SECTION I

Context and concepts: density, distance, and division

Regional integration, agglomeration, and income distribution in East Asia

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1 *chapter*

East Asia has achieved economic growth of greater than 8 percent annually over the last two decades.[1] Influenced by this high growth, the economic geography of the region has been transformed by the opposing forces of dispersion and concentration. On the one hand, industrialization has spread across the region as the intraregional trade of manufactured goods has grown substantially. On the other hand, productive activities have become geographically concentrated in each country, reinforcing the leading role of industrial agglomerations in the development process.

To explain the distribution of economic activities and associated patterns of trade, traditional international trade theory based on comparative advantage emphasizes the diversity of natural endowments, which creates differences in relative factor prices or technological advantages among countries. Given the assumption of production technology with constant returns to scale and immobility of production factors, where goods are traded under perfect competition without transportation costs, the comparative advantage perspective predicts that free trade will promote the efficient allocation of economic activities consistent with the first nature of each location across space.

The manifestation of this argument in the East Asian context is known as the "flying geese" pattern of catch-up industrialization (Kojima 2000). Up to a certain moment, Japan was the lead economy in this pattern. Intraregional division of labor developed as Japan became increasingly specialized in technologically advanced industries, while successively shedding industries in which it no longer held a comparative advantage; these industries, in turn, were relocated to nearby less-developed countries (the Asian newly industrializing economies, or NIEs). Over time, the "following geese" upgraded their industrial structures, following the "lead goose" trajectory, while shedding outdated industries to their own neighboring less-developed countries (members of the Association of South East Asian Nations [ASEAN] and China). When less-developed countries had prepared their *basic* situations correctly, freer international trade provided them with opportunities to integrate themselves into the regional production network, enabling the sequential takeoff of these economies. On the whole, the flying-geese analogy aptly describes the catch-up industrialization in East Asia.

In this context, the World Bank's report *The East Asian Miracle* (World Bank 1993) presents extensive analyses of those *basics* that qualify a country as a "following goose." The report stresses that, unlike other developing economies, East Asia achieved rapid growth with equity through the use of two sets of measures: fundamental policies and selective intervention. Fundamental policies include macroeconomic stability, large investments in human capital, stable and secure financial systems, limited price distortions, and openness to foreign technology. Selective intervention includes mild financial regulation, directed credit, selective industrial promotion, and trade policies that push nontraditional exports (World Bank 1993: 10–11).

The report contends that the two types of policy tools are mutually complementary and cannot be addressed separately. For example, macroeconomic stability is fundamental to cultivate high savings as well as to achieve exchange rate stability, required for economic opening, which, in turn, engender feedback to growth and stability through large investments and exports. The accumulation of savings and achievement of highly productive exports were sustained by wealth-sharing public policies on education, landholdings, and small and medium-size enterprises. Because of their crucial complementarities, developing economies can miss development opportunities if they fail to coordinate these measures. Consequently, the World Bank (1993) concludes that the government's commitment to social coordination through consistent and unbiased policies is the key to growth with equity.

Although providing the *basic* conditions for sound economic development remains necessary, a somewhat new scenario has unfolded in East Asia since the 1990s. Above all, the remarkable growth of the Chinese economy subsequent to market-oriented reforms has been a decisive feature. Based on China's abundance of labor and the explosive growth of its market of middle-class consumers, scale economies in China have become the dominant factor attracting investment. Middle-income countries were rapidly surpassed by China's leapfrogging growth. Countries in a lower stage of development cannot take it for granted that merely having the right *basics* will put them on track to catch up given the existence of exceedingly strong agglomeration economies in China. It is now impossible for any East Asian country to consider its development strategy without seriously considering the impact of China.

In addition, in contrast to the simplified version of the flying geese analogy, which stipulates a vertical division of labor, the manufacturing of high-technology products has spread to countries at heterogeneous levels of development. These industries tend to agglomerate in large urban areas in each country to benefit from access to consumers and higher productivity based on the large pool of educated workers and intermediate goods, as well as the availability of good infrastructure. Urbanization also stimulates the interaction of people, encouraging technological innovation and new kinds of economic activities.

Agglomeration economies have enabled Japanese industries to play the role of the cutting-edge "lead goose." According to Fujita and others (2004), Japan accounted for 72 percent of total gross domestic product (GDP) in East Asia in 1990; within Japan, core economic regions represented 40 percent of the national total, which implies that Japan's core regions, with a mere 0.18 percent of the total area and 2.5 percent of the total population of East Asia, represented 29 percent of the total regional GDP, displaying remarkable geographic concentration. Recently, Asian NIEs caught up with Japan in many technological areas such as semiconductors and information and telecommunications equipment manufacturing (for example, notebook computers and mobile telephones). Leading technological firms in Asian NIEs compete intensely with Japan's firms in the global market. In these countries, the geographic concentration of high-technology firms is growing in places such as Daejeon, Hsinchu, and Seoul. Industrialization in China clearly is concentrated in coastal regions; agglomeration has intensified in many parts of the region, and the East Asian economy has been transformed from the traditional one-dimensional flying geese pattern to a pattern encompassing multiple technological centers.

According to the framework of the new economic geography (Fujita, Krugman, and Venables 1999), agglomeration is a self-organizing process that results from the balance of concentration and dispersion forces. As explained by Fujita (2007a), at least three types of concentration forces (forward linkages) are identified: the wide variety of consumption enhances consumers' real income, the wide variety of intermediate inputs increases firms' productivity, and the wide variety of talented people stimulates the creation of knowledge. These attract consumers, final goods producers, and innovative research, respectively. Scale economies, in turn, exert a pull on an even greater variety of consumer products, intermediate inputs, and talented people (backward linkages). Because the new economic geography models are built on this positive feedback mechanism, no a priori assumption of the difference in the first nature, as required in the models based on comparative advantage, is necessary to explain the formation of uneven economic geography. Because of the nature of increasing returns to scale, agglomeration enhances long-run economic growth (Romer 1986).

Yet, as a counterpoised dispersion force, high transportation costs necessitate that production be dispersed in proportion to the size of each local market without realizing agglomeration economies. Therefore, actual formation of agglomeration requires sufficiently low transportation costs (Fujita, Krugman, and Venables 1999). Consistent with this result, agglomeration in East Asia has developed together with the deepening of regional economic integration through increasingly numerous free trade agreements as well as unilateral and bilateral deals that reduce the costs of trading.

The foregoing discussion emphasizes that not only factor price differences but also scale economies play an important role in reshaping the economic geography of East Asia. A recent report published by the World Bank, *An East Asian Renaissance* (Gill and Kharas 2007), addresses this point. Compared to the focus on coordination failure of the earlier World Bank report (World Bank 1993), the later report contends that to sustain economic growth, especially for middle-income economies, product differentiation, knowledge creation, and agglomeration based in cities are expected to play key roles. If scale economies prevail, further improvement in market integration (both international and domestic) must foster the advantages of agglomeration, while mitigating the negative effects, such as road congestion, pollution, and inflated housing prices, through the appropriate provision of urban infrastructure and regulation of land use.

