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On measuring concentration in banking systems

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Abstract

Assuming a Pareto-type distribution of bank sizes, we investigate the effect of changes in Zipf's exponent (α) and the sample size on the behavior of different concentration indices, such as the 3-bank concentration ratio, the Herfindahl–Hirschman index and the top 5%-concentration ratio. We derive analytical relations between these concentration indices and investigate the elasticity of these indices to changes in α and in the sample size N. We show different regimes under which each index can be used most appropriately. Our results are highly relevant for policymakers who rely on such concentration measures to derive public policy recommendations in banking.
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1. Introduction

Deregulation, liberalization, and consolidation in the banking industry, reflected by increasing cross-border mergers and growing M&A activity within national boundaries, have increasingly prompted concerns about greater market power enjoyed by banks and the subsequent impact upon financial stability (Mishkin, 1999; De Nicoló et al., 2004).

It is therefore critical to assess the implications of these developments on bank market structure to draw appropriate policy inferences. Moreover, commonly used concentration mea-

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sures such as the k-bank concentration ratio[1] and the Herfindahl–Hirschman index (HHI) are extensively used as a proxy for competition in models explaining banking sector performance as a function of market structure (De Nicoló et al., 2004; Barth et al., 2004; Beck et al., 2006). In some countries, such as in the U.S., these concentration measures play a pertinent role in the enforcement of anti-trust laws (Bikker, 2004). In sum, precise measures of concentration are crucial for welfare-related public policy making in the banking industry.

This letter compares and contrasts alternative measures of concentration, Zipf's α, and the top 5% concentration ratio ($k_{5\%}$) with the more widely used 3-bank concentration ratio (k_3) and the Herfindahl–Hirschman index (HHI). We also discuss the regimes in which the application of these indices is appropriate in order to draw better inferences for public policy in banking. To this end, we evaluate the sensitivity of our measures to different sample sizes and different bank size distributions, since the number of banks varies considerably across banking systems. Finally, we present an empirical illustration of the proposed measures using bank data obtained for 15 countries.

2. Zipf's law

An increasing body of literature shows that the distribution of firm sizes in terms of total assets, sales, income, and employees[2] follows Pareto's law where the rank of firm R_i and its size Z_i are related by

$$Z_i = \text{const} \cdot R_i^{-\alpha}. \tag{1}$$

When the exponent $\alpha = 1$ then Eq. (1) is known as Zipf's law. This empirical relationship is well established in explaining the distribution of city sizes (Axtell, 2001; Gabaix, 1999) and country sizes (Rose, 2006). On the firm level, Ramsden and Kiss-Haypál (2000), Okuyama et al. (1999), and Stanley et al. (1995) have shown that firm sizes in terms of assets, income, and sales respectively also have power law tails with different α in different industrial sectors. This literature argues that the degree of deviation from a normal distribution and the exponent α are thought to be related to the degree of interaction (competition, cooperation, or collusion) of the firms within each sector. Thus, observing changes in this exponent may provide useful insights into market structure and competition in an industry.

The Zipf exponent α can be obtained by using Zipf's plot where the log-rank is plotted against the log of bank size. To compute Zipf's exponent α, we use a log-transformation of (1)

$$\log(R_i) = \text{const} - \alpha \log(Z_i) \tag{2}$$

so that the slope of the regression line is α; obtained by regressing the tails of the distribution using OLS. As a consequence, we refer to α henceforth as slope coefficient, or simply as Zipf's α.[3] The cut-off point is arbitrary but usually one selects values above the 10% point of the distribution, this is: $R_i/N > 0.1$. The higher α, the lower the dispersion of extreme bank sizes, suggesting higher bank concentration in the system. The inverse applies for lower values of α.

[1] The k-bank concentration ratio is the general way of referring to the ratio of the assets (deposits) held by a certain number of banks to total assets (deposits) in the banking system. Most studies assume $k = 3$ and we therefore refer to this measure subsequently as 3-bank concentration ratio, see also Beck et al. (2006).

[2] Okuyama et al. (1999) argue that these quantities give all consistent results when analyzing company statistics.

[3] See Gabaix (1999), Axtell (2001), Okuyama et al. (1999), and Rose (2006) for further details on Zipf's law and estimation of α using OLS.

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