506,129	23,422
HOME	0	1,815	18,596	174
SCSV	0	21,202	244,245	2,283
RETL	0	90,097	881,927	8,242
FCTY	0	11,007	100,364	938
LGSG	0	7,912	28,036	262
2000/01				
Total	0	548,564	3,457,905	32,317
OFFC	0	445,735	2,257,002	21,093
HOME	0	2,456	26,009	243
SCSV	0	20,469	196,150	1,833
RETL	0	88,525	820,371	7,667
FCTY	0	14,057	131,405	1,228
LGSG	0	3,404	26,968	252
Change				
Total	-21,197	85,899	321,381	3,004
OFFC	-17,162	85,425	249,127	2,328
HOME	-1,715	411	-7,413	-69
SCSV	-1,874	11,091	48,095	449
RETL	-4,378	11,862	61,556	575
FCTY	-7,908	2,417	-31,041	-290
LGSG	-2,912	4,508	1,068	10

Notes: OFFC: Office; HOME: Home Office; SCSV: Social and Community Service; RETL: Retail and Restaurant; FCTY: Factory; LGSG: Logistics and Storage.

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Table C.2.2 Descriptive Statistics of Job Density (DN), 2000/01 and 2005/06 (N=107)

Workplace Categories	Minimum	Maximum	Mean	Std. Deviation
2005/06				
Total	76	170,542	19,670	28,911
OFFC	20	140,194	11,609	21,452
HOME	0	915	111	139
SCSV	0	7,172	1,371	1,593
RETL	0	34,533	6,104	8,071
FCTY	0	3,059	387	529
LGSG	0	984	87	163
2000/01				
Total	0	165,440	18,200	27,306
OFFC	0	134,428	10,496	20,082
HOME	0	1,074	152	196
SCSV	0	6,924	1,159	1,435
RETL	0	29,914	5,690	7,594
FCTY	0	5,792	608	1,022
LGSG	0	996	95	175
Change				
Total	-12,091	16,546	1,470	3,939
OFFC	-9,789	13,895	1,114	3,386
HOME	-667	288	-42	143
SCSV	-743	1,716	212	407
RETL	-2,497	9,753	414	1,393
FCTY	-5,003	1,769	-220	906
LGSG	-878	639	-8	164

Notes: OFFC: Office; HOME: Home Office; SCSV: Social and Community Service; RETL: Retail and Restaurant; FCTY: Factory; LGSG: Logistics and Storage.

Table C.2.3 Descriptive Statistics of Job Location Quotient (LQ), 2000/01 and 2005/06 (N=107)

Workplace Categories		Minimum	Maximum	Mean	Std. Deviation
2005/06					
	OFFC	0.174	2.170	1.056	0.506
	HOME	0.000	3.260	0.517	0.591
	SCSV	0.000	5.465	0.911	0.785
	RETL	0.000	3.175	1.294	0.702
	FCTY	0.000	3.994	0.547	0.912
	LGSG	0.000	18.095	0.855	2.301
2000/01					
	OFFC	0.057	2.280	1.080	0.510
	HOME	0.000	3.784	0.568	0.637
	SCSV	0.001	6.871	0.984	1.049
	RETL	0.002	3.759	1.229	0.717
	FCTY	0.001	3.935	0.635	0.988
	LGSG	0.000	12.340	0.732	1.724
Change					
	OFFC	-0.879	1.210	-0.024	0.284
	HOME	-1.958	1.996	-0.046	0.528
	SCSV	-4.121	2.337	-0.064	0.648
	RETL	-0.647	1.512	0.077	0.360
	FCTY	-3.729	2.193	-0.114	0.658
	LGSG	-4.556	9.153	0.131	1.361

Notes: OFFC: Office; HOME: Home Office; SCSV: Social and Community Service; RETL: Retail and Restaurant; FCTY: Factory; LGSG: Logistics and Storage.

Table C.2.4 Descriptive Statistics of Job Shift-Share (SS) %, 2000/01-2005/06 (N=107)

Workplace Categories	Minimum	Maximum	Mean	Std. Deviation
Total	-61.3	6,500.4	83.2	630.6
OFFC	-66.4	3,096.4	62.5	322.8
HOME	-80.3	12,720.8	150.6	1,232.7
SCSV	-119.6	162,274.9	1,629.9	15,696.0
RETL	-44.1	45,100.4	467.8	4,359.0
FCTY	-86.0	3,414.0	107.2	485.5
LGSG	-84.0	41,616.0	1,097.6	4,730.2

Notes: OFFC: Office; HOME: Home Office; SCSV: Social and Community Service; RETL: Retail and Restaurant; FCTY: Factory; LGSG: Logistics and Storage.

Table C.2.5 Descriptive Statistics of Labor Absolute Number (AN), 2000/01 and 2005/06 (N=107)

Occupational Categories	Minimum	Maximum	Mean	Std. Deviation
2005/06				
Total	0	58,945	664,978	6,215
SKPR	0	13,083	131,437	1,228
MNGR	0	2,421	23,693	221
ADMN	0	15,487	167,947	1,570
SALE	0	12,240	122,334	1,143
SVLB	0	4,802	71,496	668
TRCM	0	1,249	15,557	145
FCLB	0	9,603	121,456	1,135
2000/01				
Total	0	50,906	624,296	5,835
SKPR	0	11,239	116,702	1,091
MNGR	0	2,351	24,558	230
ADMN	0	12,866	149,089	1,393
SALE	0	10,861	120,198	1,123
SVLB	0	4,471	67,317	629
TRCM	0	1,187	15,731	147
FCLB	0	8,853	120,068	1,122
Change				
Total	-1,812	12,037	40,682	380
SKPR	-358	1,989	14,735	138
MNGR	-159	353	-865	-8
ADMN	-225	2,621	18,858	176
SALE	-674	2,161	2,136	20
SVLB	-624	1,646	4,179	39
TRCM	-528	420	-174	-2
FCLB	-1,051	3,615	1,388	13

Notes: SKPR: Skilled Professional; MNGR: Manager; ADMN: Administrator; SALE: Sales Worker; SVLB: Service Worker; TRCM: Transportation and Communication Worker; FCLB: Factory Labor.

Table C.2.6 Descriptive Statistics of Labor Density (DN), 2000/01 and 2005/06 (N=107)

Occupational Categories	Minimum	Maximum	Mean	Std. Deviation
2005/06				
Total	0	11,035	3,505	2,945
SKPR	0	2,564	693	600
MNGR	0	543	124	117
ADMN	0	3,437	927	833
SALE	0	2,212	658	581
SVLB	0	1,865	397	384
TRCM	0	245	75	63
FCLB	0	1,836	583	468
2000/01				
Total	0	12,380	3,418	3,087
SKPR	0	2,955	632	610
MNGR	0	708	139	141
ADMN	0	3,593	840	801
SALE	0	2,471	680	647
SVLB	0	1,860	404	426
TRCM	0	244	75	64
FCLB	0	1,812	600	503
Change				
Total	-1,797	3,144	88	718
SKPR	-391	938	61	183
MNGR	-279	145	-15	48
ADMN	-287	1,014	87	201
SALE	-607	554	-22	160
SVLB	-352	353	-6	94
TRCM	-52	90	0	17
FCLB	-470	776	-17	134

Notes: SKPR: Skilled Professional; MNGR: Manager; ADMN: Administrator; SALE: Sales Worker; SVLB: Service Worker; TRCM: Transportation and Communication Worker; FCLB: Factory Labor.

Table C.2.7 Descriptive Statistics of Labor Location Quotient (LQ), 2000/01 and 2005/06 (N=107)

Occupational Categories		Minimum	Maximum	Mean	Std. Deviation
2005/06					
	SKPR	0.000	2.726	1.169	0.386
	MNGR	0.000	3.633	1.267	0.670
	ADMN	0.027	1.477	1.058	0.217
	SALE	0.000	1.728	1.062	0.223
	SVLB	0.000	2.229	1.021	0.321
	TRCM	0.144	28.715	1.033	2.807
	FCLB	0.000	1.857	0.763	0.375
2000/01					
	SKPR	0.000	2.929	1.099	0.431
	MNGR	0.000	4.469	1.201	0.615
	ADMN	0.000	1.894	1.016	0.209
	SALE	0.000	1.785	1.066	0.257
	SVLB	0.000	3.167	1.140	0.448
	TRCM	0.000	27.612	1.006	2.648
	FCLB	0.000	1.841	0.790	0.372
Change					
	SKPR	-0.645	1.769	0.062	0.241
	MNGR	-0.841	3.199	0.092	0.428
	ADMN	-0.359	0.549	0.050	0.122
	SALE	-0.287	0.364	-0.007	0.092
	SVLB	-0.938	0.214	-0.130	0.213
	TRCM	-0.714	1.102	0.020	0.179
	FCLB	-0.390	0.217	-0.026	0.089

Notes: SKPR: Skilled Professional; MNGR: Manager; ADMN: Administrator; SALE: Sales Worker; SVLB: Service Worker; TRCM: Transportation and Communication Worker; FCLB: Factory Labor.

