Production, Manufacturing and Logistics

A frontier measure of U.S. banking competition ☆

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ABSTRACT

The three main measures of competition (HHI, Lerner index, and *H*-statistic) are uncorrelated for U.S. banks. We investigate why this occurs, propose a frontier measure of competition, and apply it to five major bank service lines. Fee-based banking services comprise 35 percent of bank revenues so assessing competition by service line is preferred to using a single measure for traditional activities extended to the entire bank. As the Lerner index and the *H*-statistic together explain only 1 percent of HHI variation and the HHI is similarly unrelated to the frontier method developed here, current merger/acquisition guidelines should be adjusted as banking concentration seems unrelated to likely more accurate competition measures.

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1. Introduction

The three standard indicators of banking competition used in empirical studies (HHI, Lerner index, and *H*-statistic) measure competition differently. Even so, the expectation would be that when the HHI suggests competition is weak, the Lerner index and the *H*-statistic could generally be counted upon to draw a similar conclusion. For the banking industry, however, these measures are essentially uncorrelated with each other and inferences regarding competition appear to be measure-specific: results obtained with any one measure need not be confirmed by either of the other two.

While regulators rely on the HHI because it has been predictive in concentrated industries, this measure shows only the potential for competitive/collusive behavior and is thus augmented with additional market/behavioral information (e.g., U.S. Department of Justice, 2010). Academics have for solid theoretical reasons favored the Lerner index and/or the *H*-statistic which seeks to measure realized competition. Using a procedure based on efficient frontier analysis, we derive inferences of competition separately for five bank service lines which the other competition measures, except for loans and deposits, are currently unable to do.

The HHI focus on market shares does not account for how they may have been achieved—through lower costs or by uncompet-

itive behavior, the so-called efficient structure controversy (cf., Berger, 1995). If lower costs have been an important reason for some banks in achieving a relatively high HHI, this will overstate the apparent lack of competition. While the Lerner index examines the spread between average price and estimated marginal cost all divided by average price, the influence of scale economy, productivity, and risk differences among banks cloud the interpretation. Observed input costs will be higher than their true value for banks with greater productivity, making productive banks appear to be more competitive than they are since their measured spread from output price will be lower. Passing on these productivity-reduced costs would lower observed output prices making the bank appear to be even more competitive. Here the influence is productivity-related, rather than due to competition. The *H*-statistic faces much the same problem as it relates changes in total revenues to changes in observed input prices, holding output level constant. For both measures, observed factor prices need not reflect their true value at more productive banks. Finally, a lack of detailed price and output data limits the application of the three standard measures to traditional loan and deposit bank service lines but neglects fee-based services that generate over a third of bank revenues. Our competition efficiency (CE) approach is not limited in this regard.

In what follows, the lack of a correlation among the HHI, Lerner index, and *H*-statistic are illustrated for U.S. banks in Section 2, a condition that holds for Europe as well. Our revenue-based competition frontier measure is explained in Section 3 as is our econometric framework. Section 4 contains our results where we assess relative competition among five bank service lines. In Section 5 we illustrate how the competition frontier differs from the three standard competition measures. Characteristics of the most and least competitive

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Table 1
Competition measure statistics and correlation for U.S. banks.

	382 banks with TA > $1 billion (90 percent of TA)		
	Average	Most competitive Quartile	Least competitive Quartile
HHI	1364	789	2109
Lerner index	0.26	0.13	0.39
H-statistic	0.82	0.90	0.73
	R^2	R^2	R^2
HHI with Lerner index	0.001	0.001	0.000
HHI with *H*-statistic	0.000	0.003	0.017
Lerner with *H*-statistic	0.001	0.017	0.015
	2273 banks with $100 million < TA < $1 billion (10 percent of TA)		
	Average	Most competitive Quartile	Least competitive Quartile
HHI	1132	624	1513
Lerner index	0.22	0.16	0.29
H-statistic	0.89	0.86	0.92
	R^2	R^2	R^2
HHI with Lerner index	0.002	0.006	0.002
HHI with *H*-statistic	0.005	0.003	0.002
Lerner with *H*-statistic	0.007	0.010	0.005

banks are outlined in Section 6 while conclusions are presented in Section 7.

