

Impact of Japan's Declining Birth Rate and Aging Society on Railways

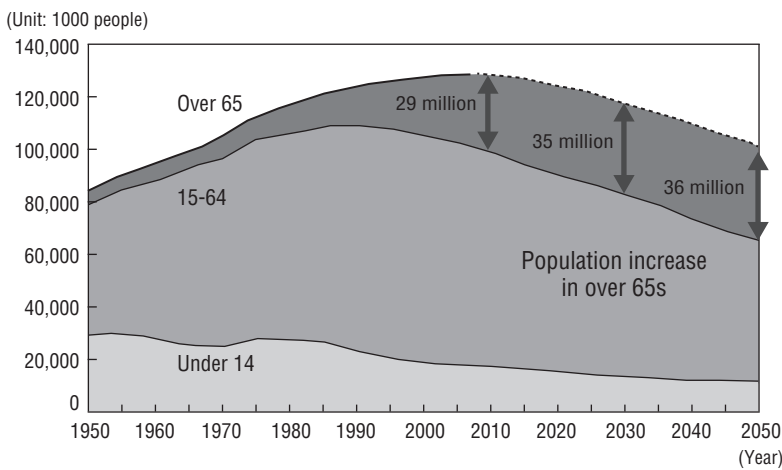
Shigeru Morichi

Introduction

After the collapse of the bubble economy, Japan has endured a long period of deflation from the mid-1990s. Provincial economies were particularly hard hit by the slump because these regions felt the first effects of a declining

population and aging society. Furthermore, there was no set vision for the future due to the severe fiscal situation facing national and local governments, which served to perpetuate a vicious deflationary cycle. This article reports on how population decline and aging in Japan, both of which are progressing at an unprecedented rate, affect railways.

Figure 1 Population Decrease and Increase in Number of Elderly Persons



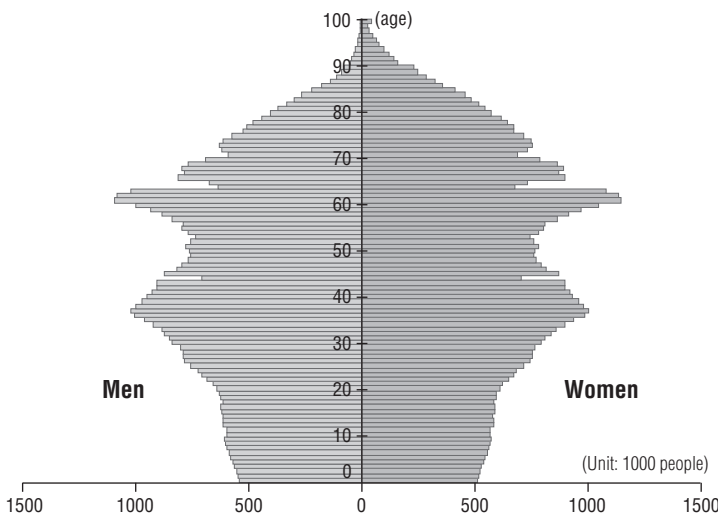
(Compiled from *Population Census*, Ministry of Internal Affairs and Communications; and *Population Projections for Japan*, National Institute of Population and Social Security Research (IPSS))

Declining Birth Rate and Aging Society in Japan

After peaking in 2004, the population of Japan started declining (Fig. 1). The so-called 'baby boomer' generation born immediately after WWII is especially numerous, and their children, or the 'second baby boomers' also account for a sizeable proportion of the population. These 'baby booms' have created a population with the pyramid structure shown in Figure 2. Although the total fertility rate in Japan has recovered slightly from its nadir in 2005, it remains at an extremely low level compared to other countries (Fig. 3). Due to the declining birth rate and large baby boomer population now entering old age, the proportion of the total population accounted for by people over 65 is rising rapidly compared to Western countries (Fig. 4).

As well as considering total population, it is also important to take changes in population distribution by region into account. After WWII, there were large population migrations to major cities resulting from regional income disparities caused by differences in the industrial base, where secondary and tertiary industries dominated in major cities, and primary industries were the mainstay of provinces. However, in the high-economic-growth period from 1960 to 1975, efforts to transfer industries to the provinces through infrastructure development and private-sector investment

Figure 2 Population Pyramid



(Compiled from *Population Projections for Japan*, National Institute of Population and Social Security Research (IPSS))

helped narrow regional disparities, resulting in a rapid drop in migration of population to the three major urban areas of Japan. Although the rate of population growth in the Tokyo Metropolitan Area (hereafter Tokyo MA) fell, the population increase continued in absolute terms. However, from 1975 onwards, the population of the Osaka Metropolitan Area (in Kansai region, hereafter Osaka MA) saw the start of a slight downward trend, while the population of Metropolitan Nagoya (in Tokai region, hereafter Nagoya MA) largely stabilized. Thereafter, the concentration of population in the Tokyo MA advanced further in the bubble years from 1985. Although the rate of increase tailed off after the bubble collapsed, heavy concentration of population in the Tokyo MA accelerated subsequently yet again (Fig. 5).

Among these changes in population structure, a decrease in the total population is thought to have a variety of social impacts. These include the possibilities of reduction in market scale, labour shortages, failure to pass on technical expertise and know-how due to retirement of skilled engineers and experts, and collapse of health insurance and pension systems. However, the annual overall rate of population decrease stands at 0.42%, with an annual rate of decrease in the working population of 0.43%. In contrast, long-term growth forecasts for the Japanese economy issued by the Organisation for Economic Co-operation and Development (OECD) before the start of 'Abenomics' (inflationary policy of Prime Minister Shinzo Abe's cabinet) projected 1.3% growth. In other words, productivity is projected to outstrip the rate of population decline. In fact, the long period of deflation has resulted in shrinking of markets, exacerbating the impact of population decline. In response to this situation, discussions are being advanced on reforming many social structures. After coming to power in December 2012, the Abe administration has embarked on a programme of structural reforms and also raised the consumption tax to 8%, which are gradually helping restore the economic growth rate and fiscal

