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Testing the Strong-Form of Market Discipline: The Effects of Public Market Signals on Bank Risk

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Abstract

Under the strong-form of market discipline, publicly traded banks that have constantly available public market signals from their stock (and bond) prices would take less risk than non-publicly traded banks because counterparties, borrowers, and regulators could react to adverse public market signals against publicly traded banks. In comparing the credit risk, earnings risk, capitalization, and failure risk between publicly traded and non-publicly traded banks, the evidence in this paper, on balance, rejects the strong-form of market discipline. In fact, publicly traded banks are found to have systematically worse supervisory ratings than non-publicly traded banks.

Key words: market discipline, bank risk-taking
JEL classification: G21, G32, G34

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The Effects of Public Market Signals on Bank Risk

I. Introduction

In recent years, policy makers and bank regulators have been warming up to the idea of leveraging market forces to supplement banking supervision, in order to enhance the safety and soundness of the banking system. The motivations for promoting market discipline in banking are three folds. First, with the growing complexity of banking organizations, banking supervision becomes increasingly demanding in terms of both scope and depth. To partially offset this development, it is argued that regulators ought to enlist the market on their side to help safeguard the increasingly complex banking industry. This may include relying more on monitoring by market participants such as stockholders, bondholders, and banks' counterparties, as well as mandating banking firms to issue publicly traded securities on a regular basis to subject them to ongoing market issuance tests.[1] Second, to the extent that market signals are freely available at a relatively high frequency, as compared to the bank examination process which is both costly and sparse, the timely information embedded in bank security prices should be valuable to supervisors, alerting them to potential problems early and assisting them in allocating scarce supervisory resources. Third, one of the prerequisites for market discipline is that uninsured bank debt holders and equity holders must have incentives to monitor bank risks. Thus, promoting market discipline also means avoiding the unduly extension of the bank safety net, reining in both regulatory forbearance and the invoking of "too-big-to-fail."

Both the Federal Reserve and the Basel Committee on Banking Supervision are actively

[1] See, for example, the Federal Reserve Staff Study (1999).

promoting the concept of market discipline in banking. In the New Basel Capital Accord to be implemented by 2006, market discipline is prominently placed as one of the three pillars, along with capital regulation (Pillar One) and banking supervision (Pillar Two), in safeguarding the banking system. In the U.S., the Chairman of the Federal Reserve System, Alan Greenspan, has remarked that "the real pre-safety-net discipline was from the market, and we need to adopt policies that promote private counterparty supervision as the first line of defense for a safe and sound banking system. Uninsured counterparties must price higher or simply not deal with banking organizations that take on excessive risk."[2]

While the concept of market discipline is intuitively appealing, there has been very little research on whether the availability of market information has any effects on bank risk-taking. In this paper, I compare bank risk-taking between two classes of banking firms: publicly traded banking organizations with constant market signals from their stock (and bond) prices versus privately owned banking companies that do not send out such market signals. To isolate the effects of market signals on bank risk-taking, I control for firm size, portfolio characteristics, time effects, and geographic effects across the two classes of firms in conducting the comparisons. Studying the effects of the availability of market signals on bank risk-taking directly tests a specific channel of market discipline in banking.

This specific channel of market discipline, thereafter referred to as the "strong-form of market discipline," is most closely related to Greenspan (2001). The way this channel of market discipline works is the following. The market prices of publicly traded securities issued by the bank reflects the latest market assessment of the bank's financial condition. In observing these

[2] Please see Greenspan (2001).

market signals, market participants who engage in financial transactions with the bank, and regulators who conduct prudential supervision, could take certain actions to influence or force the bank to change its risk profile. For example, a bank's counterparties may limit or withdraw their trading with the bank if the counterparty risk is deemed to be unacceptable by market participants. In addition, researchers have shown that relationship banking is valuable to both banks and their client firms [see for example, Ramakrishnan and Thakor (1984), Sharpe (1990), and Diamond (1991)], and deterioration in bank durability imposes costs to borrowing firms [see for example, Slovin, Sushka, and Polonchek (1993), Gibson (1995), Kang and Stulz (2000), and Bae, Kang, and Lim (2002)]. Thus, upon observing negative market signals from its bank, a borrower may lessen its reliance on this bank to protect itself from downside risk. Finally, armed with up-to-date market information, banking regulators could use their supervisory power to force bank management to lessen its risk-taking. Just the mere threats of regulatory, borrower, and counterparty responses to unfavorable market signals by themselves have the potential to constrain bank risk-taking.

The reason I refer to this particular channel of market discipline as the strong-form of market discipline is because the disciplinary force is actually not exerted by bank stockholders nor bondholders, but by the bank's counterparties, borrowers, and regulators. This is to be distinguished from stockholders' and bondholders' discipline. It is an important distinction because stockholders' and bondholders' discipline works on improving the information efficiency of bank security prices in reflecting bank risk-taking. In pricing bank risk-taking properly, stockholders and bondholders try to force banks to maximize shareholders' and bondholders' wealth, respectively, but that does not necessarily mean limiting bank risk-taking

pe se. For example, Merton (1974) studied equity claims in the option pricing framework and showed that the value of stockholders' claims could increase with the underlying asset volatility, resulting in incentive conflicts between stockholders and bondholders.[3] And while a bank's existing bondholders generally do not like to see any increases in bank risk, a risky bank can still issue high-yield debts to marginal bondholders, so long as those risks are properly priced. Hence, under certain conditions, stockholders may actually like bank risk-taking, and marginal bondholders may not care about the level of bank risk as long as they are properly compensated for bearing such risks. Only the discipline from counterparties, borrowers, and regulators has the unambiguous constraining effect on bank risk-taking.[4] Because this particular channel of discipline relies on observing information efficient bank security prices by market participants and regulators, stockholders and bondholders discipline is a necessary condition for the strong-form of market discipline to work.

