Role of Nonmotorized Transportation and Public Transport in Japan's Economic Success

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The public policies in Japan that enabled the development of an urban transportation system dominated by nonmotorized transport and rail-based mass transit were studied. The key role played by public policies that discouraged automobile use, encouraged bicycle use, channeled investment into rail, and drove up the cost of land is highlighted. It is argued that this urban transportation system contributed to rapid economic growth in Japan since World War II by constraining consumption, encouraging savings, and reducing labor costs. Finally, it is argued that the Japanese experience could serve as a better guide to developing countries than does past U.S. policy.

The extensive use of nonmotorized modes of transportation, such as bicycling, pedicabs, and walking, is often associated with a lower level of economic development. Writing in 1960, Rostow (*1*) equated the automobile-dependent post-World War II United States with the highest stage of economic development:

> What were those leading sectors in the American age of high consumption? They were, once again, the automobile, suburban home building, road-building, and the progressive extension of the automobile and other durable consumers' goods to more and more families.

From the perspective of 1990, however, it appears that the achievements of the post-war Japanese economy are far more impressive than those of the United States, with Japan having the fastest rate of economic growth and the fastest increase in its productivity of all the countries of the Organization for Economic Cooperation and Development (OECD). Yet Japan is also the least dependent on the private automobile of all the OECD countries, and the most dependent on rail, mass transit, the bicycle, and walking.

Japan industrialized later than the other OECD countries and thus had to break into already highly competitive international markets. As a result, it faced problems similar to those of developing countries today, such as how to promote its own indigenous industries in the face of highly cost-competitive foreign imports.

High urban density and a transportation system heavily reliant on nonmotorized transportation and its linkages with rail-based mass transit have been critical to Japan's economic success. By minimizing aggregate transportation costs, Japan has been able to minimize its production costs, making its goods more competitive in international markets. Further, by discouraging the consumption of private automobiles and encouraging savings, a larger pool of potential investment capital was created, also critical to rapid economic growth. Japan was able to achieve this transportation-land use system in part as a result of conscious public policies discouraging the use of the private automobile and in part as the indirect result of policies that drove up the price of land.

Japan's initial decision to discourage the use of the private automobile was in large measure because the industry was dominated by foreign firms. Investments into road infrastructure comparable with those of U.S. levels did not emerge until the mid-1970s when the strength of the Japanese automobile industry was firmly established.

As the result of a historical pattern of investment favoring rail, Japan was able to encourage a high-density settlement pattern centered on its rail network, which also made walking and bicycling convenient. Not being dependent on the automobile for commuting, Japan was able to minimize total transportation costs, albeit with a decided lack of attention to passenger comfort. Because people did not have to buy automobiles to get to work, they were encouraged to save this money instead, which lowered the cost of capital in Japan. This, among other factors, explains why Japan has had one of the highest savings rates among the OECD countries since 1950, saving and investing an average of 30 percent of its annual national income, compared with only 18 percent in the United States (*2*). The high savings rate in turn encouraged investment into modern technology.

The automobile, far from being a symbol of economic prowess, is more a symbol of economic assets being wasted on consumption instead of on job-creating and productivity-increasing investment. Meanwhile, the bicycle and other nonmotorized vehicles, far from being a symbol of economic backwardness, are more a symbol of a society able to meet its passenger transportation needs in the most cost-effective and least environmentally damaging way, allowing scarce economic resources to be invested elsewhere.

COMPARISON OF EFFICIENCY OF JAPANESE AND U.S. TRANSPORTATION SYSTEMS

The relative efficiency of the Japanese and U.S. transportation systems can be assessed by comparing the percentage of gross national product (GNP) that each country spends on its transportation system. In 1960 the United States spent 20.7 percent of its GNP on transportation, a figure that has fallen slightly to 17.9 percent in 1990 (*3*). By contrast, Japan in 1985 spent only 10.79 percent of its GNP on transportation (*4*). This gap of 7 percent has alarming implications for the relative costs of Japanese and U.S. products in international markets. Transportation costs are an

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input into every good produced, both directly in terms of shipping the good and indirectly because the wage rate must cover the commuting costs of the labor force. The differences in aggregate transportation costs are considerably wider than the gap between the percentage of GNP spent on health care that has so alarmed economists. The United States spends roughly 12 percent of its GNP on health care, relative to about 9 percent in Japan, a difference of only 3 percent.

From the disaggregated GNP figures, it is clear that the domination of the U.S. passenger transportation system by the private automobile is the key reason for the cost differences. In the United States, of the total 17.9 percent of GNP spent on transport, fully 9.5 percent is consumed by private automobile and taxi transportation, and 5 percent is consumed by truck transportation. Rail-based modes for both freight and passengers account for only 0.7 percent of GNP. In Japan, by contrast, only 2.37 percent of its GNP is consumed by private passenger vehicles and small pickup trucks, whereas only 2.25 percent is spent on road freight. Rail, at 1.4 percent, accounts for a considerably greater share of GNP than in the United States. In both cases the share of GNP spent on bicycle transportation was negligible.