Figure 3 Total Fertility Rate of Developed Countries

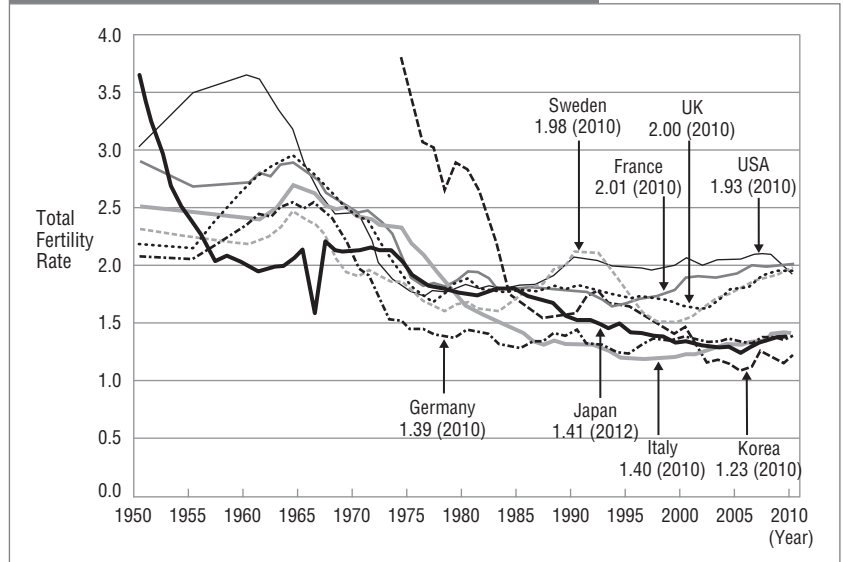


Figure 4 Speed of Aging Rate

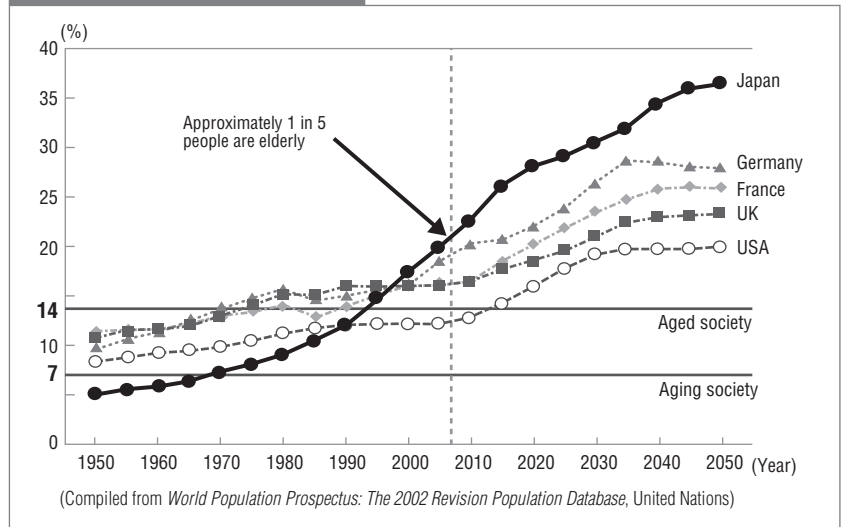


Figure 5 Population Inflows to Tokyo Metropolitan Area

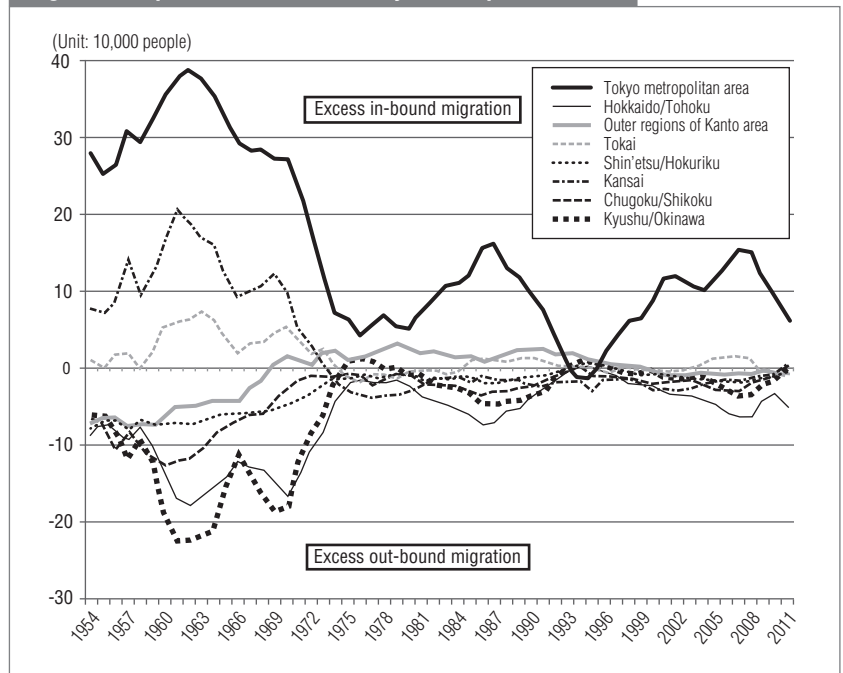


Figure 6 Average Daily Passengers Carried on Major Private Railways in Tokyo and Osaka MA

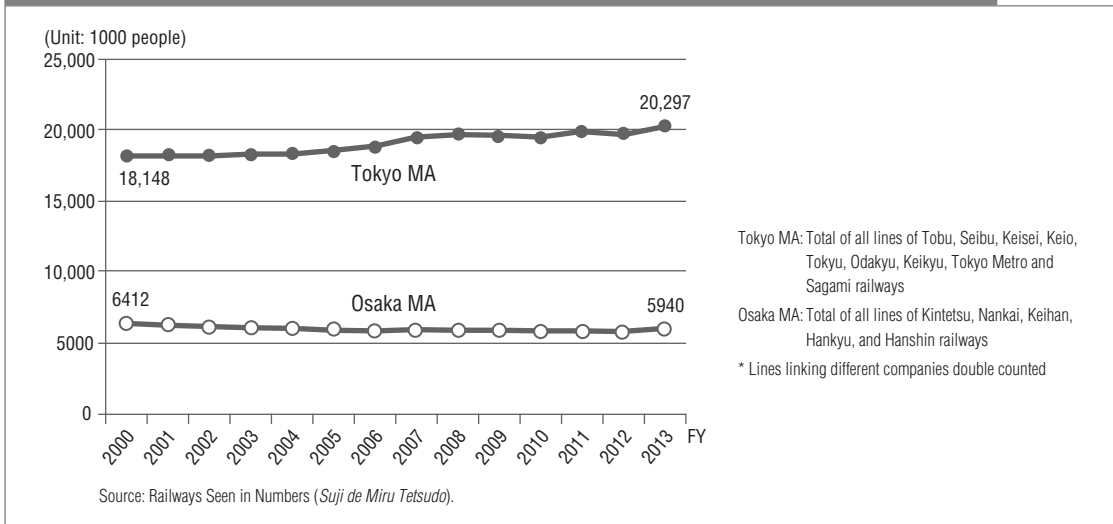
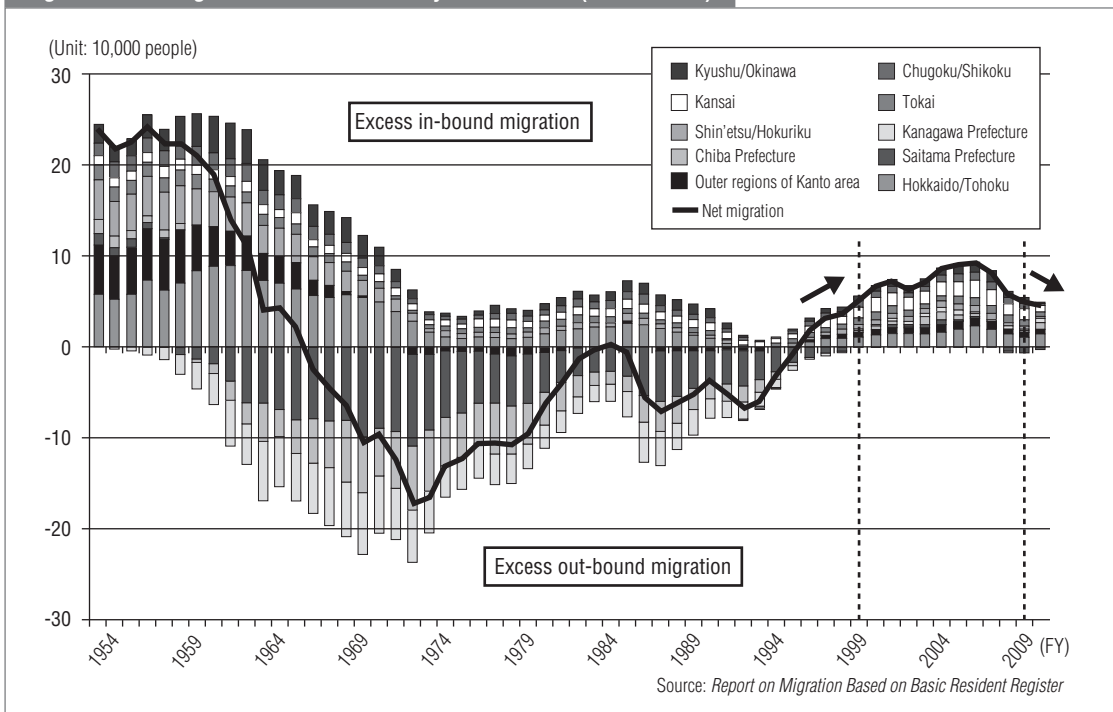