Table C.2.8 Descriptive Statistics of Labor Shift-Share (SS) %, 2000/01-2005/06 (N=107)

Occupational Categories	Minimum	Maximum	Mean	Std. Deviation
Total	-98.4	8,661.6	112.8	877.0
SKPR	-100.7	24,999.3	273.1	2,429.1
MNGR	-81.7	7,518.3	99.8	750.3
ADMN	-100.6	14,499.3	190.3	1,466.2
SALE	-94.9	13,605.1	153.5	1,329.9
SVLB	-109.2	4,290.8	67.0	516.2
TRCM	-94.1	48,258.7	467.0	4,664.9
FCLB	-95.8	4,804.2	61.4	484.9

Notes: SKPR: Skilled Professional; MNGR: Manager; ADMN: Administrator; SALE: Sales Worker; SVLB: Service Worker; TRCM: Transportation and Communication Worker; FCLB: Factory Labor.

Table C.2.9 Descriptive Statistics of Job and Labor Mixture Indices (MIs) and Job-Labor Balance Index (BI), 2000/01 and 2005/06 (N=107)

	Year	Minimum	Maximum	Mean	Std. Deviation
Job MI					
	2005/06	0.240	0.904	0.593	0.140
	2000/01	0.066	0.923	0.602	0.148
	Change	-0.295	0.290	-0.007	0.089
Labor MI					
	2005/06	0.019	0.899	0.836	0.087
	2000/01	0.000	0.911	0.838	0.090
	Change	-0.053	0.150	-0.002	0.022
Job-Labor BI					
	2005/06	0.000	0.996	0.469	0.304
	2000/01	0.001	1.000	0.482	0.304
	Change	-1.000	0.783	-0.013	0.193

Table C.2.10 Descriptive Statistics of Job Accessibility within 30 minutes by Rail, 2000/01 and 2005/06 (N=107)

Workplace Categories		Minimum	Maximum	Mean	Std. Deviation
2006					
	Total	657	8,769,105	3,184,590	2,976,940
	OFFC	108	5,161,540	1,884,450	1,916,432
	HOME	12	134,503	47,222	37,520
	SCSV	107	764,141	279,388	233,210
	RETL	97	1,993,071	722,311	613,807
	FCTY	11	616,345	215,981	173,695
	LGSG	0	108,518	35,238	30,167
2001					
	Total	616	8,522,762	2,822,759	2,920,449
	OFFC	79	4,892,828	1,629,466	1,826,354
	HOME	30	180,718	58,022	53,416
	SCSV	58	627,049	208,706	196,894
	RETL	145	1,964,775	649,957	619,671
	FCTY	37	740,482	238,619	214,905
	LGSG	0	122,878	37,988	35,130
Change					
	Total	-51,383	5,916,300	361,831	884,831
	OFFC	-21,290	3,690,697	254,984	556,248
	HOME	-46,215	72,049	-10,800	20,890
	SCSV	-248	471,322	70,682	72,866
	RETL	-9,526	1,279,347	72,354	193,951
	FCTY	-127,424	340,431	-22,638	75,713
	LGSG	-17,058	62,454	-2,750	12,544

Notes: OFFC: Office; HOME: Home Office; SCSV: Social and Community Service; RETL: Retail and Restaurant; FCTY: Factory; LGSG: Logistics and Storage.

Table C.2.11 Descriptive Statistics of Job Accessibility within 30 minutes by Road, 2000/01 and 2005/06 (N=107)

Workplace Categories	Minimum	Maximum	Mean	Std. Deviation
2006				
Total	60,998	7,685,832	2,661,757	2,540,025
OFFC	19,562	4,705,828	1,481,376	1,710,747
HOME	466	119,044	48,480	32,383
SCSV	12,950	664,211	253,284	189,927
RETL	15,692	1,627,084	600,151	491,448
FCTY	4,064	509,196	237,960	138,852
LGSG	1,298	101,129	40,504	25,719
2001				
Total	45,416	7,508,704	2,607,210	2,459,296
OFFC	20,915	4,461,594	1,410,563	1,622,331
HOME	826	163,145	63,617	45,634
SCSV	4,997	541,212	202,936	155,711
RETL	14,315	1,623,195	593,962	487,245
FCTY	3,016	618,312	287,442	168,914
LGSG	1,347	108,982	48,690	29,464
Change				
Total	-228,773	282,672	54,547	120,297
OFFC	-42,962	245,761	70,814	93,127
HOME	-46,072	1,947	-15,137	14,144
SCSV	-8,319	124,862	50,348	38,135
RETL	-54,286	74,080	6,189	24,784
FCTY	-127,811	56,271	-49,482	42,514
LGSG	-21,961	2,901	-8,185	6,313

Notes: OFFC: Office; HOME: Home Office; SCSV: Social and Community Service; RETL: Retail and Restaurant; FCTY: Factory; LGSG: Logistics and Storage.

Table C.2.12 Descriptive Statistics of Labor Accessibility within 30 minutes by Rail, 2000/01 and 2005/06 (N=107)

Occupational Categories	Minimum	Maximum	Mean	Std. Deviation
2005/06				
Total	1,013	5,190,577	1,770,052	1,442,735
SKPR	98	898,394	313,496	253,114
MNGR	25	166,872	56,164	49,692
ADMN	206	1,326,029	447,895	369,514
SALE	143	947,991	318,964	265,023
SVLB	111	567,413	192,536	161,389
TRCM	41	152,328	50,111	40,812
FCLB	331	1,067,896	364,407	287,900
2000/01				
Total	1,042	5,191,434	1,630,184	1,483,549
SKPR	86	863,951	280,043	249,988
MNGR	26	194,648	61,213	58,822
ADMN	195	1,269,633	395,998	361,958
SALE	131	989,066	305,612	283,304
SVLB	83	548,284	168,830	161,396
TRCM	49	161,064	48,818	44,755
FCLB	227	1,098,571	347,687	308,763
Change				
Total	-117,010	2,752,077	139,868	427,712
SKPR	-8,747	447,271	33,453	66,730
MNGR	-27,776	89,948	-5,049	17,098
ADMN	-5,756	690,198	51,897	103,010
SALE	-51,238	513,388	13,352	82,573
SVLB	-9,187	309,309	23,706	46,182
TRCM	-10,852	81,454	1,293	14,454
FCLB	-52,298	576,935	16,720	98,414

Notes: SKPR: Skilled Professional; MNGR: Manager; ADMN: Administrator; SALE: Sales Worker; SVLB: Service Worker; TRCM: Transportation and Communication Worker; FCLB: Factory Labor.

Table C.2.13 Descriptive Statistics of Labor Accessibility within 30 minutes by Road, 2000/01 and 2005/06 (N=107)

Occupational Categories	Minimum	Maximum	Mean	Std. Deviation
2005/06				
Total	41,056	4,532,523	1,739,128	1,236,298
SKPR	12,518	803,764	298,492	217,344
MNGR	846	154,010	53,309	44,666
ADMN	8,812	1,156,195	430,625	318,071
SALE	4,701	814,966	303,886	226,093
SVLB	3,769	510,383	187,541	141,015
TRCM	743	140,680	55,135	37,680
FCLB	7,921	911,148	383,785	244,907
2000/01				
Total	38,111	4,715,790	1,760,472	1,279,700
SKPR	11,860	798,390	292,160	215,049
MNGR	812	183,277	63,813	52,487
ADMN	7,576	1,139,190	418,984	310,419
SALE	4,371	880,754	319,473	243,240
SVLB	3,201	511,698	177,475	142,640
TRCM	774	159,706	59,472	42,542
FCLB	7,784	1,007,192	404,766	268,651
Change				
Total	-206,103	127,607	-21,344	69,149
SKPR	-23,993	49,324	6,332	10,288
MNGR	-30,370	213	-10,504	8,122
ADMN	-11,863	61,494	11,641	13,862
SALE	-68,912	12,875	-15,587	19,792
SVLB	-6,676	38,269	10,066	10,237
TRCM	-19,026	3,637	-4,337	5,429
FCLB	-96,044	30,368	-20,982	28,309

Notes: SKPR: Skilled Professional; MNGR: Manager; ADMN: Administrator; SALE: Sales Worker; SVLB: Service Worker; TRCM: Transportation and Communication Worker; FCLB: Factory Labor.

