

## MARKET DISCIPLINE OF FINANCIAL INSTITUTIONS AND THE CRISIS OF 2007-2008

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### ABSTRACT

We determine if participation in risky mortgages by financial institutions (FIs) prior to and including the period of 2007-08 impacted systematic risk of their stocks which would affect the required rate of return. We examine the stocks of 59 banks and thrifts rated by *American Banker* having the largest amounts of first mortgages on their balance sheets as of December 31, 2006. A GARCH model is used to determine if systematic risk changes over the time studied. We find systematic risk increases each year during the entire period studied (2004-2008) for stock returns of thrifts and to a lesser extent for stock returns of regional banks. Stock returns of large banks show a decline in systematic risk during 2004 and 2006 and an increase in 2008. There is no significant change in systematic risk in 2005 and 2007. In the case of foreign bank stock returns, systematic risk declines during the years (2004-2005) and shows no significant change in 2006-2008. This suggests that systematic risk is impacted for thrifts and regional banks prior to the crisis but not for large banks until the time of the crisis. In the case of foreign banks, there is no change in systematic risk in 2008 and a decline in 2004 and 2005.

**GEL Code:** G21

**Key Words:** Financial institutions, banks, market discipline, risk

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## **I. INTRODUCTION**

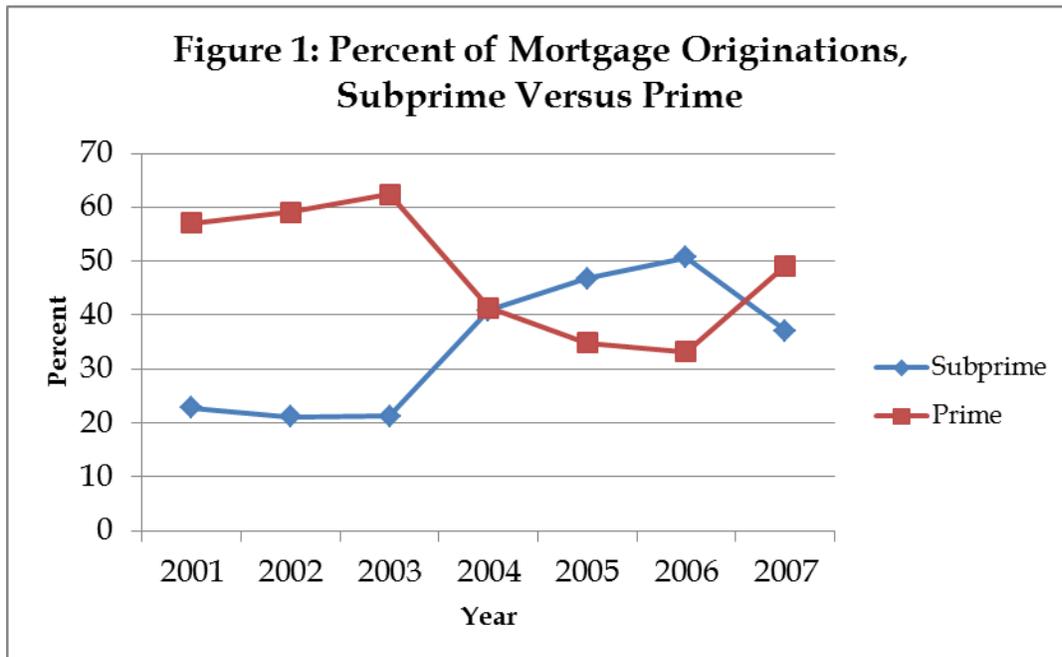
Market discipline as it relates to deposit and debt rates of banks is well represented in the literature. See, for example: Hannan and Hanweck [1988], Baer and Brewer [1986], and Ellis and Flannery [1992] among others. According to the results of many of these papers, evidence of market discipline exists. However, there is a body of literature which suggests a potential lack of market discipline. For example, Niinimäki [2009] raises questions about the moral hazard of using the value of collateral to underwrite loans, particularly subprime loans rather than the character of the borrower. Flannery [2007] raises questions about the ability of rating agencies to accurately measure risk, banks that are too large to control and difficult to close down, the risk characteristics of BASEL II and nonbanks applying for bank charters. Minton, Stulz, and Williamson [2009] question the use of derivatives to increase bank soundness because the notional amount of credit derivatives exceeds the amount of loans and few large banks use credit derivatives for hedging but prefer to act as dealers in these instruments.