These differences are also reflected in household expenditure data. The Japanese household sector consumed 9.4 percent of their income on transportation and telecommunications in 1985, whereas the U.S. household sector consumed 15.2 percent on transportation and telecommunications (*5*). Other sources indicate that automobile related expenses account for between 18.6 and 22 percent of total household expenditures in the United States (*6*). Figures for Britain and West Germany were only slightly lower than those for the United States, with 16.6 and 15 percent respectively, whereas that for France was only 12.9 percent.

The enormous differences in the cost of transportation for society as a whole are primarily a result of the fact that Japan has been able to transport its work force much more cheaply than the United States. This is clearly reflected in the mode share data.

In Los Angeles in 1980 the private automobile accounted for 88 percent of work trips, whereas public transport (buses) accounted for only 7.7 percent and walking and cycling accounted for only 4.2 percent. However, private motor vehicle travel is dominant even in the New York City tri-state region, which is the most transit-oriented metropolis in the United States, accounting for more than 25 percent of all mass transit miles traveled nationally. In New York in 1990 the private vehicle accounted for 71 percent of all work trips, whereas public transit accounted for only 10 percent and walking and cycling only 6 percent—a sharp decline even from 1980, when only 63.6 percent of work trips were made by automobile, 28.3 percent by mass transit, and 8.1 percent by walking and bicycling (*7*).

These figures differ radically from those in Japanese cities. In the Tokyo metropolitan area, bicycling and walking accounted for 25.8 percent of all commuting trips in 1968 and fell only slightly to 21.7 percent of all commuting trips by 1988. Rail accounted for 51.9 percent of all commuting trips in 1968 and still accounted for 46 percent in 1988. The automobile accounted for only 12.9 percent of all commuting trips in 1968 and now accounts for some 29.4 percent of all commuting trips, still exceedingly low by OECD standards (*8*).

Thus, the transportation needs of at least half of the Japanese population are met by the 1.4 percent of GNP spent on rail transport and the negligible amount spent on nonmotorized transportation. It is in its role of minimizing the costs of the entire transportation system and increasing the catchment area and hence the viability of the rail-based mass transit system that nonmotorized transportation has played a critical role in the competitiveness of the Japanese economy.

Nonmotorized transportation has not only played a key role in Japan's transportation system historically; its role is actually increasing in several key areas. Over the past few decades the role of nonmotorized vehicles in Japan has changed slightly. As people are moving farther from urban centers, the use of the bicycle and walking for an entire commute has fallen slightly. However, the use of the bicycle to commute to rail stations has increased rapidly since the 1970s. In 1975 there were only 300,000 bicycles parked at commuter rail stations throughout the country. By 1981 this figure had risen to 1.25 million, and it is now well above 3 million, with 1 million of them in Tokyo. In suburban areas around major cities between 15 and 45 percent of rail station access is by bicycle. For Tokyo as a whole the percentage of people who use the bicycle to reach rail stations rose from 4 percent in 1975 to 11 percent in 1980 to 13 percent in 1985 to closer to 15 percent today. This growth in bicycle use has not been exclusively in the lower-income areas but has been at least as prevalent in higher-income neighborhoods (*8*).

This massive increase in bicycle commuting to rail stations has been facilitated by the rapid improvement of bicycle parking facilities near stations. Increasing numbers of bicycles illegally parked in front of rail stations began to be a serious problem for pedestrians in the late 1970s, prompting government action. The Bicycle Law, passed in 1977, provided public funding and tax incentives for the construction of bicycle parking facilities. Japan's 1980 Bicycle Law provides that newly constructed or enlarged department stores, supermarkets, and banks must provide bicycle parking. Japan has spent more than $10 billion on bicycle-related infrastructure over the past two decades, which led to the construction of some 8,952 parking facilities holding some 3 million bicycles, of which 3,250 are in Tokyo. Each year another 237,000 new bicycle parking spaces are constructed, an increase of over 10 percent a year. About 73 percent of these are controlled by provincial or local governments, 13 percent by public authorities such as the railroad, and 13 percent by the private sector. Roughly 66 percent of these parking spaces were within 100 m of a rail station entrance, and most hold from 500 to 1,000 bicycles. Land for these parking facilities is usually donated to the government by a railroad company or a large business during a "land readjustment," a process similar to urban renewal. One-half to one-third of the capital costs for construction can be paid for from public subsidies, and tax benefits and subsidized financing are available to the private sector for bicycle parking provision (*8,9*).

There are about 60 million bicycles in Japan—roughly double the number of motor vehicles—and since 1986 the increase in the number of nonmotorized vehicles has kept pace with the increase in car ownership (*9,10*). They are assuming an increasingly important role in providing cheap, pollution-free, and convenient access to suburban commuter rail stations.

The rapid increase in the role of the bicycle as a way of reaching commuter rail stations has considerable economic and environmental advantages over automobile park-and-ride facilities. The provision of parking for private motor vehicles is far more expensive than the provision of parking for bicycles. It costs some $3,500 to $5,000 to provide surface-level parking for a single motor vehicle and closer to $20,000 for a single parking space in

a parking garage. Meanwhile, it costs only $100 for a bicycle in a rack, and only $1,000 per bicycle for a state-of-the-art, fully automated and secure bicycle storage facility. This does not include the relative difference in the cost of land, which in Japan is the determining factor. A single bicycle requires some 6 to 12 ft^2 of ground-level storage space, compared with a minimum of 330 ft^2 for a single automobile parking space (*11*).