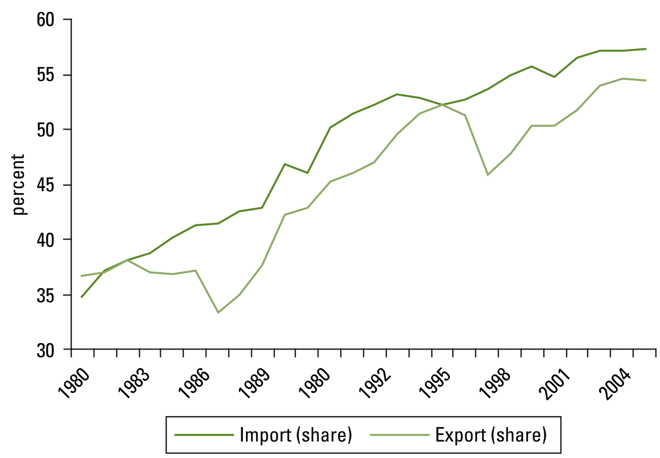
Although we expect agglomeration to enhance growth, this strategy inevitably exacerbates regional income disparities, especially in the rural-urban context.[2] Inequality cannot be overlooked because the concentration of wealth and power can foment discontent in the bypassed regions and threaten social stability. Government programs for income transfer from urban to rural areas are usually implemented in this context. However, if farmers residing in disadvantageous locations were to continue producing only generic goods under perfect competition, intensifying pressure from global trade liberalization would require subsidies, which are not sustainable in the long run. In Japan, for example, the dwindling prospects for traditional farming have encouraged farmers to migrate to cities, thereby accelerating the aging of society in rural areas and exacerbating related problems such as the difficulty of providing essential public services in such areas. In many developing countries, large cities tend to be overcrowded, leaving huge populations living in makeshift conditions.

Innovative ideas are needed to establish nontraditional agricultural production and make the periphery lively and livable without depending heavily on income transfers from the core region. In this context, Fujita (2007b) argues that the introduction of highly differentiated branded agriculture is a viable strategy. Branded agriculture makes full use of cheap land and labor, which are abundant resources in the periphery, while overcoming the disadvantages of unfavorable market access because consumers will buy differentiated products even at higher prices. For instance, Japan imported 359 tons of roses from Kenya in 2006, corresponding to roughly 8 percent of the quantity and 20 percent of the value of total imports of that product. As the data suggest, the unit price of Kenyan roses is very high not only because of the distance but also because roses are transported by air via the cold storage facilities of Dubai airport. Still, sales are growing thanks to high product quality. Being in the highland more than 1,000 meters above sea level and right on the equator, Kenya offers ideal natural conditions for such horticulture: constant daylight hours all year long and a large temperature gap between day and night, lowering the risk of insect infestations. This example suggests that remote rural areas can be connected to a large market if they produce sufficiently differentiated products, take advantage of the local natural conditions, and establish innovative market access. Product differentiation of branded agricultural products must be understood in a broader sense, which involves the whole value chain—including quality control and logistics management—rather than innovations in the product itself. In contrast to the general perception of the periphery as a static supplier of generic foods, innovation is needed in the periphery as much as in large cities.

Production networks in East Asia

Intraregional trade accounted for 57.3 percent of all imports and 54.5 percent of all exports of East Asian countries in 2005. These shares increased over the past quarter century, as shown in figure 1.1, except for the temporary setback during the economic crises of the 1980s and the 1990s, which increased the share of exports out of the region to compensate for the precipitous drop in regional demand. The current share of intraregional trade approaches that of the European Union (EU); the pattern contrasts with that of the North American Free Trade Agreement (NAFTA), where the gap between the intraregional share of exports and imports in trade is widening because of the growth of imports from outside the region (mainly from the EU and East Asia).

Figure 1.1 East Asia's share of intraregional trade, 1980–2004



Source: METI (2007: fig. 2-1-14).

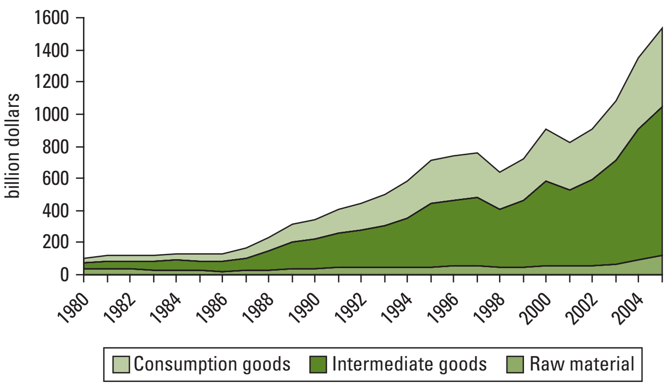
As described in the preceding section, reasons for the steady growth of intraregional trade include the increasing trade of intermediate goods. As shown in figure 1.2, trade in intermediate goods dominates intraregional trade, corresponding to nearly 60 percent of total intraregional trade in 2005. It is multidirectional: as presented in table 1.1, Japan, the NIEs (Hong Kong and Taiwan, China; Republic of Korea; and Singapore), ASEAN-4 (Indonesia, Malaysia, the Philippines, and Thailand), and China export and import intermediate goods within the region. Although Japan is still the net supplier of intermediate goods in the region, its imports of intermediate goods from the remainder of East Asia are growing rapidly. Although the NIEs show a deficit of interregional trade in intermediate goods, the collective exports from these economies are already greater than those of Japan. The export of intermediate goods from China and ASEAN-4 has also grown substantially. According to METI (2007), in the electric machinery industry, which accounts for more than one-third of all intraregional exports of intermediate goods, the share of Japan's exports dropped from 42 to 22 percent between 1995 and 2005, although the share of ASEAN-4 rose from 25 to 31 percent and the share of China rose from 5 to 17 percent. Localization of intermediate goods firms following the expansion of foreign direct investment for the assembly of final goods in ASEAN-4 and China and the reduction in tariffs on intermediate goods traded among ASEAN-4 countries have contributed to the dispersion of intermediate goods production.

Using data from the Institute of Developing Economies (IDE), we have compiled a trade matrix including transactions of semiconductors and integrated circuits to present an example of intraregional production linkage of electronic parts (IDE 2006; see table 1.2). The table presents the total value of output in the second column; the third column details the destination of shipments consisting of (1) same-country intermediate inputs, (2) intermediate inputs for electronic parts produced in other East

Asian countries, (3) intermediate inputs for electronics and electronic final products in other East Asian countries, (4) intermediate inputs for other types of industries in other East Asian countries, and (5) other goods (for final consumption in East Asia and shipments to outside East Asia); and the fourth column gives the share of each destination. Among the listed countries, Japan boasts the highest value of regional shipments of these products (destinations 2, 3, and 4). Especially, US$9.7 billion worth of semiconductors and integrated circuits are exported to other East Asian countries for use as inputs for electronic parts production there. They are then used for local assembly of final goods or are exported. This suggests upstream characteristics of the Japanese semiconductors and integrated circuits for other East Asian countries, partly because of high product differentiation and partly because of intrafirm trade between mother factories in Japan and affiliated plants in other East Asian countries. In contrast, 70 percent of Chinese semiconductor and integrated circuits are consumed locally, and intraregional exports are few. Exports to final goods assemblers within the region (destination 3) are quantitatively similar for exports to Japan; Republic of Korea; Malaysia; and Taiwan, China. Sales outside of East Asia (destination 5) show higher shares for Korea, Malaysia, Singapore, and the Philippines.