Thus, in this paper, I define the strong-form of market discipline to be the effects of publicly available market signals from bank-issued securities that lead to less risk-taking by the issuing bank, relative to otherwise similar banks that do not issue publicly traded securities. Therefore, my criteria for the strong-form of market discipline to work is that not only does it force a publicly traded bank to make the appropriate trade-off between risk and return, it must be able to reduce the bank's overall risk relative to non-publicly traded banks that are not subject to

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[3] This stockholder-bondholder conflict is well known in the corporate finance literature. For example, see Smith and Warner (1979).

[4] This is true in spite of the fact that stockholders and bondholders may have different incentives for bank risk-taking, so long as market participants and regulators understand their differences in incentives and react to changes in stock and bond prices accordingly.

the strong-form of market discipline. Also note that it is the net difference in risk-taking between a privately held and a publicly traded bank that counts, not just the marginal change in risk-taking by a publicly traded banking organization because of its market signal.[5]

Previous research on market discipline in banking focuses narrowly on the information efficiency of bank security prices. They generally ask the question: do bank-issued securities, including bank stocks and subordinated debts, accurately reflect bank risk-taking? While the answer seems to be yes,[6] it only means that the market is able to price risk correctly, thus forcing banks to make the appropriate trade-off between risk and return. As I argued earlier, this kind of market discipline may not have any effects on bank risk-taking. Here, condition on the information efficiency of bank security prices, the strong-form of market discipline takes the concept of market discipline to a higher level. It raises the hurdle for the role of market forces to safeguard the banking system by asking the following question: does the presence of readily available bank security prices result in lower bank risk-taking, on net, by publicly traded banking organizations?

There has been very little research into whether market forces are capable of influencing banking firms' behavior. Bliss and Flannery (2002) is the only paper to my knowledge that looked into this question. Using a sample of publicly traded banking companies, they found little evidence that stock or bond investors influence managerial actions, casting doubts on the

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[5] The presence of public market signal may lead a publicly traded bank to take less risk at the margin. However, in order for the strong-form of market discipline to be considered successful in reducing bank risk-taking, the overall risk of a publicly traded bank must be less than the overall risk of an otherwise similar privately held bank.

[6] For details, see the survey paper by Flannery (1998).

effectiveness of the market in shaping management behavior. In this paper, rather than looking at managerial actions, I focus on the end results by comparing the risk-taking of publicly traded banking firms versus their privately held counterparts, and the forces of market discipline come from counterparties, borrowers, and regulators, instead of stock and bond holders. Although my criteria for the operation of the strong-form of market discipline is whether a banking organization issues stocks that are publicly traded, the analysis subsumes any signaling effects from the bond market, since all banks that issue bonds publicly have publicly traded stocks.

My main findings are that both the credit risk and the earnings volatility between publicly traded and non-publicly traded banking companies are statistically indistinguishable, suggesting that both classes of banking firms have similar asset risk. Despite having similar portfolio risk, publicly traded banking companies on average are found to hold significantly more capital than non-publicly traded banking firms. Nevertheless, having more capital does not improve publicly traded banks' failure risk nor supervisory ratings. In fact, publicly traded banking organizations are found to have systematically worse supervisory ratings than their privately owned counterparts. On balance, the evidence does not seem to support the presence of the strong-form of market discipline in banking.

The rest of the paper is organized as follows. Section II describes the data and provides summary statistics for the sample banking organizations. Section III discusses the seven bank risk measures to be used in this study, and the methodology in testing the strong-form of market discipline. Empirical findings are presented in Section IV. Section V summarizes and concludes this study.

II. Data

To construct a sample of publicly traded and privately held banking firms, I begin with all bank holding companies (BHCs) that file the Consolidated Financial Statements for Bank Holding Companies (FR Y-9C) with the Federal Reserve from 1986 to 2001.[7] Federal regulation requires all BHCs with total consolidated assets of $150 million or more to file this report quarterly. To avoid double counting of multi-tiered BHCs, only the top tier BHCs are retained for analysis. I then match these BHCs to their commercial bank subsidiaries who file the Report of Condition and Income (Call Report) to find out the total banking assets controlled by each BHC. To ensure that my sample includes only BHCs that engage mainly in banking activities, BHCs that have more than 10 percent of assets in non-banking subsidiaries are excluded from the analysis. To control for the geographic location of the BHC, I use the Federal Reserve District in which the BHC is located and exclude all off-shore BHCs. To control for the possibility of unusual performance due to de novo banking, bank failure, IPO, and takeover, the first year and the last year of observations for each BHC that does not have a complete time-series of data in either the public or the private sample are dropped from the analysis.[8] The above criteria yields a preliminary sample of 12,518 firm-years.

To determine whether a BHC is publicly traded in a certain year, I match the BHC data with the common stock data from the Center for Rearch in Security Price (CRSP) by the name of the banking company. To confirm that a BHC's stock is the one identified in the CRSP data, I

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[7] Thereafter, the term bank refers to bank holding company.