Automobile park-and-ride facilities also do little to control the increase in emissions that are causing global warming and severe health problems. Most emissions come from cold starts and cold-running engines, whereas only a minimal amount of extra emissions are generated once the engine is warm and running. Thus, if passengers first drive to a park-and-ride facility the number of cold starts is not reduced at all. Bicycle and walking trips, of course, generate minimal air pollution.

Several factors have led to the growth in combined bicycle-rail commuting in Japan. First, with housing extremely expensive and cramped in Japan, housing development is expanding farther and farther away from commuter rail stations. The bicycle expands the catchment area of a rail station from about 1 km^2 for walking to about 25 km^2 for a commuter with a bicycle. Thus, bicycles are replacing some trips that otherwise would have been walking trips. Second, as traffic congestion continues to worsen on Japanese streets, the travel speed of buses has fallen dramatically. Average travel speeds on the Tokyo Metropolitan Region roads have slowed from an average of 9 mph in 1960 to 7 mph in 1983, and the slowing trend continues (*12*). This pace has particularly hurt the popularity of buses, which travel even more slowly. As a result, people who used to ride the bus to commuter rail stations are increasingly switching to faster bicycles. Finally, the increase in road congestion and the lack of parking continue to discourage people from using their private automobiles.

With passenger transportation relying on bicycles and mass transit, Japan has been able to dedicate its available road infrastructure primarily to trucking. Trucks account for nearly every other vehicle on Japanese roads and take up more than half of the total road space (*13,14*).

Automobiles are an important form of consumption. Every dollar spent on them is a dollar that could have been saved and thus invested into increasing economic growth. If this consumption were entirely "luxury" consumption, at least one could claim that this is how Americans are choosing to spend their surplus wealth. Being able to own a car is a luxury that most people in an affluent society should be able to enjoy. However, being dependent on the automobile to take care of basic commuting needs is not liberating. It means that families have no other option than to sit in traffic jams. This imposes significant costs on the American family, which could be avoided if bicycling, walking, and public transportation alternatives were more viable.

Because it has become necessary for commuting, the automobile has become an indirect cost of production. In the United States each employee must be paid some $5,000/year for the purchase and maintenance of their automobile to get back and forth to work each day (*6*). Furthermore, taxes have to be collected to pay the estimated $2,400 per passenger car of public subsidy to make automobile transportation viable (*15*). This $7,400/worker is reflected in the costs of all goods produced in the United States, albeit indirectly.

In Japan, by contrast, a one-time purchase of a $100.00 bicycle and a $500.00/year rail pass can take care of a person's annual commuting costs. Japanese workers therefore need only to be paid about $600.00/year to cover their commuting costs. These are significant cost differences that are undermining the competitiveness of U.S. products in international markets.

The automobile-based U.S. transportation system also led to the development of very low density suburbanization, whereas the rail-based Japanese transportation system led to the development of higher-density clusters around rail stations. The low-density U.S. pattern imposes important inefficiencies in the provision of many other forms of infrastructure and public service, such as telecommunications, electricity, water, sewerage, postal service and drainage. Several studies (*16,17*) indicate that the cost of providing housing in low-density unplanned suburban areas is at least 60 percent higher than providing the same number of units in planned, higher-density areas. More than half of these costs are underwritten by the tax payers. In low-density sprawling human settlements the costs of providing roads and streets are 4 to 15 times higher than in high-density areas, the costs of copper pipe and utility pipe for water supply 5 times higher, the costs of providing postal delivery 300 times more expensive, the costs of heating 5 times higher, and the amount of water and electricity consumed are double (*16*). Because of the ability to rely on walking, bicycling, and commuter rail, residents in Tokyo use $^1/_7$ the gasoline consumed by residents in large U.S. cities. The macroeconomic implications of these cost differences, which are reflected ultimately in the costs of U.S. products, are disturbing.

U.S. dependence on the automobile is also exacerbating the trade deficit. In 1989 Japan produced 9,052,000 passenger cars while consuming only 4,404,000 cars. In the same year the United States produced only 6,823,000 passenger cars while consuming 9,853,000 cars (*18*). If each one of these important cars cost $10,000, then $30 billion of the U.S. annual trade deficit at 1990 levels, or roughly 15 percent, can be directly attributed to the deficit in automobiles. If oil imports are also considered, automobile-related imports account for closer to 45 percent of the U.S. trade deficit.

Although many scholars have asked why the United States has lost the competitive edge in the production of automobiles, fewer have asked why it consumes so many. It is telling that in Toyota City most employees live in company housing near their factories and are picked up each morning by a company bus to minimize the worker's transportation costs (*19*). In the United States, automobile plants in Detroit are located in distant suburbs that are accessible only by private automobile to ensure that their employees are also customers.

HISTORICAL AND PUBLIC POLICY CAUSES OF JAPAN'S URBAN TRANSPORTATION SYSTEM

The radical differences between the transportation systems of Japan and the United States have developed in part as the result of historical processes, in part as a result of conscious public policy decisions, and in part as a result of the relative roles of Japan and the United States in the global economy.

Since World War II the Japanese government has pursued a set of public policies known as the "Maruyu system," which aimed at constraining private consumption. For example, interest earned on savings in the Postal Savings Bank was not taxed up to the first $13,000 before 1989, whereas there were a host of consumption taxes, with the automobile being a major target (*20,21*). With domestic demand weak after the war, and wanting to increase the

pool of savings available for investment, Japan had to focus on selling its products in international markets. To make their products competitive the Japanese had to minimize their production costs, including their transport costs.