The FDICIA (1991) and other acts do penalize banks that are considered risky. Banks can be forced to correct capital inadequacies. Moreover, the FDIC and DIF (both administered by the FDIC) charge insurance premiums based on the risk of the assets. The impression is that much of moral hazard is eliminated.

We focus on determining the ability of the investment community to recognize risky behavior that would affect required rates of return on stocks of financial institutions (FIs). Risk recognition is an important concern because in the case of insolvency, stockholders generally lose everything, regardless of whether the FI is closed or force merged. An increase in the measure of systematic risk of stock returns of FIs during periods of risky behavior would signal an appropriate market discipline.

Starting around 2003, there was an increase in the proportion of non-prime loans as a percent of total mortgage originations and an increase in cash-out refinancing. Subprime loans are made to individuals with low credit scores or lacking verifiable credit information. Increasing the proportion of these loans signals an increase in risk. Cash out refinancing increases the size of the loan rather than reducing the payment. The purpose of the loan is to take cash out of one's house or other collateral to use for other purposes. If the value of the collateral declines or economic changes in the purchaser's ability to pay occurs, the probability of foreclosure increases. As FIs increasingly participate in these behaviors, risk should increase as well.

Figure 1 shows the relationship in proportion of subprime versus prime mortgage originations. In 2004, subprime and prime originations were equally at 50% of loan originations. Previously, subprime loans hovered at about 20% or lower



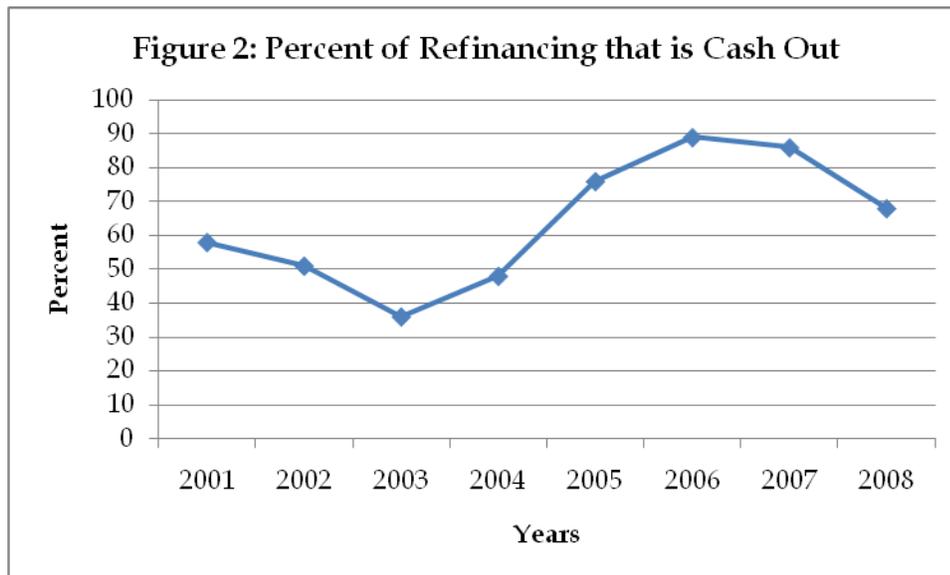
Source: Inside Mortgage Finance, [www.insidemortgagefinance.com](http://www.insidemortgagefinance.com)

of loan originations. After 2004, subprime mortgage originations continued to increase and exceeded prime loans in percentage of loan originations.

Figure 2 shows the percent of refinancing activity resulting in a 5% higher loan. Starting in 2004, the percent of refinancing resulting in a larger loan increased and hit a maximum of over 80% in 2006. By relying on the stability of interest rates and the economy, and the continuing increase in value of the collateral, FIs increased risk by originating increasing proportions of cash out refinancing as well as nonprime loans.

To summarize, risk increases because originating larger portions of non-prime loans and increasing levels of cash out refinancing produce a good outcome only if housing prices continue to increase, the economy is stable, and interest rates remain unchanged.<sup>1</sup> The question to be asked in this paper is this: did the increase in risky loan behavior affect systematic risk of FIs with heavy investment in mortgages and mortgage products at the time of increases in non-prime loan originations and cash out refinancing? This paper is divided into the following sections: literature review, data and methodology, results, and conclusions.

<sup>1</sup>Many of these loans were adjustable rate mortgages whose payments are sensitive to changes in interest rates. Moreover, even if the loans are securitized and sold, under some circumstances, the loan can be returned to the original lender. The lender continues to bear the risk.



