



# Scale economies, technical change and productivity growth in Japanese local telecommunications services

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## Abstract

This paper aims to examine the cost structure of local telecommunications services in Japan to provide measurements of productivity growth and a decomposition of this growth. We estimate a variable cost function using panel data on eleven regional telecommunications sectors of NTT for the 1992–1997 period. Total factor productivity (TFP) is measured on the basis of the estimated parameters, and the TFP growth rate is then decomposed into three sources: scale economies, technical change and capital adjustment. Our results reveal that the contributions of technical change to productivity growth are greater than those of scale economies and capital adjustment.

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## 1. Introduction

This paper aims to examine the cost structure of local telecommunications services in Japan to provide measurements of productivity growth and a decomposition of this growth. We estimate a variable cost function using panel data on eleven regional

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telecommunications sectors of NTT for the period 1992–1997.<sup>1</sup> Total factor productivity (TFP) is measured on the basis of the estimated parameters, and the TFP growth rate is then decomposed into three sources: scale economies, technical change and capital adjustment. Our results reveal that the contributions of technical change to productivity growth are greater than those of scale economies and capital adjustment. We also find out that sluggish adjustment of capital prevents the fast growth of productivity for some regional sectors.

This paper has some policy implications for the price regulation of incumbent local exchange carriers. Like British Telecom in the UK, the regional sectors of NTT have been subject to the price-cap regulation in the form of RPI-X, where RPI and X are the inflation rate and the expected rate of productivity growth, respectively.<sup>2</sup> Thus, the increase in the average price of local services must be kept to less than an increase in RPI-X. In implementing the price-cap regulation, the level of the X factor is debated because a high X factor may jeopardize the firm's survival while a low X factor may fail to provide incentives for cost reduction. The analysis in the present paper suggests that the current X set by MPT is comparable to our estimates of TFP growth if its slowdown tendency is taken into consideration.<sup>3</sup>

Although the telecommunications industry has received increasing attention worldwide, there are only a few empirical studies on cost structures and productivity of Japanese telecommunications. To the best of our knowledge, these include Oniki et al. (1994) and Sueyoshi (1996, 1997). Oniki et al. (1994) investigated the productive performance of NTT during 1958–1987 using a framework similar to that of the present study. Their primary concern was the effects of the 1985 reform by which NTT was privatized and the telephony market was liberalized. Sueyoshi (1997) used the data envelopment analysis (DEA) to evaluate the 1985 reform by comparing NTT's managerial efficiency before and after 1985. Using econometric techniques as well as DEA, Sueyoshi (1996) also examined the divestiture of NTT in 1999 by testing whether the cost structure exhibits subadditivity or economies of scope.

The previous studies are mainly concerned with the managerial form of NTT and thereby deal with its entire cost structure. Unlike those studies, we focus on the local services, for which issues of regulating incumbents provoke considerable controversy. We intend to shed light on the possibilities of fostering competition in the local telecommunications market in Japan.

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<sup>1</sup> The former NTT was a public enterprise and had a monopoly on domestic telecommunications services. It was privatized in 1985 with a proviso obligating the Ministry of Posts and Telecommunications (MPT) to review its system after 5 years. Based on the decision by MPT to implement the Independent Division System in 1990, NTT was reorganized into 11 regional sectors and a long-distance communications sector. While the regional sectors were still parts of NTT, they were required to report financial statements separately and expected to improve efficiency through yardstick competition. With the divestiture of NTT in 1999, the regional sectors were integrated into two companies: NTT East Japan and NTT West Japan. These are currently the incumbent local exchange operators and participate in the holding company NTT, together with NTT Communications, a long-distance operator.

<sup>2</sup> In October 2000, MPT shifted its regulation regime from traditional rate-of-return regulation to the price-cap.

<sup>3</sup> Similarly to the price-cap regulation for British Telecom, the X factors for the regional NTTs are not determined by TFP, but on the basis of estimated future costs incorporating anticipated technological progress. In the US, TFP was once used in setting the X factor for AT&T during the 1989–1995 year. See Laffont and Tirole (2000) for theoretical rationale and practical aspects of the price-cap regulation.

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