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Productivity and its Decomposition in the Japanese Broadcasting Market

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The purpose of this paper is to calculate the total factor productivity (TFP) as well as scale economies of Japanese terrestrial broadcasters and examine the industry's characteristics through the decomposition of TFP growth. In order to calculate TFP growth rate, a variable cost function is estimated using data on twenty-five broadcasters for the period 1997–2002, and the TFP growth rate is decomposed into three sources: output effect, capital adjustment and technical change. Calculation reveals that a decrease in output causes low TFP growth. However, TFP growth is observed to improve through technical advances, although the rate of technical change in broadcasting is generally low. Furthermore, the average rate of technical change among small-scale broadcasters is smaller than that of large-scale broadcasters.

Keywords: total factor productivity, scale economies, broadcasting
JEL Classification Numbers: D24, L82

1. Introduction

The 1990s in Japan has been referred to as "the lost decade". Since the economic bubble burst in 1991, the Japanese economy has experienced low or negative growth in gross domestic product (GDP) and the unemployment rate has remained high. Due to the recession, we have also been confronted with deteriorating productivity in several industries. The Japanese Cabinet Office (2002) reported that the growth rate of total factor productivity (TFP) decreased from 1.6 percent in the 1980s to 0.2 percent in the 1990s on average for all industries and that the average rate of TFP growth in the service sector was a negative value in the 1990s[1)]. In contrast, the U.S. enjoyed an increase in TFP in the late 1990s[2)].

[1)] See Cabinet Office (2002) pp.188–191.
[2)] For the change in productivity growth in the U.S., see *The Economic Report 2000* published by the Council Economic Advisers (CEA), available at http://www.gpoaccess.gov/usbudget/fy03/pdf/2002.erp.pdf.

The Japanese Economic and Social Research Institute ed. (2003) measured TFP growth rates in all eighty-four sectors during the period 1970–1998. It reported that since 1990, TFP growth rates in broadcasting ranged from −3.7 percent to 2.1 percent, and the average for the eight years was a negative value[3]. Moreover, Asai (2005) calculated the Malmquist productivity index of Japanese terrestrial broadcasters for the period 1997–2002 using Data Envelopment Analysis (DEA) and evaluated the average deterioration in productivity.

Broadcasting and telecommunications are common ways of transmitting information through electronic networks. However, while many studies measured TFP in the telecommunications market[4], little attention has been given to the productivity analysis of broadcasting. Several reasons for this have been pointed out. First, since the terrestrial broadcasting market has experienced steady expansion until now, little attention has been paid to the productivity and management of broadcasters. Second, since viewers are not charged for terrestrial commercial broadcasting services, researchers are more inclined to study the cultural aspects of broadcasting than its economic aspects. Third, regarding the telecommunications business, state-owned telecommunications carriers have undergone privatization, and deregulation has been proceeding in advanced countries since the 1980s. The productivity effect of regulatory reform has been an attractive subject to both researchers and policymakers, and several researchers have also been interested in studying the technological progress of telecommunications as one component of productivity, since telecommunication technology has progressed rapidly. On the other hand, the industry structure of terrestrial broadcasting has not changed fundamentally from its beginning and analog technologies have been used until the present. We may say that change in the terrestrial broadcasting market is slow compared to the telecommunications market. Fourth, in several countries, the fees charged for services provided by dominant telecommunications carriers have been regulated by price-cap regulations. Since the TFP growth rate has been usually used as the X factor in the price-cap formula "Price Index – X", telecommunications regulators that adopt price-cap regulations need to calculate the TFP of dominant carriers. In contrast, terrestrial broadcast services have been provided free of charge. Furthermore, in the case of pay television such as CATV and satellite broadcasting, the rates have not been subjected to significant regulation in Japan, and policymakers do not need to calculate the TFP of broadcasters for the purpose of regulation. For these reasons, few economic analyses of Japan's terrestrial broadcasting have been conducted so far.

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[3] The broadcasting industry as classified by the Economic and Social Research Institute ed. (2003) consists of public and private broadcasting and CATV. The broadcasters covered by the Economic and Social Research Institute ed. (2003) are different from those covered in this study and Asai (2005).