Source: Freddie Mac, [www.freddiemac.com/news/finance/refi\\_archives.htm](http://www.freddiemac.com/news/finance/refi_archives.htm)

## II. LITERATURE REVIEW

The literature on market discipline addresses pricing debt, deposits, and equity. Gorton and Santomero [1990] use a theoretical model of bank instrument valuation to determine appropriate testing of market discipline. By examining accounting measures of risk, they find that these measures only marginally predict the volatility of bank assets.

When examining market discipline as related to the cost of bank deposits, Baer and Brewer [1986] find that the market charges riskier banks more for funds. This occurs even in the case of solvent banks. Even reducing the reliance on uninsured deposits still generates a cost. Hannan and Hanweck [1988] examine the rates on large certificates of deposit and perceived bank risk and find the market requires a premium for risk. Characteristics of the bank's customer base matter when explaining large CD rates. These rates are affected by the variability of the bank's return on assets, the likelihood of bank insolvency, and bank capitalization

Ellis and Flannery [1992] examine default risk premium paid by large money center banks for CD rates. Their hypothesis is that large depositors may not feel exposed to credit risk. Using time series data on bank offer rates, it is shown that a significant default risk premium is included in the rates. Park [1995] examines the effects of bank risk on the interest rates and growth of large time deposits between 1985 and 1992. In the case of risky banks, offering a higher interest rate did not attract investors to make large time deposits. Moreover, depositors have not necessarily preferred large banks with their perceived deposit safety due to the "too big to fail" paradigm. Park and Peristiani [1998] find that risk in a thrift institution has an

adverse effect on the growth and pricing of insured deposits. Depositors avoid institutions that are on the verge of failure, even if the deposits are insured.

When examining debt yields for evidence of market discipline, Avery, Belton, and Goldberg [1988] evaluate the ability of subordinated notes and debentures to enhance bank supervision and offer market discipline. The risk premium of these securities is only weakly tied to the riskiness of the institution. Flannery and Sorescu [1996] examine yields of debentures over the period of 1983-1991 to determine if the market is sensitive to bank risk. Poor credit quality and high leverage is felt to pose the greatest risk for banks. Government guarantees are included in the price and as the guarantees change over time, the prices change. Investors become more diligent about pricing default risk as regulators fail to protect them.

In the case of the cost of deposit insurance, Peria and Schumkler [2001] examine the interaction of market discipline and deposit insurance. They specifically examine the interaction during banking crises and focus on the experiences of Argentina, Chile, and Mexico during the 1980s and 1990s. They find evidence of market discipline among the insured depositors. Moreover, they find that the responsiveness of depositors increases after the crisis. Reasons include the fact that deposit insurance may be underfunded and governments may renege on their promise to pay insured depositors.

Ashcraft [2008] examines the effects of capital requirements permitting the substitution between equity and subordinated debt. He finds that if a bank subsidiary issues debt, this improves the future outcome of the bank, particularly if the debt has restrictive covenants. If equity is substituted for debt, the probability of failure increases.

In the case of market discipline and bank stocks, Viale, Kolari, and Fraser [2009] examine risk factors that are connected to the value of bank stocks. They find the two significant factors are market excess returns and shocks to the slope of the yield curve. Other firm specific factors such as size and book-to-market ratios are not priced.

Most of the literature on market discipline deals with deposits and debt of banks. There is little research on market discipline and stock returns. In light of the fact that there is no insurance for losses accrued to FI stock holders, it is important to determine if market discipline signals risky behavior in FIs. The next section addresses the methodology and data used in the study.

### **III. DATA AND METHODOLOGY**

Following the suggestion of Gorton and Santomero [1990], we use a theoretical model to value the stock of firms. Bank stock returns and their relationship to the market are best measured using the two variable model represented in equation [1] Stone [1976].

We examine each year separately to determine if there was an impact on measures of systematic risk as measured by changes in the regression coefficients. We use a GARCH model to estimate the level of risk as we expect increasing volatility in stock returns at the time of the crisis in 2007-2008.

$$R_{jt} = \hat{\alpha}_0 + \beta_{mt} R_{mt} + \beta_{it} R_{it} + \sum D_{04-08} \hat{\alpha}_t + \sum D_{04-08} \beta_{mt} + \sum D_{04-08} \beta_{it} + \epsilon f(h_t) + \epsilon_t \quad [1]$$

where

j = stock j;

t = time t;

m= market;

i=interest rate;

R = return;

D = 1 during 2004, 2005, 2006, 2007, or 2008 and 0 otherwise;

$\epsilon f(h_t) = \hat{\alpha}_0 + \hat{\alpha}_1 \hat{\alpha}_{t-1}^2 + \hat{\alpha}_2 \cdot h_{t-1}$ ;

h = conditional variance;

$\hat{\alpha}$  = error from the mean.