Table C.2.14 Descriptive Statistics of Other Candidate Variables for Entry into the Location Models (N=107)

Attributes: Variables	Minimum	Maximum	Mean	Std. Deviation
Urban Agglomeration Pattern, 2000/01 :				
Strategic Development Area (SDA) Size [sq km]	0.10	31.09	3.07	4.38
Megalopolis Location:				
Ave. Travel Time Distance to CBD [min.]	1	92	43	20
Ave. Travel Time Distance to NIA [min.]	1	161	96	26
Ave. Travel Time Distance to HNA [min.]	1	145	63	25
1/Ave. Travel Time Distance to CBD [min.]	0.011	1.000	0.041	0.098
1/Ave. Travel Time Distance to NIA [min.]	0.006	1.000	0.021	0.096
1/Ave. Travel Time Distance to HNA [min.]	0.007	1.000	0.028	0.095
Public Institute:				
Number of National Government Offices	0	28	2.50	4.96
Number of Local Government Offices	0	8	0.95	1.53
Number of Public Research Institutes	0	46	1.89	5.32
Number of University Departments	0	11	0.75	2.10
Number of Public Cultural Facilities	0	14	1.31	2.18
Transportation Infrastructure, 2000/01:				
Density of Highway [m/100ha]	0	3,018	260	566
Density of National Roadway [m/100ha]	0	2,802	482	616
Density of Local Arterial [m/100ha]	0	5,852	2,323	1,453
Number of HSR Stations	0	2	0.07	0.32
Number of CRT Stations	0	15	2.35	2.57
Number of Subway Stations	0	28	1.09	3.76
Number of LRT Stations	0	11	0.30	1.36
Transportation Investment, 2000-2006:				
Number of New HSR Stations	0	1	0.01	0.10
Number of New CRT Stations	0	2	0.21	0.43
Number of New Subway Stations	0	9	0.26	1.11
Number of New LRT Stations	0	1	0.02	0.14
Proportion of New Pedestrian Space in SDA [%]	0	38.77	2.15	4.60

Notes: NIA: Narita International Airport; HNA: Haneda Airport.

C.3 Descriptive Statistics of Variables for the Hedonic Price Models

Table C.3.1 Descriptive Statistics of Variables for the Residential Land Price Model (N= 4,404)

Attributes: Variables	Minimum	Maximum	Mean	Std. Deviation
Dependent Variable:				
Land Price adjusted by CPI in FY2007 [JPY/sq m]	12,400	3,150,000	313,858	228,750
ln Land Price adjusted by CPI in FY2007 [JPY/sq m]	9.425	14.963	12.458	0.634
Land Parcel:				
Land Area [sq m]	43	2,045	198	135
Maximum FAR [%]	0	600	167	74
Strategic Development Area (SDA) Size [sq km]	0.10	15.57	1.85	2.34
1/Distance to the Nearest Coastline [m]	1.53E-05	5.38E-03	1.87E-04	3.57E-04
1/Distance to the Nearest River [m]	1.06E-04	2.50E-01	1.43E-03	5.91E-03
Urban Agglomeration Pattern, 2000/01:				
Total Job Density	0	88,157	19,352	19,328
Total Labor Density	0	12,380	4,530	3,078
Job Mixture Index [0~1]	0.000	0.923	0.588	0.126
Labor Mixture Index [0~1]	0.000	0.911	0.833	0.109
SKPR Location Quotient	0.000	2.929	1.207	0.357
MNGR Location Quotient	0.000	4.469	1.252	0.576
ADMN Location Quotient	0.000	1.894	1.067	0.210
SALE Location Quotient	0.000	1.785	1.105	0.224
SVLB Location Quotient	0.000	2.242	1.110	0.359
TRCM Location Quotient	0.000	2.521	0.618	0.377
FCLB Location Quotient	0.000	1.857	0.672	0.301
Job Access, 2000/01:				
Total Jobs with 30 min. by Rail + Road	52,962	16,324,613	6,363,637	5,027,967
Job Accessibility MAG [+1~-1]	-0.996	0.818	0.006	0.319
Megalopolis Location:				
Ave. Travel Time Distance to CBD [min.]	1	92	42	18
Ave. Travel Time Distance to NIA [min.]	8	161	99	23
Ave. Travel Time Distance to HNA [min.]	15	145	63	22
Public Institute:				
Number of National Government Offices	0	28	2.43	4.85
Number of Local Government Offices	0	8	1.12	1.58
Number of Public Research Institutes	0	46	1.67	4.90
Number of University Departments	0	11	0.58	1.76
Number of Public Cultural Facilities	0	14	1.25	1.98
Transportation Infrastructure, 2000/01:				
1/Distance to the Nearest Highway Interchange [m]	6.80E-05	9.09E-02	1.16E-03	2.43E-03
1/Distance to the Nearest National Roadway [m]	1.35E-04	2.00E-01	2.65E-03	8.24E-03
1/Distance to the Nearest Local Arterial [m]	1.03E-03	1.00E+00	2.26E-02	7.02E-02
1/Distance to the Nearest HSR Station [m]	1.97E-05	2.26E-03	1.35E-04	1.97E-04
1/Distance to the Nearest CRT Station [m]	1.05E-04	2.44E-02	1.67E-03	1.46E-03
1/Distance to the Nearest Subway Station [m]	2.20E-05	8.93E-03	6.21E-04	1.02E-03
1/Distance to the Nearest LRT Station [m]	2.20E-05	7.25E-03	2.52E-04	4.98E-04
Transportation Investment, 2000-2006:				
1/Distance to the Nearest New HSR Station [m]	0.00E+00	1.68E-03	3.58E-05	8.79E-05
1/Distance to the Nearest New CRT Station [m]	0.00E+00	5.59E-03	1.09E-04	3.11E-04
1/Distance to the Nearest New Subway Station [m]	0.00E+00	9.62E-03	1.23E-04	4.59E-04
1/Distance to the Nearest New LRT Station [m]	0.00E+00	3.77E-03	4.66E-05	1.64E-04
Proportion of New Pedestrian Space in SDA [%]	0.00	38.77	0.79	2.71

Notes: CPI: Consumer Price Index; SKPR: Skilled Professional; MNGR: Manager; ADMN: Administrator; SALE: Sales Worker; SVLB: Service Worker; TRCM: Transportation and Communication Worker; FCLB: Factory Labor; NIA: Narita International Airport; HNA: Haneda Airport; MAG: Modal Accessibility Gap.

Table C.3.2 Descriptive Statistics of Variables for the Commercial Land Price Model (N= 1,802)