[4] For example, Denny et al. (1981) measured the TFP of Bell Canada. Oniki et al. (1994) conducted a study of the decomposition of TFP through the estimation of Nippon Telegraph and Telephone Corporation's (NTT) variable cost function and examined the productivity effect of the privatization of NTT. Nemoto and Asai (2002) measured the TFP of NTT's local communications business and analyzed the relationship between NTT's technological progress and the development of digitalization.

On the other hand, concern over the development of the content industry has grown recently among Japanese policymakers and businesspeople[5], in tandem with the rapid development of the Internet. Most video content in Japan has been produced and distributed by terrestrial broadcasters[6], and they have therefore made a significant impact on the video content market. Accordingly, analyses of terrestrial broadcasting deserve attention from the viewpoint of the development of the content industry.

The rest of this paper is organized as follows. Section 2 gives an overview of the Japanese broadcasting industry. Sections 3 and 4 describe the model and the data. Empirical results are presented in Section 5. Finally, Section 6 offers our conclusions.

2. Overview of the Japanese Broadcasting Industry

An overview of the structure of the Japanese broadcasting industry is provided as a background to the productivity analysis in this paper[7]. In the case of terrestrial commercial broadcasting, viewers can enjoy broadcasting services without charge, and the average ratio of advertising revenues to total revenues of terrestrial commercial broadcasters is more than 0.9. In other words, economic transactions are not carried out between broadcasters and viewers, but carried out between broadcasters and advertisers. In this respect, the revenue structure of terrestrial broadcasting is different from that of pay television, such as CATV and satellite broadcasting.

While Nippon Hoso Kyokai (NHK), as a public broadcaster, provides services nationwide, the service area of commercial terrestrial broadcasters is limited to their respective prefectures, in accordance with the conditions of the license issued by the Ministry of Internal Affairs and Communication (MIC). However, some broadcasters in the Kanto, Kansai and Tokai areas are allowed to operate across several prefectures, in consideration of the economic connections that exist among these areas. The large-scale broadcasters in the Kanto area are usually called "networks", and the others are called "local stations" or "local broadcasters"[8].

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[5] For example, the Japanese Cabinet published *The Intellectual Property Strategic Program* 2004 which included the policy regarding intellectual property for content, on May 27, 2004, available at http://www.kantei.go.jp/singi/titeki2/kettei/040527f.html.

[6] According to the investigation by the Ministry of Internal Affairs and Communications (MIC), the ratio of video content distributed by terrestrial television broadcasters to total video content sales was about 0.68 in 2003. See the press release from the MIC dated July 29, 2005 available at http://www.soumu.go.jp/s-news.

[7] For a detailed structure of the Japanese broadcasting system, see Sugaya (1997).

[8] Local broadcasters are sometimes classified into "quasi-networks" and "other local broadcasters". Quasi-networks are broadcasters that operate in the Kansai or Tokai areas. Networks and quasi-networks are common ways of providing services across several prefectures. However, quasi-networks and other local broadcasters receive programs from their networks under affiliate contracts, and more than half of their broadcast hours are devoted to transmission of programs produced by networks, according to the investigation by the National Association of Commercial Broadcasters in Japan. Since quasi-networks have basically similar revenue and cost structures as other local broadcasters, this paper does not distinguish quasi-networks and other local broadcasters. Regarding the models that include dummy variables for quasi-networks, see note 11.

Television programs transmitted by local broadcasters consist of those produced in-house, those purchased from program production companies, and those transferred from other broadcasters under affiliate contracts. First, self-produced programs are those produced by the broadcasters themselves, employing their own labor, capital and facilities such as studio and equipment. As the Broadcasting Law assumes that broadcasters produce programs, this conforms to the Law's intended purpose.

Second, broadcasters often order television programs from production companies. In addition to ordering such programs, broadcasters enter into contracts with the copyright holders of popular products such as feature films in order to purchase the right to transmit them. Since the value of advertising media increases proportionally with the audience, commercial broadcasters have an incentive to transmit popular programs that achieve high audience ratings. For this reason, broadcasters purchase packaged popular videos from a third party and transmit the videos along with their commercial messages. Since broadcasters receive their revenues by transmitting commercial messages from advertisers, packaged videos correspond to materials for broadcasters.