The data set includes stocks of banks and thrifts having the largest dollar amounts of first mortgages at the end of 2006 as reported by *American Banker*. Banks having stock price information for the entire period of January 1, 2003 to December 31, 2008 are chosen for study.<sup>2</sup> Daily stock prices are download from the historic price file on the Yahoo Finance web site.<sup>3</sup>

Returns are computed as  $(p_2 - p_1) / p_1$ . The proxy for the stock market is the S&P500. The 10-year T-bond rate is used as the bond index. Bond rates are collected from the Federal Reserve Bank Board of Directors web site and the yield is  $-(y_2 - y_1) / y_1$ .<sup>4</sup>

Appendix 1 lists 59 banks, thrifts, or foreign banks and their mortgage loan/assets ratio as of the end of 2006. We divide the institutions into the following groups: large banks, regional banks, foreign banks, and thrifts.<sup>5</sup> We use these divisions due to the anticipated differences in balance sheet composition and mission of these institutions. We expect that the market may differentiate the risk inherent in these institutions as well. To determine if the market adequately reflects changes in systematic risk, we estimate the market model of banks and check for changes in the market and interest rate risk coefficients during the years studied.

<sup>2</sup> Since some of the banks in the original list were merged or closed during 2008, a survivorship bias may exist.

<sup>3</sup> The foreign banks trade on U.S. exchanges.

<sup>4</sup> According to Kane and Unal, [1988] long-term rates are considered more appropriate in this situation.

<sup>5</sup> Large banks are those listed in the February 2009 group of banks to be stress tested for capital adequacy or banks that were absorbed by these banks. It was announced that these banks would not be permitted to fail.

#### IV. EMPIRICAL RESULTS

Table 1 gives the average first mortgage loans/assets results by FI group. As expected, thrifts have the largest average measure of mortgage loans/assets followed by regional banks, large banks and foreign banks. Although all the FIs are in the top 100 of first mortgage activity, the proportions may vary. Table 2 shows the statistical results of the daily stock returns of the four groups. Daily returns are used in the computations. The distributions of returns are non-normal. Significant skewness and kurtosis exists. Engle [2001] indicates that in the case of financial data, risk varies over time and the variation may not be a random occurrence but may cluster. As a result, we use the GARCH model to deal with these possible outcomes.

**Table 1: Information on First Mortgages/Total Assets by Financial Institution Group as of December 31, 2006: American Banker**

FI Group	Average	Median
Thrifts	39.67%	41.16%
Regional Banks	16.20%	13.33%
Large Banks	15.64%	15.83%
Foreign Banks	13.62%	13.16%

**Table 2: Summary Statistics of Daily Stock Returns by Financial Institution Group over the period of 2003-2008**

Bank	Average Return on Stock	Variance of Return on Stock	Skewness	Kurtosis	Jarque-Bera
Thrifts	.00067	.00036	1.32*	14.29*	1932.38*
Regional Banks	.00065	.00041	.70*	16.32*	469.62*
Large Banks	.00058	.00064	.49*	33.98*	988.17*
Foreign	.0012	.00037	-.073	11.23*	76.70*

\*significant at the 5% level.

Table 3 gives the results of the regressions for all FIs in the sample by group. The systematic risk of thrifts increases significantly during each year of the study (2004-2008). There is a significant increase in interest rate risk in 2004 but not after. The expected volatility shock is significant. A weak persistence is shown in the results. A large proportion of the assets of thrift are in first mortgages. Therefore, it is expected that any interest rate increases, changes in housing values or economic shifts would be reflected in the stock returns of thrifts. Initially, thrifts have good profits due to the fees from increased real estate lending but as real estate prices decline, thrifts are left with bad loans and a serious reduction in fee income as business slows.