[8] Admittedly, this procedure eliminates only the short-term abnormalies in firm performance.

use the CUSIP number from CRSP to look up the total assets with the same CUSIP in Compustat and compare it to the reported total assets in the Y-9C. This classification method assigns 3,313 observations to the public sample and 9,205 observations to the private sample.

To compare the risk-taking between publicly traded and non-publicly traded BHCs, an important dimension to control for is the scale effect, since publicly traded banks tend to be larger than those that are privately held. Another reason for controlling the size effect is that large money center or regional banks often have a different emphasis on their product and funding mix than smaller community banks. Hence, in comparing between the two types of banking firms, the two samples of publicly traded and privately held BHCs should be as homogenous as possible.

To control for firm size, I assign each sample observation into size quartile. Since public firms tend to be larger than private firms, firm size from the private sample is used to determine the cutoffs for each size class to ensure that for each size class, public and private firms are comparable in size. Specifically, for each sample year, I first sort the total assets of all private BHCs. Firms with total assets at or above the 90^{th} percentile are assigned to Size 1; firms with total assets at or above the 75^{th} percentile but less than the 90^{th} percentile are assigned to Size 2; firms with total assets at or above the 50^{th} percentile but less than the 75^{th} percentile are assigned to Size 3; and firms with total assets less than the 50^{th} percentile are assigned to Size 4. Based on the minimum and the maximum total assets of private BHCs in each size class at each year, I compare the total assets of each public BHC at each year to those size class cutoffs and assign public BHCs to size class accordingly. For the public BHCs whose total assets exceed the maximum total assets of private BHCs in Size 1, these very large public BHCs are eliminated

from the sample. Hence, for each size class at each year, the largest BHC will always be a private company. This is to ensure that my results are not driven by the very large, publicly traded BHCs that are not directly comparable to those that are privately held.[9] In addition, after all remaining public BHCs are assigned to each of the four size classes, I find out the smallest public BHC in Size 4 at each year. All private BHCs whose total assets are smaller than the smallest public BHC at each year are also eliminated from the sample. Again, this is to ensure that the results are not driven by the very small privately held BHCs that do not have directly comparable public counterparts. Dropping the very large public BHCs and the very small private BHCs from the sample reduces the sample size to 10,821 firm-years.

Table 1 provides descriptive statistics for the final sample covering the entire period from 1986 to 2001. As expected, the number of observations for the public sample is skewed towards the larger size quartile, with 1,812 observations in the Size 1 public sample but only 986 in the private sample for that size class. The private sample has the exactly opposite skew, with 3,091 observations in the private sample for Size 4 firms but only 149 observations in the public sample. Except for the largest size class, the mean and median total assets of the sample public and private firms are very similar, suggesting that these firms with different ownership structures are indeed comparable in size. In the largest size class, despite my effort to control for size differences, the mean and the median public firms are almost twice as large as the average private firm. Nevertheless, we know for sure that the largest firm in that size class is always a

[9] While excluding the very large publicly traded BHCs from the sample is an empirical necessity, it limits the analysis of very large banking firms. Market discipline of very large banking firms may be of particular interest due to the potential systemic implications of large bank failures.

private firm in each of the sampling year. For robustness, the analysis is done separately for each size class, and I further control for the within size class scale effect by using the log of total assets as a control variable in the multi-variate analysis.

Table 1 also shows certain firm characteristics for the public and private samples. Regarding portfolio composition, both the loan-to-asset ratio and the C&I loan ratio (defined as the ratio of commercial and industrial loans to total loans) are quite similar between the public and private BHCs in each size class, and both ratios do not seem to vary much across size classes. For the consumer loan ratio (defined as the ratio of consumer loans to total loans), both the mean and the median are fairly stable across the four size classes in the private sample, but are declining from Size 1 to Size 4 in the public sample. For the fee ratio (defined as the ratio of total noninterest income to the sum of interest and noninterest income), while larger BHCs tend to derive a larger share of their income from fee-based activities than smaller BHCs, the fee ratio is quite similar between the private and public BHCs within each size class. Turning to the funding mix, both the core deposit ratio (defined as the ratio of demand and savings deposits to total assets) and the large CD ratio (defined as the ratio of large CDs to total assets) are remarkably similar between public and private BHCs within each size class. Overall, there does not seem to be notable differences in average portfolio composition and funding mix between publicly traded and privately held BHCs, especially after grouping firms into size classes.

III. Methodology

To test the strong-form of market discipline, I compare the risk-taking between publicly traded BHCs that are subject to the strong-form of market discipline versus privately owned

BHCs that are not. Multiple measures of bank risk-taking are analyzed. These measures are designed to capture the BHCs' credit risk, earnings volatility, capitalization, and failure risk.

In general, credit risk represents the major source of risk exposures in banking firms. It is measured by: (i) BADLOAN, defined as the ratio of the sum of past due and nonaccural loans to total loans; and (ii) CHARGEOFF, defined as the ratio of net charge-offs to total loans. Both BADLOAN and CHARGEOFF should reflect the quality of the banking firm's loan portfolio. Earnings volatility is measured by SDROA and SDROE, the standard deviations of quarterly return on assets and return on equity, respectively. They should reflect the earnings risk of the banking company, encompassing not only credit risk but also other sources of bank risks. Given a bank's risk exposure, capitalization measures the bank's ability to withstand unexpected losses. It is measured by CAPITAL, defined as the ratio of equity capital, including preferred stocks, common stocks, and retained earnings, to total assets. Since a key role of bank capital is to support bank risk-taking, a bank's capitalization should be taken into consideration in evaluating bank risks. BADLOAN, CHARGEOFF, SDROA, SDROE and CAPITAL are all expressed in percent.

