

## **Concentration, the Internet and Pricing of Bank Assets and Liabilities**

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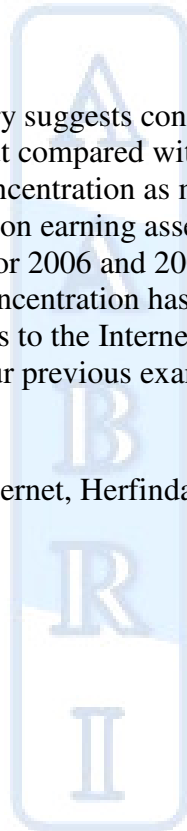
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### **Abstract**

Conventional economic theory suggests concentrated markets are associated with higher prices and reduced output compared with competitive markets. In this paper we examine the impact of market concentration as measured by the Herfindahl Hirschman Index (HHI) on the yield on earning assets and the cost of funds for commercial banks at the state level for 2006 and 2007.

We find that while market concentration has no significant impact on yield on earning assets or cost of funds, access to the Internet does have a meaningful effect. These findings are consistent with our previous examination of earlier time periods (1998 and 2003).

Keywords: Market concentration, Internet, Herfindahl Hirschman Index, Regression



## Background

One of the important concepts discussed in Principles of Economics is the relationship between market concentration, and the quantity and prices of goods and services. Students are dutifully taught that competitive markets generally result in lower prices and greater quantities and choice for consumers, compared with imperfectly competitive markets, especially monopoly and oligopoly.

Historically, regulators have embraced antitrust laws such as the Sherman Act (1890) and Clayton Act (1914) that address excessive market power conditions which may substantially lessen competition or tend to create or promote monopoly. The U.S. Department of Justice and the Federal Trade Commission have formulated Horizontal Merger Guidelines (<http://www.usdoj.gov/atr/public/guidelines/hmg.htm>) to evaluate the probable impact on market concentration of mergers between firms in the same industry or business.

The Federal Reserve System has adopted a similar approach in weighing the potential anti-competitive consequences of bank mergers under the Bank Holding Company Act (1956). The Federal Reserve has historically used concentration ratio analysis along with Herfindahl Hirschman Indices (HHI) to evaluate the potential anti-competitive effects of bank mergers. [The calculation of HHI and comparison benchmarks are discussed later in this paper]

Anecdotal evidence suggests that in the current environment, dramatically different levels of market concentration may be associated with similar prices for banking services in different states. For example, based on June 30<sup>th</sup> 2008 data (<http://www2.fdic.gov/sod/sodMarketBank.asp?barItem=2>), Missouri (HHI=378) was one of the most competitive statewide banking markets in the United States. [Major MSAs within Missouri including Kansas City and St. Louis are likewise highly competitive] By contrast, South Dakota (HHI=3578) was highly concentrated [Citibank has 52.8% of total state deposits while Wells Fargo has 27.9%; The Sioux Falls MSA by comparison is highly concentrated with Citibank controlling 62.6% of deposits]. For the same time period, the yield on earning assets in Missouri was 7.21% while South Dakota was 7.58%, a difference of only 47 basis points or less than ½%. Similarly, the cost of funds was 3.31% in Missouri and 3.24% in South Dakota, a difference of only 7 basis points or 7/100% (Calculated from the SNL Financial banking Database). These small differences are not predicted by conventional economic theory. We suggest that a possible explanation lies in the increasing pervasiveness of Internet access available to banking customers, especially in remote, thinly populated rural areas. This provides consumers with access to competitive loan and deposit rates, regardless of their geographic location a point made by Sullivan (2000).

Data from the Pew Foundation *Internet and American Life Project* (2003) suggest dramatic increases in both the percentage of households with computers as well as the percentage with Internet access. In 1998, only 42.6% of consumer households had computers; by 2003 this had increased to 62.2%. For the same years, the percentage of households with Internet access were 26% and 54.6%, respectively. In a more recent survey, the Pew Foundation found that 73% of adult Americans use the Internet. Fifty three percent use the Internet for on-line banking, while 89% use a search engine to find information. (Pew Foundation, 2008)

This unprecedented access to current, free on-line information allows consumers to search websites such as Bankrate.com for the best available rates for bank deposits, including money market accounts and certificates of deposit. Consumers interested in finding the best rates on mortgage loans can search sites such as LendingTree.com, Ditech.com and Internetmortgage.com. For other types of loans, consumers can access sites such as eloan.com and uswitch.com.