**Table 3: GARCH Results of Systematic Risk Measures by Year and Financial Institution Group: 2003-2008**

FI Group	Large	Regional	Thrift	Foreign
$\beta_0$	.00020(.00023)	.00047(.00041)	-.000055	.0012*(.00062)
S&P 500	1.04*(.029)	.79*(.038)	.75*(.045)	1.30*(.078)
Interest Rate	.019(.014)	-.013(.026)	.0042(.037)	-.024(.034)
$\beta_{02004}$	.000096(.00034)	-.00053(.00054)	.00027(.00089)	-.00063(.00074)
$\beta_{02005}$	-.000064(.00034)	-.0012(.00050)	-.00096(.00088)	-.0012**(.00071)
$\beta_{02006}$	.00028(.00041)	-.00067(.00047)	-.00031(.00081)	-.00099(.00075)
$\beta_{02007}$	-.00065(.00044)	-.0020(.00061)	-.0015(.00090)	-.0019*(.00073)
$\beta_{02008}$	-.0020(.0024)	-.0023(.0019)	-.0012(.0021)	-.0011(.0013)
S&P2004	-.12*(.0046)	.14*(.052)	.20*(.077)	-.26(.10)
S&P2005	-.057(.052)	.25*(.059)	.65*(.097)	-.47*(.095)
S&P2006	-.19*(.063)	.21*(.056)	.61*(.065)	.0080(.11)
S&P2007	.061(.078)	.27*(.093)	.47*(.10)	-.078(.090)
S&P2008	.92*(.019)	.64*(.13)	.62*(.21)	-.080(.12)
Int2004	.072*(.037)	.076**(.039)	.078**(.047)	.14*(.050)
Int2005	.010(.027)	.0090(.031)	.0034(.053)	.0073(.037)
Int2006	.082*(.040)	.069**(.039)	.0084(.050)	.067(.060)
Int2007	-.037(.048)	-.017(.061)	-.064(.064)	3038(.044)
Int2008	.068(.084)	.012(.081)	-.098(.13)	-.031(.072)
$\alpha_0$	.00000085**	.00000077*	.0000011	.00000067
$\alpha_1$	.17*(.053)	.12*(.027)	.097**(.057)	.071*(.023)
$\alpha_2$	.83*(.050)	.87*(.027)	.90*(.057)	.92*(.026)
Adjusted R <sup>2</sup>	.73	.56	.56	.66

\*Significant at the 5% level. \*\* Significant at the 10% level. Standard errors are in parentheses. The equation is  $R_{jt} = \hat{\alpha}_0 + \beta_{mt} R_{mt} + \beta_{it} R_{it} + \sum D_{04-08} \beta_{it} + \sum D_{04-08} \beta_{mt} + \sum D_{04-08} \beta_{it} + \epsilon_t(h_t) + \epsilon_t$ , where  $D = 1$  during the year mentioned and 0 otherwise,  $\beta_{it}$  is interest rate risk,  $\beta_{mt}$  is market risk. The expression  $\epsilon_t(h_t) = \hat{\alpha}_0 + \hat{\alpha}_1 \hat{\alpha}_{t-1}^2 + \hat{\alpha}_2 h_{t-1}$ ; where  $h$  is conditional variance.

The results for regional banks also show a significant increase in systematic risk for all years studied but the changes are somewhat smaller than for thrifts. There is a significant increase in interest rate risk in 2004 and 2006. The volatility shock is significant and expected to be persistent. The results reflect the fact that a smaller portion of the asset portfolio is devoted to mortgages suggesting a lower level of risk.

The market is somewhat forbearing in the measurement of systematic risk in large banks. In 2004 and 2006, systematic risk shows a significant decline. The only year showing a significant increase in systematic risk is the crisis year of 2008. Interest rate risk increased in 2004 and 2006. The volatility shock is significant and persistent.

It is likely that these banks fall into the "too big to fail" category so the stocks carry additional protection. Moreover, these banks are heavily invested into derivatives and other securities that would be used to hedge loans in the asset portfolio. The loans on the books of large banks are invested in a variety of locations and types so it would be expected that they could better survive a downturn in the real estate market. Finally, the focus of larger banks is more likely to be on commercial and industrial loans rather than real estate loans indicating a lower exposure to mortgages.

Systematic risk of stocks of foreign banks shows a decline in 2004 and 2005. The systematic risk measure for the other years shows no significant change. Interest rate risk increases significantly in 2004. The volatility shock is significant and persistent. Since the average investment in first mortgage loans/assets is the lowest of all the groups, risk from mortgage loans may have little effect on these banks. However, like the large banks, these banks may also be quite heavily diversified into other types of loans and this would deflect risk.