Next, figure 1.3 portrays the remarkable concentration of the production of information technology–related products in East Asia. Of world production, more than 73 percent of VCRs and DVD players and 80 percent of personal computers are made in China. On the other hand, about 70 percent of hard disk drives and 43 percent of DVD-ROM drives are produced in other Asia, which includes 62 percent of the former and 38 percent of the latter in ASEAN countries. These products are used for assembling personal computers; for that reason, the production linkage between ASEAN and China is readily explainable. Japan still has large market shares in some products, such as 25 percent of flat-panel televisions and 39 percent of digital cameras, whereas Korea has 26 percent of mobile phone production. Technological advantages in these products sustain the competitiveness of firms in

Figure 1.2 Composition of intraregional trade in East Asia, by category of use, 1980–2004



Source: METI (2007: fig. 2-1-15).

Table 1.1 Intraregional trade of intermediate goods in East Asia, 1995, 2000, and 2005
US$ billion

Indicator and year	Japan	NIEs	ASEAN-4	China
Intraregional exports				
1995	137.2	129.8	62.1	40.0
2000	143.9	174.3	108.3	63.8
2005	216.5	309.5	175.4	171.4
Intraregional imports				
1995	–51.1	–201.9	–83.8	–40.9
2000	–72.1	–252.5	–93.9	–78.5
2005	–110.4	–386.1	–148.5	–228.7
Balance				
1999	86.1	–72.1	–21.6	–0.9
2000	71.8	–78.2	14.4	–14.7
2005	106.1	–76.5	26.8	–57.4

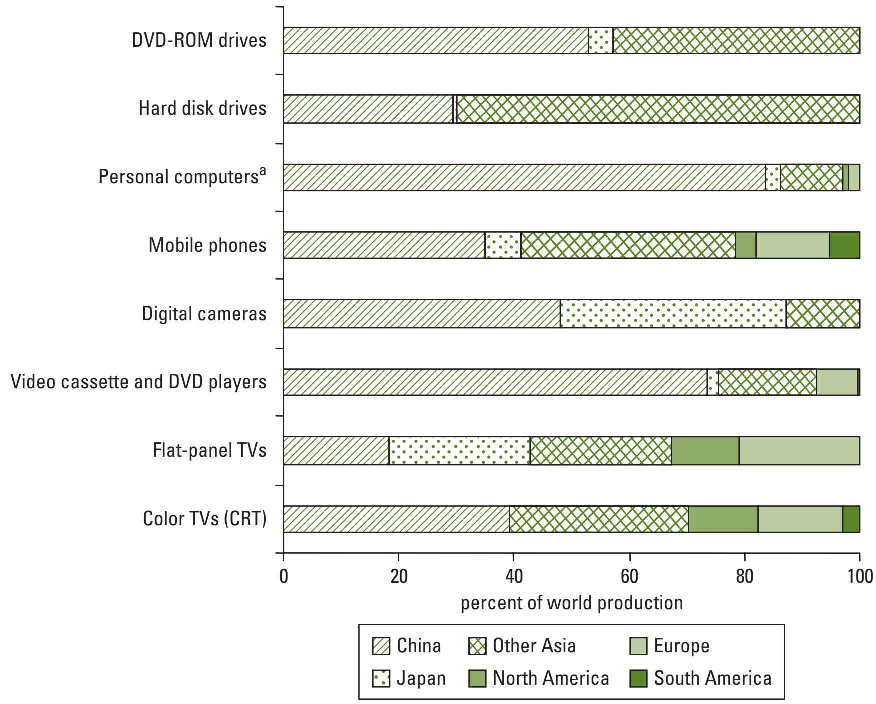
Source: METI (2007: fig. 2-2-8).

Table 1.2 Transactions of semiconductors and integrated circuits in East Asia, 2000
US$ billion

Economy	Total output	Shipment to					Shares (percent)				
		(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Japan	58.1	23.5	9.7	7.4	0.5	16.9	40.5	16.8	12.7	0.9	29.1
China	42.2	29.6	0.8	0.9	0.1	10.8	70.2	1.8	2.1	0.1	25.7
Korea, Rep. of	30.4	5.3	3.5	6.8	0.5	14.2	17.6	11.6	22.3	1.8	46.7
Malaysia	22.3	2.5	3.0	5.1	0.4	11.3	11.4	13.7	22.8	1.6	50.5
Taiwan, China	20.1	0.8	3.1	7.8	0.6	7.8	4.0	15.4	38.9	3.0	38.7
Singapore	19.6	1.6	3.5	3.5	0.3	10.6	8.2	18.0	18.0	1.7	54.0
Philippines	15.4	0.2	1.8	3.0	0.3	10.2	1.0	11.6	19.4	1.7	66.3

Source: IDE (2006).
Note: (1) used as intermediate inputs in own country, (2) used as intermediate inputs in electronic parts production in other East Asian countries, (3) used as intermediate inputs for electronics and electronic final products in other East Asian countries, (4) used as intermediate inputs for other types of industries in other East Asian countries, and (5) other goods (for final consumption in East Asia and shipments outside East Asia).

Figure 1.3 Regional production shares of information technology–related goods, 2005



Source: JEITA (2006).
a. Notebook and desktop computers.

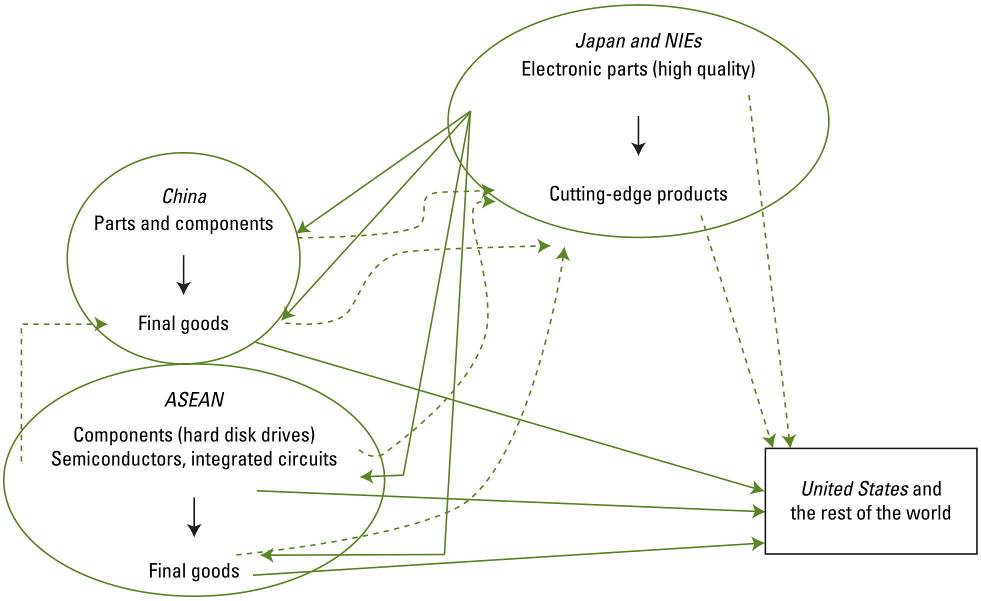
these industries despite higher costs. Notwithstanding, their advantages might not last long because of "commoditization," or rapid deterioration of prices resulting from short product cycles, which are expected to force firms to seek cost savings through off-shoring, as has already occurred for the production of laptop personal computers in Taiwan, China.

Summarizing these observations, figure 1.4 portrays the value chain of the electronics sector. Major trade flows are represented as solid arrows; broken arrows represent minor flows. This figure is fundamentally identical to the *triangular trade* scheme described by Fujita (2007a).

