THE EFFECTS OF RAILWAY PRIVATIZATION ON COMPETITIVE PERFORMANCE : A CASE STUDY OF JAPANESE RAILWAYS

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[Abstract]: In 1987, Japan undertook the privatization of one of its largest public enterprises, the Japan National Railways, or JNR. The experience of the Japanese railway privatization could offer valuable lessons to the many countries currently engaged in the reform or the privatization of their own national railways. This paper focuses on how privatization has enhanced the competitiveness of the privatized JNR, which was divided into six passenger companies called JRs and one freight company called JR Freight. First, this paper will summarize the political economic process of JNR's privatization. Second, the paper will examine the economic effects of various types of competition, such as (1) firm-based competition, (2) line-based benchmark competition, and (3) intermodal competition. Although there are still difficulties in evaluating the competitiveness of the privatized JNR, several results show that privatization has improved JRs' competitive performance.

1. INTRODUCTION

Because they are all different geographically, economically, and sociologically, no two countries in Asia have the same kind of transport system. However, they have one important element in common, the fact that they heavily depend on railways to carry passengers from suburbs to major cities and from city to city. A typical example is Japan, where the heavy concentration of the population in major cities such as Tokyo, Osaka, and Nagoya has made railways indispensable for passenger transport. A unique characteristic of the Japanese railway system, however, is the existence of numerous private railways which largely operate the commuter lines linking the CBD with neighboring bed towns. The great commuter demand during rush hours as well as their diversification into various lines of business have kept these private railways largely profitable, and their independence of government subsidy has made them a model for the private railways which emerged from the 1987 privatization of the Japan National Railways (hereafter JNR). Privatization has in general been successful, with productivity and service quality showing improvement. This paper explains why JNR was privatized and then examines, from theoretical and empirical points of view, how the privatization policy has encouraged JRs to improve their competitive edge.

2. WHY WAS JNR PRIVATIZED?

2.1 Major Reasons for JNR Privatization

Major reasons can be cited for the privatization of JNR. First, beginning in the mid-1960s, JNR began to suffer heavy operating deficits and snowballing interest payments for accumulated debt. Although JNR had enjoyed monopolistic power until the 1950s, its competitiveness was eroding from the increasing competition with the private automobile and later from air transport. JNR's share in passenger transport, for example, declined sharply, from 55% in 1955 to 23% in 1985, forcing JNR to turn to government subsidies for survival. Meanwhile, the government itself was facing financial difficulties, from serious

inflation problems caused by the oil crisis of 1973 to increasing dependency on the issue of public bonds. To cope with these financial problems, the government decided in April 1985 to privatize both JNR and Nippon Telegraph and Telephone Public Corporation, as these entities were absorbing huge subsidies. Another reason for the ultimate privatization of JNR was that, although JNR had been profitable for a short time immediately prior to opening its Bullet Train Service (known as the Shinkansen) between Tokyo and Osaka, this brief period of profitability had provoked such unrealistic hopes for railways both inside and outside JNR that unwise investments in unprofitable lines proliferated during the following years. Third, JNR as a public corporation was given little managerial freedom and operated under the strict control of the government and the Diet, allowing no strong incentive for efficiency. Fourth, due to the inherent character of public enterprise, JNR management and labor unions lacked the sense of crisis which might have spurred improvement, but instead succumbed to the so-called X-inefficiency or organizational slack. Finally, reforms were delayed and the financial situation further damaged by political interference. On the one hand, vote-seeking politicians used their influence to force JNR into constructing unprofitable local lines. Political pressure prevented JNR from halting construction of unpromising lines and doing away with or transferring 3,000 km (1,800 miles) of deficit-ridden lines to private railways or to the third sector. Political posturing in the name of the public good also delayed the fare raises that might have slowed the increasing reliance on government subsidies.

2. 2 Characteristics of JNR Privatization Policy

The government established the Second Ad Hoc Committee on Administrative Reform to address the issue of balancing the government budget without raising taxes. The Committee proposed the privatization of JNR as well as of two other public enterprises, and following this proposal, the JNR Reform Committee was set up directly in the Prime Minister's Office. The Prime Minister at the time was Yasuhiro Nakasone, who supported the committee's proposal that JNR be privatized in 1987 and broken up into six regional passenger railway companies (JRs) and one nation-wide freight railway company (JR Freight).

The major points of the privatization policy were as follows: First, the majority of the long-term liability which had accumulated to 37.1 trillion yen by the end of 1986, as well as redundant workers, were transferred to the JNR Settlement Corporation, with the Settlement Corporation being expected to liquidate about 70% of liabilities by selling real estate and issuing stock. The second point was that the most profitable Shinkansen lines were owned by the Shinkansen Holding Company, which absorbed about 15% of total liabilities, but which was later reorganized by selling Shinkansen lines to the three Honshu JRs (i.e. main island JRs). The remaining 15% of liabilities was allocated to the Honshu JRs and JR Freight. Because the three island JRs have limited markets with gloomy prospects for growth due to competition from private autos, a special fund was created for them called The Management Stabilization Fund, in order to smooth the transition from subsidy-dependence to private ownership. JR Freight, which had been a self-supporting entity, became separate from the passenger companies.

There are a number of reasons behind the successful transition from JNR to JRs. First, the economic climate in the late 1980s and early 1990s favored the implementation of reform. Although the sharp appreciation of the yen against the dollar in 1985 had a negative impact on the Japanese economy, the impact was brief, and Japanese industry was in fact fortified by the strong yen. The rapidly expanding economy brought about increased traffic demand, providing a good environment for privatization. Second, the general public showed an interest in privatization by voting for the Liberal Democratic Prime Minister Nakasone, who gave priority to privatization. Third, The Reform Committee was given autonomous authority for proposing the JNR plan, and was headed by the late Toshio Doko, an influential business leader whose thrifty lifestyle provided good public relations for the reform of the sluggish public railways. Fourth, although in the beginning there was strong opposition from JNR labor unions and politicians, labor union members became cooperative in response

to the criticism of the media and a public heavily dependent on the rail industry and weary of the repeated strikes of the 1970s and 1980s. Finally, privatization succeeded because it was not as abrupt a change as it seemed--repeated failed efforts at reform from within JNR ultimately led to the smooth transition to private ownership in 1987.