Total transport costs in Japan were minimized by several public policies. First, before 1975 Japan had a relatively low level of public investment into roads and highways and a relatively high level of public investment into rail-based transportation. Japanese investment into rails was actually higher than its investment into roads in absolute terms before 1964 [Figure 1 (*22–24*)]. Japanese investment into road infrastructure (as a percentage of GNP) was considerably below investment levels in the United States, but only before 1975 ([Figure 2 (*3,24*)]. Japanese investment into rail has been considerably higher than that in the United States throughout the post-war period [Figure 3 (*3*)]. In part as a result of these differences the amount of urban land dedicated to road traffic circulation is much lower in Japanese cities (5 to 15 percent) than in U.S. cities (20 to 25 percent) (*12*). The limited available road infrastructure quickly became congested in Japan, encouraging commuters to seek alternative, faster modes.

This pattern of investment in favor of rail, which had a major impact on the nature of urbanization in Japan, has long historical roots. When Japan entered the modern era after the Meiji Restoration, its road system was extremely underdeveloped. During the Tokugawa Shogunate wheeled vehicles were prohibited, the use of roads was tightly controlled, and the bridge infrastructure was left undeveloped, all as security measures to prevent sudden attacks by road on Edo (modern Tokyo). In Japanese cities wheeled traffic was also banned. Thus, when the Japanese economy began to modernize, its road infrastructure was very primitive, inducing modernizers to focus on the rapid development of rail, while the road system was used as a feeder system to the rail network.

Not long before the Meiji Restoration the ban on wheeled vehicles was lifted. The rickshaw, introduced in 1870, quickly came to dominate the urban transport scene, replacing the hand-carried palanquin or sedan chair. The first railroad was also introduced in 1872 between Yokohama and Tokyo. In the 1880s horse-drawn carriages and later omnibuses came to compete with the rickshaws. It was ultimately the bicycle and then the electric tram around the turn of the century that undermined the rickshaw. By World War II, the rickshaw had all but disappeared, resurfacing briefly after the war until about 1956 (*25*). The bicycle was thus a relatively modern vehicle that developed at roughly the same time as the first imported motor vehicles. Therefore, the notion that the motor car is more "modern" than the bicycle is a fallacy.

Economic nationalism was an important factor in the continued dominance of rail and bicycle relative to the motor vehicle in Japan. Rickshaws were almost certainly invented in Japan and first mass produced there, and from almost the beginning bicycles were manufactured domestically (*26*). By 1880 Japan had regained national control of shipping, and by 1920 Japan was manufacturing all of its own railroad equipment as well. The rail system also ran on coal and electricity, both of which were widely available domestically. By contrast, the Japanese automobile industry was destroyed by competition from General Motors and Ford, which had set up U.S.-owned subsidiaries in Japan by 1926. Japan's road-based modes were thus dependent on foreign-owned producers, foreign spare parts, and approximately 99 percent dependent on