Fragmentation

The growth of intraregional trade with the relevant share of intermediate goods and the triangular trade scheme is related closely to the development of the intraregional

Figure 1.4 Triangular trade in East Asian electronics industry



Source: Author's calculations based on IDE (2006).

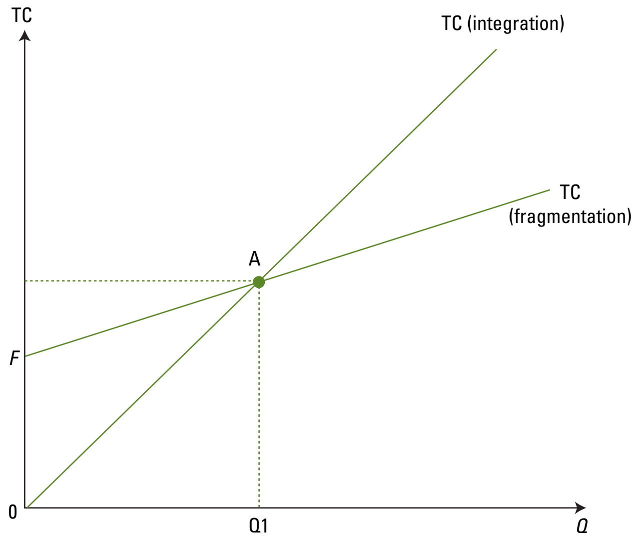
production network. Ando (2006) identifies the explosive increase of vertical intraindustry trade in the machinery industry in East Asia in the 1990s. According to Kimura and Ando (2005), reductions in the costs of transportation and communication have enabled firms to cut production processes into pieces of tasks and to allocate each to the most suitable location given factor price differences.

This phenomenon is dubbed "fragmentation" in the literature on international trade theory, which includes the important report of Jones and Kierzkowski (2001). Fragmentation refers to the splitting up of a previously integrated production process into two or more stages. For example, consider a production process consisting of a capital-intensive stage and a labor-intensive stage. Fragmentation allows the firm to locate the former in a country endowed with more capital and the latter in a country endowed with abundant labor. The firm can thereby reduce marginal costs by taking advantage of factor price differences in contrast to locating the two production components together in either of the two countries. However, such cost savings are made possible by incurring a "setup cost" of establishing extra production plants and a "service-link cost" for using transportation and communication services to link the two operations. The firm's choice of whether or not to split up production depends on the balance between the marginal cost saving and the additional costs.

Borrowed from Jones and Kierzkowski (2001), figure 1.5 depicts the decision making of the firm. The horizontal axis shows the quantity of production; the vertical axis shows the total costs of production. The sum of the setup costs and the service-link costs of fragmentation is considered as a fixed cost represented by *F*. The line for the fragmentation case is drawn flatter, implying the marginal cost savings. Expanding output further than *Q*1 entails a switch to fragmented production if a firm chooses the lower-cost production modality.

This illustration is not complete because the decision depends only on the scale of output. The diagram also does not address the interaction between transport costs and scale economies. To add geographic perspectives, we turn to a straightforward extension by modifying the graph to produce figure 1.6. Let *F* now represent the setup costs only. Total cost is given as TC

Figure 1.5 Framework for fragmentation



(integration) if a firm decides to integrate the production process at one location and produce under higher marginal cost without the fixed cost. Under free entry and exit, the total cost is equal to the total revenue (TR). Presuming that the service-link cost imparts a cost of transportation and communication per unit of fragmented production, which is discounted from the revenue, the total revenue for the fragmented firm denoted as TR* or TR** is lower than TR by the magnitude of the cost of linking the fragmented operations across the distance. Here, TR* is depicted as the total revenue of a firm that locates the affiliate in a distant location. As a result, the service-link cost is higher than in the case of TR**. Imagine that each firm produces *Q*1. Consequently, the integrated firm produces at point A with zero profit. Given the output level, the firm can set up an affiliate abroad and conduct a multiplant operation. In figure 1.6, such a decision is represented by the move to point B. Although the firm can reduce its total cost by fragmentation, the strategy is not profitable because B passes above TR**; that is, the cost is greater than revenue because of the service-link cost. For that reason, at the individual firm level, fragmentation will not occur. However, if the firm is able to sell *Q*2 instead of *Q*1, the move from point A to point C on TC (fragmentation) turns out to be profitable if the firm chooses to locate its affiliate in the location with a lower service-link cost such as TR**. The setup cost is compensated by sufficiently large scale economies. However, if the service link cost is too high, point C is still not profitable.

Figure 1.6 enables us to examine the interaction between scale economies and transportation involved in the fragmentation. Clearly, if each firm's output is given at *Q*1, no individual firm will choose fragmentation. It is interesting that, with *Q*2, fragmentation might be an outcome under the same service-link cost TR** and the same production technology TC (fragmentation), suggesting the possibility of multiple equilibriums.

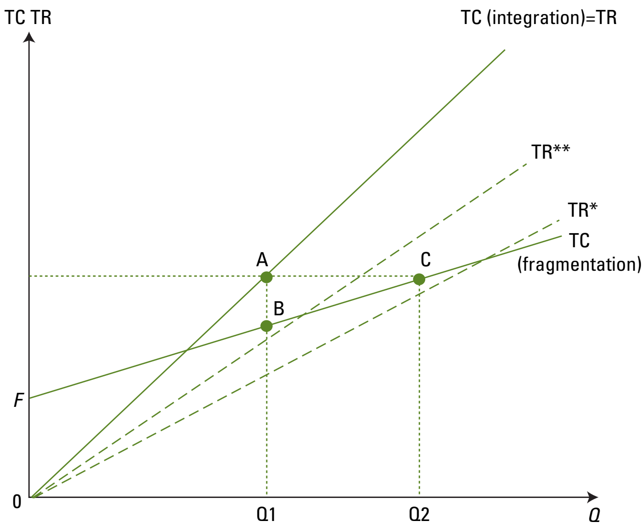
What kind of a reality does this result describe? We can infer the following effect of externalities. Imagine that, initially, all firms integrate production in an industrial country. Technological developments in transportation and communication open the possibility of fragmentation, but each firm alone will find it unattractive to do so if the output size is insufficiently large for the given service-link cost. Presuming some sort of coordination that induces all firms to opt for fragmentation, the move creates industrial jobs and raises the income in the less-industrial country, increasing the total demand to *Q*2 and enabling firms to operate profitably at point C under the service-link cost TR**. Therefore, the big push–like concerted shift (Murphy, Shleifer, and Vishny 1989) toward fragmentation is important when the service-link cost is reduced to a moderate level. This shift does not necessarily require government coordination, but the rush for Japanese investment in China in the 1990s might have been a self-organizing shift from point A to C.

If the service-link cost is sufficiently high, as in the case of TR*, fragmentation with output *Q*2 is still not profitable. This observation implies that fragmentation is more likely to occur with a lower service-link cost, suggesting the case of regional integration among the neighboring countries. Using firm-level micro data of Japanese multinational firms, Kimura and Ando (2005) find that Japanese firms investing in East Asia are more likely to deinternalize their production processes flexibly and to conduct outsourcing activities than those investing in other regions such as Europe and North America. Fragmentation might be more sensitive to distance than the case of ordinary trade because the service-link cost entails frequent travel of people in need of technical assistance and just-in-time delivery of intermediate products across countries. East Asian countries have lowered their international transaction costs through trade policies facilitating imports of intermediate goods, favorable treatment of foreign direct investment, and development of infrastructure. Kimura and Ando (2005) also suggest the existence of scale economies in infrastructure, strengthening the benefits of more intensely used service links.