Liberation from various managerial constraints and the benefits of the asset-inflated "bubble" economy up until early 1991 greatly improved the financial performance of JRs. The three Honshu JRs, especially the East Japan Railway, have done remarkably well, but this was expected, as the company includes the heavily populated Tokyo area. In general, JRs have made efforts to improve productivity and service quality, and they have become cost-conscious in the process.

3 ANALYSIS OF JRS' COMPETITIVENESS AFTER PRIVATIZATION

3.1 Firm-Based Benchmark Competition

This section analyzes how firm-based competition improved JR's performance. Two kinds of firm-basis competition are examined here: first, competition among JRs and second, competition between JRs and large private railways. The first kind of competition might work among JRs. After privatization, each JR as a new independent railway began to engage in this kind of competition owing to the strong motivation to become better than others who used to be like members of the same JNR family. It is assumed that there could be competition among Honshu JRs, which are divided into two different categories due to their large size, and among three islands JRs separately. The second kind of competition is between JRs and large private railways. Since the large private railways are regarded as the most efficient railways, after privatization JRs would often model themselves after them.

Sample mean and variance of performance measures are used here to assess competition among JRs, because each JR's performance could be improved by competing with other JRs, even if there are differences in their performance at the beginning. We assume that the difference in performance would be narrowed down gradually through competition. For example, if competition works, the mean value of operating cost would decrease over time. Furthermore, the variance of the cost is expected to be gradually smaller due to competition. Therefore, decreasing mean and smaller variance value of operating cost would be a measure to assess how competition has affected performance of each JR. The following five elements are examined here: average operating cost; labor productivity; fare; load factor; train density. The first two measures indicate productive efficiency and the remaining three are quality-of-service related measures. Table 1 summarizes the anticipated and actual results of these performance measures. The calculation of mean and variance is done for 5 years after privatization from 1987 to 1991. The sample size is three for each JR category 1) Honshu JRs (JR East, JR Central, and JR West), 2) three islands JRs (JR Hokkaido, JR Shikoku, and JR Kyushu .In Table 1, the negative sign (-) means decreasing for mean and getting smaller for variance over time and the positive sign (+) means increasing for mean and getting bigger over time. A sign of zero shows almost no change.

In most cases, mean values show reasonable results, which means that actual results do not contradict the hypothesis. However, as for variance, some of the results do not match the hypothesis. For example, variance of labor productivity and train density become larger than before. According to the fact that the difference of operating cost among JRs becomes smaller, which is the most important performance measurement, we may be allowed to say that competition might have a positive effect on JR's performance. However, it should be noted that these results are obtained from only a 5-year sample so that we must be very careful when considering the results.

Table 1 Summary of Results of Mean-Variance Analysis

Measure	Hypothesis		Actual Results Main Island JRs		Actual Results Three Islands JRs	
	Mean	Variance	Mean	Variance	Mean	Variance
Operating Cost	-	-	-	-	-	-
Labor Productivity	+	-	+	+	+	+
Fare	-	-	-	-	0	+
Load Factor	-	-	0	-	-	-
Train Density	+	-	+	+	+	+

In the case of competition between JRs and large private railways, the JR-Private ration is measured. For example, the ratio of JR's operating cost to that for large private railways is equal to one indicates that the sectors are no different. If the ratio is more than (or less than) one, it means that JRs are inferior (or superior) to large private railways. Three different periods are selected to compare: 1) before privatization (1981-85), 2) during privatization (1985-89), and 3) after privatization (1987-91). If competition works owing to privatization, the JR-Private ratio would get smaller over time. In addition to the JR-Private ratio, the average annual percent change of performance measures for the same periods was calculated.

Table 2 shows the JR-Private ratio and percent change. Performance measures are improved very much except fare, which is measured as yield. In particular, operating cost and labor productivity are improved dramatically compared with before the privatization period. During privatization these performance measures took a turn for the better. Even after privatization in 1987, these were approaching the level of large private railways. According to our econometric analysis of labor productivity comparison between JRs and private railways, with controlling service output level and network factors, JRs' productivity level was much improved but it was still about 20% below that of private railways. Figure 1 indicates the narrowing gaps between JRs and the large private railways in terms of the relative labor productivity and operating cost. It may be safe to say that privatization could be a key to the improvement of efficiency in JRs.

Table 2 Results of JR-Private Ratio and Percent Change

Measure	JR-Private Ratio (JR/Private)			
	Before (1981-85)	During (1985-89)	After (1987-91)	After-Before Change
Operating Cost	1.534 (10.5%)	1.446 (- 6.7%)	1.280 (- 2.7%)	- 0.254 (0.8 %)
Labor Productivity	0.702 (2.2 %)	0.866 (13.1 %)	0.987 (5.9 %)	0.285 (2.2 %)
Fare	1.275 (3.6 %)	1.601 (10.4 %)	1.738 (- 1.0%)	0.463 (1.5 %)
Load Factor	0.697 (2.7 %)	0.757 (0.3 %)	0.783 (0.5 %)	0.086 (-0.4 %)
Train Density	0.248 (1.5 %)	0.296 (9.0 %)	0.318 (3.8 %)	0.070 (0.6%)

[Note]: The numbers in parentheses are the average % change per annual.