Using the Internet, consumers can discover not only the best deposit and loan rates, but can actually take advantage of those rates. On-line banking, coupled with free mobility of capital across state lines, allows consumers in remote areas of the US to have the same access to favorable rates as those residing in urban areas. There is pressure on banks and other non-bank financial institutions to be competitive on both loan and deposit rates. Economic theory suggests that this increased competition leads to the same or similar prices, especially since many bank products are increasingly homogeneous commodities. A typical discussion of the perfectly competitive model can be found in O'Sullivan, Sheffrin and Perez (2008).

## **Review of Literature**

Industrial organization literature in economics contains considerable discussion of the Structure-Conduct-Performance Paradigm (SCP). Gilbert and Zaretsky (2003) provide a comprehensive summary. Market structure relates to the level of concentration within a market. Structure, in turn, affects the conduct of firms within the industry. As firms gain market power, the impact may affect pricing, barriers to entry, and management behavior in general, which in turn affects performance in terms of efficiency. Summaries of the early work in SCP may be found in the works of Caves (1964; 1980)

The SCP Paradigm has been applied to commercial banking in numerous theoretical and empirical studies. Hannan (1991) develops a theoretical model of the relationship between bank conduct and performance by extending the early theory of banking advanced by Klein (1971). Hannan finds that higher local market concentration is related to higher loan rates. Berger and Hannan (1989) develop an empirical model relating bank deposit prices to the structure-performance hypothesis. They find that increased local market concentration is related to lower deposit rates.

Neuberger (1997) provides a comprehensive review of the literature of SCP applications to banking. Neely and Wheelock (1997) examine the performance differences of banks between states and conclude that it is explained largely by differences in state economic conditions. Moore (1998) examines the role of technology in reducing the importance of geographic distance in banking market competition. Radecki (1998) suggests that banks set deposit and loan rates across an entire state rather than a county or a metropolitan statistical area (MSA). Sampler (1998) discusses the impact of advanced information technology in redefining market structure and competition.

Berger (2003) investigates the impact of IT and financial technologies on the banking industry, including Internet banking and electronic payments technology, as well as information exchanges such as credit bureaus which provide the inputs for credit

scoring models used by banks in lending decisions. Frame and White (2004) criticize the lack of empirical studies that test hypotheses related to financial innovation.

### **Framing the Models**

In this study the authors develop alternative models to explain two different dependent variables:

- 1) **yield on earning assets** (YoEA= Total interest income (annualized) as a percent of average earning assets)
- 2) **cost of funds** (CoF=Annualized total interest expense on deposits and other borrowed money as a percent of average earning assets on a consolidated basis)

Yield on earning assets approximates the yield on loans while the cost of funds measures primarily the cost of interest bearing deposits used to fund earning assets.

Initially, we utilized stepwise regression analysis to identify potentially important variables. Later, we identified variables suggested by the literature as potentially contributing to an explanation of yield on earning assets as well as the cost of funds. In particular, we included the HHI values by state as measures of market concentration. Two measures of Internet penetration were included along with the loan/asset ratio as a proxy for the strength of loan demand. The loan/asset ratio is preferred to the loan/deposit ratio since the latter is influenced by non-deposit sources of funding, including short-term borrowing. The state unemployment rate is included as a proxy for economic conditions. The non-performing loan ratio is used to approximate future bank credit problems. These were included in the generalized model below.

### **The Generalized Model**

$$Y = \alpha + B_1 HHI + B_2 IH + B_3 IA + B_4 L/A + B_5 UE + B_6 NPL \quad (1)$$

Where:

Y= Yield on Earning Assets (YoEA) and Cost of Funds (CoF), respectively

A= constant

HHI= Herfindahl Hirschman Index by state

IH= % of households with Internet access at home (state level data)

IA= % of households with Internet access anywhere (state level data)

L/A= median loan to asset ratio by state

UE= unemployment rate by state

NPL= non-performing loans by state

In our first model (Model 1), Yield on Earning Assets, the dependent variable, represents the income received by banks for earning assets divided by average assets. Since loans are the primary earning asset for a bank, the yield on earning assets serves as a proxy for the average interest rate that consumers pay, on average, for loans. Theory suggests that consumers in more concentrated markets, as measured by the HHI, would pay higher loan rates than customers in more competitive markets (Hannan, 1991).