While each of the above variables represents different ways to measure bank risk, it would be useful to synthesize these different risk measures into risk scores that summarize a banking firm's risk-taking. I use two risk scores in this paper. One is the Z-score derived by Boyd and Graham (1988) that measures a banking firm's failure risk or the probability of bankruptcy. Another one is the BOPEC rating assigned by bank examiners in their course of prudential supervision. In testing the strong-form of market discipline, both the Z-score and the BOPEC rating are of particular interest because they directly address the issue of bank safety and

soundness.

To measure the failure risk, bankruptcy is defined as the situation where losses exceed a banking firm's capital. Denote the return on assets as r, and the capital to asset ratio as k, then the probability of bankruptcy can be written as:

$$p\,(r < -k) = \int_{-\infty}^{-k} \phi(r)\, dr \qquad (1)$$

where p(•) is a probability and $\phi(r)$ is the probability density function of the random variable r. Assuming r is normally distributed, then equation (1) may be rewritten as:

$$p\,(r < -k) = \int_{-\infty}^{z} N(0,1)\, dz \qquad (2)$$

and $$z = (-k - \mu) / \sigma \qquad (3)$$

where μ is the mean of the r distribution, σ is the standard deviation of r, and z is the number of standard deviations below the mean by which profits would have to fall to wipe out the firm's capital. Thus, the value of z is a useful indicator of the probability of bankruptcy.[10] To implement equation (3), I use the sample estimates of μ and σ and rewrite the estimated value of -z (since z is a negative number) as the Z-score. Note that a higher value of Z-score is associated with a lower probability of failure.

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[10] Note that even if r is not normally distributed, z is still a useful failure risk measure so long as μ and σ exist. Invoking the Bienayme-Tchebycheff inequity and $p(r \leq -k) \leq [\sigma/(\mu+k)]^2$. Then z represents the upper-bound or worst case probability of bankruptcy. See Boyd and Graham (1988) and Roy (1952).

Whereas the Z-score measures bank failure risk using publicly observable financial data, the BOPEC rating measures BHCs' safety and soundness based on private information obtained from bank examiners' on-site inspections. As the supervisor of bank holding companies, the Federal Reserve conducts full-scope, on-site inspections of BHCs on a regular basis, usually once a year. During the on-site inspection, the Federal Reserve examiners have access to detailed loan-by-loan information and internal documents that are tightly guarded by bank management and not available to the public. At the conclusion of an inspection, the supervisory team assigns the BHC a numerical rating, called a composite BOPEC rating, that summarizes in the opinion of the examiners the overall health and financial condition of the BHC. More specifically, the five areas of supervisory concerns underlying the BOPEC rating include the BHC's bank subsidiary (the B in the BOPEC), other nonbank subsidiaries (O), parent company (P), earnings (E), and capital adequacy (C). BOPEC ratings are assigned according to an absolute scale ranging from 1, which is the best rating, to 5, which is the worst rating. BOPEC ratings are confidential and are not made available to the public.

Table 2 presents descriptive statistics of the seven measures of bank risk. In this Table, I also compare the distributions of each risk measure between publicly traded and privately held BHCs using the non-parametric Wilcoxon Rank Sum test separately for each size class. The Wilcoxon Z-statistic is approximately normally distributed under the null hypothesis that the private sample and the public sample have the same distribution. This test statistic is calculated for the smaller sample of the two samples being compared, i.e., the private sample for Size 1 firms and the public sample for the other three size quartiles.

To formally test whether public ownership has any effect on bank risk-taking, two

versions of the following regression model are estimated:

$$Y_{i,t} = \alpha + \beta X_{i,t} + \gamma T_t + \delta D_i + \lambda \text{PUBLIC}_i + \epsilon_{i,t}, \quad (4)$$

where

$Y_{i,t}$ is one of the seven measures of bank risk;

$X_{i,t}$ is a vector of firm characteristic variables;

T_t is a vector of time-effect dummy variables;

D_i is a vector of dummy variables for the Federal Reserve District where the BHC is located;

PUBLIC is a dummy variable that equals one for publicly traded BHCs, zero otherwise;

α, β, γ, δ, and λ are regression coefficients; and

$\epsilon_{i,t}$ is the disturbance term.

In the first version of the model, the vector $X_{i,t}$ of firm characteristics, except for firm size, is omitted from equation (4). The time-effect dummies control for macroeconomic effects, and the District dummies control for location effects. Firm size, measured by the log of total assets, controls for any residual scale effects after grouping the sample banks into size classes. To the extent that firm characteristics, such as portfolio composition, partially determine bank risk-taking, omitting them from the model tests the effects of public ownership on overall bank risk-taking. That is, in this version of the model, I only control for the pure exogenous factors including the macroeconomic effects and the location effects.

One may argue that different banks may have different business strategies, including loan portfolio concentration and funding mix, so that no two banks are alike. Thus, in comparing bank risk-taking between two classes of banks, it may be preferable to control for their different

individual characteristics.[11] In the second version of the model, firm characteristics are included as additional control variables. The vector of firm characteristic variables falls into two categories: portfolio composition and funding mix. To control for portfolio composition, the loan-to-asset ratio, the C&I loans to total loans ratio, and the consumer loans to total loans ratio, are included as explanatory variables. Since bank risk-taking is partially determined by loan portfolio composition, controlling for portfolio mix tests whether publicly traded banks take more or less risk within the same loan categories as privately held banks. To control for funding mix, I include the core deposits to total assets ratio, and the large CDs to total assets ratio in the model. These two variables control for the effects of different funding strategies on bank risk-taking.