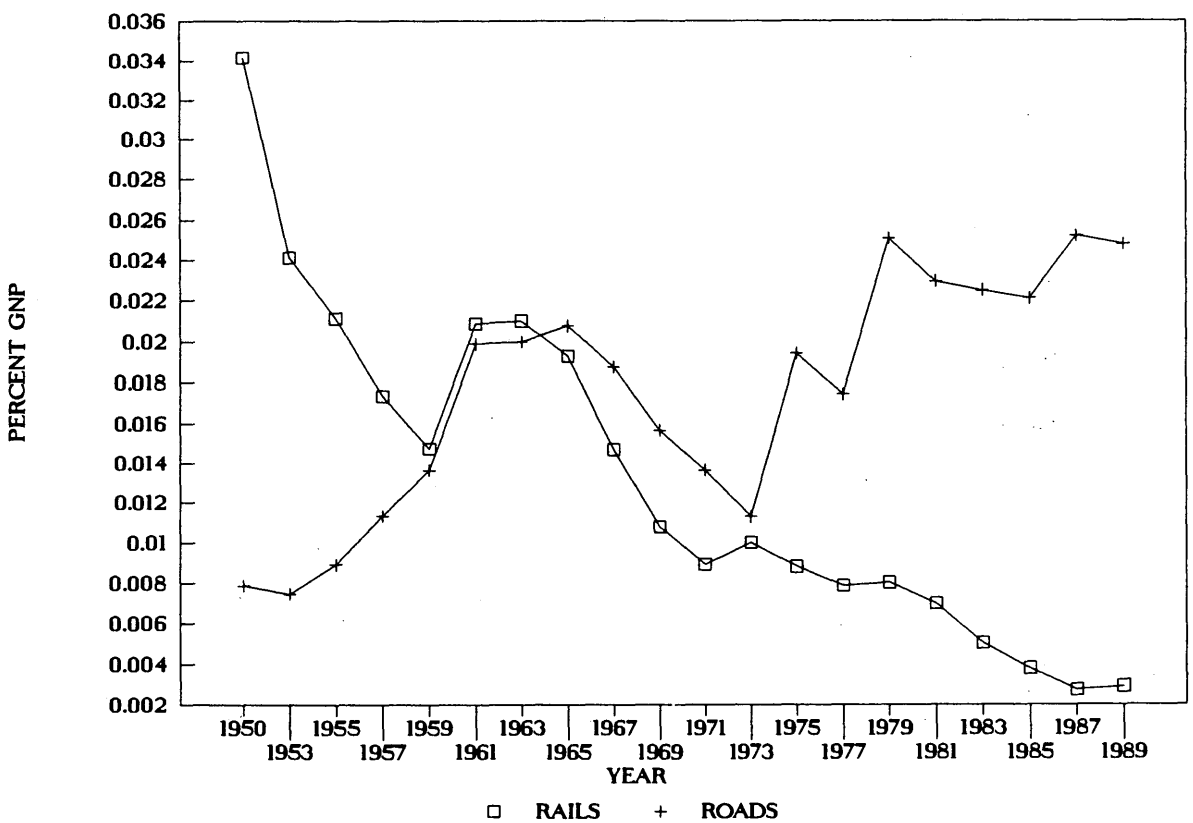

FIGURE 1 Japanese aggregate investment, roads and rail, 1950–1989 (*22–24, Japanese Ministry of Transport*).

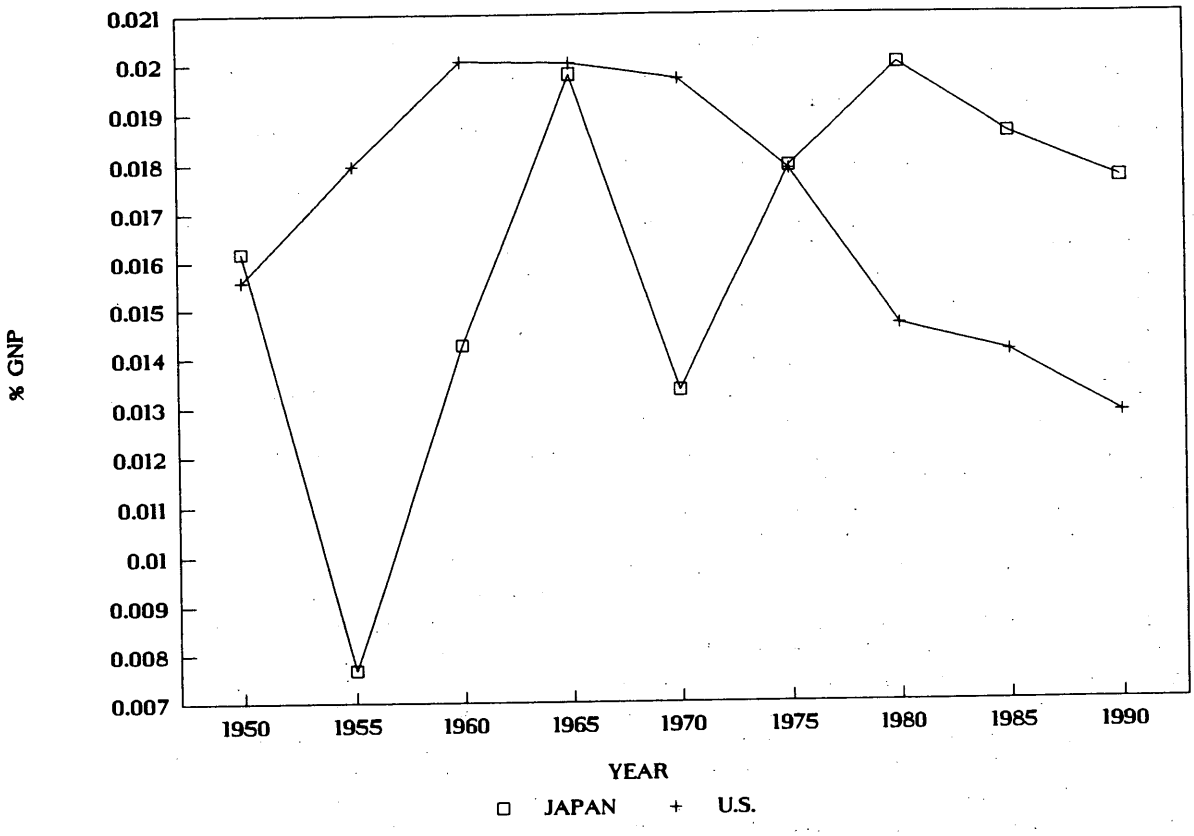

FIGURE 2 Total public spending on roads, Japan and United States (*3,24*).