The loan-to-asset ratio is a proxy for overall loan demand and is affected by the cyclical behavior of consumer income. The mean loan to asset ratio increased slightly from about 69% at year-end 2006 to about 70.5% at year-end 2007.

Two measures are included for household Internet access: Home access as well as remote Internet access from anywhere. We hypothesize that greater Internet access provides the consumer with more options for acquiring loans from a larger number of competitors. This lowers search costs and produces more competition which we argue may lower loan rates.

In our second model, (Model 2), utilizing Cost of Funds as the dependent variable, we measure the impact of market concentration, Internet access and economic factors on the rates that consumers pay on deposits in commercial banks. Theory again suggests that in more concentrated markets, customers are paid less for funds, particularly deposits, than in more competitive markets (Berger and Hannan, 1998). As consumers have greater access to comparative information on deposit rates, they can potentially improve their return on deposits. This is accentuated by Internet access which provides knowledge of rates plus a mechanism for acting on the information in the form of on-line banking options.

### **Data Sources and Issues**

This paper is constrained by the availability of data on Internet access. We rely on data collected by National Telecommunications and Information Administration as well as data from the Pew Foundation's *Internet and American Life Project*. This data on household computer ownership and Internet access is only available at the state level. Data for banking variables are obtained from the FDIC website and supplemented by the SNL Corp. commercial banking relational database (also based upon Reports of Income and Condition provided to the FDIC by all insured banks).

The Herfindahl Hirschman Index (HHI) data are obtained from the FDIC on-line website <http://www2.fdic.gov/sod/sodMarketBank.asp?barItem=2>. The data in this study are calculated by state. HHI data are calculated from the FDIC *Summary of Deposits* which is only available for the June 30th *Report of Condition* each year. Our data are for both midyear 2006 and 2007.

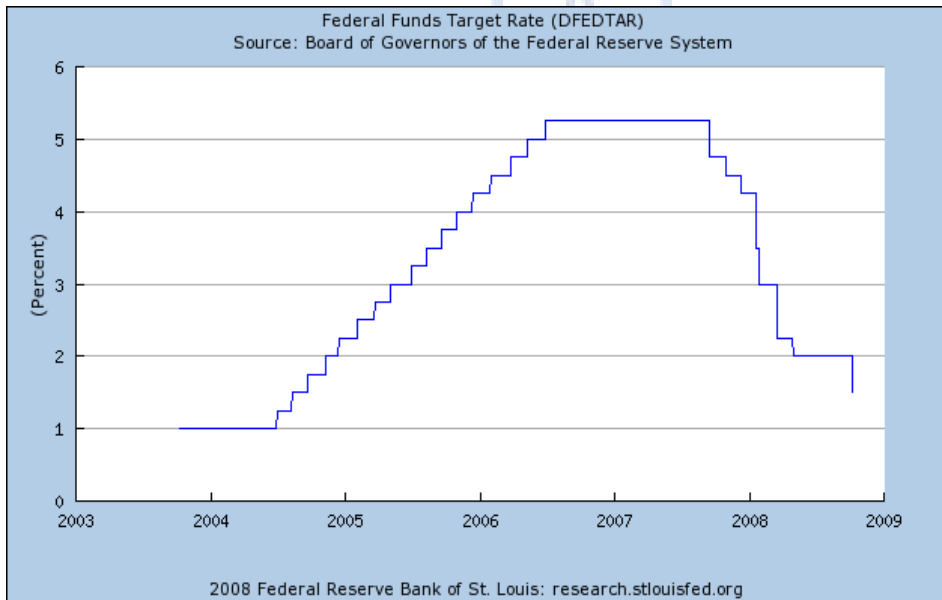
The HHI is calculated by summing the squared market shares for each major participant in the market. The Department of Justice/ Federal Trade Commission *Horizontal Merger Guidelines* provide a framework for evaluating market concentration. ([http://www.usdoj.gov/atr/public/guidelines/horiz\\_book/hmg1.html](http://www.usdoj.gov/atr/public/guidelines/horiz_book/hmg1.html))

