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Changes of firm size distribution: The case of Korea

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ABSTRACT

In this paper, the distribution and inequality of firm sizes is evaluated for the Korean firms listed on the stock markets. Using the amount of sales, total assets, capital, and the number of employees, respectively, as a proxy for firm sizes, we find that the upper tail of the Korean firm size distribution can be described by power-law distributions rather than lognormal distributions. Then, we estimate the Zipf parameters of the firm sizes and assess the changes in the magnitude of the exponents. The results show that the calculated Zipf exponents over time increased prior to the financial crisis, but decreased after the crisis. This pattern implies that the degree of inequality in Korean firm sizes had severely deepened prior to the crisis, but lessened after the crisis. Overall, the distribution of Korean firm sizes changes over time, and Zipf's law is not universal but does hold as a special case.

1. Introduction

From the size distribution of firms, researchers and policy makers often obtain information about the degree of industrial concentration and use it to understand business cycles and to implement antitrust policy.[1] In this context, the patterns of firm growth and their implications for the size distribution of firms have been one of the important issues for economists and physicists. A number of researchers have found that firm sizes can be described by lognormal distributions, as a consequence of the law of proportional effects [2–5]. This implies that firm growth follows a random process and growth rates are independent of firm sizes (Gibrat's Law).

On the other hand, Hall [6] argues that the distribution of firm sizes is not constant but rather decreasing. This finding implies that the actual distribution of firm sizes may evolve over time and may differ from a lognormal distribution [7]. In this context, some researchers show that the upper tail of the firm distribution is approximately described by Pareto (also known as power-law or scaling) distributions [8–14].[2] However, most of the previous studies in this line mainly pay their attention to the cases of developed countries. Given that the size distribution of firms depends on the economic structure of each country, the distribution of firm sizes in developing countries is also an interesting issue to be examined because these countries have had rapid changes in their economic structure in past decades [12,14,16–18].

In this paper, we investigate the distribution of firm sizes in the case of Korea. Our focus here is to look at the evolution of the degree of inequality in firm sizes over time. Considering the time dependence of firm size distribution is very interesting

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[1] Gabaix [1] argues that, if the distribution of firm sizes has fat tails, a considerable proportion of business fluctuations in the whole economy can occur as the result of impacts on some large firms.

[2] Unlike those studies which mostly consider external factors such as production-related factors, i.e., investments in physical capital and in research and development, Stanley et al. [15] emphasize the role of internal factors, such as organizational structure, and find that, for firms with similar sales, the distribution of annual growth rates has an exponential form and the spread in the distribution of rates decreases with increasing sales as a power-law over seven orders of magnitude.