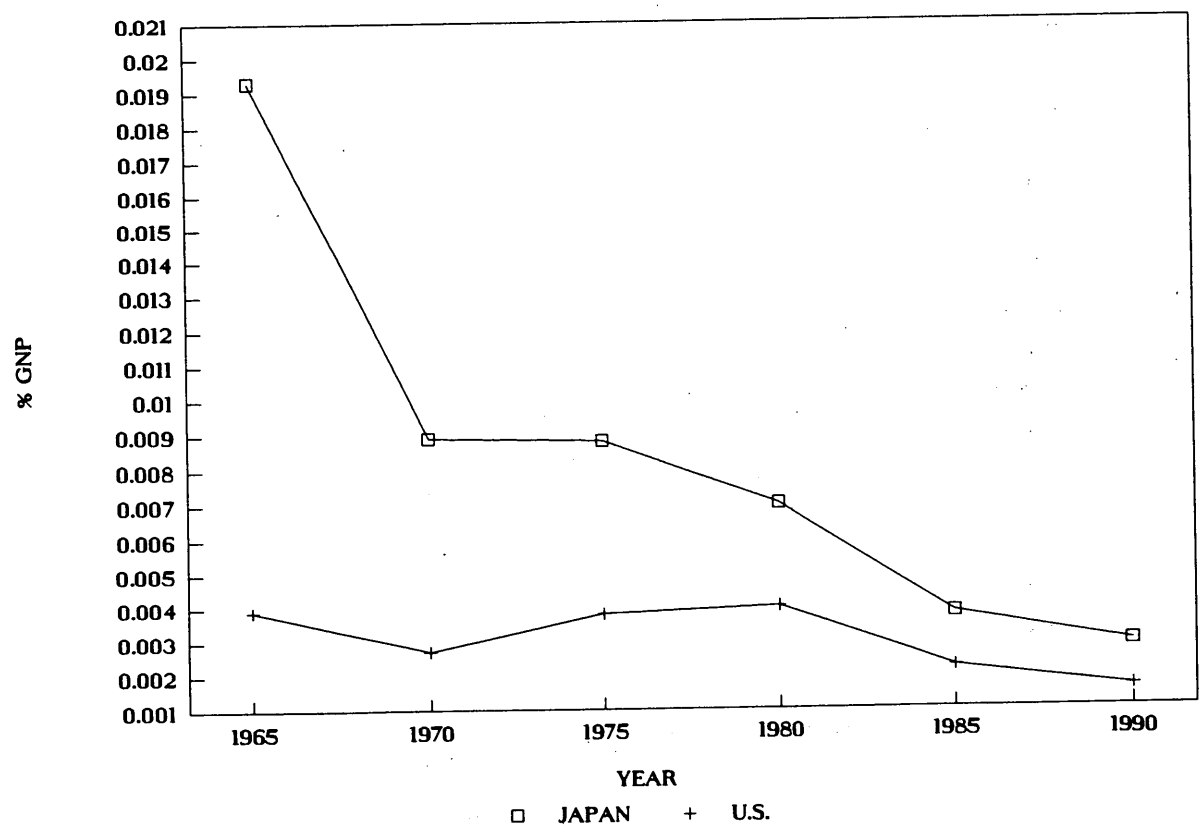

FIGURE 3 Total investment in rail, Japan and United States (*3*, Japanese Ministry of Transport).

imported oil. As a result, public spending on road infrastructure was never made a priority (*23*).

With the Japanese government pursuing an increasingly expansionist foreign policy in the 1930s the vulnerability of road-based modes to the blockade of oil and spare parts became a critical national security concern (*23*). The military government essentially created Nissan and Toyota Motors by a combination of favorable government contracts and subsidies and, after 1936, drove out the foreign motor vehicle corporations by increasingly tighter restrictions on foreign motor vehicle business operations (*27*). But during the war, with scarce oil reserves needed for the war effort and with shipping and oil supplies increasingly subject to aerial bombardment, more and more freight and passenger transport was shifted to rail.

After the war, both transportation infrastructure and production facilities were badly damaged by Allied bombarding. The occupation authorities restricted Japanese access to oil and motor vehicles for security reasons. Wanting to get the economy back on its feet, the occupation authorities decided to revitalize rail first, which was easier to monitor. As late as 1956 the main road between Tokyo and Osaka was still unpaved and almost not passable in significant sections. Thus, although investments into road infrastructure took off in Japan in the early 1960s, particularly before the 1964 Olympics, the road system was starting from a very low baseline, ensuring the continued importance of rail and continued high-density, rail-focused urbanization.

Other public policies also discourage automobile use and encourage walking, bicycling, and mass transit use. First, car owners must prove that they own a parking space before they can register their car in Tokyo, and parking is enormously expensive. It can cost over $100 to park for a day in some areas in downtown Tokyo, in part because of taxes. Parking violations can result in fines of up to $1,500. Fuel taxes and import duties also are very high, driving fuel costs in Japan to 3.1 times the U.S. level. The total tax levy on a car in Japan is roughly $1,285/year, compared with $232/year in the United States. Meanwhile, a driver can pay the equivalent of $98 in tolls to drive from Osaka to Tokyo, about the same distance as that from New York to Washington where the tolls cost a U.S. driver from nothing to $14.00, depending on the route. Another crippling cost of driving in Japan is called the "shacken." Every 2 years drivers have to have their cars inspected. The cost of inspection is roughly $900.00, and if the car does not have the inspection sticker by the end of the year the cost is doubled. Above and beyond this one must pay mandatory replacement costs on all sorts of vehicle parts (*7,8,28*).

Furthermore, most Japanese employers pay for the entirety of their employees' commuting expenses if they commute by public transportation. As a result, families tend to have only one car and treat it as a luxury, using it for weekend outings, rather than as a means of commuting.