The Federal Reserve System uses similar guidelines in considering bank merger applications. Bank markets with  $HHI < 1,000$  are considered unconcentrated and pose few competitive concerns. Markets with an  $HHI > 1,000$  but  $< 1,800$  are considered moderately concentrated. Mergers in these markets where the change in HHI is  $> 100$  points would raise some regulatory concerns. Markets where HHI exceeds 1,800 are highly concentrated and presume potential adverse consequences of market power, especially when the change in the post-merger HHI  $> 50$ .

**The Economic Environment**

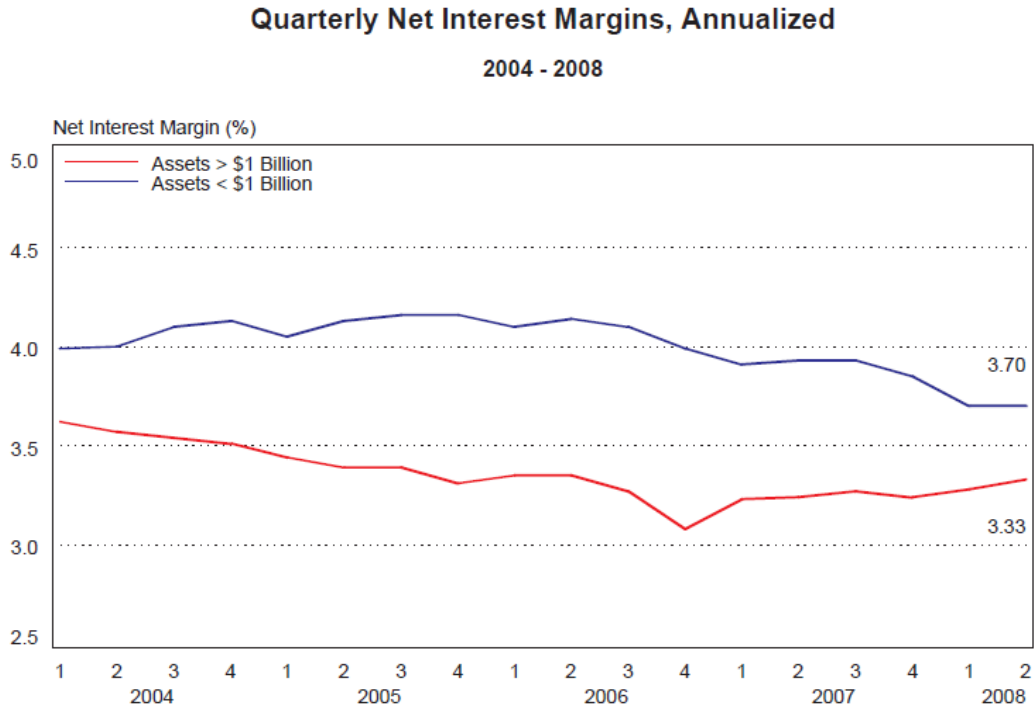
Hays and De Lurgio (2007), investigated the impact of the Internet and market concentration on bank pricing decisions for 1998 and 2003. These were periods of economic transition. The current study includes year-end data for 2006 and 2007, periods that include rising, constant and decreasing short term interest rates as a result of policy actions taken by the Federal Reserve’s Federal Open Market Committee (FOMC). Changes in the target rates for overnight Federal Funds are presented in Chart 1. Federal Funds represent short term loans by financial institutions to one another. Using 2006 and 2007 data also avoids much of the recent turbulence created by sub-prime lending and chaotic credit and equity markets.

**Chart 1**



The behavior of short-term rates impacts both the cost of funding bank liabilities, especially deposits, as well as affecting the returns on earning assets, in particular the rates charged on loans. Economic theory suggests that these rates are also influenced by the degree of concentration or competitiveness in banking markets. The difference between the yield on earning assets (primarily from making loans as depicted in Chart 4 and the cost of funds (primarily deposit costs as shown in Chart 5) is net interest margin (NIM). This margin, combined with the volume of loans originated, is the primary driver of bank revenues. The behavior of net interest margins from 2004-2008 is shown in Chart 2.