Attributes: Variables	Minimum	Maximum	Mean	Std. Deviation
Dependent Variable:				
Land Price adjusted by CPI in FY2007 [JPY/sq m]	40,900	30,600,000	2,398,584	3,586,354
ln Land Price adjusted by CPI in FY2007 [JPY/sq m]	10.619	17.237	14.035	1.103
Land Parcel:				
Land Area [sq m]	41	18,088	501	988
Maximum FAR [%]	200	1,300	574	191
Strategic Development Area (SDA) Size [sq km]	0.10	15.57	2.07	1.92
1/Distance to the Nearest Coastline [m]	1.55E-05	2.22E-02	4.43E-04	1.22E-03
1/Distance to the Nearest River [m]	1.47E-04	7.14E-02	1.57E-03	4.10E-03
Urban Agglomeration Pattern, 2000/01:				
Total Job Density	0	88,157	24,239	24,693
Total Labor Density	0	12,380	3,906	3,123
Job Mixture Index [0~1]	0.000	0.923	0.474	0.132
Labor Mixture Index [0~1]	0.000	0.911	0.825	0.155
Job-Labor Balance Index [0~1]				
OFFC Location Quotient	0.000	2.170	1.564	0.462
HOME Location Quotient	0.000	3.260	0.228	0.296
SCSV Location Quotient	0.000	2.974	0.570	0.342
RETL Location Quotient	0.000	3.113	0.970	0.559
FCTY Location Quotient	0.000	3.994	0.193	0.484
LGSG Location Quotient	0.000	18.095	0.241	0.890
Labor Access, 2000/01:				
Total Labors with 30 min. by Rail + Road	196,064	9,731,018	6,056,724	2,922,637
Labor Accessibility MAG [+1~-1]	-0.972	0.406	-0.001	0.166
Megalopolis Location:				
Ave. Travel Time Distance to CBD [min.]	1	92	25.03	19.66
Ave. Travel Time Distance to NIA [min.]	8	161	84.44	20.89
Ave. Travel Time Distance to HNA [min.]	19	145	48.94	20.03
Public Institute:				
Number of National Government Offices	0	28	5.58	7.31
Number of Local Government Offices	0	8	1.62	1.55
Number of Public Research Institutes	0	46	7.02	11.19
Number of University Departments	0	11	1.83	3.09
Number of Public Cultural Facilities	0	14	3.37	3.70
Transportation Infrastructure, 2000/01:				
1/Distance to the Nearest Highway Interchange [m]	1.29E-04	3.33E-01	5.19E-03	1.62E-02
1/Distance to the Nearest National Roadway [m]	1.40E-04	1.00E+00	2.24E-02	6.56E-02
1/Distance to the Nearest Local Arterial [m]	1.13E-03	1.00E+00	4.77E-02	9.68E-02
1/Distance to the Nearest HSR Station [m]	2.02E-05	7.94E-03	4.61E-04	7.88E-04
1/Distance to the Nearest CRT Station [m]	1.35E-04	3.13E-02	4.10E-03	4.01E-03
1/Distance to the Nearest Subway Station [m]	2.23E-05	5.26E-02	3.56E-03	5.48E-03
1/Distance to the Nearest LRT Station [m]	2.24E-05	1.61E-02	7.71E-04	1.48E-03
Transportation Investment, 2000-2006:				
1/Distance to the Nearest New HSR Station [m]	0.00E+00	4.55E-03	8.07E-05	2.60E-04
1/Distance to the Nearest New CRT Station [m]	0.00E+00	1.37E-02	2.72E-04	8.09E-04
1/Distance to the Nearest New Subway Station [m]	0.00E+00	2.56E-02	7.29E-04	1.65E-03
1/Distance to the Nearest New LRT Station [m]	0.00E+00	4.63E-03	3.65E-05	2.25E-04
Proportion of New Pedestrian Space in SDA [%]	0.00	38.77	0.81	1.96

Notes: CPI: Consumer Price Index; OFFC: Office; HOME: Home Office; SCSV: Social and Community Service; RETL: Retail and Restaurant; FCTY: Factory; LGSG: Logistics and Storage NIA: Narita International Airport; HNA: Haneda Airport; MAG: Modal Accessibility Gap.

Table C.3.3 Descriptive Statistics of Variables for the Mixed Land Price Model (N= 1,640)

Attributes: Variables	Minimum	Maximum	Mean	Std. Deviation
Dependent Variable:				
Land Price adjusted by CPI in FY2007 [JPY/sq m]	35,300	10,400,000	811,806	845,368
ln Land Price adjusted by CPI in FY2007 [JPY/sq m]	10.472	16.157	13.292	0.760
Land Parcel:				
Land Area [sq m]	51	1607	182	130
Maximum FAR [%]	80	800	416	147
Strategic Development Area (SDA) Size [sq km]	0.10	13.85	1.72	1.79
1/Distance to the Nearest Coastline [m]	1.53E-05	1.75E-02	3.36E-04	8.68E-04
1/Distance to the Nearest River [m]	1.05E-04	5.00E-01	1.98E-03	1.76E-02
Urban Agglomeration Pattern, 2000/01:				
Total Job Density	0	88,157	24,715	22,439
Total Labor Density	0	12,380	4,873	3,159
Job Mixture Index [0~1]	0.000	0.923	0.531	0.128
Labor Mixture Index [0~1]	0.000	0.911	0.843	0.101
SKPR Location Quotient	0.000	1.914	1.097	0.327
MNGR Location Quotient	0.000	4.469	1.571	0.794
ADMN Location Quotient	0.000	1.894	1.032	0.199
SALE Location Quotient	0.000	1.785	1.160	0.240
SVLB Location Quotient	0.000	3.167	1.338	0.470
TRCM Location Quotient	0.000	2.521	0.570	0.386
FCLB Location Quotient	0.000	1.857	0.619	0.270
Job Access in 2000/01:				
Total Jobs with 30 min. by Rail + Road	223,959	16,324,613	10,243,025	5,271,231
Job Accessibility MAG [+1~-1]	-0.989	0.818	0.054	0.221
Megalopolis Location:				
Ave. Travel Time Distance to CBD [min.]	1	92	27.75	19.05
Ave. Travel Time Distance to NIA [min.]	8	161	88.08	21.16
Ave. Travel Time Distance to HNA [min.]	19	145	49.26	20.77
Public Institute:				
Number of National Government Offices	0	28	3.72	6.33
Number of Local Government Offices	0	8	1.46	1.54
Number of Public Research Institutes	0	46	4.04	7.91
Number of University Departments	0	10	1.19	2.59
Number of Public Cultural Facilities	0	14	2.21	2.84
Transportation Infrastructure, 2000/01:				
1/Distance to the Nearest Highway Interchange [m]	1.11E-04	2.50E-01	2.67E-03	1.02E-02
1/Distance to the Nearest National Roadway [m]	1.60E-04	3.33E-01	9.22E-03	3.10E-02
1/Distance to the Nearest Local Arterial [m]	1.59E-03	1.00E+00	6.50E-02	1.22E-01
1/Distance to the Nearest HSR Station [m]	2.01E-05	2.22E-02	3.23E-04	1.01E-03
1/Distance to the Nearest CRT Station [m]	1.34E-04	4.76E-02	3.70E-03	4.18E-03
1/Distance to the Nearest Subway Station [m]	2.20E-05	5.26E-02	2.73E-03	6.41E-03
1/Distance to the Nearest LRT Station [m]	2.22E-05	1.61E-02	5.11E-04	1.17E-03
Transportation Investment, 2000-2006:				
1/Distance to the Nearest New HSR Station [m]	0.00E+00	1.18E-03	6.04E-05	1.13E-04
1/Distance to the Nearest New CRT Station [m]	0.00E+00	2.27E-02	3.01E-04	1.11E-03
1/Distance to the Nearest New Subway Station [m]	0.00E+00	2.94E-02	4.71E-04	1.53E-03
1/Distance to the Nearest New LRT Station [m]	0.00E+00	7.14E-03	3.89E-05	2.25E-04
Proportion of New Pedestrian Space in SDA [%]	0.00	11.40	0.74	1.70

Notes: CPI: Consumer Price Index; SKPR: Skilled Professional; MNGR: Manager; ADMN: Administrator; SALE: Sales Worker; SVLB: Service Worker; TRCM: Transportation and Communication Worker; FCLB: Factory Labor; NIA: Narita International Airport; HNA: Haneda Airport; MAG: Modal Accessibility Gap.

Table C.3.4 Descriptive Statistics of Variables for the Industrial Land Price Model (N= 391)