Surprisingly, despite some of the highest gasoline taxation, tolls, and other user charges among OECD countries, these revenues still have been significantly less than the amount of money the Japanese government has spent on road infrastructure since the 1960s [Figure 4 (*3,29*)]. The level of direct subsidy to the private automobile in Japan actually has been higher than in the

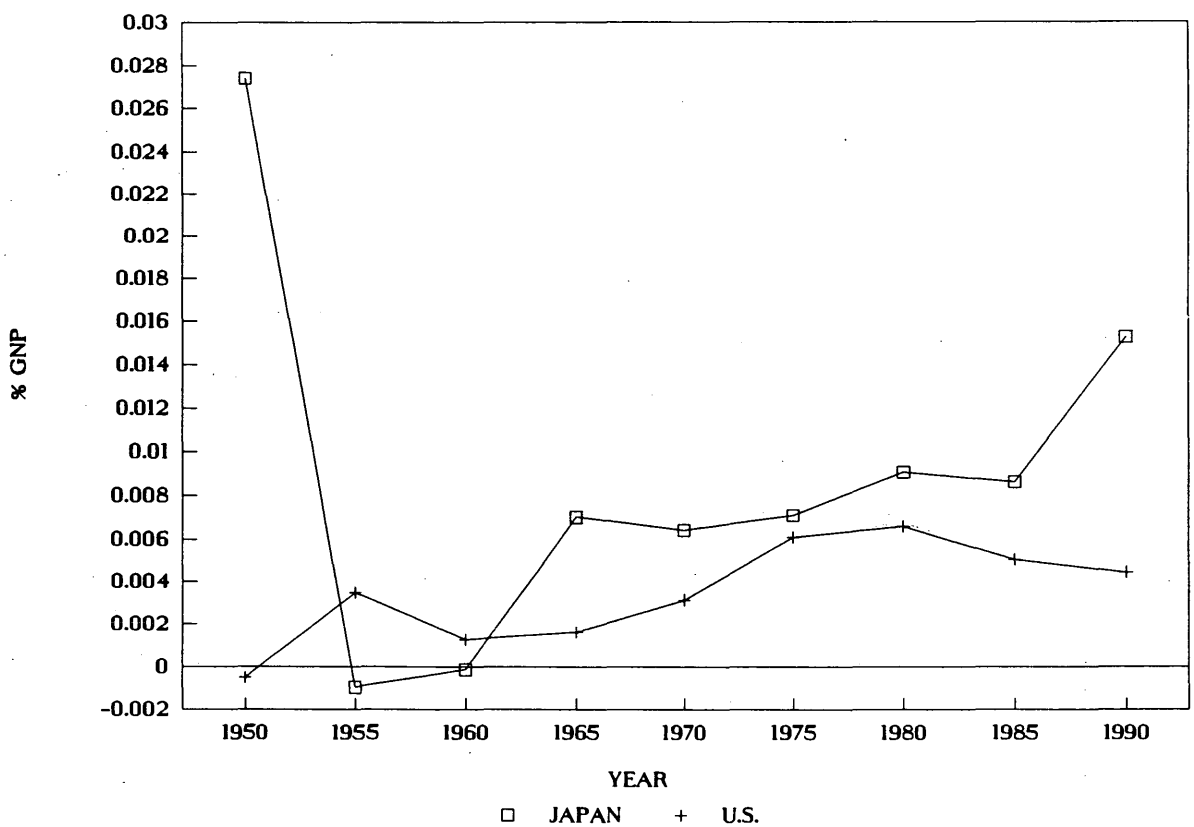

FIGURE 4 Road subsidies, Japan and United States (*3,30*).

United States for several decades. Rail and mass transit subsidies were higher in Japan than in the United States until 1970 but have been higher in the United States since then. In both countries, however, the level of public subsidy to these modes increased dramatically from 1970 until 1980 and have fallen sharply since then.

Despite enormous public expenditures into roads since the early 1960s, Japan has built far less physical road infrastructure largely because of the high cost of land acquisition. Land consistently accounts for between 70 and 80 percent of total costs for road projects in Japan, compared with some 25 percent in the United States (*30,31*). Construction costs also are higher because to minimize land acquisition costs most Japanese highways in urban areas are elevated, freeing the land below for alternative uses.

Land prices in Japan, while in part a reflection of the lack of arable land relative to the density of population, cannot be explained by purely geographical factors. According to Ricardian theory, one would generally expect that the value of land would reflect the economic activity on that land. The total value of land in the United States relative to that of Japan should be in the same ratio as the ratio between the two GNPs. This would still give Japan a much higher land value per square meter than the United State. However, since the 1970s, the total value of land in Japan has been between two and four times the total value of land in the entire continental United States (*32*).

Several factors have contributed to high land prices in Japan. First, large Keiretsu firms tend to have extensive land holdings, particularly in urban areas, giving them oligopolistic control over the land market and a vested interest in maintaining high land prices. Similarly, small landholders at the urban periphery, many of whom received their land in the post-war land reform, also have a stake in high land prices as most of their savings are tied up in land. These two groups have formed the political alliance critical to maintaining public policies that maintain high land prices.

Both price supports on rice and tax laws have slowed the conversion of agricultural land to residential and commercial uses. Property taxes on land that ostensibly is being used for agricultural purposes are minimal. Thus, speculators intentionally do not develop their land to avoid paying higher property taxes. Within major Japanese cities including Tokyo extensive land holdings are being used to grow vegetables. These and other elements of the tax laws have constricted the supply of land available for development and have worked to keep land costs high (*32,33*). It is largely these policies that have driven up land costs, which in turn have discouraged the use of the land-intensive automobile. These same policies have also driven up the cost of housing, which lies at the heart of Japan's attempt to constrain consumption and drive up the savings rate (*34*).