**Chart 2**

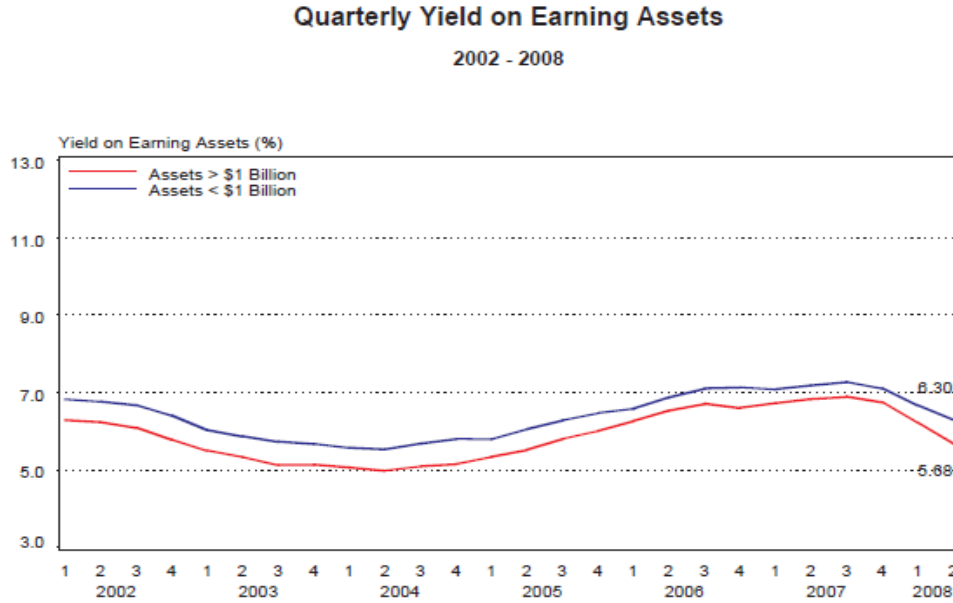


Source: *FDIC Quarterly Banking Report*, 2<sup>nd</sup> Qtr. 2008 at [www.fdic.gov](http://www.fdic.gov)

Chart 2 shows NIM for banks with assets above \$1 billion and those with assets below \$1 billion. Banks below \$1 billion are frequently referred to as “community banks” which represent the overwhelming majority of the 7,000+ banks in the U.S. Many community banks are located in rural areas without significant numbers of other financial institutions as competitors. As a consequence, they may charge somewhat higher loan rates and pay somewhat lower deposit rates than larger institutions in urban areas. We observe that the increasing penetration of the Internet and the increased participation in on-line banking increases competition even in rural areas.

Chart 3 shows the yield on earning assets from 2002-2008 for banks that are above and below \$1 billion in assets. Yield on earning assets equals total interest income (annualized) as a percent of average earning assets. Yields on earning assets respond to the overall level interest rates and are especially sensitive to the short-term rates that are influenced by Federal Reserve monetary policy actions.