Since banks are in the business of taking risk and they use their own capital to support bank risk-taking, banks that choose to take more risk may also choose to hold more capital, beyond their loan loss reserves, against unexpected losses. In the regression where CAPITAL is the dependent variable, I also estimate a third version of the model which includes BADLOAN as an additional explanatory variable to test whether, after further controlling for credit risk, publicly traded banks hold more or less capital than non-publicly traded banks. Note that BADLOAN may not have any additional explanatory power for CAPITAL, which does not include loan loss reserve, if banks do not set aside additional capital beyond expected losses.

The coefficient of PUBLIC, λ, tests the effects of having public market signals on bank risk-taking. If the presence of publicly available market signals has no net effect on bank risk-

[11] This begs the question of why some banks choose a riskier strategy while other banks do not.

taking, λ should be indistinguishable from zero. Finding significant λ coefficients provides evidence for the strong-form of market discipline in banking. Specifically, the strong-form of market discipline predicts a negative λ for the BADLOAN, CHARGEOFF, SDROA, SDROE, and BOPEC regressions, and a positive λ for the CAPITAL and Z-SCORE regressions.

Pooled time-series cross-section observations are used to fit the regression models, using the full sample as well as the sub-samples from each of the four size classes. In the panel regressions where the observations per each cross sectional unit may not be independent, I use the robust standard error that only assumes independence across banks but not within banks to draw inferences.

In the BADLOAN, CHARGEOFF, CAPITAL, and BOPEC regressions, the data consist of annual observations and the time-effect dummies are year dummies. In the SDROA, SDROE, and Z-SCORE regressions, the dependent variables are computed (estimated) using quarterly observations over three non-overlapping time periods: 1986-1990, 1991-1995, and 1996-2001.[12] Because in these regressions, each bank has at most three time-series observations (rather than 16 annual observations), the total number of observations used to fit the models is much smaller. Also, in order for the dependent variables to be meaningful, firms with less than eight quarters of

[12] The first sub-period was characterized by tremendous difficulties in the banking industry. The banking sector was suffering from the worst crisis since the Great Depression. The total number of bank failures peaked at 279 in 1988 while exceeding 200 in both 1987 and 1989. During the second sub-period, the banking industry was gradually coming out of the crisis while the economy was recovering from the recession after the first Gulf War. The banking sector was stabilizing and returning to profitability. The last sub-period was marked by a fast growing economy and financial market booms. Profitability of banking firms soared to record level while asset quality improved markedly. Those were the banner years of the banking industry.

non-missing observations in each sub-period are excluded, which also contributes to the reduction in the total number of observations. In these regressions, the firm characteristic variables are averages over each sub-period, and the time-effect dummies are sub-period dummies.

IV. Empirical Findings

The discussion of the empirical results is organized into four sub-sections: credit risk, earnings volatility, capitalization, and failure risk. In each of the regression tables, the left hand panel contains the results of estimating the model without controlling for firm characteristics, and the right hand panel contains the results of estimating the full model. In both cases, estimates of the time effect dummies and the District dummies are not reported but are available upon request.

A. *Credit Risk*

Table 3 reports the results of the BADLOAN regression. In the left hand panel, the coefficient of PUBLIC is indistinguishable from zero for both the full sample and for each of the four size classes, so is the coefficient for firm size. In the right hand panel where firm characteristics are included as control variables, firm size has a significantly negative effect on BADLOAN for the full sample, possibly due to better diversification opportunities among larger firms. The size effect disappears in the size based regressions. Regarding the other control variables, the coefficient of the loan-to-asset ratio is positive and marginally significant for the Size 1 regression, indicating that the amount of nonperforming loans is directly related to loan quantity. Within the loan portfolio, it is quite clear that the proportion of consumer loans has a

significantly negative effect on BADLOAN; the coefficient of the consumer loan ratio is significantly negative and is robust across the four size classes. This suggests that concentrating in consumer lending can reduce credit risk, possibly due to the diversification benefit of lending to a large pool of individual borrowers. In contrast, the coefficient of the C&I loan ratio is positive and marginally significant for the full sample and BHCs in Size 4, indicating that concentrating in C&I lending raises the nonperforming loan ratio. The fee ratio is found to have a significantly positive effect on BADLOAN for the full sample and three of the four size classes. One interpretation is that in making loans to risky borrowers, banks charge high risk borrowers higher fees. The higher fees may be part of the loan pricing, either to supplement the loan rate where usury ceiling is binding or simply because of the lack of bargaining power by high risk borrowers. High risk borrowers also may be more likely to purchase credit enhancements from their banks, such as standby letters of credit. Regarding the funding mix, the coefficient of the large CD ratio has a significantly positive effect on BADLOAN, suggesting that banks may be more willing to use relatively costly CDs to fund their high yield loans. Turning to the test variable, the coefficient of PUBLIC is again insignificantly different from zero, indicating that public ownership has no effect on the amount of nonperforming loans, even after controlling for asset composition and funding mix.