Acquiring the land to construct the right-of-way for roads and highways is not only expensive, it is also problematic. Since the 1960s a number of powerful urban citizens' movements in Japan have been fighting the construction of new highways. Because the state's powers of eminent domain were abused during the period of military governments leading up to and during World War II, current public officials are extremely reluctant to seize land for public purposes. By organizing property owners in the planned rights-of-way and convincing them not to sell their land, citizens' movements have successfully delayed road projects all over Japanese cities. The completion of both the inner and outer ring roads in Tokyo has been delayed for decades by environmentally oriented citizens' movements allied with local property owners (*35*).

Furthermore, Japan has very powerful tenants' rights laws. Most tenants hold leases lasting a minimum of 30 years, and even when the lease has expired the tenants cannot be removed without just case. The landlord is not able to sell the land without the tenant's approval. Highway authorities wishing to purchase land for right-of-way must enter into complex negotiations with tenants as well as landowners. As a result, even in central Tokyo there are many areas where most buildings are only one or two stories, even though the zoning permits much higher buildings.

Citizens' movements reacting against environmental degradation and concerned primarily about quality-of-life issues also were instrumental in electing progressive governors in many of Japan's major urban areas in the 1960s and 1970s, including Tokyo. In Minobe's "Blue Skies over Tokyo" campaign he promised not to build a single bridge if there was a single dissenting voice. Tokyo Governor Minobe began the "Pedestrian Paradise" program of closing city streets to motor traffic particularly on weekends and evenings. This program proved to be extremely popular and now has spread to many commercial areas of the city, and to other cities. These pedestrian areas, generally open to truck delivery in the mornings and late evenings, have played an important role in expanding the amount of public open space that is sorely lacking in most Japanese cities. This program also has helped to increase the popularity of nonmotorized modes such as bicycling and walking.

Land use controls and land use regulation may have played some role in encouraging a higher-density urban fabric, but zoning laws and development controls are notoriously weak in Japan. Both the National Capital Regional Development Law of 1956 and the Urban Planning Law of 1968, which tried to concentrate growth into subcenters and preserve "green zones," basically failed as a result of resistance by suburban property owners (*36,37*).

Thus, several public policies have reduced the supply of land available for development leading to extremely high land prices. With automobile transportation only able to move some 150 to 400 persons per meter per hour, compared with subways, which can move 9,000 persons per meter per hour, and bikeways, which can move 1,400 persons per meter per hour (*38*), the land cost of providing sufficient road infrastructure to accommodate the automobile has become prohibitive. Despite extensive subsidies to road infrastructure in Japan since the early 1960s, the cost of land has driven the Japanese transportation system to more land-efficient and cost-efficient modes.

CONCLUSION

A history of extensive investment into rail-based transportation, policies discouraging the use of the automobile, and policies encouraging high land costs have led to a high urban density in Japan. With densities high, a transportation system increasingly reliant on nonmotorized transportation linked with rail-based mass transit proved to be economically more viable. This cost-efficient and land-efficient transportation system has been critical to Japan's economic success. Society as a whole, spending far less of its economic resources on transportation than in the United States, has been able to use these extra resources on new investment. With the costs of commuting low, Japanese workers were

able to save more of their money, thereby increasing the savings rate, decreasing the cost of capital, and encouraging investment. As an input into Japanese products, the low transportation costs have helped lower the total cost of producing Japanese goods, making them more competitive in international markets.

Although before the mid-1970s the relative weakness of the domestic automobile industry discouraged high levels of expenditure into road infrastructure, since then road investments have increased to levels well above those of the United States as a share of GNP. However, continuing high land costs and the resistance of environmentally oriented citizens' groups have meant that these expenditures did not translate into as many kilometers of new and expanded roadway as might have been expected. With severe limitations on the ability to further expand road infrastructure in Japan, traffic congestion continues to worsen and travel speeds decline. These factors have forced Japanese automobile manufacturers to look to Southeast Asia as their primary growth market. As a result, Japanese Overseas Development Assistance is increasingly focusing on road building in East and Southeast Asia.

Although nonmotorized modes have been important to travel in Japan since the 1870s, particularly for short distances in urban areas, recently this role has been expanding. With growing congestion on the road network, and in the absence of any attempt to use congestion pricing, many Japanese motorists and bus users are switching to bicycles, particularly for reaching commuter rail stations. Growing distances between new housing developments and rail stations have also induced new residents to reach rail stations by bicycle rather than by walking.

Thus, the view that the widespread use of nonmotorized vehicles is associated with economic backwardness is a fallacy. Not only are nonmotorized vehicles a long-established and increasingly important part of Japan's urban transportation system, they have played a critical role in Japan's low-cost transportation system and high-density land use pattern. This transportation-land use system has in turn played an important role in Japan's economic success. It is, in a sense, the spatial manifestation of Japan's export-oriented growth model. Thus, developing countries wishing to promote a transportation system that will best facilitate rapid economic development would do well to follow Japan's historical example.

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