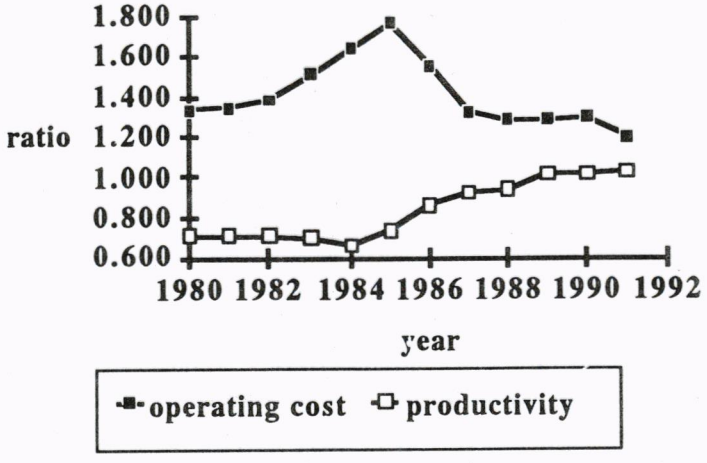

Figure 1 JR-Private Ratio in Selected Performance Measure: operating cost and productivity

3.2 Line-Based Benchmark Competition

3.2.1 The Concept and Theoretical Implications of Line-Based Benchmark Competition

A unique characteristic of the JNR privatization policy could be the horizontal division of a nationwide railway network. JNR was regionally broken up into three main island JRs and three island JRs, because almost all traffic demand was fulfilled within each region. As was expected, the regional division of JRs has enhanced competition among regional JRs and between JRs and private railways. When JRs operate lines parallel with the private railways in major urban areas, JRs seem to use the performance of the large private railways as a benchmark. We call this kind of line-based competition "benchmark competition." This section attempts to assess benchmark competition between JRs and the large private railways in the commuter markets. We focus on JR's strategy to improve competitiveness through the quality of service.

There seem to be two reasons why JRs are interested in improving service quality. First, compared with service quality competition, fare competition between JRs and private railways would not easily occur, because fares are strictly regulated by Ministry of Transport as a price of public service. Second, since JRs before privatization were notorious for the bad quality of service, it was expected that they would improve service quality, to attract more commuters not only from the rival private railways but also from private cars. Fortunately JRs inherited the higher grade of infrastructure, especially heavy-duty tracks which could be used for freight transport so that they could easily increase the capacity of the commuter trains by increasing train frequency or the number of trains. JRs have been using an increase in the frequency of trains as a major marketing strategy in benchmark competition.

From a theoretical point of view, the increase in frequency indicates an increase in the consumer's surplus through expanding a product menu. This can be proved by the Hotelling-type spatial location model. As discussed in the industrial organization theory, suppose that commuter railway services at rush hours are differentiated horizontally by frequency (or departure time) and the load factor. This assumption might be relevant since, as mentioned earlier, fares (prices) or difference in fares between JRs and the rival private railways have been stable because neither side wants to lose customers by taking initiatives to

raise fares. For the sake of simplicity, we will neglect the load factor here. As in Figure 2, assume that a JR (JR) sets departure time at t1 in the first period and his rival private operator (PV) sets departure time at t2. In this model their fares are assumed to be comparable to each other, and are shown as the same height of f1 and f2 in Figure 2. The straight lines in the northeast and northwest directions from the tips of f1 and f2 suggest the time cost for waiting for the next trains.

However if JR reduced its fares, it could capture some of the commuters traveling the adjacent PV and increase its share, as is the case in f1' < f1 = f2, in Figure 2. It might be difficult to reduce fares, because fares at peak time can barely cover costs. The marketing strategy JR could take would be to increase frequency in the second period. This is the case where JR sets a new departure time, which is shown as t1' in Figure 1. JR could increase its market share up to t1", although some portions of its own passengers from t1''' to t1' would be taken away by the new schedule at t1'. However, from the viewpoint of consumer surplus, this increase in frequency contributes to an increase in the consumer's surplus by expanding a product menu , which is shown as the shaded areas in Figure 2. This is one of the important results which might be brought by benchmark competition through horizontal product differentiation.

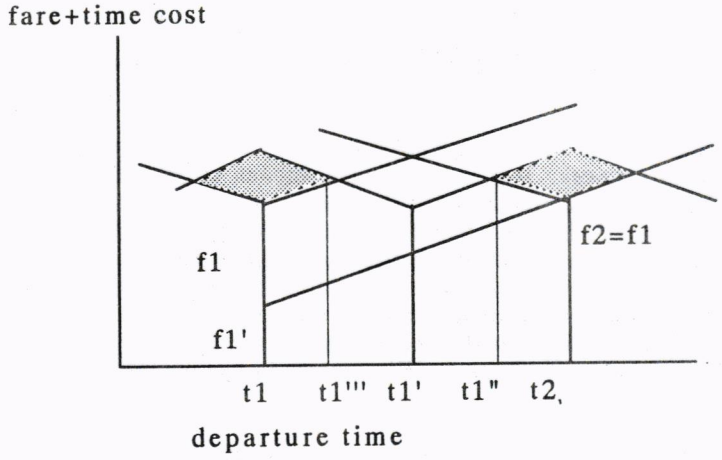

Figure 2 A Model of Benchmark Competition à la Hotelling

3.2.2 Analysis of Line-Based Benchmark Competition

(1) Benchmark competition between JRs and private railways in three commuter lines

To assess how benchmark competition has influenced the market share of JRs in terms of the number of passengers, three commuter lines (X, Y and Z) are examined, where JR and private railways are operating in parallel. These lines are typical commuter railways which connect the central business district of a large city with neighboring cities such as dormitory towns and they are likely to compete with each other in the same commuter market. These railways are in every sense a life-line, because they carry about 25 to 50 thousand commuters in one-hour rush time every day. These private railways not only run the railway lines but also operate department stores and engage in real estate development.