Third, Japanese broadcasters are classified into network and local broadcasters, as mentioned above. Networks enter into affiliate contracts with several local broadcasters and provide these affiliates with programs free of charge[9]. That is to say, economic transactions are not carried out with regard to the transfer of programs. However, since programs and commercial messages produced by networks are transmitted into other areas through the local broadcasters under affiliate contracts, the value of advertising media increases and networks can attract substantial advertising revenues from national advertisers. On the other hand, since local broadcasters do not generally possess adequate operational resources to produce all programs required to fill their television schedules[10], network affiliates provide benefits to both networks and local broadcasters.

3. Model

Terrestrial broadcasters produce advertising service Y from three inputs: labor X_L, materials X_M and capital X_K. Capital in the terrestrial broadcasting business mainly consists of transmission stations, relay stations, other transmission and receiving equipment, and studio facilities. While these facilities can be used for the long term, it is difficult to adjust them to the change in demand instantly. Therefore, capital is treated as a quasi-fixed input, while labor and materials are assumed to be variable. A translog form for the variable cost function is specified as Equation (1).

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9) More precisely, in addition to the free provision of programs, networks allocate part of their advertising revenue to affiliates as a payment for transmitting their programs.

10) In addition to local broadcasters, networks often commission the production of programs to production companies for economic reasons.

$$
\begin{aligned}
\ln VCt \;=\; & \alpha_0 + \sum_{i=L,M} \alpha_i \ln W_{it} + \alpha_K \ln X_{Kt} + \alpha_Y \ln_{Yt} + \alpha_t t \\
& + \frac{1}{2} \sum_{i=L,M} \sum_{j=L,M} \beta_{ij} \ln W_{it} \ln W_{jt} + \sum_{i=L,M} \beta_{iK} \ln W_{it} \ln X_{Kt} \\
& + \sum_{i=L,M} \beta_{iY} \ln W_{it} \ln Y_t + \sum_{i=L,M} \beta_{it} \ln W_{it} t + \frac{1}{2} \beta_{KK} (\ln X_{Kt})^2 \\
& + \beta_{KY} \ln X_{Kt} \ln Y_t + \beta_{Kt} \ln X_{Kt} t + \frac{1}{2} \beta_{YY} (\ln Yt)^2 + \beta_{Yt} \ln Y_t t + \frac{1}{2} \beta_{tt} t^2
\end{aligned}
\tag{1}
$$

$$
\beta_{ij} = \beta_{ji},\;\; i, j = L, M,\;\; \sum_{i=L,M} \alpha_i = 1,\;\; \sum_{i=L,M} \beta_{ij} = \sum_{i=L,M} \beta_{iK} = \sum_{i=L,M} \beta_{iY} = \sum_{i=L,M} \beta_{it} = 0
$$

where W_L and W_M are the prices of labor and materials, respectively, and VC denotes the variable cost. The state of technology is assumed to be represented by a time trend variable t. Variable cost share Equations (2) are obtained by the Shephard's lemma.

$$
\begin{aligned}
S_L &= \alpha_L + \beta_{LL} \ln W_{Lt} + \beta_{LM} \ln W_{Mt} + \beta_{LK} \ln X_{Kt} + \beta_{LY} \ln Y_t + \beta_{Lt} t \\
S_M &= \alpha_M + \beta_{LM} \ln W_{Lt} + \beta_{MM} \ln W_{Mt} + \beta_{MK} \ln X_{Kt} + \beta_{MY} \ln Y_t + \beta_{Mt} t
\end{aligned}
\tag{2}
$$

where $S_L = W_L X_L / VC$ and $S_M = W_M X_M / VC$. To avoid singularity, one of the share equations is dropped from estimation. The variable cost function (1) and the labor cost share equation are jointly estimated using the maximum likelihood method.