2. Correlations among the standard measures of competition

Our analysis is restricted to banks with $100 million or more in assets in 2010. This covers over 98 percent of all commercial bank assets and close to 1.9 million workers.[1] Various screens were applied to eliminate shell banks, special purpose banks, banks with no loans, or no deposits, or no full time employees, etc., or that contained variables beyond five standard deviations from the mean and are clearly unrepresentative of the banking industry. The final sample contained 2655 banks and the 382 institutions with more than $1 billion in assets accounted for 90 percent of total sampled assets. These large banks are the focus of our analysis as they have by far the greatest impact on the competitive efficiency of the U.S. banking sector.

All bank income, expense, and balance sheet data (deposits excepted) are reported at the level of the bank regardless of where it operates. This means that our competition indicators reflect the weighted average of the local and regional markets they are in. The median bank has branches in only two Metropolitan Statistical Areas (MSAs).[2] Although the subset of billion dollar banks have a broader geographical representation, the median billion dollar bank has branches in only four MSAs and operates in only one state out of 50. Even at the 99th percentile, the average billion dollar bank has offices in only 26 states. While a deposit-based HHI can be computed for each MSA, all the measures in this study—including our frontier indicator—will reflect the weighted average of the separate markets they are in.

Following Hirtle (2007), a deposit-based HHI was determined for each of the 2655 commercial banks for 2010. Lerner indices and *H*-statistics were estimated using a standard translog or Fourier specification applied to quarterly bank level data over 2008–2010. These specifications and the HHI calculation are shown in the appendix. Table 1 shows the overall average of all three competition measures for the 382 banks with total assets (TA) greater than $1 billion (accounting for 90 percent of total assets) as well as the 2273 banks with assets between $100 million and $1 billion (accounting for

10 percent). We also ranked each of the three competition measures separately and report their average values for the most and least competitive quartiles. The least competitive quartile of banks has the highest HHIs and Lerner indices but the lowest *H*-statistics (where 1.0 is the expected maximum for the most competitive group).

The U.S. Justice Department's 2010 horizontal merger guideline suggests that markets with an HHI below 1500 can be considered to be unconcentrated. The guideline also suggests that a moderately concentrated market exists when the HHI lies between 1500 and 2500 while a highly concentrated market has a HHI above 2500. Based on the average HHI in Table 1 for billion dollar banks, U.S. institutions appear to operate in unconcentrated and hence apparently competitive markets. Indeed some 75 percent of billion dollar banks have a HHI at or below this level. In the sample of smaller banks ($N = 2273$), 4.0 percent of banks are in highly concentrated markets (with an HHI ≥ 2500), while only 3.1 percent of the billion dollar banks are ($N = 382$). Using the stronger 1992 guidelines, the percent of banks in highly concentrated markets (HHI > 1800) would be 16.1 percent and 16.0 percent, respectively. For the same banks, the average mark-up of price over marginal cost is 26 percent while the average *H*-statistic is 0.82.[3] As seen in the lower half of Table 1, similar average values were found for banks with $100 million to $1 billion in assets (as well as when the entire sample was used—not shown).

The three competition measures in Table 1 are unrelated to one another as their R^2s are effectively zero.[4] This holds whether using the entire sample (first column) or the most or least competitive quartiles of the sample.[5] The correlation coefficients (*r*) between the *H*-statistic and either the HHI or Lerner index are not shown but the signs here were at times the opposite (but small) of what they should

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[1] Banks having less than $100 million in assets are smaller than the average branch office at large banks ($125 million). The average size of the 2300 commercial banks with less than $100 million is only $57 million.

[2] MSA refers to the 956 MSA and non-MSA counties that are covered in the FDIC Summary of Deposits data.

[3] The median HHI is slightly smaller (at 1271) than the average in Table 1 while the median values of the Lerner index and *H*-statistic are equal to their averages for billion dollar banks. Marginal cost from the less flexible translog function yields an average Lerner index of 0.31. Replacing marginal cost with average cost—which is observed rather than estimated—gives an average Lerner index of 0.26.

[4] Some studies have noted that the Lerner index is not well related to the HHI (Maudos & Guevara, 2004) and others have shown the same for the *H*-statistic and HHI (Claessens & Laeven, 2004). What seems to be missing is looking at how the Lerner index is or is not related to the *H*-statistic. As far as we know, there are no studies comparing all three competition measures together (in banking or otherwise).

[5] The bivariate correlation results are the same if marginal cost from a translog cost function for billion dollar banks replaces marginal cost from the Fourier function. Also, there is no change if average cost replaces marginal cost. The same holds if the number of bank branches replaces the value of each branch's deposits used to weight the MSA and non-MSA counties for each bank's HHI.