

Analysis of Labor Productivity using Large-scale Data of Firm's Financial Statement

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The Japanese non-manufacturing sector, which is the service sector in the extended sense of the meaning, was reported to have low productivity in economic studies [1,2]. Many researchers have cited the low productivity as a serious problem of the Japanese economy. The previous study clarified that the low productivity of the Japanese non-manufacturing sector was caused by the low productivity of small firms [3].

In this paper, we analyzed financial statement data consisting of listed and unlisted Japanese firms in order to clarify the characteristics of time variation of the shape of Labor productivity distributions and the power-law indices. Analyzed data were combined data of Nikkei NEEDS and credit risk database (CRD) [4]. Nikkei NEEDS includes only listed firms, and CRD includes only unlisted small firms. The combined data includes 4×10^5 firms approximately from 1996 to 2006.

Figure 1 represents the rank-size plots of labor productivity for firms in service industry sector at 2006. In the left panel, the rank is given in increasing order of productivity. On the other hand, the rank is given in decreasing order of productivity in the right panel. These figures show that the labor productivity distribution exhibits the power-law distribution at the both side of mode. The labor productivity distributions of firms in various industry sectors from 1996 to 2006 were fitted using the generalized beta distribution of the second kind, defined by the following pdf:

$$p(x; \mu, \nu, q, x_0) = \frac{q}{B(\mu/q, \nu/q)} \frac{1}{x} \left(\frac{x}{x_0}\right)^\nu \left[1 + \left(\frac{x}{x_0}\right)^q\right]^{-(\mu+\nu)/q}, \quad (1)$$

where the parameters μ and ν are the power-law indices for large side and small side of the distribution, respectively.

Modes of the distribution vary largely depending on industry sectors. This means that equilibrium state was not achieved in labor market. It should be noted that the observed non-equilibrium state is evidence against the prevailing view in economics. The left panel of Figure 2 shows that the indices for small side of the distribution were decreased for firms in manufacturing sectors at 1999 and 2002. At the same periods, the nominal GDP in Japan

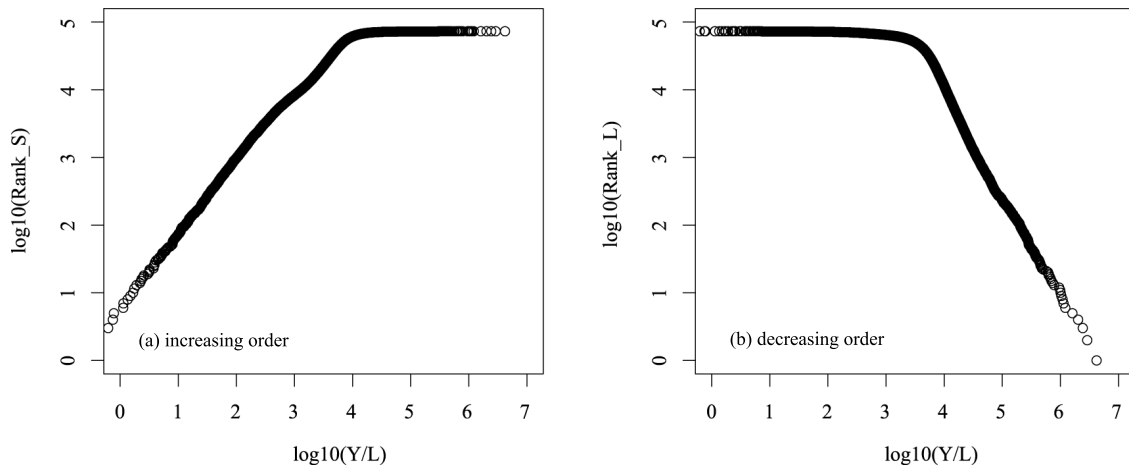


Figure 1 Rank size plot of labor productivity

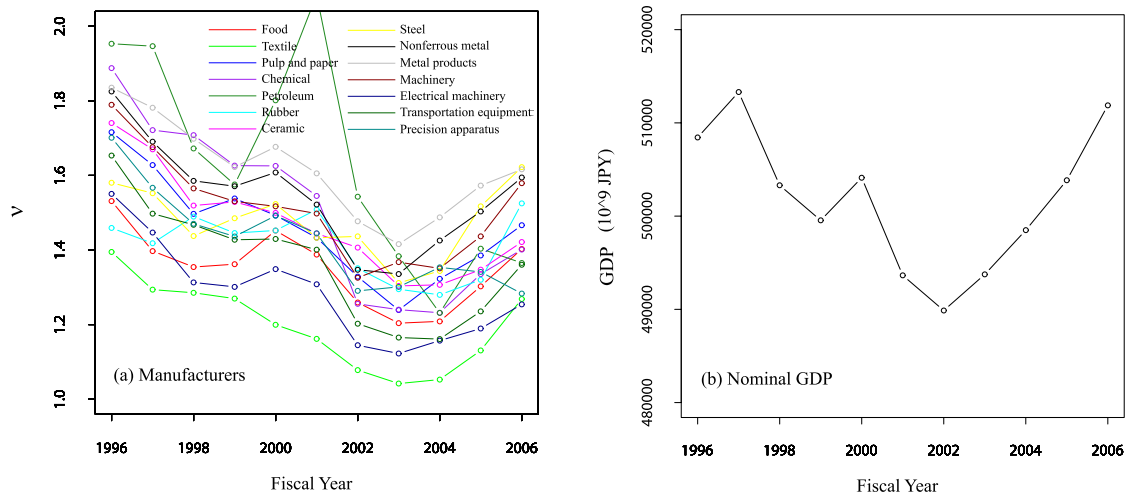


Figure 2 Time variation of power-law index of low productivity side and nominal GDP

decreased (see the right panel). The result suggested that the decreases of GDP at 1999 and 2002 were caused by the broadening of the small side of the distribution for firms in manufacturing sectors. This is an evidence of the long tail phenomena [5] in real economy.

Keywords

income distribution, growth statistics, microeconometrics, distributions and correlations

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