Attributes: Variables	Minimum	Maximum	Mean	Std. Deviation
Dependent Variable:				
Land Price adjusted by CPI in FY2007 [JPY/sq m]	24,500	5,000,000	414,258	528,780
ln Land Price adjusted by CPI in FY2007 [JPY/sq m]	10.106	15.425	12.573	0.818
Land Parcel:				
Land Area [sq m]	46	66,549	1,798	6,143
Maximum FAR [%]	100	700	278	119
Strategic Development Area (SDA) Size [sq km]	0.10	12.36	1.84	2.11
1/Distance to the Nearest Coastline [m]	2.11E-05	5.00E-02	8.63E-04	4.06E-03
1/Distance to the Nearest River [m]	1.62E-04	2.22E-02	1.53E-03	2.62E-03
Urban Agglomeration Pattern, 2000/01:				
Total Job Density	0	88,157	20,502	20,205
Total Labor Density	0	10,843	4,724	3,136
Job Mixture Index [0~1]	0.000	0.923	0.570	0.136
Labor Mixture Index [0~1]	0.000	0.911	0.835	0.132
OFFC Location Quotient	0.000	2.170	1.200	0.507
HOME Location Quotient	0.000	2.226	0.448	0.502
SCSV Location Quotient	0.000	2.001	0.621	0.379
RETL Location Quotient	0.000	3.175	1.188	0.695
FCTY Location Quotient	0.000	3.994	0.604	0.976
LGSG Location Quotient	0.000	18.095	0.671	1.578
Labor Access, 2000/01:				
Total Labors with 30 min. by Rail + Road	270,054	9,731,018	5,346,262	2,863,031
Labor Accessibility MAG [+1~-1]	-0.985	0.291	-0.048	0.290
Megalopolis Location:				
Ave. Travel Time Distance to CBD [min.]	1	92	30.36	19.97
Ave. Travel Time Distance to NIA [min.]	52	161	89.16	21.39
Ave. Travel Time Distance to HNA [min.]	19	114	51.02	19.60
Public Institute:				
Number of National Government Offices	0	13	2.08	3.55
Number of Local Government Offices	0	8	1.24	1.59
Number of Public Research Institutes	0	19	1.42	2.60
Number of University Departments	0	11	0.94	2.50
Number of Public Cultural Facilities	0	10	1.24	1.76
Transportation Infrastructure, 2000/01:				
1/Distance to the Nearest Highway Interchange [m]	1.29E-04	5.88E-02	2.83E-03	6.50E-03
1/Distance to the Nearest National Roadway [m]	1.41E-04	1.00E+00	1.65E-02	8.77E-02
1/Distance to the Nearest Local Arterial [m]	9.21E-04	5.00E-01	2.54E-02	5.10E-02
1/Distance to the Nearest HSR Station [m]	2.81E-05	8.91E-04	1.97E-04	1.97E-04
1/Distance to the Nearest CRT Station [m]	2.29E-04	7.75E-03	1.62E-03	1.09E-03
1/Distance to the Nearest Subway Station [m]	3.14E-05	7.58E-03	1.00E-03	1.37E-03
1/Distance to the Nearest LRT Station [m]	3.96E-05	7.14E-03	5.55E-04	7.27E-04
Transportation Investment, 2000-2006:				
1/Distance to the Nearest New HSR Station [m]	0.00E+00	1.03E-03	5.17E-05	1.13E-04
1/Distance to the Nearest New CRT Station [m]	0.00E+00	4.26E-03	2.44E-04	5.62E-04
1/Distance to the Nearest New Subway Station [m]	0.00E+00	4.31E-03	2.17E-04	6.10E-04
1/Distance to the Nearest New LRT Station [m]	0.00E+00	1.88E-03	2.62E-05	1.03E-04
Proportion of New Pedestrian Space in SDA [%]	0.00	9.72	0.51	1.41

Notes: CPI: Consumer Price Index; OFFC: Office; HOME: Home Office; SCSV: Social and Community Service; RETL: Retail and Restaurant; FCTY: Factory; LGSG: Logistics and Storage NIA: Narita International Airport; HNA: Haneda Airport; MAG: Modal Accessibility Gap.

C.4 Location Quotient and Shift-Share Models

Table C.4.1 Ordinary Least Squares (OLS) Regression Results: Determinants of ln Job Location Quotient (LQ) Growth Rates, 2000/01-2005/06

Category i	OFFC		HOME		SCSV		RETL		FCTY		LGSG	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
Urban Agglomeration, 2000/01												
ln Total Labors [10K]	-0.075	0.000	0.350	0.000	0.176	0.000			0.232	0.001		
ln Job Mixture Index [0~1]					-1.217	0.000					1.011	0.053
ln Labor Mixture Index [0~1]	0.124	0.049			0.203	0.034	-0.177	0.010	-0.586	0.000		
ln Job Location Quotient in Category i	-0.424	0.000	-0.533	0.000	-0.373	0.000	-0.303	0.000	-0.276	0.000	-0.498	0.000
Labor Access, 2000/2001												
ln Labors in 30min by Rail [100K]					-0.119	0.000	0.066	0.000	-0.126	0.013		
Megalopolis Location												
ln ATT Distance to CBD [min.]			0.346	0.026								
ln ATT Distance to HNA [min.]	-0.243	0.001					0.193	0.021				
Regional Institute												
ln # of Local Government Offices			-0.105	0.010			0.046	0.003				
ln # of University Departments			-0.123	0.008								
ln # of Public Cultural Facilities	0.040	0.003					-0.067	0.000				
Transportation Infrastructure, 2000/01												
ln National Roadway [km/100ha]					-0.099	0.000					0.094	0.083
ln Local Roadway [km/100ha]	0.107	0.000	-0.125	0.082			-0.069	0.006	-0.179	0.014		
ln # of CRT Stations											-0.179	0.017
ln # of LRT Stations									-0.142	0.036		
Transportation Investment, 2000-2006												
ln # of New CRT Stations			0.139	0.008								
ln New Pedestrian Space [%]					0.025	0.069	-0.015	0.051				

(Continued)

Table C.4.1 (Continued)

Category i	OFFC		HOME		SCSV		RETL		FCTY		LGSG	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
Joint Development, 2000-2006												
SP Type [1/0]							0.445	0.023				
SS Type [1/0]							0.675	0.000	-0.939	0.069		
LS Type [1/0]	-0.649	0.007					1.558	0.000			2.750	0.018
MR Type [1/0]							0.174	0.015				
MM Type [1/0]												
LM Type [1/0]									1.924	0.007		
LO Type [1/0]			-0.700	0.063	-0.585	0.017						
LC Type [1/0]												
(Constant)	1.757	0.000	-1.200	0.177	8.208	0.000	1.607	0.000	5.673	0.000	-4.713	0.164
R-Squared	0.503		0.354		0.544		0.710		0.348		0.326	
Number of Observations*	106		106		106		106		106		106	

Notes:*One of the 107 SDAs had no job in 2000/01 and 2005/06.

OFFC: Office; HOME: Home Office; SCSV: Social and Community Service; RETL: Retail and Restaurant; FCTY: Factory; LGSG: Logistics and Storage; ATT: Average Travel Time; HNA: Haneda Airport; SP: Small-scale Pubic; SS: Small-scale Shopping; LS: Large-scale Shopping; MR: Mid-scale Residential; MM: Mid-scale Mixed; LM: Large-scale Mixed; LO: Large-scale Office; LC: Large-scale Commercial.

Table C.4.2 Ordinary Least Squares (OLS) Regression Results: Determinants of Job Shift-Share (SS) %, 2000/01-2005/06

Category i	Total		OFFC		HOME		SCSV		RETL		FCTY		LGSG	
Variables	**Beta**	**Prob.**	**Beta**	**Prob.**	**Beta**	**Prob.**	**Beta**	**Prob.**	**Beta**	**Prob.**	**Beta**	**Prob.**	**Beta**	**Prob.**
Urban Agglomeration, 2000/01														
Total Job Density [1,000]											0.352	0.009		
Total Labor Density [1,000]	0.251	0.007												
Job Mixture Index [0~1]	0.205	0.016	0.135	0.043	-0.274	0.000	-0.250	0.000	-0.118	0.088			-0.263	0.003
Job Location Quotient in Category i							-0.166	0.005	-0.142	0.043	-0.183	0.035		
MNGR Location Quotient			0.106	0.098							-0.821	0.000		
Megalopolis Location														
ATT Distance to CBD [min.]	0.327	0.002											-0.290	0.011
ATT Distance to NIA [min.]					0.153	0.012	0.199	0.001						
ATT Distance to HNA [min.]	-0.197	0.021												
1/ATT Distance to CBD [min.]													-0.877	0.018
1/ATT Distance to HNA [min.]											-0.392	0.045		
Regional Institute														
# of Public Research Institutes	0.290	0.012											-0.297	0.015
Transportation Infrastructure, 2000/01														
Highway [km/100ha]	0.507	0.000											0.182	0.059
Local Arterial [km/100ha]											-0.217	0.012		
# of HSR Stations	0.190	0.047												
# of CRT Stations	-0.177	0.061												
# of Subway Stations	-0.431	0.003									-0.328	0.016		
# of LRT Stations	0.149	0.066									-0.230	0.094	-0.318	0.017
Transportation Investment, 2000-2006														
# of New CRT Stations			-0.272	0.000					-0.124	0.084				
# of New LRT Stations											0.226	0.005	0.232	0.006
New Pedestrian Space [%]	0.326	0.000	0.706	0.000	0.717	0.000	0.744	0.000						

(Continued)

Table C.4.2 (Continued)

Category i	Total		OFFC		HOME		SCSV		RETL		FCTY		LGSG	
Variables	**Beta**	**Prob.**	**Beta**	**Prob.**	**Beta**	**Prob.**	**Beta**	**Prob.**	**Beta**	**Prob.**	**Beta**	**Prob.**	**Beta**	**Prob.**
Joint Development, 2000-2006														
SS Type [1/0]			0.225	0.000										
LS Type [1/0]	0.142	0.067							0.697	0.000			0.566	0.000
MM Type [1/0]							-0.104	0.063						
LM Type [1/0]											0.320	0.000		
LW Type [1/0]											0.320	0.034	0.308	0.050
LO Type [1/0]	0.394	0.000	0.324	0.000										
LC Type [1/0]													0.716	0.033
R-Squared	0.518		0.667		0.675		0.716		0.545		0.508		0.467	
Number of Observations*	106		106		106		106		106		106		106	

Note:*One of the 107 Strategic Development Areas had no job in 2000/01 and 2005/06.