In the parallel commuter lines, JRs seem to have a strong incentive to compete with the private railways, because JRs want to recapture rail ridership from their rival private railways. After privatization, JRs have become very keen to improve quality of service by increasing train frequency, decreasing congestion by upgrading cars, and keeping fares relatively low in order to win more passengers. Since fare is regulated by the government, fare competition does not occur and fares tend to be very comparable between JR and private railways. Even in the lines where fares are different, the fare discrepancy tends to plateau. Although JR's market share in these lines is influenced by various factors, it is obvious that JRs' commitment to the improvement of service quality is the key to an increase in their market shares. Due to data availability problems, we must limit ourselves to studying how fare and service quality have influenced JR's relative market share. Although we must take transfers of commuters from cars into account, this was not explicitly considered here. Figure 3 shows the changes in JRs' market share before and after privatization. We could observe the gradual increase in their market share after privatization.

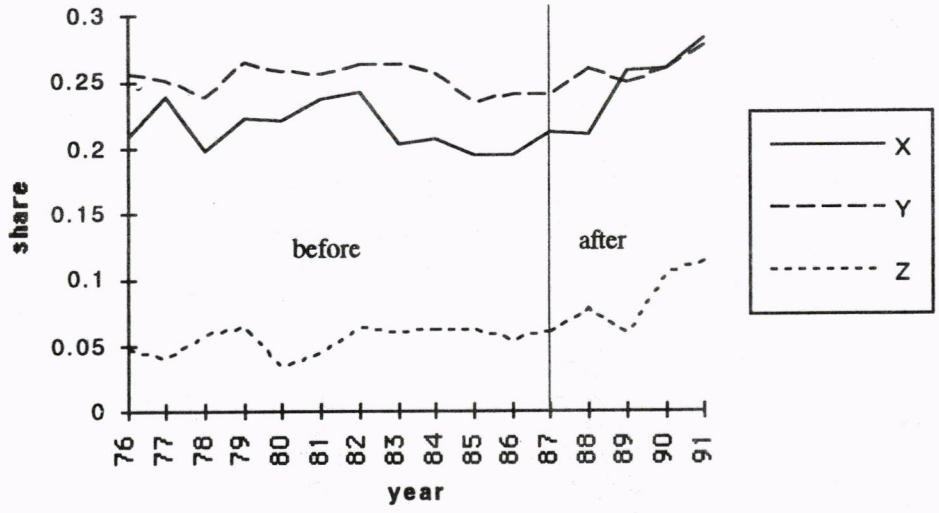

Figure 3 Changes in JR's Market Share in X, Y and Z Lines

The followings are summaries of the strategic characteristics of the three commuter lines.

X Line Case: In the case of X line, the JR had a relatively large share of the market before privatization. The JR after privatization made efforts to increase the frequency of trains at peak time by 60% from 1987 to 1991. In contrast to this, the private railway did not have room to increase frequency, because of the limited capacity of infrastructure. As a result, JR has succeeded in expanding its market share from 19% to 28% in the five years after privatization. Because fares were in balance between the JR and the private railways, the competition took the form of increasing frequency and reducing the load factor. The following Table 3 indicates the strategic policies of both JR and the private railway in competing lines.

In X line, both the JR and the private railway did not raise fares for six years except for the introduction of a consumption tax on fares in 1989. However, the JR's market share has increased drastically, because JR increased its frequency and became more attractive than before. When fares are not different between rivals, the relative level of service quality becomes important to determine relative market shares. In this line the relative increase in train frequency seems to be a key to increasing JR's market share.

Table 3 Benchmark Competition in X Line

Measure	Operator	1987	1988	1989	1990	1991
Number of Passengers at Peak Hour	JR	8,876	9,899	12,871	13,013	14,706
	Private	36,829	37,127	36,815	36,970	37,170
Fare (yen)	JR	430	430	440	440	440
	Private	430	430	440	440	440
Load Factor at Peak(%)	JR	174	167	134	124	130
	Private	181	178	171	169	168
Frequency at Peak Hour (no. of trains)	JR	8	10	10	11	13
	Private	26	26	26	26	26

Y Line Case: As Table 4 shows, JR had a relatively high share in this market and expanded its market share after privatization from 1987 to 1988. However, the private railway counterattacked JR's expansion policy by increasing its frequency from 1989 to 1991. As a result, JR was forced to reduce its market share compared to the private railway from 1988 to 1989. JR has gradually regained its competitiveness from 1990 onwards when the rival concern raised its fares. JR's lower load factors may have provided favorable conditions for the JR to regain its market share. Note that due to changes in the location of traffic research from 1989, train frequencies and load factors in 1987 and 1988 are adjusted to maintain consistency of data. In Y line the relative low fares of JR and the increase in train frequency may be responsible for the increases in JR's market share from 1987 to 1991. Since the private railway continued to increase its frequency from 1989 to 1991, JR's competitive edge was reduced. However, the situation for JR began to improve gradually after JR increased its frequency in 1990.

Table 4 Benchmark Competition in Y Line

Measure	Operator	1987	1988	1989	1990	1991
Number of Passengers at Peak Hour	JR	9,515	10,515	10,117	10,933	12,404
	Private	29,574	29,768	30,290	31,075	32,259
Fare (yen)	JR	380	380	390	390	390
	Private	390	390	400	460	460
Load Factor at Peak(%)	JR	176	169	126	122	130
	Private	173	171	166	162	159
Frequency at Peak Hour (no. of trains)	JR	7	9	9	10	11
	Private	27	27	28	30	32

Z line Case: As shown in Table 5, the JR has been increasing frequencies at peak time since privatization. Although the private railway still keeps its dominant market share in this line, the JR has been successful at obtaining more patronage than before and expanding significantly its market share from 5.7% in 1987 to 11.3% in 1991. Since the difference in fares between the JR and private railways has been widening, this may have some influence on the growing number of passengers using the JR. It seems that the relatively lower fares and higher train frequency of JR have been contributing to an increase in its relative share of passengers on this line from 1987 to 1991.