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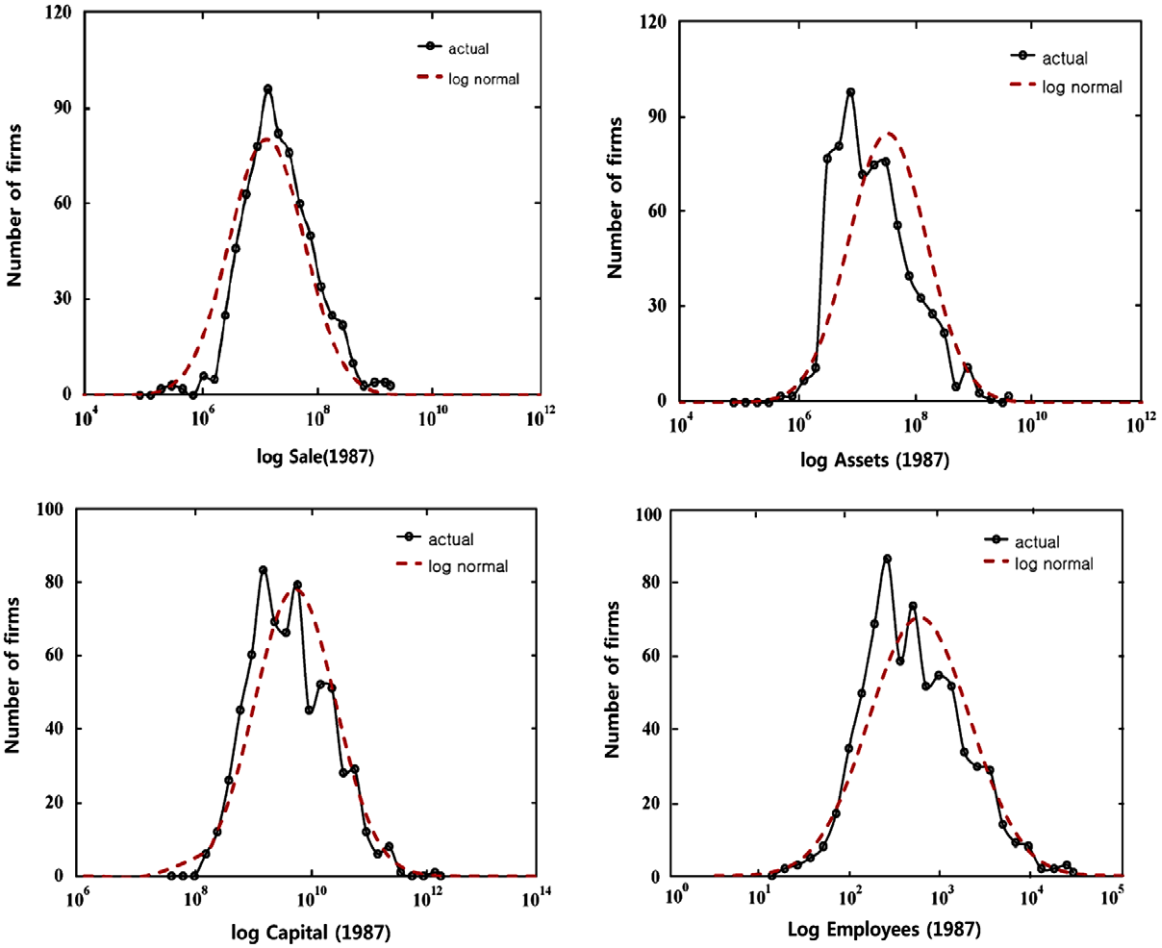

Fig. 1. Frequency of firm sizes (year 1987).

in the case of Korea, since the country has experienced a lot of structural changes in the industrial sector with a rapid economic growth in the past several decades. The evidence presented herewith may add an extra dimension to the literature and provide a basis with which future studies in this line can be compared. The empirical results using four proxy variables as firm sizes suggest that the upper tail of firm size distributions in Korea can be described by power-law distributions rather than lognormal distributions. Based on this characteristic of the Korean firm size distribution, the Zipf exponents estimated over time indicate that it had gradually increased until the financial crisis in 1997 but decreased since the crisis, implying that the degree of inequality of Korean firm sizes was severely deepened prior to the crisis, but lessened after the crisis.

The paper is organized as follows. In Section 2, we briefly discuss the stylized distributions of firm sizes in the literature. Section 3 gives the distribution of Korean firm sizes and examines the evolution over time. In Section 4, conclusions are provided, together with an implication.

2. The distribution of firm sizes

Beginning with Gibrat, a number of earlier studies on firm sizes have found that firm sizes seem to be lognormally distributed. This distribution is interpreted as a direct consequence of the law of proportional effect, implying that the firm sizes follow a random walk and that firm growth is erratic and independent of sizes [19]. A highly skewed distribution of firm sizes is often interpreted as an indication that the firm sizes are asymmetric with much of the probability mass to the right of the modal value, i.e., the modal firm size is less than the median, which in turn is less than the mean.

To see this characteristic in firm size distribution, let us denote that $x(t)$ is the size of the firm at time t and $\varepsilon(t)$ is an identically and independently distributed random variable denoting the proportionate growth between $x(t)$ and $x(t-1)$ with mean μ and variance σ^2, so that $x(t) = [1-\varepsilon(t)]\,x(t-1) = x(0)\,[1+\varepsilon(1)][1+\varepsilon(2)]\cdots[1+\varepsilon(t)]$. Taking logs with an approximation $\log[1+\varepsilon(t)] \cong \varepsilon(t)$ leads to $\log x(t) = \log x(0) + \sum_{t=1}^{T} \varepsilon(t)$. As $t \to \infty$, using the central limit theorem, $\log x(t)$ can be approximated as a normal distribution with mean μt and variance $\sigma^2 t$, since the term $\log x(0)$ is very small