Figure 7 Net Migration Volume for Tokyo Prefecture (1954–2011)

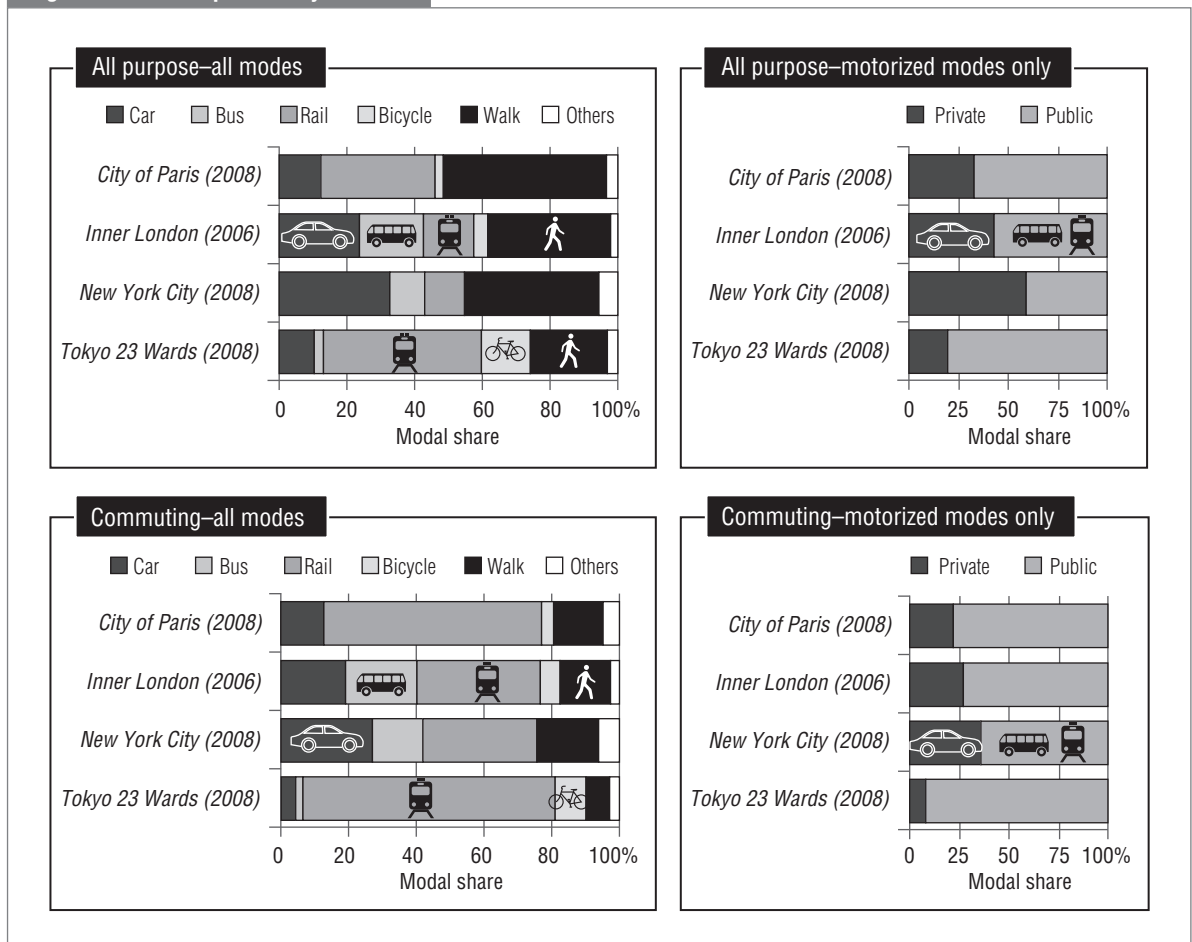


reconstruction. Furthermore, changes in the population distribution by region, namely the declining birth rate and aging population, are most pronounced in provincial areas and cause various problems such as stagnation of regional economies, lowering in public service quality, and difficulty in maintaining communities. For this reason, various provincial incentives are an important part of 'Abenomics' and it is hoped they will be effective.

A decline in the total population also impacts the railways in the same way as it affects society overall as noted above. In addition, changes in population distribution by region have a significant impact on railways; in the provinces, a decline in the total population and the working

population, and increasing car ownership reduced demand for railways, leading to more local railways going out of business. Urban railways in provincial cities are also being affected by falling demand. At the same time, although the Tokyo, Osaka, and Nagoya MA are all tracking the respective population trends, the Osaka MA is showing a decline in railway demand, the Tokyo MA is increasing (Fig. 6) and the Nagoya MA is stable. However, as noted below, the impact of the declining birth rate and aging population differs by railway line in the Tokyo and Osaka MA. Population decline has little impact on the shinkansen, which is more affected by economic trends. Shinkansen demand has been tracking upwards in recent years.

Figure 8 Modal Split in City Centres



Impact on Railways in Major Metropolitan Areas

In response to rapid population increases in the Osaka, Nagoya, and Tokyo MA during the high-economic-growth period (1960–75), the government promoted new housing developments in suburbs with low land prices away from railway lines. Concurrently, it proceeded with construction of railways to link these suburbs to the city centres. Private railway companies (not including the then Japanese National Railways (JNR)) also developed new lines and trackside residential areas. This was one of the world's first cases of value capture (the return of development-related benefits to railways) and transit-oriented development (TOD). Populations were distributed not along roads, but along railway lines, and many suburban commercial facilities were also developed near stations.