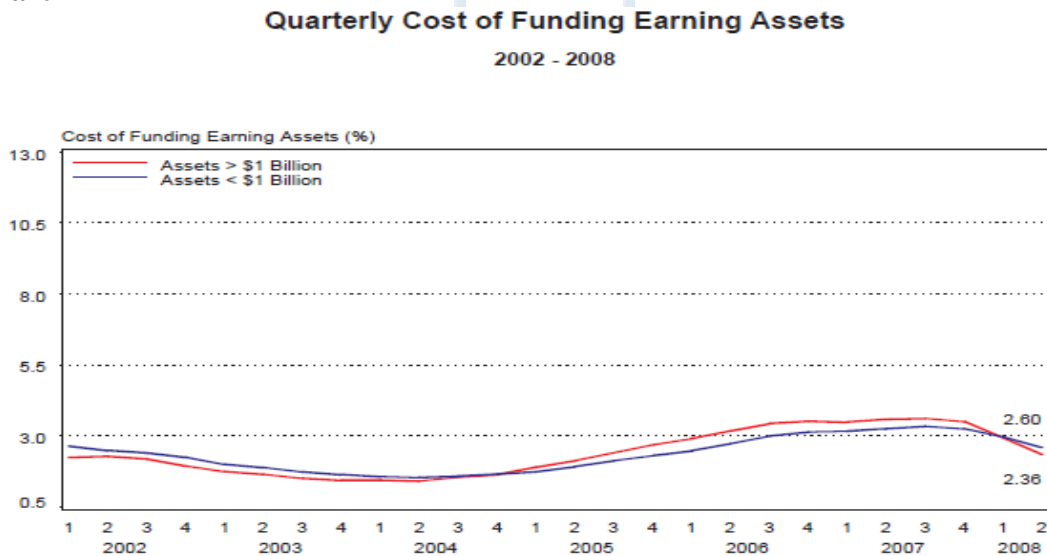
**Chart 3**



Source: FDIC Quarterly Banking Report, 2<sup>nd</sup> Quarter 2008 ([www.fdic.gov](http://www.fdic.gov))

Chart 4 shows the behavior of the cost of funding earning assets, by bank size, from 2002-2008. The cost of funds ratio represents the annualized total interest expense on deposits and other borrowed money as a percent of average earning assets on a consolidated basis

**Chart 4**



Source: FDIC Quarterly Banking Report, 2<sup>nd</sup> Quarter 2008 ([www.fdic.gov](http://www.fdic.gov))



The banks' cost of funding earning assets is also influenced by Federal Reserve policy actions. Bank management can control net interest margin by skillfully pricing bank earning assets, controlling the cost of liabilities and managing the rate sensitivity of bank assets and liabilities across the business cycle, a technique that is frequently labeled asset/liability management or "gap" management.

**Univariate Analysis**

This study utilizes data for both 2006 and 2007. Table 1 presents univariate paired t-tests for several financial variables that were included in our initial investigation.

**Table 1:** Descriptive Statistics and Univariate Tests 2006 vs. 2007

<u>Variables Included in Models</u>	<u>2006</u>	<u>2007</u>	<u>t-value</u>	<u>Significance level</u>
Yield on Earning Assets	6.88	7.15	21.47	.000
Cost of Funds	2.68	3.11	35.72	.000
Home Internet Access % (2007 data only)	---	59.73	na	---
Internet Access Anywhere % (2007 data only)	---	70.53	na	---
HHI (mid year data)	1,058.84	962.34	-1.56	.124*
Loan to Asset Ratio	68.98	70.46	4.52	.000
Non Performing Loans to Loans	0.41	0.41	9.95	.000
Unemployment Rate %	4.41	4.32	-1.90	.064*
<u>Other Variables</u>				
Return on Avg. Assets	1.04	.88	-7.14	.000
Net Interest Margin	4.21	4.08	-6.69	.000
Non Interest Income to Avg. Assets	0.65	0.63	-2.00	.050
Overhead Expense to Avg. Assets	3.05	3.10	2.47	.017
Loan Charge-offs	0.06	0.09	5.68	.000
Home Prices (%Δ)	-14.58	-23.65	-5.12	.000

\*not significant at 95% confidence level

Of the 12 paired variables for 2006 and 2007, only two pairs, the unemployment rate variable and the HHI were not significant at the 95% confidence level. The statistically significant variables were subsequently used in stepwise exploratory regression models as well as the final regression models.

**Multivariate Regression Results**

The univariate variables in Table 1 were initially included in a linear multiple regression analysis using SPSS 16.0. Results for Model 1, Yield on Earning Assets, are presented in Table 2 for 2006 and 2007. In general, market concentration as measured by HHI, has no statistically significant impact on explaining changes in yields on earning assets as a proxy for the price consumers pay for bank loans.

Finding no relationship between concentration and return on earning assets is consistent with the anecdotal evidence discussed earlier. The availability to consumers of comparison data on loan rates by different providers quickly and at a minimal search cost may offer an explanation for the convergence of the yield on earning assets. The absence of a strong relationship between yield on earning assets and HHI suggests that the concern of regulators about adverse consequences of market concentration may be unwarranted.

An important finding is that Internet access from anywhere (home, office, hotel, airport, public library or elsewhere) is significantly related to the yield on earning assets. Enhanced Internet access to loan rates at institutions across the country may increase the overall demand for loans and therefore result in a small but positive increase in loan rates (reflected by the increase in the yield on earning assets). Data are only available for Internet usage for 2007 and were used for both the 2006 and 2007 models.