Table 5 Benchmark Competition in Z Line

Measure	Operator	1987	1988	1989	1990	1991
Number of Passengers at Peak Hour	JR	1,214	1,653	1,230	2,391	2,680
	Private	20,050	19,510	19,890	20,430	20,450
Fare (yen)	JR	440	440	450	450	450
	Private	480	480	490	490	540
Load Factor at Peak (%)	JR	139	140	118	131	143
	Private	162	158	161	165	165
Frequency at Peak Hour (no. of trains)	JR	4	5	7	7	7
	Private	18	18	18	18	18

(2) A Huff-type Analysis of Line-Based Benchmark Competition

To assess how stiff the line-based benchmark competition between JRs and the private railways in these three commuter lines has become after privatization, we examine the following hypothesis: if privatization has promoted benchmark competition in a market, JR's carrying capacity at peak time would increase, and its fare would be kept low, and as a result, JR's relative market share would increase in these lines. To see how the changes in JR's relative capacity and relative fare to those for the rival private company have affected JR's market share in these lines, the elasticities are estimated using regressions. We found that the elasticities of JR's relative fare with respect to its market share were extremely low or statistically insignificant in most cases, which indicates that both operators would not be able to use fare as a marketing strategy to increase ridership because changes in the level of fare require the permission of the Ministry of Transport and operators want to avoid fare wars which might enhance destructive competition. By contrast, the elasticities of JR's relative capacity were high, which suggests that the increase in JR's capacity would be a major factor behind the expansion of JR's relative market share in these commuter lines. Notice that capacity is measured by train frequency times the load factor times the maximum number of passengers per train. [1]

We use the Huff-type model in order to assess the effect of JRs' privatization on their competitive edge in these lines. As in the original Huff model, we assume that the larger JR's relative capacity is and the lower JR's fare is, the higher the probability passengers will choose JR rather than the private railways in the competitive markets. The Huff-type equation (1) may be taken to describe roughly the interaction between fare and capacity. As in the Huff model, we assume that fare plays a role of resistance not to choose JR and

capacity is an important element to attract passengers to JR.

$$SHAR = (CAJR^{\delta} / FAJR^{\lambda}) / \{(CAJR^{\delta} / FAJR^{\lambda}) + (CAPV^{\delta} / FAPV^{\lambda})\} \quad (1)$$

where SHAR = the probability of JR's market share
CAJR = JR's capacity which is obtained by frequency times the number of trains times the maximum number of passengers per train
FAJR = JR's fare
CAPV = the private railway's capacity
FAPV = the private railway's fare.
δ, λ = parameters

The following analytical procedures are introduced to examine the degree of improvement in JRs' competitiveness after privatization. First, we estimate the parameters δ and λ which may show how fares and capacity would affect the market share. In the Huff model, generally speaking δ is assumed to one and λ is equal to two. First of all we estimate δ and λ. As we don't know what these parameters are in our case, using data of before-privatization, we determine values of the parameters, δ and λ, in which we minimize the sum of the square of residuals (i.e. minimizing the differences between the estimated market share and the actual share). Second, using these estimated parameters, we calculate the market share from 1987 to 1991. These estimated values are hypothetical results assuming JRs were not privatized. Third, we compare these estimated market shares with the actual market share in the after-privatization period. If the latter exceeds the former, it may mean that the privatization of JRs has helped to enhance their competitiveness.

Table 6 and Figures 4, 5, and 6 show the estimated market share (without privatization) and the actual market share (with privatization). In every line the actual market shares (with privatization) exceeded the hypothetical market shares (without privatization). It indicates that JRs' competitiveness has been improved due to benchmark competition, which would make them more responsive to passenger needs and encourage efficient utilization of inherited assets such as heavy-duty tracks, spacious stations and rail vehicles.

Table 6 A Comparison of the Estimated Market Share and Actual Market Share

Line	X Line		Y Line		Z Line	
parameters	δ=1.4	λ=1.1	δ=1.2	λ=1.0	δ=1.5	λ=1.6
Year	estimated share	actual share	estimated share	actual share	estimated share	actual share
1987	0.138	0.213	0.154	0.241	0.024	0.061
1988	0.141	0.211	0.176	0.261	0.033	0.078
1989	0.233	0.259	0.237	0.250	0.027	0.0582
1990	0.253	0.260	0.249	0.260	0.071	0.105
1991	0.271	0.283	0.250	0.2778	0.071	0.113

[Note]: The parameters δ and λ are obtained by minimizing the sum of squares of residuals (i.e. minimizing between the estimated market share and the actual market share in the pre-privatization period from 1976 to 1986.) These parameters were used to estimate market share in the post-privatization period from 1987 to 1991. The estimated market share may indicate the hypothetical JR's market share if it had not been privatized.