Tokyo Metropolitan Area

In the Tokyo MA, Chiba Prefecture is east of Tokyo Prefecture, Saitama Prefecture is north, and Kanagawa Prefecture is west. The era of population inflows to the Tokyo MA including the neighbouring prefectures of Kanagawa, Saitama, and Chiba

from all regions of Japan followed by population outflows to those areas from the Tokyo Prefecture continued from the late 1960s to late 1990s (Fig. 7). The Tokyo MA commuting radius from where people commute into the city centre expanded to about 50 km. It was the hierarchical rail network that ensured efficient transport of the Tokyo MA's 35 million inhabitants. In other words, the network, comprising the shinkansen (which is primarily an inter-city railway for long distance travellers but is also used by commuters for distances of 50 to 100 km), JR inter-urban railways, JR commuter lines, private railway expresses, local trains, subways, AGTs, and LRTs, offers a combination of lines with different station intervals and scheduled speeds. As shown in Figure 8, the Tokyo MA, which expanded along railway lines, has a high modal share of railways helped by the high cost of motorway tolls and parking charges.

Subsequently, following the 1994 collapse of the economic bubble, the sudden large drop in city centre land prices caused by the deflationary economy and deregulation of land-use resulted in supply of reasonably priced city-centre condominiums, sparking a recovery in the city-centre population. The population outflow from Tokyo to the neighbouring three prefectures has stopped and the

Table 1 Changes in Number of Trips and Length (All-purpose)

| | 2000 | ➡ | 2015 | Growth |
|-----------------------|--------------------|---|--------|--------|
| | (1000 persons/day) | | | |
| Number of passengers | 23,000 | ➡ | 23,100 | + 1% |
| (Elderly persons) | 1300 | ➡ | 2100 | + 62% |
| (Non-elderly persons) | 21,700 | ➡ | 21,000 | ▲ 3% |

| | 2000 | ➡ | 2015 | Growth |
|-----------------------|-------------------------|---|---------|--------|
| | (1000 passenger-km/day) | | | |
| Passenger-km | 486,000 | ➡ | 473,000 | ▲ 3% |
| (Elderly persons) | 28,000 | ➡ | 44,000 | + 57% |
| (Non-elderly persons) | 458,000 | ➡ | 429,000 | ▲ 6% |

Sources: Estimates prepared using *Population Census (1980-2000)*, Ministry of Internal Affairs and Communications; *Mid-range Population Projections by Municipality (2003)*, IPSS; and *PT Study for the Tokyo Metropolitan Area (1998)*.

Table 2 Changes in Number of Trips

| | 2000 | ➡ | 2015 | Growth |
|--------------------|--------------------|---|--------|--------|
| | (1000 persons/day) | | | |
| Commuting purposes | 15,700 | ➡ | 15,800 | + 1% |
| (Elderly persons) | 600 | ➡ | 1100 | + 83% |
| (Aging rate) | 4% | ➡ | 7% | |

| | 2000 | ➡ | 2015 | Growth |
|-------------------|--------------------|---|--------|--------|
| | (1000 persons/day) | | | |
| Private purposes | 20,100 | ➡ | 21,200 | + 5% |
| (Elderly persons) | 3400 | ➡ | 5800 | + 71% |
| (Aging rate) | 17% | ➡ | 27% | |

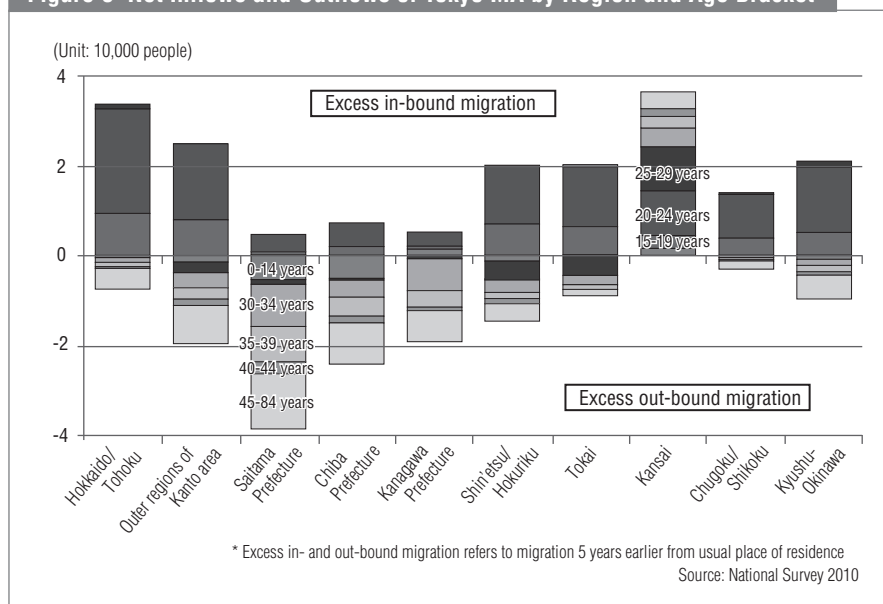
Sources: Estimates prepared using *Population Census (1980-2000)*, Ministry of Internal Affairs and Communications; *Mid-range Population Projections by Municipality (2003)*, IPSS; and *PT Study for the Tokyo Metropolitan Area (1998)*.

population in Tokyo Prefecture has again turned to increase. Despite the deflationary economy, declining birth rate and aging population, the increasing Tokyo MA population has ensured an increase in demand and profitability of urban railways.

Tables 1 and 2 show the estimated future transport volume, based on the results of an age-based behaviour analysis of a person-trip survey. From these tables, transport volume is expected to continue to grow despite the increasingly aging society. Although older people no longer commute, other trips for purposes such as recreation and shopping are expected to increase. Furthermore, the number of rail passengers has increased since 2000 after these estimates were made, due to factors such as raising the retirement age and increasing demand for older workers due to labour shortages caused by the improving economy. Railway demand that slumped during the post-bubble deflationary years has turned upwards (Fig. 6).

However, looking at individual areas and districts, the aging population and general population decrease from place-to-place is resulting in failures of shops and daily consumer services, causing the emergence of unsustainable communities. For example, the new-town developments of the high-economic-growth period were populated *en masse* by new residents in their 30s and