Results of the CHARGEOFF regressions are presented in Table 4. In the left hand panel, the coefficient of PUBLIC in general is insignificantly different from zero, but is significantly positive for BHCs in Size 3. In the right hand panel, estimates of the control variables for firm characteristics are broadly consistent with those in the BADLOAN regressions. Some evidence of firm size having a negative effect on loan charge-offs is detected. While the C&I loan ratio is

found to have a stronger effect on charge-offs (than bad loans), the consumer loan ratio is actually found to have a positive effect on charge-offs, albeit only for the full sample and BHCs in Size 1. Both the fee ratio and the large CD ratio are found to have a positive effect on charge-offs. Similar to the left hand panel, the coefficient of PUBLIC is insignificant except for the Size 3 regression.

In summary, the credit risk between publicly traded BHCs and non-publicly traded BHCs is statistically indistinguishable. There is some evidence that publicly traded BHCs in Size 3 tend to have more loan charge-offs than non-publicly traded BHCs, which is in contradiction to the strong-form of market discipline.

B. *Earnings Volatility*

Table 5 reports the estimates of the SDROA regressions. The results have some striking similarities to those of the BADLOAN and CHARGEOFF regressions. In the left hand panel, publicly traded BHCs in general exhibit similar ROA volatility as non-publicly traded BHCs, except for those in Size 3 where a significantly positive coefficient of PUBLIC is found. In the right hand panel, firm size is found to have a negative effect on ROA volatility for the full sample, again indicating better diversification opportunities among larger firms. The size effect disappears after the sample firms are grouped into size classes. The loan-to-asset ratio has a significantly positive effect on ROA volatility for the full sample, and is marginally significant for the Size 1 regression, suggesting that higher loan concentration raises earnings volatility. Regarding portfolio composition, both C&I lending and fee based activities are found to raise earnings volatility, while consumer lending tends to lower it. On the funding side, there is some

evidence that relying on large CD funding tends to raise earnings volatility, as rates on large CDs fluctuate with market interest rates whereas rates on core deposits tend to be more stable. The coefficient of PUBLIC is insignificant in general but is significantly positive for Size 3 firms.

Results of estimating the SDROE regressions, presented in Table 6, are almost qualitatively identical to those of the SDROA regressions. Moreover, for robustness, using alternative computations of SDROA and SDROE that exclude tax and extraordinary items from calculating the returns provides qualitatively similar results. In summary, publicly traded BHCs and non-publicly traded BHCs exhibit very similar earnings volatility. Like the analysis of credit risk, there is some evidence that publicly traded BHCs in Size 3 actually have higher earnings volatility than otherwise similar non-publicly traded BHCs, a finding that is in contradiction to the strong-form of market discipline being at work.

C. *Capitalization*

Table 7 reports the results of estimating the CAPITAL regressions. In the left hand panel, the effect of firm size on bank capitalization is unclear; the coefficient for firm size is insignificant for the full sample, but is significantly positive for BHCs in Sizes 1 and 2 while significantly negative for BHCs in Size 3. Public ownership is found to have a significantly positive effect on bank capital for the full sample. In the size based regressions, public ownership is found to be significantly positive only for BHCs in Size 3. Turning to the right hand panel, some of the firm characteristic variables are found to be significant determinants of bank capital. Interestingly, the coefficient of the loan to asset ratio is negative and marginally significant for the full sample and BHCs in Size 3; it is significantly negative in the Size 4

regression. Banks that concentrate in C&I lending are found to hold significantly more capital, and so are banks that engage in more fee based activities. Regarding funding mix, banks with a higher core deposit ratio are found to hold more capital, perhaps because banks with strong capital are able to attract more core deposits. On the other hand, large CDs, which compete on interest rate terms, are found to have little effect on bank capitalization. After controlling for asset composition and funding mix, public ownership is found to have a significantly positive effect on capitalization. For the full sample, publicly traded BHCs on average hold 1.7 percentage points more capital than otherwise similar non-publicly traded BHCs. This seems to be economically significant as well, as the capital ratio averages about 8 to 9 percent in Table 2. While the coefficient of PUBLIC has the positive sign in the size based regressions, it is statistically significant only for BHCs in Size 3 and Size 4. Publicly traded BHCs in these two size classes on average hold about three percentage points more capital than otherwise similar non-publicly traded BHCs. The findings support the strong-form of market discipline that the availability of public market signals leads to more bank capital.

For robustness, to allow for the possibility that banks which engage in more risk taking may hold additional capital against unexpected losses in their loan portfolio that could not be absorbed by loan loss reserve, the CAPITAL regression is also estimated with an additional regressor, BADLOAN, to control for credit risk. The results are reported in Table 8. After controlling for asset composition, the amount of bad loans is found to provide no marginal explanatory power for bank capital, indicating that the average bank does not set aside additional capital (beyond the reserve for loan losses) against nonperforming loans.

D. Failure Risk

Table 9 reports the estimates of the Z-score regressions. Recall that banks with lower bankruptcy risk have higher Z-scores. In the left hand panel, firm size is found to have a significantly positive effect on Z-score, suggesting that large firms tend to have higher Z-scores, possibly due to the better diversification opportunities available to large firms. The size effect disappears in the size based regressions. Regarding the effect of public ownership on failure risk, the results are somewhat mixed. For the full sample, public ownership is found to have an insignificant effect on the Z-score. In the regression for Size 1 BHCs, the coefficient of PUBLIC is positive and marginally significant, while in the Size 3 regression, it has a significantly negative coefficient. In the right hand panel, higher loan to asset ratio is found to lower the Z-score, so does the higher concentrations in C&I lending and fee based activities. On the other hand, higher concentration in consumer lending tends to raise the Z-score. On the liability side, using more large CD funding is found to lower the Z-score. Note that the effects of firm characteristics on the Z-score are broadly similar to their effects on credit risk and earnings volatility. However, the effect of public ownership on the Z-score remains somewhat mixed.