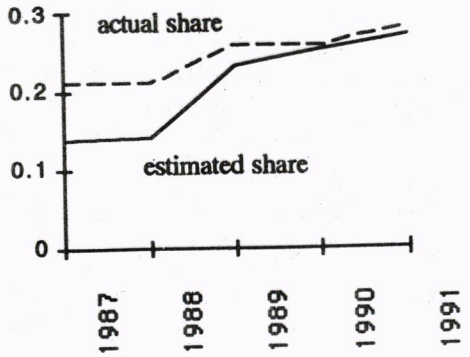

Figure 4 The Estimated and Actual Market Share of JR in X Line

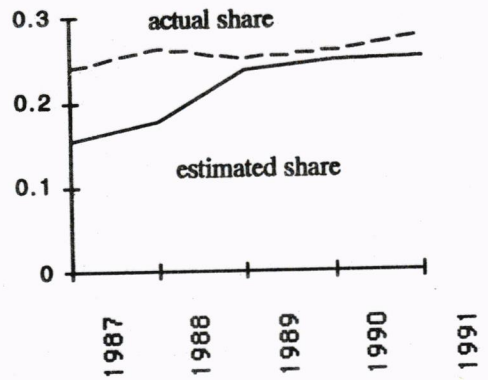

Figure 5 The Estimated and Actual Market Share of JR in Y Line

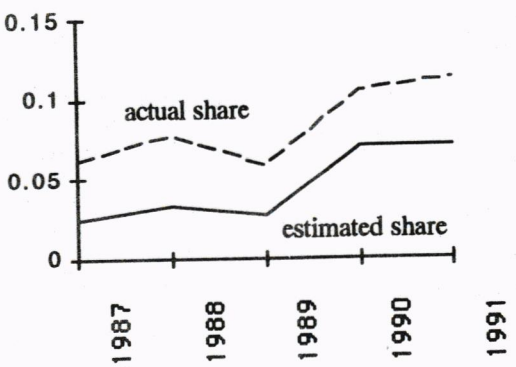

Figure 6 The Estimated and Actual Market Share of JR in Z Line

Although, due to the small sample, we can't clarify directly how privatization has influenced JR's market share by this model, it may be safe to say that JR's marketing strategy of increasing capacity and setting competitive fare paved the road for the subsequent expansion of its market share. Owing to stiff benchmark competition between JR and private railways in these lines, the commuters have been enjoying benefits such as upgraded service quality and improved convenience.

Obviously there is no single decisive factor for increases in the relative share of JR's passengers in these three lines, because various elements jointly have contributed to improvements in JR's market share. The above-mentioned model is only a first approximation to analyze the effect of privatization on JR's competitiveness. It may be peculiar to such a high-density populated country as Japan that there is such very tough competition among the railways, especially in the commuter lines. Due to the extreme concentration of the population in the major urban areas, the severe shortage of railway capacity is always problematic. It seems that the extraordinary high load factor which usually exceeds 200% of capacity at rush hour may be used to make ends-meet. In addition, JRs are in a good position to take advantage of the inherited spare capacity established in the JNR period by which they could easily increase frequency of trains. Although it is difficult to examine precisely what marketing strategies adopted after privatization have been decisive for the relative increase in JR's market share, we may conclude that after the privatization of JRs benchmark competition has improved the competitive position of these commuting lines, and more importantly the benefits of improvements have been passed on to commuters.

3.3 Intermodal Competition : JR vs. Air Transportation

Last, we will analyze intermodal competition's effects on JR's share. Because JR's main role is intercity passenger transport, it is relatively easy to observe competition with air transportation. The privatization of the Japan National Railways increased managerial incentives for JR railways to increase their service performance, in order to retain or increase rail ridership. Here, we take three cases in which direct competition seems to work between JRs and air transportation. The markets of (1)Tokyo-Osaka, (2)Osaka-Fukuoka, (3)Tokyo-Fukuoka are main routes in Japan, along which JRs operate the Shinkansen (bullet train). As for service quality as a force in competition, we take frequency (number of trains or airplanes in both directions), fare for one way trip, and transport time. And JRs' share in these three markets is taken as the result of competition. There are 18 data samples from between 1975 and 1992.

3.3.1 Privatization Effects on JR's Share

First of all, trends of JRs' share in three different markets are shown in Figure 7. This figure shows that in the market of Tokyo-Osaka, JRs are dominant, with over 80% of share, a number which, despite fluctuations, has not changed much in the past 18 years. On the other hand, in the market of Tokyo-Fukuoka, JRs' share declined dramatically. Actually, the sharp decline in share occurred between 1975 and 1980. Since then the share has decreased gradually. In 1992, JRs' share was only 20%, in sharp contrast with the 1975 share of 63%. The case of Osaka-Fukuoka shows a very interesting result. The share between 1975 and 1980 dropped dramatically, as in the case of Tokyo-Fukuoka, but since 1980 it has increased steadily.

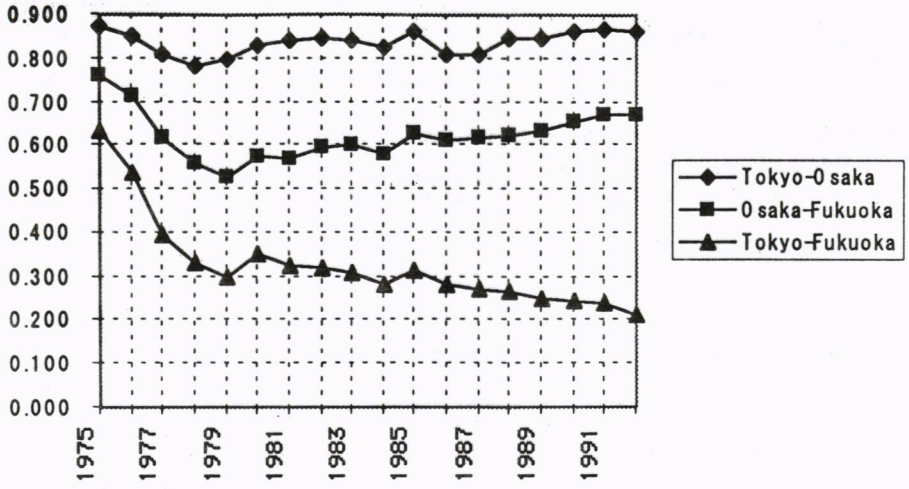

Figure 7 Number of Passengers as Basis of JR Share

Did privatization affect JRs' market share, or did JRs simply manage to stop their declining rates of market share? Table 7 shows a before-after comparison of JRs' market share. In this comparison, we take two measures in the share: (1) JRs' share level, (2)% change in JRs' share. This table shows that in the case of Tokyo-Osaka andOsaka-Fukuoka, the share after privatization increased. Even in the case of Tokyo-Osaka, the percentage of change in the share is still increasing. However, in the case of Tokyo-Fukuoka, there is no clear privatization effect on the market share. One reason is that JRs have not changed service quality in order to attract rail ridership. The other reason is that any service quality change taken in order to compete with air transportation was so small as to have no effect on ridership. In the next section, we will examine whether or not JRs improved service quality after privatization.