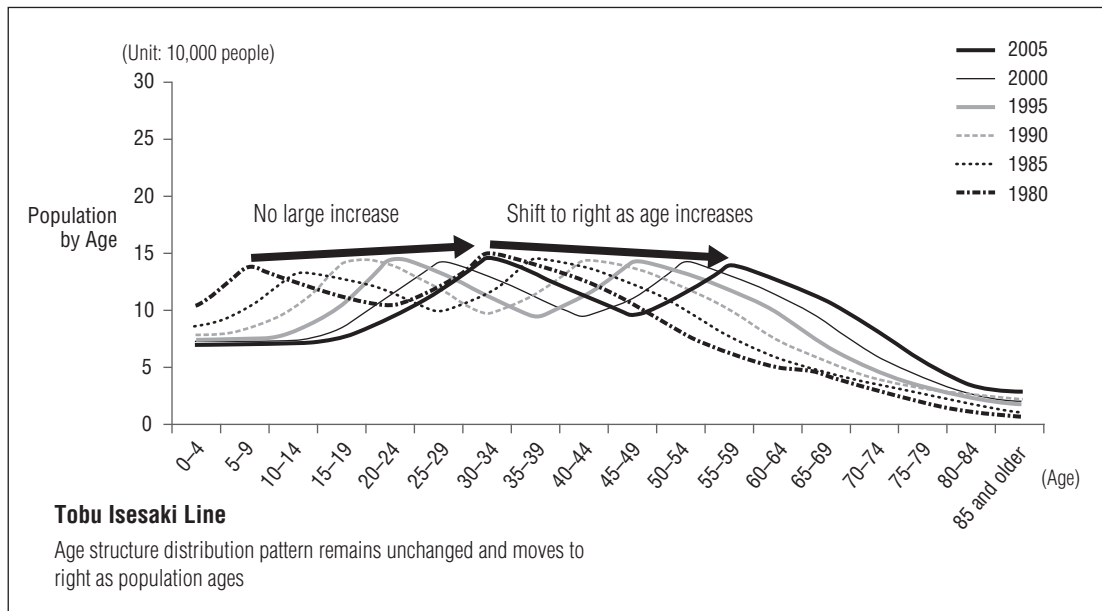
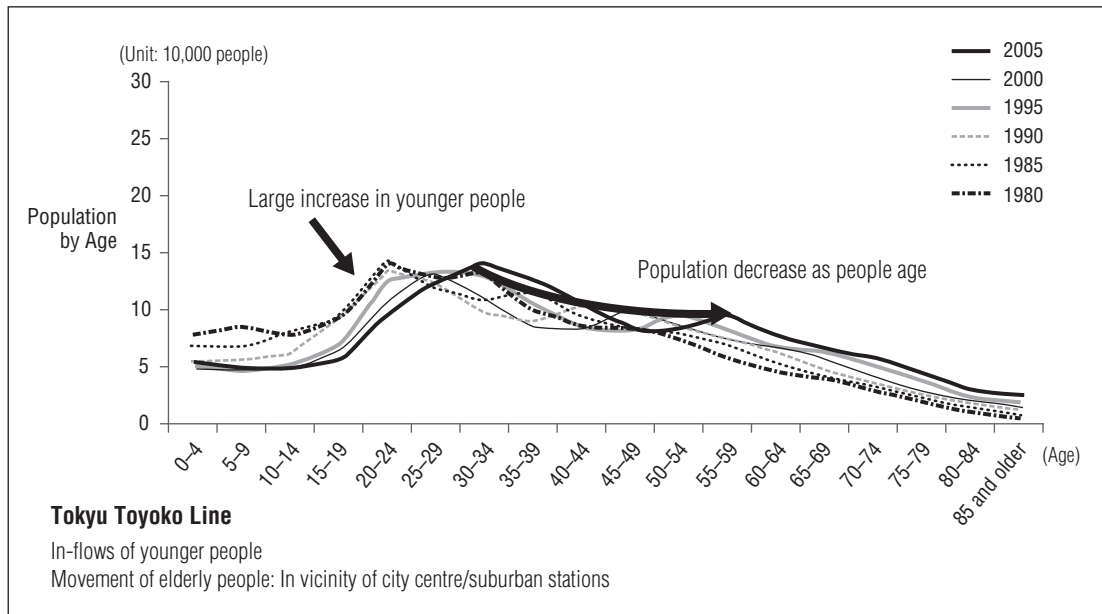
Figure 9 Net Inflows and Outflows of Tokyo MA by Region and Age Bracket



40s. This uniform age range now means that these towns are populated increasingly only by old people who do not commute and more blocks are becoming empty as residents die. Old urban areas too that have been overlooked by redevelopment initiatives are also full of elderly residents. Local governments have taken measures in some of these districts, including redevelopment to attract the younger generation, support for families raising children, incentives for the elderly to sell their homes, and development of sheltered community housing for the elderly.

However, a more serious problem is progressing today. Most current migrants to the Tokyo MA are almost exclusively young (at university entrance and university graduation/

Figure 10 Changes in Population Structure by Railway Line



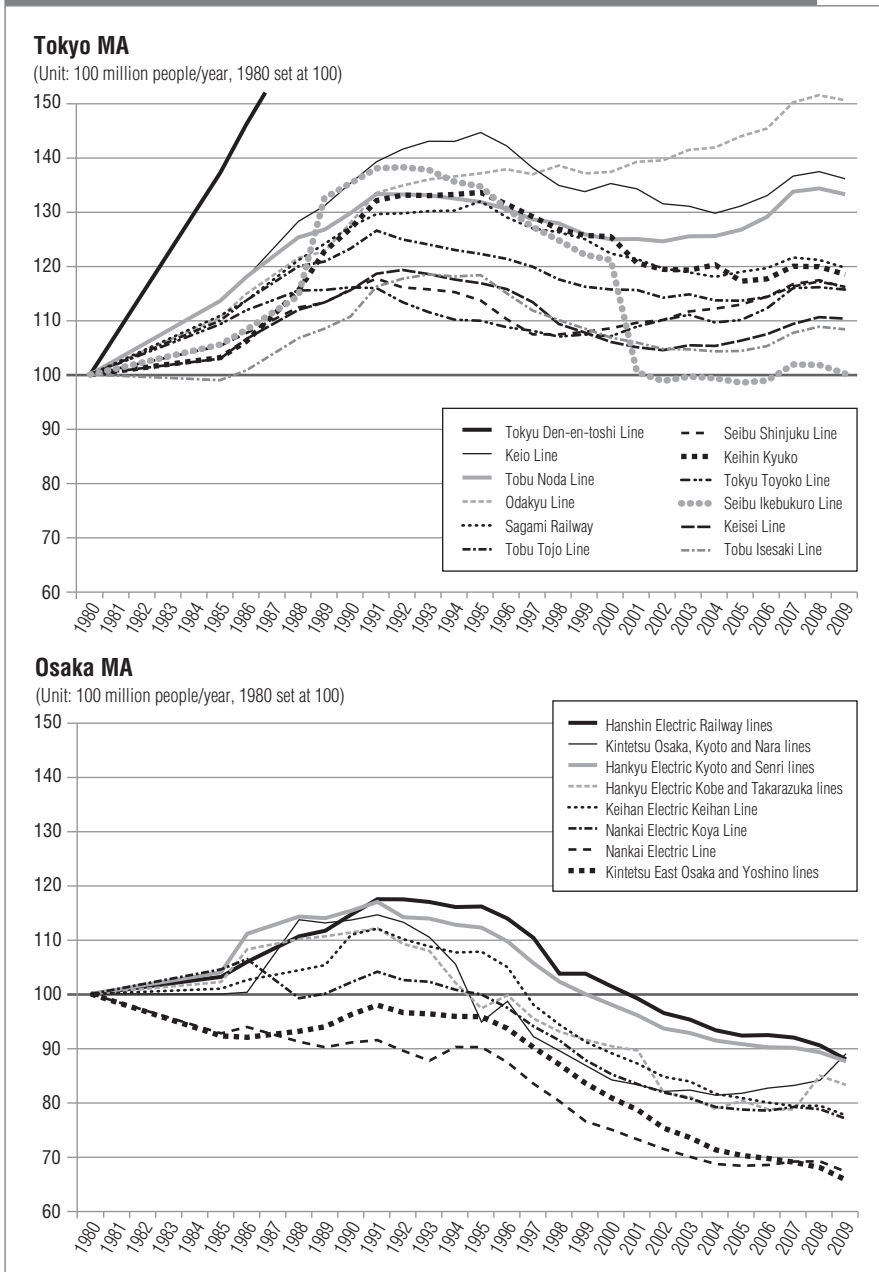
employment ages), while more people in other age groups are leaving the Tokyo MA. Only the Kansai region which includes the Osaka MA is seeing outflows of people of all age ranges to the Tokyo MA (Fig. 9).