Table 10 reports the estimates of the BOPEC regressions. Note that unlike the ordering of the Z-score, BHCs with higher BOPEC ratings are associated with higher failure risk. In the left hand panel, firm size is found to have a negative effect on BOPEC rating for the full sample, but the size effect largely disappears after grouping the sample BHCs into size classes. Public ownership is found to have a significantly positive effect on the BOPEC rating. The result is fairly robust with respect to bank size, except for the largest size quartile. The findings indicate that publicly traded BHCs tend to have a higher BOPEC rating and hence higher failure risk than

non-publicly traded BHCs. In the right hand panel, the loan to asset ratio, the fee ratio, and the large CD ratio are all found to have significantly positive effects on the BOPEC rating, while the consumer loan ratio and the core deposit ratio are found to reduce the BOPEC rating significantly. After controlling for portfolio composition and funding mix, publicly traded BHCs are found to have significantly higher numerical BOPEC ratings and hence higher failure risk than otherwise similar non-publicly traded BHCs. These findings reject the strong-form of market discipline that the availability of public market signals would lead to less bank risk-taking.

Whereas the Z-SCORE regressions provide somewhat mixed results, the BOPEC regressions yield strong and robust evidence that publicly traded BHCs actually exhibit worse supervisory ratings than privately owned BHCs. Assuming that BOPEC ratings accurately reflects the true failure risk of banking organizations, the evidence here suggests that we may want to rethink what exactly will market signals do to bank risk-taking.[13]

V. Summary and Conclusions

This paper tests the strong-form of market discipline that publicly traded banking organizations with constantly available market signals from their stock (and bond) prices would take less risk than otherwise similar non-publicly traded banks that do not have constant market signals. The source of market discipline comes from banks' counterparties, borrowers, and

[13] The question of why do publicly traded BHCs tend to have worse supervisory ratings than otherwise similar privately owned BHCs is beyond the scope of this paper but definitely worthy of investigation. For example, does the availability of public market signals has anything to do with their worse BOPEC ratings? I leave these interesting questions for future research.

regulators who can costlessly observe, and respond to, those public market signals. Unlike non-publicly traded banks that are completely immune from this kind of market discipline, the strong-form of market discipline predicts that publicly traded banks tend to take less risk. My tests involve comparing seven measures of bank risk between similar sized publicly traded and non-publicly traded BHCs, with and without controlling for portfolio compositions and funding fix.

Regarding credit risk and earnings volatility, there is very little evidence that publicly traded BHCs are less risky than non-publicly traded BHCs. In fact, there is some evidence that publicly traded BHCs in a certain size quartile actually exhibit higher credit risk and earnings risk than their non-publicly traded counterparts. However, I do find that publicly traded BHCs tend to hold more capital than non-publicly traded BHCs, most notably among smaller firms.

After synthesizing the risk measures into a summary statistic, the Z-score, which measures a banking firm's probability of bankruptcy, the effect of public ownership on bank failure risk is somewhat mixed. Public ownership is found to lower the failure risk for large BHCs but raises it for smaller BHCs. However, when I use the confidential supervisory BOPEC rating to measure a banking firm's overall soundness, I find strong evidence that publicly traded banks tend to have worse supervisory ratings than otherwise similar non-publicly traded banks.

On balance, the results in this paper reject the strong-form of market discipline. While publicly traded BHCs tend to hold more capital, their additional capital do not seem to improve their bankruptcy risk in a significant way. Most importantly, the evidence of systematically worse supervisory ratings among public traded BHCs is unsettling. At the minimum, the argument of relying on the strong-form of market discipline to promote the policies of market discipline and bank disclosure may need some further thinking.

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Table 1: Summary Statistics of Publicly Traded and Privately Held Banking Companies

This table shows the sample mean and median (in parentheses) total assets, loan-to-asset ratio, ratio of commercial and industrial (C&I) loans to total loans, ratio of consumer loans to total loans, ratio of fee income to total income, ratio of core deposits to total assets, and ratio of large CDs to total assets of publicly traded and privately held BHCs by size class from 1986 to 2001. Size 1 contains the largest firms.

	Size 1		Size 2		Size 3		Size 4	
	Public	Private	Public	Private	Public	Private	Public	Private
Total assets (in $ millions)	$2,145.4 ($1,491.3)	$1,118.9 ($778.0)	$451.3 ($442.6)	$420.8 ($413.1)	$293.3 ($290.6)	$270.8 ($267.1)	$197.3 ($201.1)	$188.0 ($187.5)
Total loans to total assets	62.4% (63.4%)	59.3% (61.0%)	63.8% (65.1%)	59.8% (60.8%)	63.8% (64.6%)	59.4% (60.7%)	64.0% (64.0%)	58.1% (59.3%)
C&I loans to total loans	20.8% (18.8%)	21.4% (19.6%)	19.9% (17.5%)	20.1% (18.2%)	19.7% (17.8%)	19.5% (17.0%)	21.0% (18.3%)	18.7% (16.8%)
Consumer loans to total loans	18.2% (17.2%)	16.5% (13.7%)	14.0% (11.7%)	15.5% (13.5%)	13.7% (10.7%)	15.5% (13.3%)	12.7% (9.8%)	16.0% (14.1%)
Fee income to total income	12.1% (11.3%)	12.7% (11.2%)	10.5% (9.6%)	11.2% (10.0%)	10.9% (10.3%)	10.3% (9.2%)	8.9% (8.6%)	9.6% (8.7%)
Core deposits to total assets	37.1% (36.4%)	37.2% (37.2%)	37.4% (35.9%)	35.7% (34.8%)	36.7% (35.2%)	34.2% (33.4%)	35.0% (34.5%)	32.8% (31.8%)
Large CDs to total assets	9.6% (8.3%)	10.5% (8.9%)	10.2% (9.6%)	9.9% (8.7%)	9.8% (9.1%)	10.6% (9.4%)	10.7% (10.3%)	10.1% (9.1%)
N	1812	986	520	1471	347	2445	149	3091