OFFC: Office; HOME: Home Office; SCSV: Social and Community Service; RETL: Retail and Restaurant; FCTY: Factory; LGSG: Logistics and Storage; ATT: Average Travel Time; NIA: Narita International Airport; HNA: Haneda Airport; SS: Small-scale Shopping; LS: Large-scale Shopping; LM: Large-scale Mixed; LW: Large-scale Waterfront; LO: Large-scale Office; LC: Large-scale Commercial.

Table C.4.3 Ordinary Least Squares (OLS) Regression Results: Determinants of ln Labor Location Quotient (LQ) Growth Rates, 2000/01-2005/06

Category j	Total		SKPR		MNGR		ADMN	
Variables	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**	**Coeff.**	**Prob.**
Urban Agglomeration, 2000/01								
ln Total Labor Density [1,000]	-0.007	0.001	0.511	0.000	0.435	0.000	0.470	0.000
ln Job Mixture Index [0~1]			-0.647	0.007	-1.175	0.000	-0.490	0.020
ln Labor Mixture Index [0~1]			0.253	0.088	0.843	0.000	0.491	0.072
ln Labor Location Quotient in Category j			-0.914	0.000	-1.412	0.000	-1.372	0.000
Job Access, 2000/2001								
ln Jobs in 30min by Rail [100K]	-0.004	0.027						
Megalopolis Location								
ln ATT Distance to CBD [min.]	-0.018	0.000	0.641	0.000			0.542	0.000
ln ATT Distance to NIA [min.]	0.008	0.048						
ln ATT Distance to HNA [min.]	0.008	0.078						
Regional Institute								
ln # of National Government Offices							-0.041	0.053
ln # of Local Government Offices	-0.002	0.063						
ln # of University Departments			0.060	0.063				
Transportation Infrastructure, 2000/01								
ln Highway [km/100ha]			0.076	0.007	0.079	0.002	0.087	0.001
ln National Roadway [km/100ha]			0.043	0.029	0.062	0.005	0.051	0.007
ln # of HSR Stations	-0.005	0.027	-0.201	0.020				
ln # of Subway Stations	0.004	0.012						
ln # of LRT Stations			-0.079	0.095				
Transportation Investment, 2000-2006								
ln # of New CRT Stations			0.118	0.003	0.100	0.010	0.103	0.005
Joint Development, 2000-2006								
MM Type [1/0]			0.535	0.087				
LM Type [1/0]	0.091	0.000	2.593	0.000			1.636	0.001
LO Type [1/0]					-1.379	0.000	-0.556	0.027
LC Type [1/0]			3.080	0.001			1.627	0.039
(Constant)	0.087	0.008	-0.075	0.960	4.648	0.003	0.190	0.881
R-Squared	0.503		0.354		0.544		0.710	
Number of Observations*	102		102		102		102	

(Continued)

Table C.4.3 (Continued)

Variables / Category j	SALE Coeff.	SALE Prob.	SVLB Coeff.	SVLB Prob.	TRCM Coeff.	TRCM Prob.	FCLB Coeff.	FCLB Prob.
Urban Agglomeration, 2000/01								
ln Total Labor Density [1,000]	0.422	0.000	0.143	0.021	0.234	0.000	0.363	0.000
ln Labor Mixture Index [0~1]			-0.410	0.003	-0.687	0.000	-0.456	0.000
ln Labor Location Quotient in Category j	-0.444	0.001			-0.392	0.000		
Megalopolis Location								
ln ATT Distance to CBD [min.]	0.468	0.000						
ln ATT Distance to NIA [min.]			0.336	0.033	0.495	0.005	0.383	0.011
Regional Institute								
ln # of National Government Offices			-0.049	0.017	-0.057	0.020		
Transportation Infrastructure, 2000/01								
ln Highway [km/100ha]	0.099	0.000	0.079	0.001	0.102	0.000	0.105	0.000
ln National Roadway [km/100ha]	0.039	0.030			0.046	0.028	0.035	0.034
ln # of HSR Stations					-0.130	0.055	-0.173	0.013
ln # of Subway Stations			-0.040	0.159			-0.071	0.015
Transportation Investment, 2000-2006								
ln # of New CRT Stations	0.112	0.001			0.066	0.066	0.085	0.004
Joint Development, 2000-2006								
MM Type [1/0]							0.428	0.092
LM Type [1/0]	1.327	0.004	0.719	0.096	1.907	0.001	1.303	0.005
LO Type [1/0]	-0.396	0.099	-0.482	0.036	-0.579	0.037	-0.545	0.014
LC Type [1/0]	1.597	0.034					1.254	0.063
(Constant)	-3.395	0.000	-1.413	0.019	2.137	0.030	-1.692	0.003
R-Squared	0.478		0.456		0.443		0.510	
Number of Observations*	102		102		102		102	

Notes:*5 of the 107 Strategic Development Areas had no labor in 2000/01 and 2005/06.

SKPR: Skilled Professional; MNGR: Manager; ADMN: Administrator; SALE: Sales Worker; SVLB: Service Worker; TRCM: Transportation and Communication Worker; FCLB: Factory Labor; ATT: Average Travel Time; NIA: Narita International Airport; HNA: Haneda Airport; MM: Mid-scale Mixed; LM: Large-scale Mixed; LO: Large-scale Office; LC: Large-scale Commercial.

Table C.4.4 Ordinary Least Squares (OLS) Regression Results: Determinants of Labor Shift-Share (SS) %, 2000/01-2005/06

Category j	Total		SKPR		MNGR		ADMN	
Variables	**Beta**	**Prob.**	**Beta**	**Prob.**	**Beta**	**Prob.**	**Beta**	**Prob.**
Urban Agglomeration, 2000/01								
Total Jobs	-0.982	0.000	-0.982	0.000	-0.843	0.000	-0.987	0.000
Labor Mixture Index [0~1]	-0.808	0.000	-0.805	0.000	-0.773	0.000	-0.806	0.000
Labor Location Quotient in Category j			-0.185	0.006				
Megalopolis Location								
1/ATT Distance to CBD [min.]	0.657	0.000	0.665	0.000	0.619	0.000	0.661	0.000
1/ATT Distance to HNA [min.]	-0.732	0.000	-0.783	0.000	-0.699	0.000	-0.726	0.000
Regional Institute								
# of Local Government Offices	0.128	0.063					0.129	0.061
# of University Departments			0.136	0.055				
Transportation Infrastructure, 2000/01								
Highway [km/100ha]	0.119	0.098					0.119	0.099
# of HSR Stations	-0.358	0.000	-0.358	0.000	-0.379	0.000	-0.356	0.000
# of CRT Stations	0.230	0.006	0.266	0.001	0.283	0.001	0.229	0.006
Transportation Investment, 2000-2006								
# of New CRT Stations	-0.103	0.068	-0.140	0.027			-0.103	0.067
# of New Subway Stations	0.596	0.000	0.631	0.000	0.560	0.000	0.599	0.000
New Pedestrian Space [%]	0.264	0.000	0.119	0.039	0.202	0.001	0.263	0.000
Joint Development, 2000-2006								
MM Type [1/0]	0.136	0.030	0.122	0.055	0.139	0.031	0.130	0.038
LM Type [1/0]	0.596	0.000	0.612	0.000	0.631	0.000	0.596	0.000
HC Type [1/0]	0.106	0.080	0.135	0.031	0.110	0.075	0.108	0.075
R-Squared	0.737		0.730		0.708		0.737	
Number of Observations*	102		102		102		102	

(Continued)

Table C.4.4 (Continued)