Following Caves et al. (1981), the degree of economies of scale in the variable cost function is obtained by Equation (3). If Scale > 0, the broadcasters enjoy scale economies. If Scale < 0, the broadcasters have diseconomies of scale.

$$
Scale = 1 - \left(1 - \frac{\partial \ln VC}{\partial \ln X_K}\right)^{-1} \left(\frac{\partial \ln VC}{\partial \ln Y}\right) \tag{3}
$$

On the other hand, the Törnqvist approximation to the Divisia-based index of growth rate in TFP between the sequential periods, t and $t-1$, is given by Equation (4).

$$
\ln \frac{TFP_t}{TFP_{t-1}} = \ln \frac{Y_t}{Y_{t-1}} - \sum_{i=L,M} \left(\frac{S_{it} + S_{it-1}}{2}\right) \ln \frac{X_{it}}{X_{it-1}} - \left(\frac{S_{Kt} + S_{Kt-1}}{2}\right) \ln \frac{X_{Kt}}{X_{Kt-1}} \tag{4}
$$

where $S_{it} = \frac{W_{it} X_{it}}{C_t}$, $\quad S_{Kt} = \frac{W_{Kt} X_{Kt}}{C_t}$ $C_t = VC_t + W_{Kt} X_{Kt}$

Following a similar analysis to that in Denny et al. (1981) and Oniki et al. (1994), by totally differentiating the variable cost function $VC = f(P_L, P_M, Y, t)$ and the definition of variable cost $VC = P_L L + P_M M$ with respect to time, respectively, and then rearranging them using the Törnqvist discrete approximation, Equation (5) is obtained.

$$\begin{aligned}\frac{1}{2}\sum_{i=L,M}(S_{it}+S_{it-1})\ln\frac{X_{it}}{X_{it-1}} &= \frac{1}{2}(\eta_t\varepsilon_{Kt}+\eta_{t-1}\varepsilon_{Kt-1})\ln\frac{X_{Kt}}{X_{Kt-1}}\\ &+\frac{1}{2}(\eta_t\varepsilon_{Yt}+\eta_{t-1}\varepsilon_{Yt-1})\ln\frac{Y_t}{Y_{t-1}}\\ &+\frac{1}{2}\left[\frac{1}{C_t}\frac{\partial VC_t}{\partial t}+\frac{1}{C_{t-1}}\frac{\partial VC_{t-1}}{\partial t}\right]\end{aligned}\tag{5}$$

where $\eta_t = VC_t/C_t \quad \varepsilon_{Kt} = \partial\ln VC_t/\partial\ln X_{Kt} \quad \varepsilon_{Yt} = \partial\ln VC_t/\partial\ln Y_t$

Substituting Equation (5) into Equation (4), Equation (6) which decomposes the growth rate of TFP is given.

$$\begin{aligned}\ln\frac{TFP_t}{TFP_{t-1}} &= \frac{1}{2}[(1-\eta_t\varepsilon_{Yt})+(1-\eta_{t-1}\varepsilon_{Yt-1})]\ln\frac{Y_t}{Y_{t-1}}\\ &-\frac{1}{2}[(\eta_t\varepsilon_{Kt}+S_{Kt})+(\eta_{t-1}\varepsilon_{Kt-1}+S_{Kt-1})]\ln\frac{X_{Kt}}{X_{Kt-1}}\\ &-\frac{1}{2}\left[\frac{1}{C_t}\frac{\partial VC_t}{\partial t}+\frac{1}{C_{t-1}}\frac{\partial VC_{t-1}}{\partial t}\right]\end{aligned}\tag{6}$$

The first term of the right-hand side of Equation (6) represents the amount of change in TFP due to change in output scale. The second term of Equation (6) captures the effects of capital adjustment on TFP growth. The level of optimal capital stock X_K^* is obtained by solving the first order condition to minimize total cost: $C = VC + W_K X_K$.

$$\frac{\partial VC}{\partial X_K} + W_K = 0 \tag{7}$$

Let ρ be the ratio of the shadow value of capital to its market value, that is,

$$\rho = -\frac{\partial VC/\partial X_K}{W_K} \tag{8}$$

When $\rho > 1$, capital is scarce. Conversely, when $\rho < 1$, excess capital exists. The second term of Equation (6), $-\frac{1}{2}[(\eta_t\varepsilon_{Kt}+S_{Kt})+(\eta_{t-1}\varepsilon_{Kt-1}+S_{Kt-1})]\ln\frac{X_{Kt}}{X_{Kt-1}}$ can be rewritten by using Equation (8) as $+\frac{1}{2}[S_{Kt}(\rho_t-1)+S_{Kt-1}(\rho_{t-1}-1)]\ln\frac{X_{Kt}}{X_{Kt-1}}$. When $\rho < 1$, that is, excess capital exists, the increase in capital decreases TFP growth. When $\rho > 1$, TFP growth is raised by an increase in capital. When $\rho = 1$, that is, the capacity utilization rate is at an optimal level, the second term of Equation (6) does not contribute to change in TFP. The last term is the rate of technical change. Thus, Equation (6) explains TFP growth by factoring in the effects of output scale, capacity adjustment and technical change.