Table 7 Before-After Comparison of JRs' Share

Kind	Time Period	Case-1 (Tokyo-Osaka)	Case-2 (Osaka-Fukuoka)	Case-3 (Tokyo-Fukuoka)
Share Level	before	0.836	0.603	0.301
	after	0.847	0.640	0.255
	after / before	1.01	1.06	0.85
% Change in Share	before	0.68 %	2.61 %	- 0.47 %
	after	1.83 %	1.96 %	- 3.32 %
	after / before	2.69	0.75	7.06

(Note):
(1) These values in share level are sample mean for before (1982 - 1986) and after (1987 - 1991)
(2) These values in the percentage change in share are sample mean for before (1981 - 1985) and after (1987 - 1991)
(3) JRs' share is defined as follows: JRs' share = JRs' passengers / air transportation's passengers.

3.3.2 Service Quality as Competition Forces

(1) Trend of Service Quality

Service quality measures are obtained as relative values to air transportation. That is, all three measures are obtained by dividing JRs' service quality by air transportation's service quality. Figures 8 to 10 show trends in relative frequency, relative fare, and relative transport time.

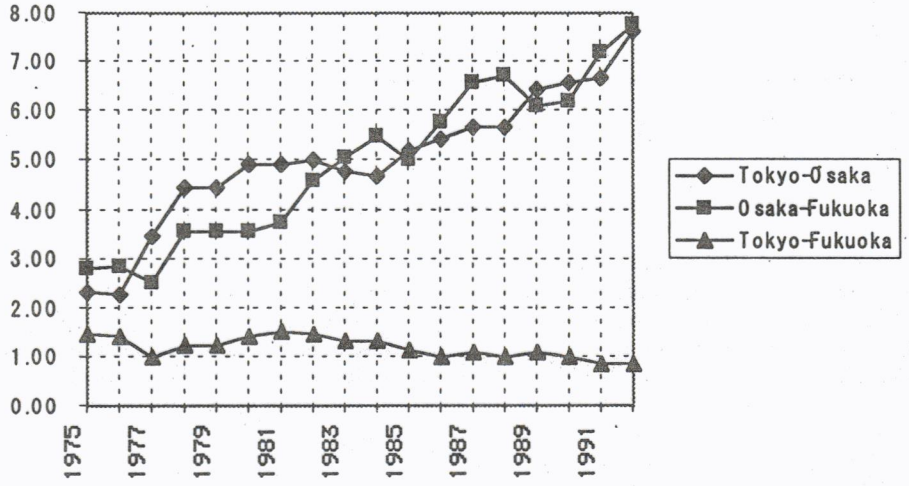

Figure 8 Relative Frequency Comparison

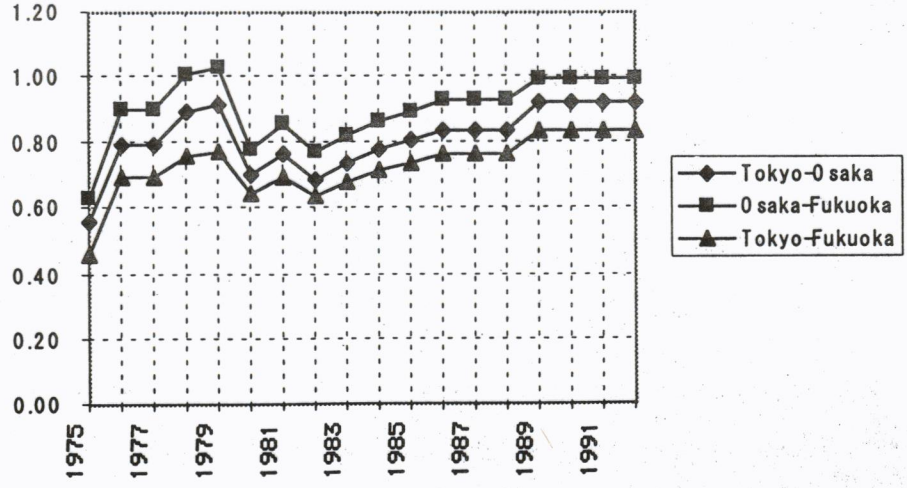

Figure 9 Relative Fare Comparison

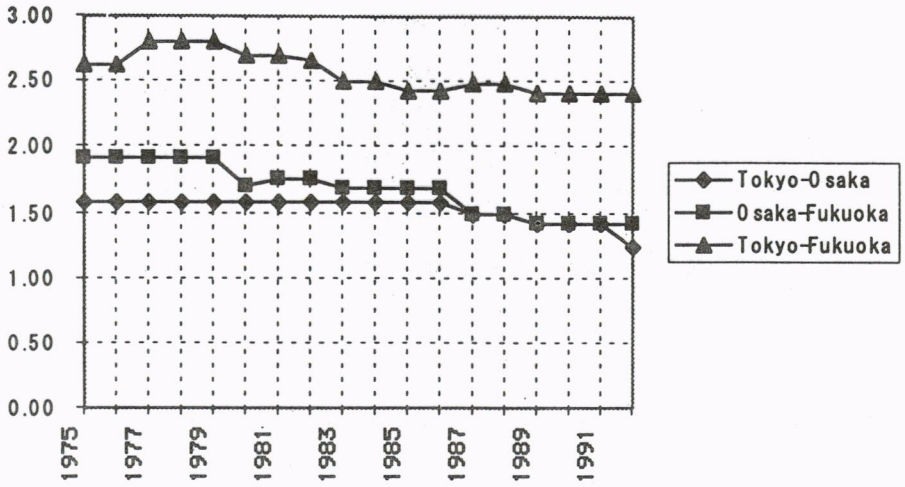

Figure 10 Relative Transport Time Comparison

First, as for relative frequency, in the case of Tokyo-Osaka and Osaka-Fukuoka, JRs' competition forces over air transportation have improved dramatically. For example, in 1975 this measure shows between 2.0 and 3.0 but in 1992 it becomes almost 8.0. On theother hand, in the case of Tokyo-Fukuoka, JRs' competitive force has gradually declined. In 1975, JRs' relative frequency was about 1.5 but it became almost 1.0 in 1992. As for relative fare, we can see three characteristic patterns over time. First, before 1980 JRs' relative fare increased sharply. And then JRs' relative fare dropped sharply in 1980, before once again increasing steadily. After privatization, relative fare increased slightly but has since maintained the same level. Most relative fare is less than 1.0 so JRs' competitive force in terms of fare is stronger than in air transportation. However, after privatization, the fare difference between JRs and air transportation became much smaller. Last, as for transport time, compared with the previous two measures, there are no clear characteristics. In any case, JRs have no competitive force over air transportation in terms of relative transport time because all these measures are over 1.0. However, when we consider access time, in the case of Tokyo-Osaka and Osaka-Fukuoka, JRs have adequate competitive force. In the case of Tokyo-Osaka and Osaka-Fukuoka, relative transport time after privatization seems to have increased.

(2) Privatization's Effects on Competitive Force

In this section, we will examine privatization's effects on competitive forces. As we mentioned before, privatization is a trigger to increase managerial incentives. As a result, privatized JRs would improve their service performance to increase their rail ridership. If this is true, service quality would certainly be better after privatization, making rail travel more competitive with air travel. Table 8 shows that, except for fare, service qualities seem to be improved, with the first clear result being in transport time, especially between Osaka and Fukuoka. As for frequency, in the cases of both Tokyo-Osaka and Osaka-Fukuoka, the improvement is very large. But in the case of Tokyo-Fukuoka, the relative quality decreased. Actually, the frequency of air transportation increased sharply but JRs' frequency remained almost the same, one of the reasons being that the share difference was already too large to recapture rail ridership, most likely causing JR to drop attempts to improve frequency. Last, as for fare, the result is contrary to the idea that JRs consistently improved service quality. Fares did not decrease, partly because fare is regulated by the Ministry of Transport so that transport companies are prevented from competing freely. Another reason for the lack of change is that JRs' fare level remains lower than that of air transportation, with JRs thereby