**Table 2:** Model 1: Yield on Earning Assets 2006 and 2007 (year-end) Multiple Regression Results

	<u>Yield on Earning Assets</u>	<u>2006</u>		<u>Yield on Earning Assets</u>	<u>2007</u>	
<u>Explanatory Variables</u>	<u>Coefficient</u>	<u>t-value</u>	<u>p</u>	<u>Coefficient</u>	<u>t-value</u>	<u>p</u>
Constant	2.544	2.374	.022	3.367	3.225	.002
HHI	3.46 E-6	.063	.950	-5.69 E-6	.013	.918
Home Internet Access %	-.025	-1.10	.278	-.031	-1.480	.146
Internet Access Anywhere%	.052	2.199	.033	.053	2.317	.025
Loans to Assets	.032	2.913	.006	.029	2.365	.023
Unemployment Rate %	-.034	-.436	.665	-.131	-1.663	.103
Non-performing loans/loans	.064	.476	.637	.232	1.999	.052
Adj. R <sup>2</sup>	.266			.265		
F statistic	3.966			3.947		
Significance F			.003			.003

The loan to assets ratio is also statistically significant in both time periods. It is an important measure since it is a driver of bank earnings, representing the volume of demand for earning assets.

The findings on Cost of Funds in Table 3 likewise show that market concentration as measured by HHI is not significant. Home access to the Internet is statistically significant while Internet access from anywhere is not. A plausible explanation might be that consumers make infrequent loan searches but may search for deposit rates frequently, perhaps away from the office and business demands. This increased competition for deposits leads to a small but statistically significant reduction in the interest rates paid by financial institutions. The loan to asset ratio, a proxy for overall loan demand, is likewise significant and important as cost driver

**Table 3:** Model 2: Cost of Funds 2006 and 2007 Multiple Regression Results

	<u>Cost of Funds</u>	<u>2006</u>		<u>Cost of Funds</u>	<u>2007</u>	
<u>Explanatory Variables</u>	<u>Coefficient</u>	<u>t-value</u>	<u>p</u>	<u>Coefficient</u>	<u>t-value</u>	<u>p</u>
Constant	1.744	3.307	.002	1.896	3.647	.001
HHI	-1.32 E-5	-.486	.629	-4.11 E-6	-.15	.881
Home Internet Access %	-.028	-2.541	.015	-.032	-3.047	.001
Internet Access Anywhere %	.016	1.335	.189	.017	1.492	.143
Loans to assets	.024	4.446	.000	.028	4.597	.000
Unemployment Rate %	-.036	-.948	.348	-.032	-.806	.425
Non-performing loans/loans	.027	.402	.690	.039	.668	.508
Adj. R <sup>2</sup>	.353			.379		
F statistic	5.461			5.991		
Significance F			.000			.000

### Summary and Conclusion

Using multiple regression analysis we investigate the impact of market concentration as measured by the Herfindahl Hirschman Index as well as the impact of Internet access on both the yield on earning assets and the cost of funds for commercial banks for 2006 and 2007.

This study provides evidence that, contrary to theory, there is little or no impact on bank yield on earning assets or the cost of funds from changing market concentration, even though market concentration has risen over the past two decades through consolidation in the banking industry. In 1980 there were 14,434 banks; at the end of the first quarter of 2007 there were 7391 (FDIC, 2007) resulting in fewer but larger banks.

Our explanation is that the diffusion of financial information through the Internet allows bank customers, even in remote locations, to compare asset rates on loans as well as deposit rates between competing institutions. Moreover, on-line banking allows customers to act upon this information, therefore creating more competitive loan and deposit rates.

Using state level data from the Federal Deposit Insurance Corporation and National Telecommunications and Information Administration plus the Pew Foundation *Internet and American Life* study on the percentage of households with Internet access we find statistically significant evidence that the Internet is compressing the differences in yields on earning assets and cost of funds regardless whether the markets are unconcentrated or highly concentrated. This raises issues about the conventional Structure-Conduct-Performance Paradigm that anchors the conventional microeconomic theory of firms.

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