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New technology and demand for educated workers: The experience of Japanese manufacturing in the era of high-speed growth

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Focusing on the 1960s, we examine the relation between new technology and educational skills, and infer how much technological investments shifted labor demand among workers of different educational levels. First, we see that the highly educated graduates were absorbed into industries with high levels of new equipment. Next, we explain this educational bias by referring to individual cases. Lastly, we show that from 1963 to 1970, due to a rise in the new-capital ratio, demand growth for upper secondary school graduates and college graduates outpaced that for lower secondary school graduates by 1.0 and 1.2 percentage points per annum respectively. *J. Japanese Int. Economies* **20** (1) (2006) 50–76. Faculty of Economics, Tezukayama University, 7-1-1 Tezukayama, Nara-shi 631-8501, Japan; Faculty of Sociology, Kansai University, 3-3-35 Yamatecho, Suita-shi 564-8680, Japan; International Research Center for Japanese Studies, 3-2 Oeyama-cho, Goryo, Nishikyo-ku, Kyoto-shi 610-1192, Japan.

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1. Introduction

In the midst of the postwar “economic miracle,” the Japanese economy achieved a transformation of its production technology. The application of growth accounting to a two-part period, from 1950 to the year of the collapse of the bubble economy (1992) with the first oil crisis (1973) as the mid point, reveals the following facts (Dornbusch et al., 1998, pp. 44–45). The average yearly per capita GDP growth was 8.01% in the period from 1950 to 1973, which was higher than the 2.42% growth of the United States for the same period. The contribution due to quantitative expansions in the workforce and capital constituted merely 1.37 of the 5.59 point difference. The remaining 4.22 points, that is, 75.5% of the difference, were due to total factor productivity growth. This contribution is particularly high when compared with the 52.1% contribution resulting from technological development in the period from 1973 to 1992.

In the 1960s there were huge technological investments in many branches of manufacturing (Inoki, 1989; Kosai, 1986; Yoshikawa, 1997, etc.), and by 1970 real private gross capital stock (installation basis) was four times that of 1960.¹ But only when new capital is brought together with a suitably qualified workforce are potential levels of productivity achieved. If the pre-existing allocation of human resources is relied upon in implementing new technologies, then a large amount of time and costs have to be incurred in training. In fact, in the 1960s new production technologies pushed many firms to restructure their workforces. It is thought that the need for more “educational skills” (those skills acquired through school education) shifted labor demand from lower secondary school graduates to upper secondary school graduates and then also to college graduates.²

According to existing theories, the introduction of new technologies has the effect of skill-biased technological change (SBTC), shifting relative demand toward highly educated workers. The reason for such a bias is that in order to deal with the various problems resulting from the introduction of a new and unfamiliar production technology, along with scientific knowledge, logical reasoning and cognitive skills are required (Nelson and Phelps, 1966; Welch, 1970; Bartel and Lichtenberg, 1987; Murnane and Levy, 1996, etc.). In this paper, we clarify the routes by which technological development led to an educational bias in labor demand, and we infer the degree to which technological development actually shifted relative demand in the 1960s.

This paper is related to recent studies that examine the effects of computerization. It is well known that in the 1980s the level of wage inequality in the United States increased and economists have pursued various causes. Currently, the main suspect is SBTC brought about by the spread of IT (Information Technology). In a cross-sectional analysis, Autor et al. (1998) found that the point increase in the employment share of college graduates was

¹ Economic Planning Agency (1977, pp. 54–55).

² Using the general equilibrium framework, Ueshima (2003) finds a large demand shift from lower secondary school graduates to upper secondary school graduates in blue-collar occupations.

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