These younger people tend to live in Tokyo MA residential areas along railway lines leading westward. Figure 10 shows the population trends along two private railway lines; the Tokyu Toyoko Line has an influx of younger people and movements of the older generation along the line have also remained robust, leading to a mixed-generation-type area. Other lines on the west side of the Tokyo MA show a similar tendency. However, the populations along lines leading east and north, such as the Tobu Isesaki Line,

follow the standard age-distribution model and continue to age. In other words, disparities between railways are growing, with the aging rate continuing to rise on eastern and northern lines, threatening the vitality of communities along these lines. Although there are land-price differences from line-to-line, this does not result in a more even population distribution.

As noted above, local governments are implementing measures to attract the younger generation. However, private railways are also expected to implement their own measures. More than half the income of private railway companies comes from businesses along railway lines, including urban development projects, retail business such as department

Figure 11 Passenger-km on Private Railways in Tokyo MA and Osaka MA



stores and supermarkets, distribution, education, and entertainment. Accordingly, if railway lines lose their vitality not only will this impact demand for rail travel, it will also mean a decline in local business overall. This should be sufficient motivation for private railways to take measures to attract the younger generation. Some railway companies have concluded agreements with local governments to run joint projects in both the Tokyo MA and Osaka MA.

Osaka Metropolitan Area

As seen in Figure 6, demand continues to decline in the Osaka MA. Figure 11 shows the changes in demand for private railways in the Tokyo MA and Osaka MA. In contrast to the Tokyo MA, where demand dropped following the collapse of the bubble economy but rebounded thereafter, the downward trend has continued in the Osaka MA since the end of the bubble economy. Competition is especially fierce in the Osaka MA, where JR West and private railway lines run close to each other or in parallel. Following the JNR privatization, JR West enhanced its competitiveness by improving services, including increasing speeds and train frequencies. Approximately half the decreased demand for private railways has moved to JR West lines. This explains why demand for private railways has declined significantly, although the Osaka MA population has decreased only slightly.

Other factors are the stagnating employment situation due to the economic downturn, as well as population outflows and the aging society noted above. When manufacturers shifted operations from large cities to provincial locations in Japan, or further afield to Asia to offset the effects of the appreciating yen, employment increases in the service, finance and information-related industries in the Tokyo MA more than compensated for reductions

Figure 12 Population Trends in Prefectures in Osaka MA

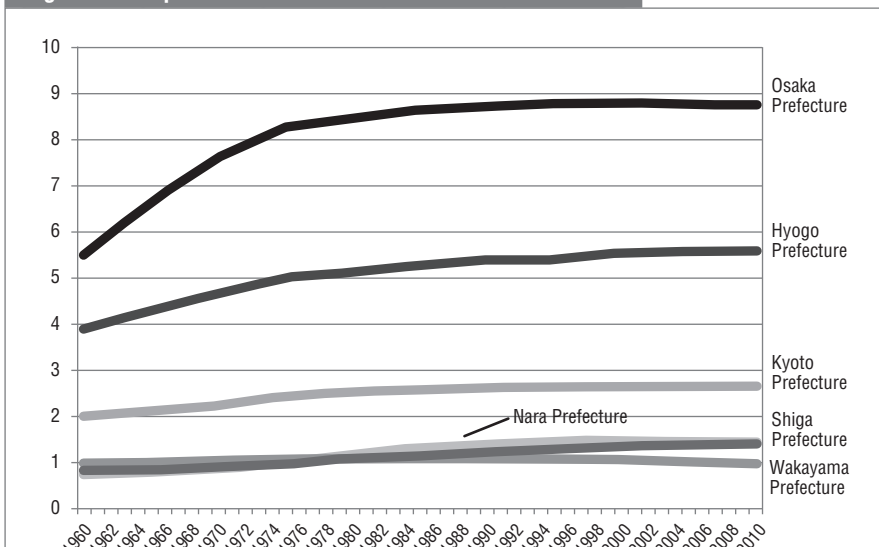
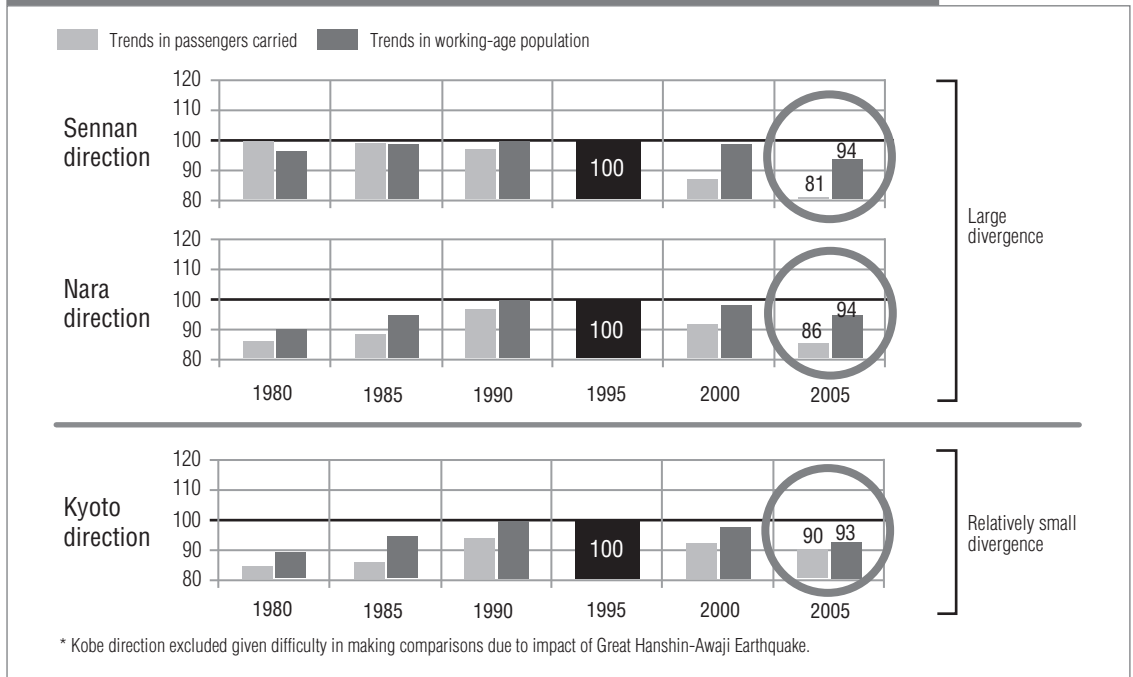