Receiving the spin-off labor-intensive factories of the fragmentation process facilitates the industrialization of developing countries. Governments in the region competitively offer unilateral and bilateral provisions to reduce the setup costs of offshore factories and operational costs of linking with factories in other countries. Nevertheless, Baldwin (2006) asserts that East Asian integration is still fragile because each country's preferential trade deals are neither disciplined by the World Trade Organization (WTO) rules nor supported by a supranational regional-level management body such as the European Union; consequently, countries in the region are expected to strengthen such de jure features.

In this respect, it is notable that trade policy in East Asia has shifted from mere export promotion, which is a fundamental policy tool analyzed by the World Bank (1993), to regional integration and free trade agreements. Initially, ASEAN was launched to form the ASEAN Free Trade Area (AFTA) for the 15 years since 1993. Subsequently, ASEAN incorporated Vietnam, Myanmar, Lao PDR, and Cambodia in the late 1990s; leaders of China, Japan, and Korea have been invited to the annual ASEAN summit since 1997 in an effort to establish a political framework for ASEAN+3. China agreed to establish a free trade area with ASEAN by 2010. Japan signed bilateral

Figure 1.6 Modified framework for fragmentation



economic partnership agreements with six ASEAN member countries (Brunei, Indonesia, Malaysia, the Philippines, Singapore, and Thailand), which are going to be extended with an economic partnership agreement between Japan and ASEAN as a group (including Cambodia, Lao PDR, Myanmar, and Vietnam). Aside from Thailand, because of disagreements related to opening of the rice market, Korea and 9 of 10 ASEAN members reached an agreement in 2007 to form a free trade area, and negotiations are being held to include trade in services. In fact, ASEAN's aggressiveness in AFTA diplomacy is partly a response to the rise of China, which ASEAN members fear will bring a hollowing out of investment.[3] The substantial progress of the AFTA is expected to contribute to consolidation of the fundamentals for production networks.

Border effect between China and Japan

Our next task is to evaluate the magnitude of transportation costs, emphasizing the cost of crossing national borders (that is, the border effect). For this, we have constructed a simple version of the McCallum (1995) type of gravity model to analyze border effects involved in interregional trade between China and Japan. The estimated model is given as follows:

$$\mathrm{LN}(x_{ij}) = \text{constant} + a_1 1\mathrm{LN}(y_i) + a_2\, \mathrm{LN}(y_j) + a_3\, \mathrm{LN}(d_{ij}) + b\ \text{DUMMIES} + \varepsilon_{ij} \quad (1),$$

where x_{ij} denotes the shipment between region i and j, and where y_i and y_j, respectively, represent the GDP of regions i and j. Furthermore, d_{ij} is the distance between i and j, and ε_{ij} is an error term (for a detailed explanation of the data, see the annex to this chapter). As DUMMIES, we included the following dummy variables:

- China: intraregional and interregional trade in China;
- Border_China: cross-border interregional trade from a Japanese region to a Chinese region;
- Border_Japan: cross-border interregional trade from a Chinese region to a Japanese region; and
- Inland: cross-border interregional trade from a Japanese region to a Chinese inland region.

The data set includes intraregional trade, that is, $i = j$.

The estimated results are portrayed in table 1.3. It is apparent that this simple model has reasonably good explanatory power, with adjusted R^2 greater than 0.8. The elasticities of trade with respect to GDP of the region of origin and of the region of destination are, respectively, 0.86 and 0.72 according to equation 1, which includes observations of domestic regional trade in both China and Japan. These coefficients are estimated as larger in equation 2, which includes cross-border interregional trade. However, elasticity with respect to distance is of similar magnitude in both equations. In equation 1, the coefficient of the dummy variable *China* implies that the domestic trade among regions in China tends to be twice as large as that of Japan ($e^{1.14} - 1 = 2.13$). In fact, as figure 1.7 shows, the domestic trade in China is heavily biased toward intraregional trade. The share of trade within each region in China is distributed between 62.5 and 85.8 percent for intermediate transactions and between 81.1 and 92.8 percent for final demand, compared to that of regions in Japan, which is distributed between 48.3 and 62.5 percent for intermediate transactions and between 69.6 and 83.3 percent for final demand. Given the large factor price differences within the country, if China reduces transport costs internally and its provinces become better linked, industrial specialization within the country is expected to develop, and interregional trade is expected to grow. Without such development, production is expected to concentrate heavily in the coastal regions: low-cost production there will require a large inflow of migrant workers from inland regions.

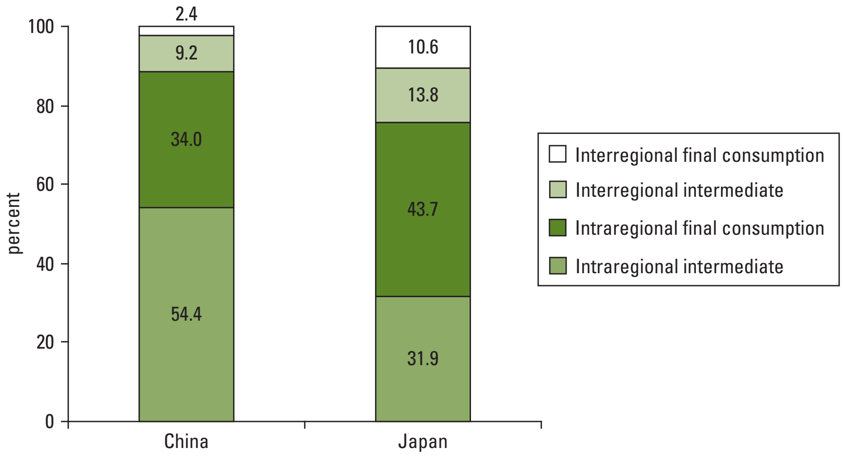
Our primary interest is the magnitude of the border effect. Our results show that, all things being equal, Chinese regions trade with the Japanese regions about 9 times less than they do with Chinese regions

Table 1.3 Gravity model estimates of China-Japan intraregional trade

	1		2	
Variable	**Coefficient**	**Standard error**	**Coefficient**	**Standard error**
Constant	−8.28	2.20	−21.84	2.37
$\mathrm{LN}(y_i)$	0.86	0.08	1.21	0.08
$\mathrm{LN}(y_j)$	0.72	0.07	1.00	0.07
$\mathrm{LN}(d_{ij})$	−1.22	0.05	−1.24	0.08
China	1.14	0.14	1.48	0.18
Border_China			−2.38	0.19
Border_Japan			−2.31	0.18
Inland			−2.76	0.15
Number of observations		226		450
Standard error		0.79		1.11
Adjusted R^2		0.82		0.90

Source: Author's calculations.
Note: All estimated coefficients are statistically significant at the 1 percent level.
Equation 1, domestic regional trade, China and Japan; equation 2, both domestic and cross-border interregional trade.

Figure 1.7 Structure of interregional trade between China and Japan



Source: Compiled based on IDE (2007).