Systematic risk of bank stocks declined during the periods of risky behavior (2004-2006) in the case of large banks and foreign banks. In agreement with the results of Peria and Schmukler [2001] the responsiveness of investors increased after a crisis in the case of large banks. During periods of obvious risky behavior, as long as real estate prices remained high and the economy and interest rates stable, there was little or no change in risk for large and foreign bank stocks although they carried considerable risk. Stocks of thrifts and regional banks show an increase in systematic risk during the noncrisis years as well as the crisis years. Stocks of foreign banks showed no real risk increase but this may be due to the lower investment in first mortgages.

## **V. CONCLUSION**

Changes in systematic risk vary by the financial institution type and the year examined. In the cases of the domestic thrifts, regional and large banks, changes in systematic risk are strong during the periods of crisis i.e. 2008. During earlier years, changes in systematic risk varied by bank type. Risk measures for stocks of large and foreign banks actually declined over the 2004-2006 period. Regional banks and thrifts

show systematic risk increases during the entire period although the changes are less for regional banks. It is likely that the market is measuring the potential investment in mortgages as a proportion of the loan portfolios of these financial institutions and their ability to hedge risk. Thrifts and regional banks would be expected to have a larger investment in mortgages and a lesser ability to hedge for risk whereas large and foreign banks were expected to have smaller investments in these loans and may be better hedged against the risk of these loans. Finally the “too big to fail” paradigm may be at work as well.

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**APPENDIX 1: The List of Financial Institutions with the Largest Levels of First Mortgages as of December 31, 2006: American Banker**

<b>Financial Institution</b>	<b>Type</b>
Astoria Federal Savings and Loan	Thrift
Bancorp South Inc	Bank- Regional
B.F. Saul Real Estate Investment	Thrift
BB&T Corp	Bank-Large <sup>1</sup>
Bank Atlantic	Thrift
Bank of America Corp	Bank-Large
Bank of Hawaii Corp.	Bank-Regional
Bank of New York	Bank-Large
Barclays Group	Foreign Bank
Bank Mutual Corp	Thrift
Boston Private Financial Holdings,	Bank-Regional
Banco Santander Central Hispan	Foreign Bank
Capital One Financial Group	Bank-Large
Citigroup Inc	Bank-Large
Comerica Inc.	Bank-Regional
Colonial BancGroup Inc.	Bank-Regional
Citizens Republic Bancorp Inc	Bank-Regional
City National Corp	Bank-Regional
CIT Group	Thrift
Commerce Bancshares Inc.	Bank-Regional
Deutsche Bank	Foreign Bank
Downey Savings and Loan	Thrift
Fifth Third Bancorp	Bank-Large
First Niagara Bank	Thrift
First BanCorp	Bank-Regional

<b>Financial Institution</b>	<b>Type</b>
First Horizon National Corp.	Bank-Regional
Fulton Financial Corp.	Bank-Regional
Flagstar Bank	Thrift
HSBC Holdings	Foreign Bank
Huntington Bancshares Inc.	Bank-Regional
Harris Financial Corp.	Bank-Regional
IndyMac Bank	Thrift
ING Group	Foreign Bank
JPMorgan Chase & Co.	Bank-Large
KeyCorp	Bank-Large
M&T Bank Corp.	Bank-Regional
Marshall & Ilsley Corp.	Bank-Regional
Mitsubishi Tokyo Financial Group	Foreign Bank
National City Corp.	Bank-Large
Northern Trust Corp.	Bank-Regional
Northwest Bancorp	Thrift
Ocean First Financial Corp.	Thrift
PNC Financial Services Group	Bank-Regional
Popular Inc	Bank-Regional
Provident Financial Services Inc	Bank-Regional
Raymond James Bank	Thrift
Regions Financial Corp.	Bank-Large
Sovereign Bank	Thrift
SunTrust Banks Inc	Bank-Large
Synovus Financial Corp.	Bank-Regional
Temple-Inland Inc	Thrift
TCF Financial Corp.	Bank-Regional
Trustmark Corp.	Bank-Regional
Valley National Bancorp	Bank-Regional
Wachovia Corp	Bank-Large
Washington Federal Inc	Thrift
Webster Financial Corp.	Bank-Regional
Wells Fargo & Co.	Bank-Large
Zions Bancorp	Bank-Regional

Source: American Banker, May 17, 2007, Page 6,