Figure 13 Decrease in Passengers Carried and Working-Age Population Along Lines

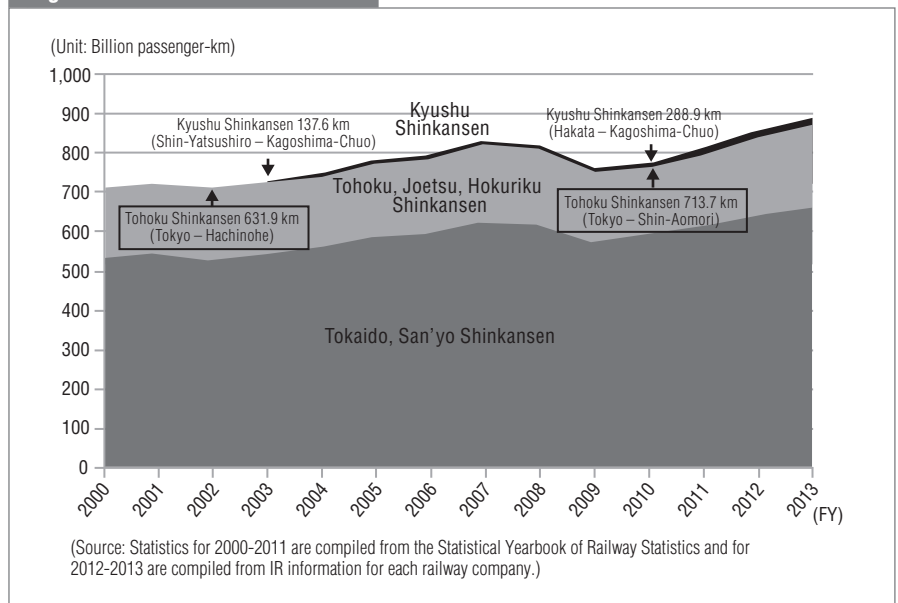


in employment opportunities in manufacturing industry. In contrast, there were fewer companies setting up business in the Osaka MA. Thereafter, many companies relocated their headquarters from Osaka Prefecture to Tokyo Prefecture and companies headquartered in Tokyo Prefecture also scaled back their Osaka Prefecture branches due to ongoing deflation. In the wake of the collapse of the bubble economy, the aging population in the Osaka MA caused a drop in the working-age population (15–65 years) that exceeded overall population decrease. However, as shown in Figure 13, demand for rail travel decreased even further than the working-age population decreases, with the rate of decrease varying from line-to-line. One reason was competition with JR West, and another was the differences in industrial structure along individual lines. As in the Tokyo MA, disparities between lines are growing due to the impact of population decrease and the aging society.

Inter-City Railways and Regional Railways

Upward trends in demand for inter-city railways differ depending on population, number of journeys per capita, and competition with planes and automobiles. Even with

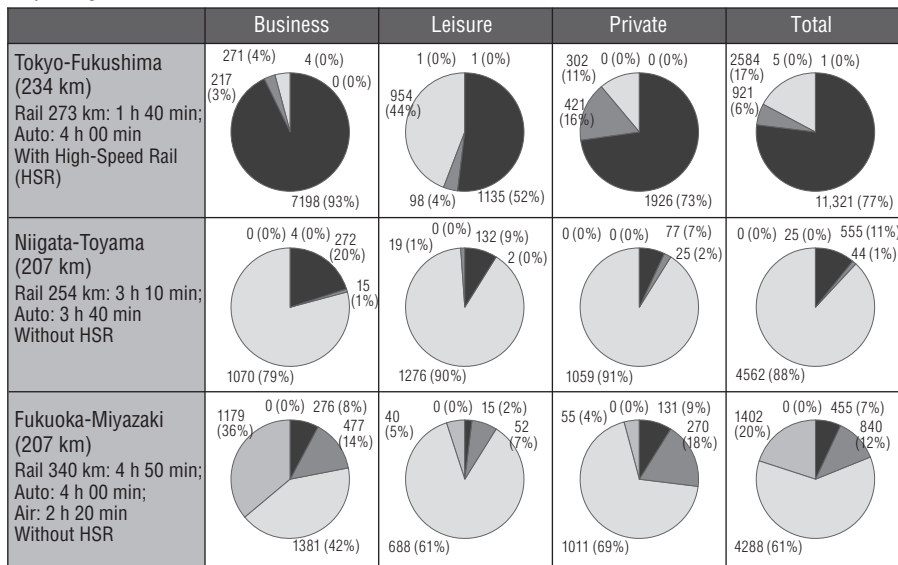
Figure 14 Shinkansen Demand



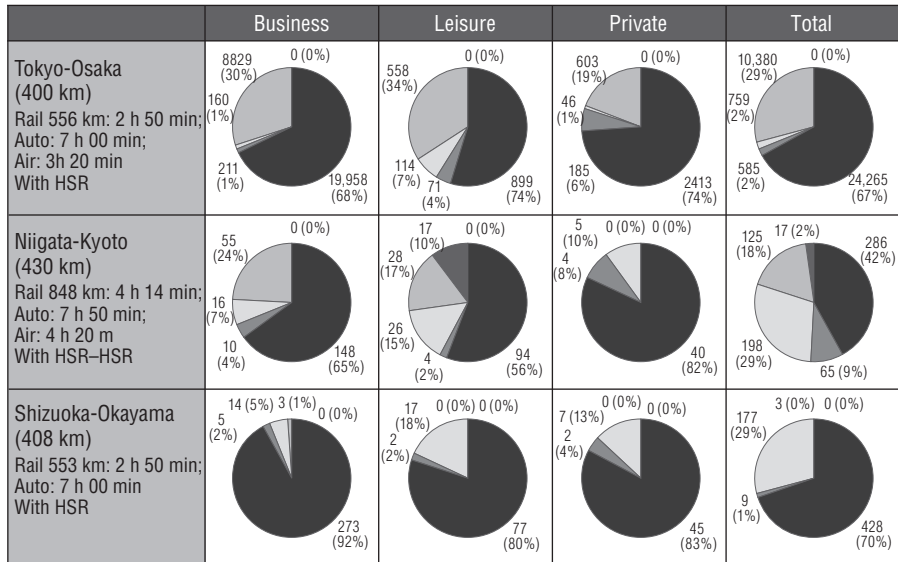
a decreasing population, business trips are increasing thanks to a recent economic growth rate in areas along the line. Although people in their 20s used to make most trips per capita for private purposes, especially tourism, now this age bracket is making less trips for such purposes. In contrast, the baby boomer generation, which is now reaching retirement age, represents a large proportion of the population and their active demand for travel is helping increase transport demand overall. Demand for inter-city shinkansen decreased during the period of economic stagnation, but is now on the rise again (Fig. 14). Demand on trunk lines, including aviation as well as shinkansen is on

Figure 15 Modal Split by Trip Length, Trip Purpose and Convenience of High-speed Rail