($e^{2.31} - 1 = 9.07$), although the Japanese regions' cross-border trade with the Chinese regions is 10 times less than their domestic regional trade ($e^{2.38} - 1 = 9.80$). These magnitudes are half of McCallum's estimate: that the cross-border provincial trade from Canada to the U.S. states is 22 times less than Canada's interprovincial trade.[4] The border effect from China to Japan must also be emphasized; that from Japan to China has almost equal magnitude, which suggests that the border handling of China is as efficient as that of Japan. Therefore, for Japanese multinational firms operating fragmented production operations between Japan and China, the service-link cost has been substantially lowered. Nevertheless, we find that if Japanese cross-border regional trade is with inland regions of China, the trade flow (both exports and imports) is about 15 times ($e^{2.76} - 1 = 14.80$) less than when it is with coastal regions. Therefore, we can conclude that the low border effect in China is restricted to the coastal regions, which implies that a fragmentation type of multinational setup in inland China is best discouraged.

It is also worth pointing out that the Huadong region (including Shanghai) exports 2.3 times more to the Huanan region (including Guangdong province) than to Japan's Kanto region (including Tokyo), although the Huadong region is almost as far from the Huanan region (1,650 kilometers) as from the Kanto region (1,771 kilometers). The Kanto region's regional GDP is 12.7 times larger than that of the Huanan region, suggesting the border effect. However, if we examine transactions for intermediate inputs only, Huadong region exports almost twice as much in intermediate goods to the Kanto region as to Huanan region. For that reason, we can infer that the border effect on intermediate goods is smaller than the border effect on final goods (for a description of each region, see the annex).

Regional income inequality

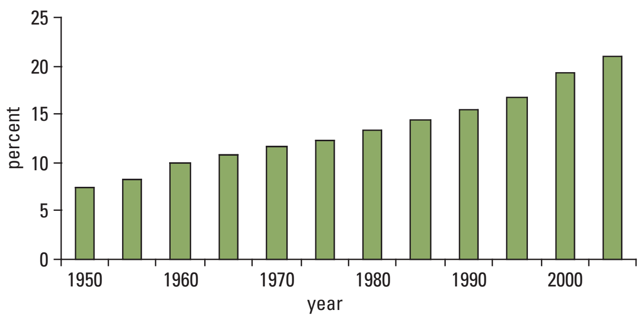
According to the United Nations (2006), in 2005, 21.0 percent of East Asia's people resided in 182 urban agglomerations with populations greater than 750,000 (see figure 1.8). This ratio has increased steadily, from 8.4 percent in 1955, when only 35 such agglomerations existed. Rapid urbanization is a spectacular feature of East Asia.

Next, we construct the ranking of East Asian cities by population size for 1950 and 2005. In 1950 there were 35 cities with populations greater than 750,000; in 2005 there were 182. Figure 1.9 depicts the relationship between cities' population size (log-transformed) and their rank numbers (log-transformed). They are placed on a remarkably straight line of almost identical slope (≈ 0.75) for the two years, illustrating the rank size rule.[5] Although this regularity is known to pertain in the context of the hierarchical urban system of a particular country, it is striking to see that the random growth of East Asian large cities has evolved according to the same kind of regularity. The degree of primacy represented by the slope of lines has not changed in East Asia.

Although most of the 20 largest cities in 2005 have remained in the ranking since 1950, Shenzhen and Dongguan of Guangdong province, which is located next to Hong Kong, China, were not even included in the list in 1950, but in 2005 they were ranked ninth and eighteenth, respectively. Including the two cities, 119 Chinese cities newly entered the list in 2005. It is also noteworthy that Jakarta, Manila, and Seoul rose in rank, respectively, from twelfth to third, ninth to sixth, and nineteenth to seventh, thereby transforming the top 10 largest agglomerations in East Asia. Although Tokyo and Osaka-Kobe remain first and fourth, other Japanese cities such as Kyoto, Nagoya, Fukuoka-Kitakyushu, and Sapporo have lowered their position. An increasing number of people in East Asia are living in large urban areas. In China the number of such agglomerations is increasing rapidly. These new entrants to the city ranking thicken the lower tail of the rank size rule distribution, whereas in other countries, population growth is concentrated in fewer cities, shifting the line upward.

Therefore, figures 1.8 and 1.9 reveal that cities in East Asia have grown both in numbers and in size above the threshold population of 750,000 between 1990 and 2005. Although the degree of primacy of the hierarchy of cities in East Asia as a whole has not changed, the concentration of higher-ranking cities has tended to intensify in each country because of the agglomeration process.

Figure 1.8 Share of East Asia's population living in agglomerations greater than 750,000 inhabitants, 1950–2000



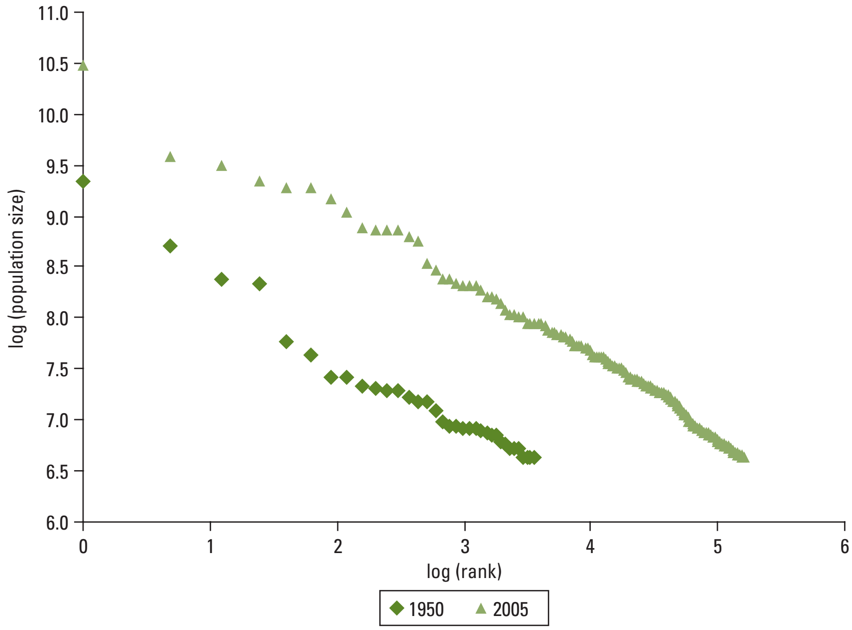
Source: Author's calculations based on United Nations data (2006, 2007).

Income distribution

Some other characteristics of the international economic catch-up in East Asia are interesting. Figure 1.10 depicts the relative size of nominal per capita GDP converted into U.S. dollars, taking Japan as the reference (Japan = 100). Because these figures are not PPP (purchasing power parity)-based data, they do not represent the purchasing power of the people in each country. Rather, because the location decision of the foreign direct investment (FDI) generally is made according to the nominal wage, the nominal figures are more appropriate. During 1990–2005, each economy in East Asia made progress toward catching up with Japan. A remarkable catch-up achievement was made by NIEs, but among NIEs, the importance of Singapore and Korea increased relative to Hong Kong, China, and Taiwan, China. The Chinese position also advanced, from just 1.4 percent of Japan to 4.9 percent, surpassing Indonesia and the Philippines. Among the least-developed countries, Vietnam experienced leapfrogging growth. The disparity among ASEAN countries is shrinking. The difference between Malaysia and Cambodia dropped from one-sixteenth to one-eleventh, although the relative importance of Thailand and the Philippines declined slightly. For that reason, in East Asia in the last 15 years, although each country narrowed the gap with the leading economies, some countries made great strides, changing the order of the income level among countries.