adopting different strategies to improve their quality option.

Overall, in some markets, for example where JR market share is more than 50%, privatization could introduce competition, but it does not always seem to do so, particularly where JR has a small market share. At least, in terms of service quality, there is no clear effect. However, because this study is the first to investigate the relationship between JR's privatization and intermodal competition, it is still too early to draw conclusions.

Table 8 Privatization Effects on Competition Force

Service Quality	Time Period	Case-1 (Tokyo-Osaka)	Case-2 (Osaka-Fukuoka)	Case-3 (Tokyo-Fukuoka)
Frequency	before	5.02	5.19	1.25
	after	6.20	6.56	1.00
Fare	before	0.77	0.86	0.71
	after	0.89	0.97	0.81
Transport Time	before	1.58	1.69	2.51
	after	1.45	1.45	2.44

(Note):
(1) These values are sample mean for before (1982 - 1986) and after (1987 - 1991).
(2) These values are relative values (= JRs' service quality / air transportation's service quality).
(3) Frequency means number of trains or airplanes in both directions per day.
(4) Transport time for air transportation includes an extra 60 minutes (waiting time for on and off-boarding).

4. CONCLUDING REMARKS

As many economists have correctly argued, competition might be more important than ownership itself in order to bring about efficiency. In the case of Japan, there was no option but to privatize JNR because the relationships among the vested interest groups such as the management of JNR, conflicting labor unions and politicians were very complicated. Privatization was a necessary step to solve the huge deficit problems and rationalize the intricate interest among the groups. It seems that JRs' privatization policy with regional break-up has been very successful in the sense that it has provided sufficient incentive for efficiency and quality of service, although it has not been successful in all respects. However, little has been studied about the effects of privatization on JRs' competitiveness and quality of service, partly because there is no theoretical and quantitative model to measure the effect of privatization in the case of railways, and partly because there is a lack of data to implement the statistical study. We recognize that competition might best be secured by privatization and deregulation. Since we believe that there should be benefits of privatization, it is very important to research to what extent privatization has improved JRs' competitiveness. Although the approach we adopted here was only a first approximation, we may safely conclude that privatization of JRs has provided an incentive for them to compete with their rivals, and that competition in services would have the effect of optimizing the price and quality of services offered.

NOTE

[1] The following table shows the estimation of the elasticities of JR's relative capacity with respect to JR's market share in these three commuter lines. Regression formula is as follows:

$$\ln(\text{Share}) = \alpha_0 + \beta * \ln(\text{Cap}) + \gamma * \text{PRV}$$

where Share = JR's market share in terms of number of passengers
Cap = JR's relative capacity
PRV = privatization dummy (after = 1)
Data sample is from 1975 to 1991

Among the three lines, the elasticity of Z line is especially high, which suggests that the increase in the relative capacity of JR was very successful in obtaining ridership when compared with the other two lines. The dummy variables which are used to distinguish before-privatization and after-privatization are statistically insignificant.

Table 9 Regression Results of Relationship Between Share and Capacity

line	constant (α_0)	JR's relative capacity	privatization dummy (PRV)	R^2
X Line	0.09 (3.62)	0.57 (5.23)	-0.003 (-0.33)	0.77
Y Line	0.21 (6.17)	0.17 (1.16)	-0.005 (-0.47)	0.13
Z Line	0.002 (0.16)	0.57 (4.01)	0.025 (4.20)	0.75

[Note] The values in parentheses are t-statistics.

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