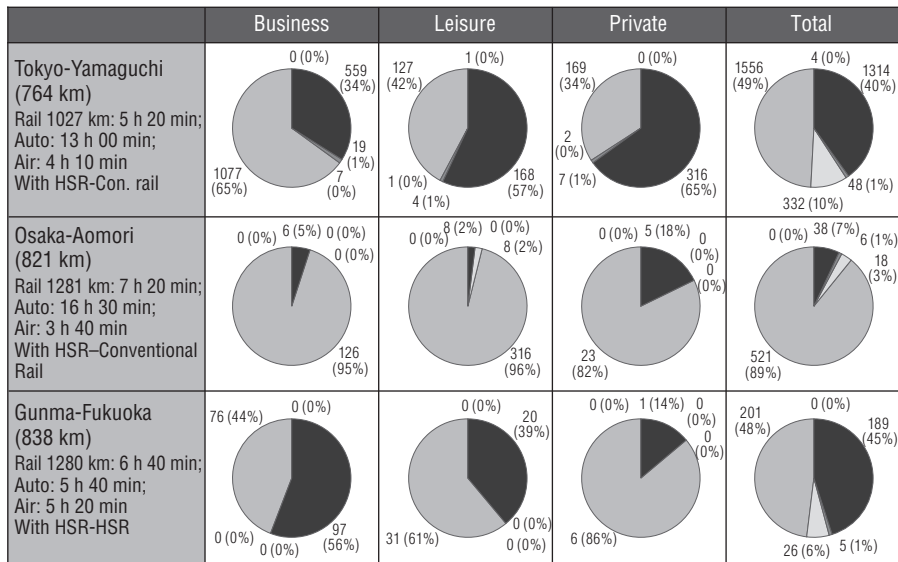
Trip Length: Direct Distance = 200 km ■ Rail ■ Bus ■ Car ■ Air



Trip Length: Direct Distance = 400 km ■ Rail ■ Bus ■ Car ■ Air



Trip Length: Direct Distance = 800 km ■ Rail ■ Bus ■ Car ■ Air



an upward trend, unaffected by population decreases. As shown in Figure 15, the modal split for transportation differs greatly by length of trip, purpose of travel and convenience of shinkansen use. The convenience of shinkansen (HSR) use means with HSR, without HSR, with transfer from HSR to HSR, or with transfer from HSR to conventional railway. In other words, although it is said the shinkansen has the greatest competitiveness over other modes of transport generally for trips of 500 to 700 km, this actually differs widely depending on these conditions. Accordingly, although society is aging, trips for purposes such as tourism are increasing and if the economy picks up, travel for business will also increase, which is why railway demand is increasing.

As noted above, although major trunk lines linking Tokyo with core provincial cities are not significantly affected by population decrease, regional railways in rural areas, including lines of operators in the JR group of companies, are being affected directly by population decrease and shrinking markets, and are facing declining demand.

Currently, there are 95 companies operating regional railways (small- to medium-size private railways other than the JRs, rail companies in the three major metropolitan areas, and tram lines) nationwide; only 34 of these are profitable. In addition, trams operate in 19 cities nationwide, but only five companies are operating profitably. Regional railways are being forced to abandon operations, due both to population decreases and aging of society, as well as to long-

term operating deficits, limited subsidies, aging of facilities, and more frequent natural disasters. Figure 16 shows the number of railway lines that have discontinued operations each year.

Aging of society is especially advanced in provincial areas and there are many municipalities facing extinction. The only response to maintain public and consumer services in these communities is for several municipalities to join together in constructing a wide-area living sphere. The government is currently deploying policies to maintain provincial populations, which include efforts to realize such concentrations of consumer and public functions. If measures are promoted to concentrate such functions, it is essential that local public transport be made available for elderly people. Support policies are being constructed to develop and implement local transport plans, including railways. At the same time, regional railways are also engaged in various efforts to attract tourists and provide services to local residents. The government established a site for sharing information about such initiatives at the national level and will seek to apply initiatives in parallel with support policies of each region and community.

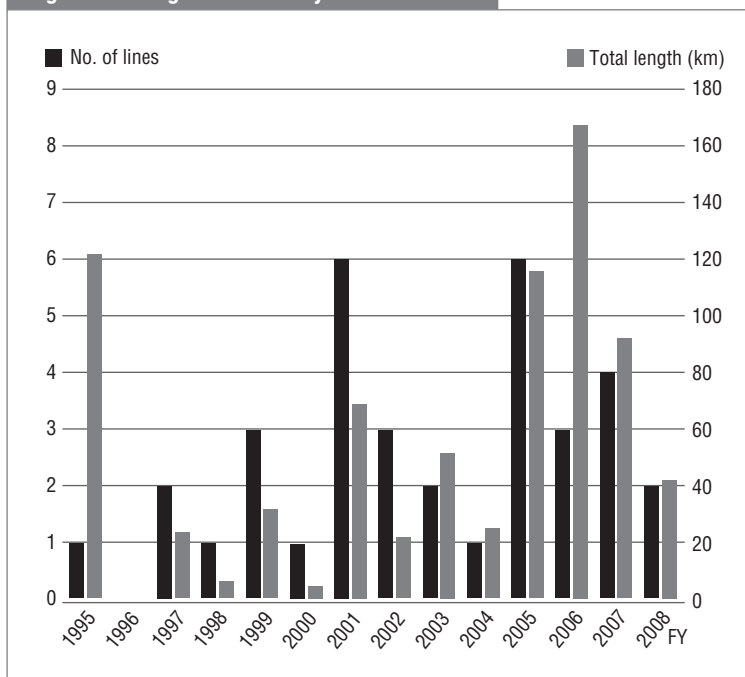
The deficit of provincial lines in the regions of the three JRs on the mainland is compensated by the high incomes from shinkansen and metropolitan railway services. In the case of the other three JR companies on the remote islands with less railway business income, the deficits have to be covered by reduction of operating costs, revenue creation from urban renewal projects, commercial building business and limited subsidy.

Conclusion

The decreasing population and aging society in Japan is having an impact on the railways.

Some years ago, I served as President of the Institute for Transport Policy Studies and engaged in research into the impact of a decreasing population and aging society on the transportation business. All railway operators have a sense of crisis about declining demand as the population decreases and all are taking the measures explained above. Population decrease and the aging of society present problems not only for the demand side but also for the supply side in terms of handing-on technical skills. Although there are many baby-boomer employees at railway companies, subsequent recruitment has tailed off as companies have sought to achieve better efficiency in railway management. Faced with the mass retirement of baby boomers, railway companies are grappling with

Figure 16 Regional Railway Line Closures



a situation in which employee numbers are falling rapidly, but are finding difficulty in recruiting outstanding young people from a decreasing population, creating problems of handing-on technical skills to a new generation. JR Hokkaido is facing a crisis of increasing breakdowns and accidents as a result of continued reductions in personnel and cost-cutting caused by poor profitability. Provincial railways are taking various countermeasures, including joint technical cooperation and requests to companies in the JR group of operators for technical assistance. ■



Shigeru Morichi

Prof. Dr. Morichi is Director of the Policy Research Center at the National Graduate Institute for Policy Studies.