Category j	SALE		SVLB		TRCM		FCLB	
Variables	**Beta**	**Prob.**	**Beta**	**Prob.**	**Beta**	**Prob.**	**Beta**	**Prob.**
Urban Agglomeration, 2000/01								
Total Jobs	-0.887	0.000	-0.591	0.003	0.503	0.009	-0.765	0.000
Total Job Density [1,000]					-0.350	0.006		
Job Mixture Index [0~1]			-0.170	0.007	-0.248	0.001		
Labor Mixture Index [0~1]	-0.764	0.000	-0.725	0.000	-0.285	0.061	-0.789	0.000
Labor Location Quotient in Category j					-0.327	0.029	-0.200	0.001
Megalopolis Location								
ATT Distance to CBD [min.]					-0.164	0.046		
ATT Distance to NIA [min.]					0.163	0.021		
1/ATT Distance to CBD [min.]	0.643	0.000	0.312	0.026			0.526	0.000
1/ATT Distance to NIA [min.]					0.112	0.091	0.104	0.070
1/ATT Distance to HNA [min.]	-0.694	0.000	-0.698	0.000			-0.724	0.000
Regional Institute								
# of National Government Offices							-0.141	0.049
# of Local Government Offices			0.119	0.076			0.231	0.002
# of Public Research Institutes					-0.172	0.087		
Transportation Infrastructure, 2000/01								
Highway [km/100ha]			0.153	0.038			0.177	0.005
# of HSR Stations	-0.385	0.000	-0.227	0.002			-0.305	0.000
# of CRT Stations	0.280	0.001	0.176	0.033				
Transportation Investment, 2000-2006								
# of New CRT Stations					-0.135	0.028		
# of New Subway Stations	0.587	0.000	0.288	0.017			0.502	0.000
New Pedestrian Space [%]	0.124	0.034	0.459	0.000	0.767	0.000	0.237	0.000
Joint Development, 2000-2006								
MM Type [1/0]	0.137	0.035					0.155	0.014
LM Type [1/0]	0.653	0.000	0.458	0.000	-0.146	0.019	0.581	0.000
LW Type [1/0]					-0.195	0.027		
LO Type [1/0]			-0.106	0.066	-0.113	0.044		
HC Type [1/0]	0.114	0.068						
LC Type [1/0]					-0.167	0.071		
R-Squared	0.703		0.746		0.744		0.734	
Number of Observations*	102		102		102		102	

Note:*5 of the 107 Strategic Development Areas had no labor in 2000/01 and 2005/06.

SKPR: Skilled Professional; MNGR: Manager; ADMN: Administrator; SALE: Sales Worker; SVLB: Service Worker; TRCM: Transportation and Communication Worker; FCLB: Factory Labor; ATT: Average Travel Time; NIA: Narita International Airport; HNA: Haneda Airport; MM: Mid-scale Mixed; LM: Large-scale Mixed; LW: Large-scale Waterfront; LO: Large-scale Office; HC: High-rise Commercial; LC: Large-scale Commercial.

Appendix D
Background Statistics on Global City-Regions

D.1 Data for Population Sizes and Growth Trends in Urban Agglomerations

Table D.1.1 Data on Urban Population Growth Trends across on the Selected Global City-Regions, 1950-2025 (Year 2005 = 100)

	Year															
City-Regions	**50'**	**55'**	**60'**	**65'**	**70'**	**75'**	**80'**	**85'**	**90'**	**95'**	**00'**	**05'**	**10'**	**15'**	**20'**	**25'**
Hong Kong	24	30	37	45	49	56	65	72	80	88	94	100	105	110	114	118
Singapore	23	30	38	43	48	52	56	63	70	80	93	100	106	111	115	118
Tokyo	32	39	47	57	66	75	81	86	92	95	98	100	102	103	103	103
London	98	97	96	93	88	89	90	90	90	93	97	100	101	101	101	101
Paris	66	69	75	81	85	87	88	91	95	97	98	100	101	102	102	102
Munich	66	75	85	94	103	103	104	101	97	99	96	100	104	105	105	105
Zurich	45	47	49	56	65	65	64	76	91	95	98	100	102	103	105	107
Copenhagen	112	113	118	127	127	108	101	97	95	97	99	100	100	101	101	101
Stockholm	59	62	65	80	83	81	79	81	83	91	97	100	103	105	106	108
New York	66	71	76	81	86	85	83	84	86	90	95	100	104	107	109	110
Los Angeles	33	42	53	60	68	73	77	83	88	92	96	100	104	107	109	111
Chicago	57	63	70	75	81	81	82	83	84	89	94	100	104	108	111	113
San Francisco	55	60	65	70	75	76	78	83	87	91	96	100	105	109	112	115
Washington DC	31	36	43	50	59	62	65	72	80	86	93	100	105	109	113	115
Boston	58	61	65	69	73	74	75	77	79	85	93	100	105	109	113	115
Atlanta	12	15	18	22	27	32	38	44	51	65	82	100	109	113	117	120
Portland	28	32	36	41	46	51	57	61	65	76	88	100	107	112	116	120
Las Vegas	2	3	5	9	14	19	25	32	41	57	78	100	111	117	121	125
Mexico City	15	20	27	36	47	57	69	75	82	90	96	100	104	108	110	112
São Paulo	13	17	22	30	42	52	66	73	81	87	93	100	107	112	115	117
Rio de Janeiro	26	31	38	47	58	66	75	79	84	89	94	100	106	111	115	117
Buenos Aires	41	46	53	58	65	70	75	79	84	89	94	100	104	107	109	110
Bogotá	9	12	17	24	32	41	48	56	64	75	86	100	113	121	126	131
Curitiba	5	8	13	17	22	32	45	53	63	74	86	100	114	123	128	132
Dubai	2	2	3	4	6	13	20	27	37	51	74	100	119	134	149	163
Istanbul	10	13	15	21	29	37	45	56	67	79	90	100	108	115	120	125
Jakarta	16	22	30	37	44	54	68	79	92	94	95	100	110	122	132	140
Bangkok	21	26	33	39	47	58	72	80	89	93	96	100	105	111	119	127
Kuala Lumpur	15	20	24	28	32	46	66	72	80	86	93	100	108	119	130	138
Manila	14	17	21	26	33	46	55	64	74	87	93	100	108	119	129	138
Seoul	10	16	24	35	54	69	84	97	107	104	101	100	99	99	99	99
Taipei	23	29	37	47	67	78	85	94	104	103	101	100	102	110	119	127
Calcutta	32	35	40	44	48	55	63	70	76	83	91	100	109	119	131	144
Madras	22	25	28	35	44	52	61	69	77	84	92	100	109	120	133	146
Delhi	9	12	15	19	23	29	37	45	55	67	83	100	113	124	136	149
Mumbai	16	19	22	27	32	39	48	57	68	78	88	100	110	121	132	145
Beijing	40	43	46	49	53	56	60	64	69	79	91	100	110	120	129	136
Shanghai	42	43	45	47	49	51	52	54	57	72	91	100	109	119	127	134
Guangzhou	18	20	22	25	28	32	36	41	47	64	88	100	112	124	133	140
Shenzhen	2	3	3	3	4	4	5	7	12	32	84	100	112	124	133	141

Source: UN (2007).

D.2 Data for Transit Investments and Urban Agglomerations

Table D.2.1 Data on Urban Population Densities and Transit Densities and across the 52 Selected Global City-Regions, 2001