The East Asian regional economy has been transformed from a one-dimensional structure led by Japan into an internationally diverse and balanced one after the emergence of industrial agglomeration in various countries. Meantime, the problem of income disparity has become more serious within each country because the core-periphery structure has been clarified.[6] Figure 1.11 presents the trend of regional

Figure 1.9 Rank-size rule of large agglomerations (population over 750,000) in East Asia, 1950 and 2005



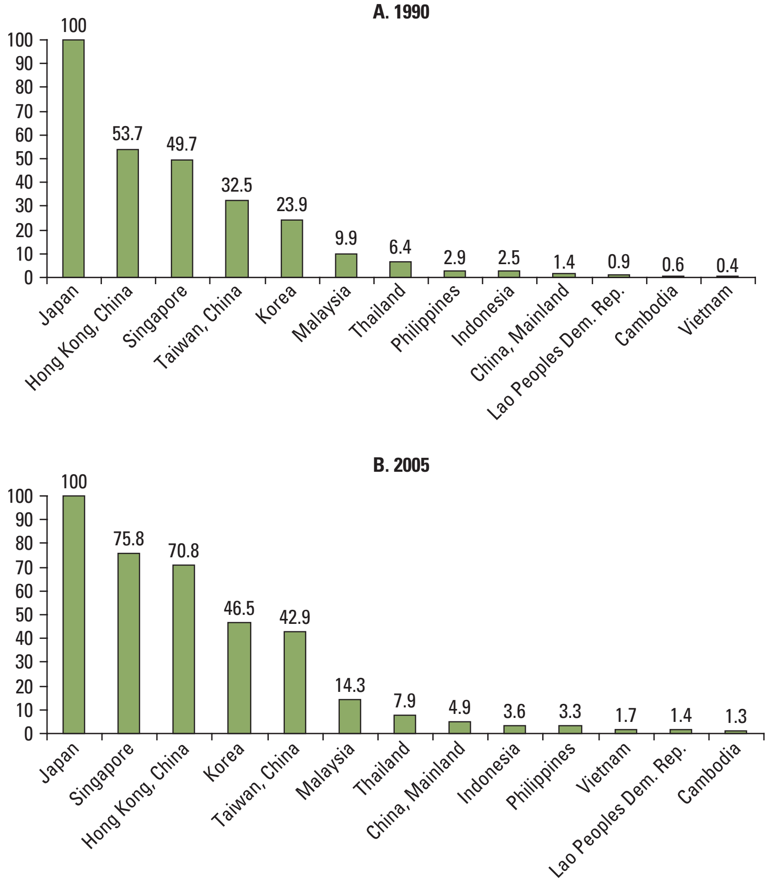
Source: Author's calculations based on United Nations (2006, 2007).

income inequality measured using the coefficient of variation (standard error/mean) of regional GDP per capita. The intensification of regional inequality is more pronounced in dynamically growing economies such as China and Thailand. Inequality in Korea is rising slightly but steadily, whereas Japan's recent economic recovery is being led by agglomeration in the Tokyo metropolitan area, whose central business districts are witnessing a rush to build new buildings. Consequently, we can infer that, although the income disparity between regionally integrated countries is shrinking, the regional disparity within each country is rising as these economies grow. Because of agglomeration economies, some small areas of each country are driving national economic growth, among which income gaps are growing. These cities correspond to the increasing primacy in the upper tail of the rank size distribution given in figure 1.9.

For China, Fujita and Hu (2001) show that income disparities between the coastal areas and the interior increased during the initial stage of economic opening in 1985–94; industrial production showed strong agglomeration toward the coastal areas, although a trend toward convergence was apparent within the coastal provinces. Higher growth was related to production agglomeration, prompted by exposure to globalization (exports and foreign direct investment) and economic liberalization (reduction in the state enterprise share). See the other studies on China in this volume for more detailed analysis.

The case of Thailand also portrays a clear tendency toward strengthening of the core-periphery structure.[7] In this case, the core includes provinces in Bangkok and its vicinities, the central region, and the eastern region. Many provinces with per capita regional GDP higher than the national average in 1981 are in noncore regions in the northeast. However, in 2003, most provinces with income higher than the national average were in the core regions. Moreover, the number of such provinces decreased from 36 in 1981 to 14 in 2003, leaving the remaining provinces below the average. It is also noteworthy that

Figure 1.10 Nominal income per capita in select Asian economies, 1990 and 2005



Source: IMF, *International Financial Statistics* (various years).

the income gap between the poorer provinces and the national average widened. This core-periphery structure, which is more accentuated than in the Chinese case, might be related to the higher mobility of labor in Thailand, which strengthens the agglomeration effect through backward and forward linkages of the core region.

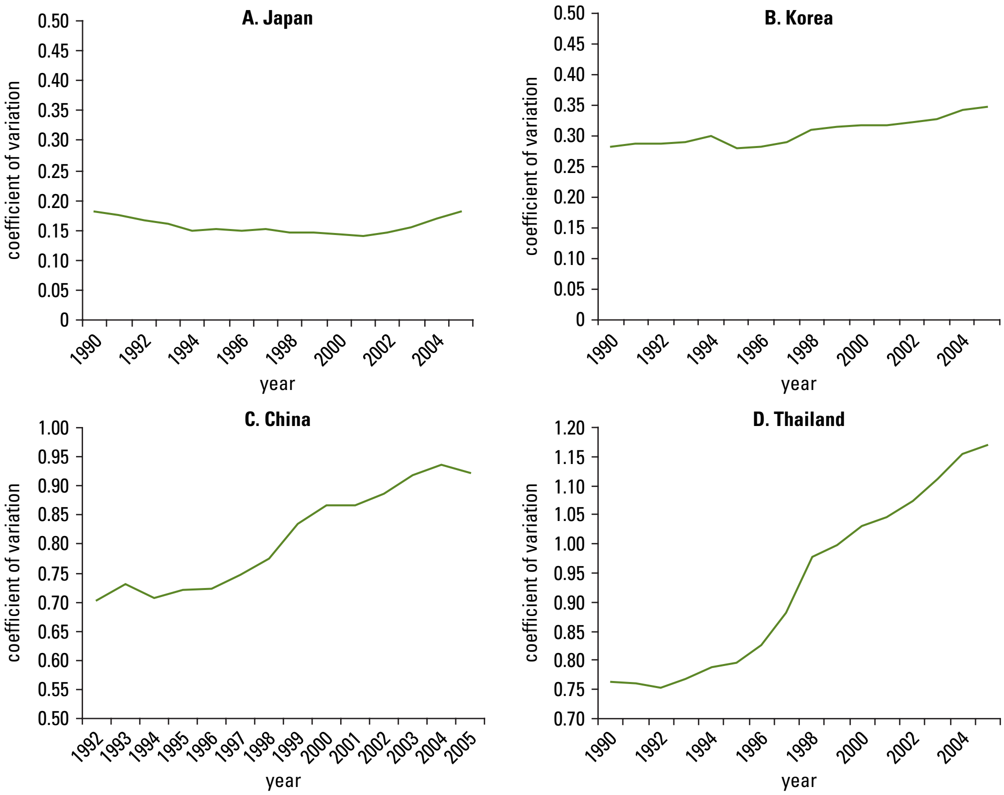
It follows that deeper economic integration and the related structural changes in economic geography can generate a mix of convergence and divergence of income inequality at different levels. First, within East Asia, some countries that have attracted industry have tended to grow faster, although others have not taken advantage of such trends and remain in the economic periphery. Second, within each country, industrial agglomeration occurs in a limited spatial range, sharpening the regional contrast between the core and the periphery, although the income gap within the core can be narrowed because of the sprawl of agglomeration economies.