4. Data

The subjects of this study are twenty-five local stations that submitted financial statements to the Ministry of Finance during the fiscal year 1997–2002. In addition

Table 1 Sample summary statistics

	Input					Output Y (million yen)
	P_L	P_M	X_L	X_M	X_K	
Average	13.78	0.993	235.03	4088.16	4668.49	14516.51
Standard error	3.48	0.025	154.96	6376.54	4130.82	17134.12
Maximum	21.7	1.031	734	30706	17824	79864
Minimum	6.48	0.954	51	576	758	3024

Table 2 Change in input and output: annual growth change rate (%)

	X_L	X_M	X_K	Output
1998	−1.017	−1.420	4.017	−9.394
1999	−3.247	−1.741	6.184	−7.887
2000	−3.445	3.559	4.365	7.423
2001	−2.849	−0.363	−4.737	−1.461
2002	−3.491	−2.762	−3.277	−4.742

to the twenty-five local stations, the financial data on a few so-called networks that provide their services in the Kanto area are available. However, since the revenue and cost structures of networks are different from those of local stations, networks are excluded from the estimation. Twenty-two broadcasters provide services within a single prefecture while the other three operate across several prefectures (the Kansai and Tokai areas).

The variable inputs are X_L=labor, and X_M=program, as materials. X_K=capital is a quasi-fixed input, as mentioned in Section 3. The data for both input and output are obtained from financial statements submitted to the Ministry of Finance.

X_L represents the number of employees at the end of a fiscal year. Program (X_M), as an input quantity, is calculated as the program cost divided by the program price (P_M). Since most of the program cost of a local broadcaster is made up of the expenditure for packaged programs, the price index of recorded materials is adopted as the program price (P_M). Capital stock is constructed using the perpetual inventory method. $K_t = (1 - \delta)K_{t-1} + I_t$, where δ is the depreciation rate of capital and is calculated as the ratio of depreciation expenses to book-valued fixed assets at the beginning of the period. Investment is calculated by adding the depreciation expenses and changes in assets between the beginning and end of the fiscal year. It is deflated using the price index of investment goods.

The price of labor (P_L) is calculated as compensation to the employees divided by the number of employees. According to Christensen and Jorgenson (1969), the price of capital service (P_K) is calculated by $p_c(r + \delta)/(1 - \tau)$. p_c is the price index of capital goods and r is the long-term prime lending rate. δ is the depreciation rate for capital as mentioned above. τ is the corporate tax rate and is computed as the

Table 3 Correlation coefficients

	P_L	P_M	X_L	X_M	X_K	Y
P_L	1.0000					
P_M	−0.0303	1.0000				
X_L	0.6001	0.0753	1.0000			
X_M	0.6421	0.0215	0.9355	1.0000		
X_K	0.6079	−0.0072	0.7801	0.7526	1.0000	
Y	0.6518	0.0240	0.9618	0.9896	0.7760	1.0000

corporate tax divided by income taken from financial statements.

The output quantity (Y) is calculated as the revenues divided by the price of the broadcast advertising service. This price index of broadcast advertising service is adopted as the output price because the revenue source of commercial terrestrial broadcasters is advertising expenditures. The price indexes of recorded materials (P_M) and capital goods (p_c), the long-term prime lending rate (r) and the price index of the broadcast advertising service as output price are taken from the *Monthly Report* issued by the Bank of Japan.

Table 1 presents some summary statistics for the variables. The maximum output is twenty-six times larger than the minimum output, and the differences in the scale of broadcasters can be seen from the data in Table 1. Table 2 shows the annual change rates of input and output. Table 2 indicates that the number of employees has decreased over the entire estimation period. Capital has decreased since 2001, and output has decreased with the exception of the year 2000. Table 3 shows the correlation coefficients of variables.