City-Regions	Population [Million]	Urbanized Area [ha]	Density [ha]	Transit Density [10,000 place km/ ha] Bus	Rail	Others	Total	Farebox Recovery %
Amsterdam	0.85	148	5,730	11.0	35.7	0.0	46.7	32.9
Athens	3.90	594	6,570	14.7	8.9	0.0	23.6	65.7
Barcelona	4.39	588	7,470	12.4	30.2	0.0	42.6	71.4
Berlin	3.39	620	5,470	13.3	58.4	0.0	71.7	42.6
Bern	0.29	70	4,190	15.3	52.5	0.0	67.8	48.4
Bilbao	1.12	216	5,190	14.2	18.7	0.0	32.9	51.9
Bologna	0.43	84	5,160	18.2	0.0	0.0	18.2	42.4
Brussels	0.96	131	7,360	22.2	42.9	0.0	65.1	26.6
Budapest	1.76	380	4,630	18.3	33.0	0.0	51.3	72.4
Chicago	8.18	5,312	1,540	1.9	4.7	0.0	6.7	42.3
Clermont Ferrand	0.26	59	4,450	9.5	0.0	0.0	9.5	43.2
Copenhagen	1.81	770	2,350	8.5	14.8	0.0	23.3	68.1
Dubai	0.91	271	3,360	5.3	0.0	0.1	5.3	11.3
Dublin	1.12	432	2,590	10.3	3.3	0.0	13.6	88.6
Geneva	0.42	85	4,920	19.2	1.7	0.0	20.9	41.8
Ghent	0.23	50	4,550	18.6	9.1	0.0	27.7	31.1
Glasgow	2.10	712	2,950	15.1	5.6	0.0	20.7	65.2
Graz	0.23	73	3,100	8.3	6.4	0.0	14.6	74.6
Hamburg	2.37	699	3,390	7.9	25.4	0.2	33.5	57.8
Helsinki	0.97	220	4,400	25.7	19.8	0.0	45.5	58.6
Honk Kong	6.72	235	28,600	310.0	146.4	5.6	462.0	157.0
Krakow	0.76	130	5,840	24.2	18.5	0.0	42.7	86.3
Lille	1.10	200	5,500	6.2	12.1	0.0	18.3	47.2
Lisbon	2.68	961	2,790	9.3	9.5	0.9	19.7	59.0
London	7.17	1,306	5,490	21.0	62.3	0.0	83.3	81.2
Lyons	1.18	295	4,000	6.9	7.4	0.0	14.3	39.4
Madrid	5.42	973	5,570	18.1	44.0	0.0	62.1	61.3
Manchester	2.51	621	4,040	14.3	3.1	0.0	17.4	96.0
Marseilles	0.80	136	5,880	15.4	7.8	0.0	23.2	53.9
Melbourne	3.37	2,460	1,370	2.1	4.4	0.0	6.5	NA
Milan	2.42	338	7,170	14.2	47.1	0.0	61.3	41.7
Moscow	11.40	708	16,100	52.6	228.0	0.0	280.6	56.9
Munich	1.25	239	5,220	11.6	69.2	0.0	80.8	64.4
Nantes	0.56	160	3,470	8.7	5.3	0.0	14.0	38.7
Newcastle	1.08	254	4,250	21.9	8.9	0.0	30.8	99.2
Oslo	0.98	376	2,610	7.2	17.9	0.2	25.3	63.0
Paris	11.10	2,741	4,050	6.9	44.9	0.0	51.9	45.5
Prague	1.16	264	4,400	19.4	51.2	0.0	70.6	30.5
Rome	2.81	449	6,260	20.2	29.2	0.0	49.4	28.5
Rotterdam	1.18	285	4,140	7.2	11.8	0.0	19.0	39.4
Sao Paulo	18.30	2,133	8,580	49.7	19.2	0.0	68.9	NA
Seville	1.12	219	5,110	8.7	2.6	0.0	11.2	71.7
Singapore	3.32	325	10,200	87.6	58.1	0.0	145.7	126.0
Stockholm	1.84	1,017	1,810	9.9	21.1	0.4	31.5	54.3
Stuttgart	2.38	674	3,530	6.1	19.4	0.0	25.6	61.2
Tallinn	0.40	95	4,190	19.8	8.3	0.0	28.1	44.0
Tunis	2.12	230	9,220	17.9	8.3	0.0	26.2	76.5
Turin	1.47	319	4,610	12.7	3.5	0.0	16.2	29.9
Valencia	1.57	313	5,020	7.6	10.5	0.0	18.1	59.5
Vienna	1.55	232	6,690	9.9	69.8	0.0	79.6	48.5
Warsaw	1.69	328	5,150	24.8	21.1	0.0	45.9	46.4
Zurich	0.81	182	4,450	13.6	78.1	0.9	92.6	50.0

Source: UITP (2006).

Table D.2.2 Data on Urban Population Densities and Fixed-Guideway Transit Densities and across the 35 U.S. Urbanized Area with Populations over 1 million, 2003

	Population	Urbanized	Density	Urban Transit Density [Direct Route Miles / 100 ha]				
City-Regions	[Million]	Area [ha]	[ha]	Commuter	Heavy	Light	Others	Total
New York	17.72	4,778	3,708	47.2	11.5	0.6	0.0	59.3
Los Angeles	12.52	2,231	5,612	34.9	0.0	3.7	0.0	38.6
Chicago	7.70	2,730	2,821	41.0	7.6	0.0	0.0	48.6
Philadelphia	5.29	2,276	2,323	26.1	4.7	3.0	0.0	33.9
Miami	5.10	1,590	3,210	8.9	2.8	0.0	0.5	12.3
Dallas	4.31	1,727	2,497	4.0	0.0	5.2	0.0	9.3
Washington DC	4.28	1,305	3,277	12.4	15.8	0.0	0.0	28.2
San Francisco	4.12	1,203	3,425	12.8	17.4	6.1	0.7	36.9
Boston	3.99	2,104	1,895	33.4	3.6	2.4	0.0	39.4
Detroit	3.94	1,439	2,737	0.0	0.0	0.0	0.2	0.2
Seattle	2.95	1,185	2,486	6.6	0.0	0.6	0.2	7.4
Atlanta	2.92	1,757	1,664	0.0	5.5	0.0	0.0	5.5
Phoenix	2.91	1,115	2,607	0.0	0.0	0.0	0.0	0.0
San Diego	2.87	733	3,918	11.2	0.0	13.2	0.0	24.4
Minneapolis	2.48	1,192	2,082	0.0	0.0	0.0	0.0	0.0
Baltimore	2.08	683	3,040	58.6	4.3	8.4	0.0	71.4
St. Louis	2.07	1,124	1,839	0.0	0.0	6.7	0.0	6.7
Tampa	2.06	1,294	1,590	0.0	0.0	0.4	0.0	0.4
Denver	2.05	814	2,518	0.0	0.0	3.9	0.0	3.9
Pittsburgh	1.79	1,215	1,476	0.0	0.0	2.9	0.0	2.9
Cleveland	1.79	897	1,998	0.0	4.2	3.4	0.0	7.6
Portland	1.69	469	3,593	0.0	0.0	18.4	0.0	18.4
Riverside	1.67	514	3,241	0.0	0.0	0.0	0.0	0.0
San Jose	1.66	365	4,559	0.0	0.0	16.0	0.0	16.0
Sacramento	1.66	383	4,324	0.0	0.0	10.6	0.0	10.6
Cincinnati	1.61	887	1,811	0.0	0.0	0.0	0.0	0.0
Virginia Beach	1.54	1,812	848	0.0	0.0	0.0	0.0	0.0
Kansas City	1.43	1,036	1,384	0.0	0.0	0.0	0.0	0.0
Milwaukee	1.36	497	2,728	0.0	0.0	0.0	0.0	0.0
San Antonio	1.33	481	2,771	0.0	0.0	0.0	0.0	0.0
Orlando	1.27	667	1,900	0.0	0.0	0.0	0.0	0.0
Providence	1.22	799	1,524	0.0	0.0	0.0	0.0	0.0
Columbus	1.20	609	1,962	0.0	0.0	0.0	0.0	0.0
Buffalo	1.12	564	1,991	0.0	0.0	2.2	0.0	2.2
New Orleans	1.01	270	3,737	0.0	0.0	5.9	0.0	5.9

Sources: Author, with data from APTA (2005) and U.S. DOT (2009b).

D.3 Data for Contemporary Transit Investments and Urban Regeneration Projects

Table D.3.1 Data on the World's 30 Busiest Airports, 2008

Rank	City (Airport)	Annual Passengers
1	Atlanta, GA (ATL)	90,039,280
2	Chicago, IL (ORD)	69,353,876
3	London (LHR)	67,056,379
4	Tokyo (HND)	66,754,829
5	Paris (CDG)	60,874,681
6	Los Angeles, CA (LAX)	59,497,539
7	Dallas/Fort Worth, TX (DFW)	57,093,187
8	Beijing (PEK)	55,937,289
9	Frankfurt (FRA)	53,467,450
10	Denver, CO (DEN)	51,245,334
11	Madrid (MAD)	50,824,435
12	Hong Kong (HKG)	47,857,746
13	New York, NY (JFK)	47,807,816
14	Amsterdam (AMS)	47,430,019
15	Las Vegas, NV (LAS)	43,208,724
16	Houston, TX (IAH)	41,709,389
17	Phoenix, AZ (PHX)	39,891,193
18	Bangkok (BKK)	38,603,490
19	Singapore (SIN)	37,694,824
20	Dubai (DXB)	37,441,440
21	San Francisco, CA (SFO)	37,234,592
22	Orlando, FL (MCO)	35,660,742
23	Newark, NJ (EWR)	35,360,848
24	Detroit, MI (DTW)	35,135,828
25	Rome (FCO)	35,132,224
26	Charlotte, NC (CLT)	34,739,020
27	Munich (MUC)	34,530,593
28	London (LGW)	34,214,740
29	Miami, FL (MIA)	34,063,531
30	Minneapolis, MN (MSP)	34,056,443

Source: ACI (2009).