Discussion

The East Asian economic geography has been transformed by the opposing forces of dispersion and agglomeration. Dispersion is related to factor price differences based on comparative advantage. Through such transformations, sequential catch-up industrialization, often described using the metaphor of flying geese, has occurred. Regional integration has lowered the cost of linking services and broadened the opportunities to divide labor by tasks in different locations. Intraregional trade in intermediate goods is rapidly growing within the regionally extensive production network. The international spread of industries has contributed to more rapid growth of low-income countries and to a narrowing of the income gap between the rich and poor countries. Regional integration, on the other hand, increases the relevance of scale economies, which in turn stimulate agglomeration. High economic growth is accompanied by urbanization. For this reason, economic development tends to concentrate geographically in each country. Because of increasing returns to scale, agglomeration enhances productivity and innovation, providing sources of long-run growth. These benefits of regional integration contributed to East Asia's dominant position in the production of many types of industrial products, especially in the electronics industry.

Two main concerns might arise in relation to the agglomeration-based development strategy. First, excessively high density in certain agglomerations might diminish the advantages that they provide because of diseconomies from congestion and higher prices of immobile resources such as land and unskilled labor. Cities might grow beyond their optimal size, but industries might have difficulty relocating to a remote periphery because such areas frequently have poor access to markets and intermediate goods. Therefore, local governments must implement appropriate urban policies to mitigate diseconomies by providing

Figure 1.11 Regional income inequality measured using the coefficient of variation for select East Asian countries, 1990–2004



Sources: For Japan, Statistics Bureau (http://www.esri.cao.go.jp/jp/sna/toukei.html#kenmin [in Japanese]); for Korea, National Statistics Office (http://www.kosis.kr/eng/index.html); for China, National Bureau of Statistics of China, *China Statistical Yearbook*; for Thailand, National Statistical Office (http://web.nso.go.th/eng/index.htm).

infrastructure and regulating land use, while encouraging specialization in knowledge-intensive activities.

Second, emphasizing the role of agglomeration inevitably widens regional income gaps. It is necessary to improve transportation connections with the periphery, which would enable urban industries to move activities that no longer are competitive to the periphery. Another possibility is to introduce product differentiation (in a broad sense), thereby taking advantage of the diversity of the natural conditions of the remote periphery.

Notes

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1. The total GDP of Northeast and Southeast Asia, excluding Japan, grew 8.9 percent in 1990–2004 (World Bank, *World Development Indicators,* 2006).

2. An interesting contrast can be made: the World Bank (1998) report highlights coordination to mitigate income inequality as an essential policy component for sustained growth, whereas Gill and Kharas (2007) predict that the strategy to sustain growth will exacerbate inequality.

3. On the other hand, there has been little progress in de jure integration among the three major economies in East Asia. In fact, free trade area talks between China and Korea remain at a preliminary stage, whereas the negotiations regarding an economic partnership agreement between Japan and Korea have been interrupted for several years.

4. McCallum (1995) explains that the intensive use of transportation by air and land is partly responsible for the high magnitude of the border effect in North American regional trade, whereas most international trade in East Asia is transported by water.

5. The rank size rule is widely studied in urban economics. We generally expect Zipf's law to hold, showing the gradient of -1. In this case, however, the slope is flatter.

6. Baldwin and Wyplosz (2003) emphasize this problem in relation to European integration.

7. Detailed figures can be found in Fujita and Hamaguchi (2008).

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Annex Data for analysis of the China-Japan border effect

The estimation uses interregional transaction data from IDE's *Transnational Interregional Input-Output Table between Japan and China 2000* (IDE 2007). This data set comprises information from seven Chinese regions (Dongbei, Huabei, Huadong, Huanan, Huazhong, Xibei, Xinan) and eight Japanese regions (Hokkaido, Tohoku, Kanto, Chubu, Kinki, Chugoku, Shikoku, Kyushu); it reports intraregional and both intranational and transnational interregional flows of trade directed for intermediate inputs as well as for final demand. The following table gives the provinces included in each region.

The data classify the transaction data into 10 sectors (agriculture, livestock, forestry, and fishery; mining and quarrying; household consumption products; basic industrial materials; processing and assembly; electricity, gas, and water supply; construction; trade; transportation; services), which does not allow us to track the input-output relationship in detail. We designate a representative city for each region: Shenyang, Beijing, Shanghai, Guangzhou, Wuhan, Xian, and Chengdu for the Chinese regions in the same order as above; and Sapporo, Sendai, Tokyo, Nagoya, Osaka, Hiroshima, Takamatsu, and Fukuoka for the Japanese regions. Road distances between cities in China are from the Web site http://www.yusen.co.jp/china/english/distance/index.html. Using software Eki-spert of Val Laboratory Corporation, we obtain railroad distances between Japanese cities. The average distance within each region is defined as $d_{ii} = \sqrt{S_i/\pi} \times (Rural_i)$, where S_i is the land area, π is the circular constant (≈3.14), and $Rural_i$ is the ratio of rural to urban population in region *i*. Namely, we assume that the region is a circle with the same land area and calculate its radius. The region with a higher ratio of rural to urban population has higher costs of intraregional trade because the population is more scattered. Therefore, the radius is multiplied by $Rural_i$. To ascertain the distances between regions of China and Japan, we measure the great circle distance between representative cities using Google Earth. Market size variables y_i and y_j, respectively, represent the total output and input of each region, except for the case of trade flows for final demand, for which y_i denotes aggregate demand in the recipient region.

Country and region	Provinces included
China	
Dongbei	Liaoning, Jilin, Heilongjiang
Huabei	Beijing, Tianjin, Hebei, Shandong
Huadong	Shanghai, Jiangsu, Zhejiang
Huanan	Fujian, Guangdong, Hainan
Huazhong	Shanxi, Anhui, Jiangxi, Henan, Hubei, Hunan
Xibei	Inner Mongolia, Shaanxi, Gansu, Qinghai, Ningxia, Xinjiang
Xinan	Guangxi, Chongqing, Sichuan, Guizhou, Yunnan, Tibet
Japan	
Hokkaido	Hokkaido
Tohoku	Aomori, Iwate, Miyagi, Akita, Yamagata, Fukushima
Kanto	Ibaraki, Tochigi, Gunma, Saitama, Chiba, Tokyo, Kanagawa, Niigata, Yamanashi, Nagano, Shizuoka
Chubu	Toyama, Ishikawa, Gifu, Aichi, Mie
Kinki	Fukui, Shiga, Kyoto, Osaka, Hyogo, Nara, Wakayama
Chugoku	Tottori, Shimane, Okayama, Hiroshima, Yamaguchi
Shikoku	Tokushima, Kagawa, Ehime, Kochi
Kyushu and Okinawa	Fukuoka, Saga, Nagasaki, Kumamoto, Oita, Miyazaki, Kagoshima, Okinawa

Source: http://www.ide.go.jp/Japanese/Publish/Books/Tokei/xls/TIIO(00).xls.