5. Empirical Results

The cost function in Equation (1) is jointly estimated with the labor cost share Equation (2) using the maximum likelihood method. The results of estimation are shown in Table 4[11)]. The estimated cost function satisfies monotonicity in output and concavity in input prices over the entire sample.

Table 5 presents estimates of the degree of scale economies. The scale economies evaluated by Equation (3) is 0.02473 at the sample means. Although this value

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11) Other models are also estimated, although the results are omitted from this paper. First, dummy variable for the output of three large-scale broadcasters is introduced, since the dimension of the market is different from that of small-scale broadcasters. Second, for the same reason, dummy variable for three large-scale broadcasters is adopted as a constant term. These models confirm that large-scale broadcasters have scale diseconomies and others enjoy scale economies. This is consistent with the result of the model in this paper. However, since dummy variables in both models are not significant at the 10 percent significance level, the two models that include dummy variables are not adopted. Third, the cost function is estimated using the data on 22 small-scale broadcasters, and the existence of scale economies is revealed. We compare this model (22 broadcasters) with the model presented in this paper (25 broadcasters) using Akaike's information criterion (AIC). Since the 25 broadcasters model is confirmed to be superior by this criterion, the third model is not adopted.

Table 4 Parameter estimates of cost function

Parameters	Coefficients
α_0	−0.09414 (0.01889)*
α_M	0.45869 (0.01621)*
α_K	0.01426 (0.03575)
α_Y	0.96135 (0.03632)*
α_t	0.00492 (0.00997)
β_{LM}	−0.19282 (0.02966)*
β_{MK}	−0.05241 (0.01566)*
β_{MY}	0.19003 (0.01736)*
β_{Mt}	0.01088 (0.00415)*
β_{KK}	−0.19388 (0.05581)*
β_{KY}	0.22638 (0.06200)*
β_{Kt}	−0.00099 (0.00895)
β_{YY}	−0.17652 (0.07120)**
β_{Yt}	−0.00517 (0.00922)
β_{tt}	−0.00541 (0.00350)
Adjusted R-squared	
Variable cost	0.988851
Share equation of labor	0.521636
Log likelihood	314.701
Number of samples	150

Heteroskedasticity consistent standard errors are in parentheses.
* 1 percent significance level, ** 5 percent significance level.

Table 5 Degree of scale economies[1)]

Large-scale	−0.03957 (0.04817)
Small-scale	0.05817 (0.01350)*
Average	0.02473 (0.02356)

[1)] The value evaluated at the sample means. Standard error is in parenthesis.
* 1 percent significance level.

indicates the existence of scale economies, it is not significant at the 10 percent significance level. Three large-scale stations in the Kansai or Tokai areas have earned more than 30 billion yen annually. The values of scale economies of the three large-scale broadcasters are negative over the entire sample, although the value evaluated at the sample means of three large-scale broadcasters is not significant. On the other hand, small-scale broadcasters enjoy scale economies, and the value is significant at the 1 percent significance level. Asai (2004) estimated the total cost function of terrestrial broadcasters and ascertained that the output achieving the minimum average cost was 25,573 million yen. Since the result of Asai (2004) implies that broadcasters with an output of more than 25,573 million yen have scale diseconomies, the conclusions of this paper correspond with those of the previous study.

Table 6 Decomposition of TFP growth: annual rate (%)

	Output Effect	Capital Adjustment	Technical Change	TFP
1998	−2.39	−1.08	0.04	−3.43
1999	−1.87	−1.24	0.44	−2.67
2000	1.69	−1.30	0.89	1.29
2001	−0.40	0.70	1.37	1.66
2002	−1.15	0.75	1.81	1.41
Average				
Total	−0.68	−0.36	0.76	−0.28
Large-scale	−0.76	−0.47	2.09	0.85
Small-scale	−0.83	−0.43	0.75	−0.50

Terrestrial broadcasters are obliged to provide services across areas prescribed by their license condition. Each broadcaster transmits television programs using one transmission station that covers a wide area including an urban area and a number of relay stations. Large-scale broadcasters need many relay stations, since their service areas stretch across several prefectures. While the number of relay stations operated by large-scale broadcasters is 142 on average, some small-scale broadcasters provide services through about 20 relay stations. Since the number of relay stations causes an increase in labor and capital cost, large-scale broadcasters are considered to be operating at beyond the optimal size.

Table 6 shows that TFP growth rates in 1998 and 1999 were negative values due to the low level of technical change as well as the negative values of both output effect and capital adjustment. The output effect is a positive value only in the year 2000, since the output growth rate was 7.4 percent. This growth rate was high, as shown in Table 2, reflecting the relatively high level of GDP growth[12)]. While an increase in capital caused the deterioration of TFP during the period 1998–2000, as can be seen from Tables 2 and 6, a decrease in capital contributed to the improvement in TFP from 2001. In the late 1980s and early 1990s, several terrestrial broadcasters invested in culture and leisure facilities by themselves or through their subsidiaries. However, they recently sold the other business facilities from the viewpoint of profitability. Part of the decrease in capital is caused by the revision of their management strategies.

The rate of technical change, as calculated in this study, is low. However, technical progress in the terrestrial broadcasting market has gradually accelerated[13)], and this acceleration caused the improvement in the TFP.

Although an upward trend in TFP growth was observed, two factors from which a high productivity growth rate cannot be expected in the future were identified.

[12)] The annual growth rate of GDP in 2000 was 2.5 percent according to the investigation conducted by the Economic and Social Research Institute, available at http://www.esri.can.go.jp/.
[13)] Digital satellite news gathering (SNG) is pointed out as technology that causes the reduction of cost.

First, the primary revenue source for terrestrial broadcasters is advertising expenditures, and this depends on economic circumstances. A significant increase in advertising revenues cannot be expected without a steady economic recovery. Furthermore, although terrestrial television broadcasting is the most common medium in Japan, broadcasting via communications satellite (CS) and CATV is starting to develop. In addition, advertising over the Internet is now penetrating the market. Terrestrial broadcasters are not expected to increase their share of the advertising market, as a result of the development of competition in the media industry.

Second, the reduction of capital has contributed to an increase in TFP since 2001. However, once other business facilities are sold as mentioned above, the improvement in TFP caused by a decrease in capital is not expected. In addition, according to the MIC's decision, several large-scale broadcasters began their digital broadcasting services in December 2003, and small-scale broadcasters are to start their digital services in a few years, which means that they need to construct their network facilities for digital services. Moreover, terrestrial broadcasters are obliged to own and operate two types of facilities to provide both analog and digital broadcasting services until the analog service is completely phased out in 2011. Viewers select analog or digital services using their television receivers during the transitional period, and therefore providing the two kinds of services is not expected to increase the total number of viewers. Since viewing hours are one determinant of the level of advertising revenue, operating both facilities without an increase in viewing hours may lead to deterioration in productivity.

The bottom of Table 6 indicates that the estimated rate of technical progress for small-scale broadcasters is smaller than that for large-scale broadcasters, with the result that the TFP growth rate between the two types of broadcasters differs. The Ministry decided in March 2004 to permit mergers between small-scale broadcasters facing financial difficulties, as the investment required for digitalization imposes a considerable financial burden on them. Since small-scale broadcasters have scale economies, the merger of broadcasters can been seen as an effective way of improving management from an economic point of view. However, merger will reduce localism which is one goal in Japanese broadcasting policy[14)]. We need to consider the management and technical progress of small-scale broadcasters in advance of merger.

6. Conclusion

In this study, the TFP was measured by estimating the variable cost function, and its low rate of growth was confirmed. Furthermore, the average rate of technical change among small-scale broadcasters was smaller than that of large-scale broadcasters.

Terrestrial broadcasters have been regulated with regard to entry and have not

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14) Although localism is not our present concern, it is necessary to consider whether terrestrial broadcasters should continue to play the role in localism.

been fully aware of their management and productivity under the stable conditions that have prevailed until now. However, the circumstances surrounding terrestrial broadcasters have been changing in the past few years, in addition to the start of digital broadcasting service. Japanese terrestrial broadcasters have played a leading role in the video content market as mentioned in the Section 1. We will need to monitor their productivity from not only the standpoint of broadcasting management, but also in terms of the development of the content industry in Japan.

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