Table 2: Descriptive Statistics of Bank Risk

This table reports the mean (median) of seven bank risk measures: BADLOAN is the ratio of past due and nonaccural loans to total loans; CHARGEOFF is the ratio of net charge-offs to total loans; SDROA is the standard deviation of return on assets; SDROE is the standard deviation of return on equity; CAPITAL is the equity to asset ratio; Z-SCORE measures bank failure risk; and BOPEC is the confidential supervisory rating of bank safety and soundness. The Wilcoxon Z derived from the Rank Sum test, with the p-value in parentheses, is computed for the smaller sample, i.e., the private sample for Size 1 and the public sample for Size 2, 3, and 4. Size 1 contains the largest firms.

BADLOAN			
Size Class	Public (in %)	Private (in %)	Wilcoxon Z
1	1.35 (0.89)	1.33 (0.90)	-1.2753 (0.2022)
2	1.22 (0.77)	1.29 (0.89)	-2.1057 ** (0.0352)
3	1.50 (0.91)	1.39 (0.89)	0.3810 (0.7032)
4	1.27 (0.81)	1.34 (0.85)	-0.3877 (0.6982)
CHARGEOFF			
Size Class	Public (in %)	Private (in %)	Wilcoxon Z
1	0.61 (0.40)	0.66 (0.36)	-3.0182 *** (0.0025)
2	0.46 (0.29)	0.52 (0.31)	-1.1527 (0.2490)
3	0.62 (0.32)	0.55 (0.30)	0.9699 (0.3321)
4	0.66 (0.30)	0.55 (0.31)	0.2375 (0.8122)
SDROA			
Size Class	Public (in %)	Private (in %)	Wilcoxon Z
1	0.12 (0.08)	0.11 (0.08)	-0.0606 (0.9517)
2	0.16 (0.06)	0.14 (0.08)	-0.1809 (0.8564)
3	0.18 (0.19)	0.16 (0.08)	1.6025 (0.1090)
4	0.22 (0.07)	0.09 (0.06)	0.7006 (0.4835)

SDROE			
Size Class	Public (in %)	Private (in %)	Wilcoxon Z
1	1.98 (0.90)	1.39 (0.97)	0.4326 (0.6653)
2	2.38 (1.07)	2.25 (0.76)	0.1480 (0.8823)
3	2.58 (2.67)	3.15 (1.15)	1.5088 (0.1314)
4	2.63 (0.88)	1.09 (0.74)	0.6351 (0.5254)
CAPITAL			
Size Class	Public (in %)	Private (in %)	Wilcoxon Z
1	8.05 (7.94)	8.06 (7.85)	-1.1412 (0.2538)
2	8.53 (8.43)	8.44 (8.27)	1.2770 (0.2016)
3	8.61 (8.69)	8.22 (8.07)	4.2188 *** (<0.0001)
4	9.06 (8.88)	8.57 (8.44)	2.0541 ** (0.0400)
Z-SCORE			
Size Class	Public	Private	Wilcoxon Z
1	127.88 (107.45)	116.27 (97.51)	-0.3031 (0.7618)
2	146.33 (100.56)	135.39 (130.08)	-0.0164 (0.9869)
3	91.68 (40.39)	103.27 (84.90)	-1.5275 (0.1266)
4	140.47 (119.99)	172.00 (142.27)	-0.8235 (0.4102)
BOPEC			
Size Class	Public	Private	Wilcoxon Z
1	1.72 (2.00)	1.72 (2.00)	0.8646 (0.3873)
2	1.74 (2.00)	1.69 (2.00)	1.8908 * (0.0586)
3	1.93 (2.00)	1.78 (2.00)	2.6597 *** (0.0078)
4	2.07 (2.00)	1.74 (2.00)	4.7534 *** (<0.0001)

***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

Table 3: Comparing Non-Performing Loans between Publicly Traded and Non-Publicly Traded Banking Organizations

BADLOAN (ratio of past due and nonaccural loans to total loans) is regressed on public ownership dummy, firm characteristics, time-effect dummies (not reported), and Federal Reserve District dummies (not reported). Robust t-statistics are in parentheses.

	All Obs.	Size 1	Size 2	Size 3	Size 4	All Obs.	Size 1	Size 2	Size 3	Size 4
Public ownership	0.02 (0.38)	0.04 (0.44)	0.03 (0.27)	0.22 (1.60)	-0.04 (-0.28)	0.03 (0.596)	0.09 (0.92)	0.002 (0.02)	0.18 (1.36)	-0.12 (-0.77)
Log of total assets	-0.05 (-1.51)	0.01 (0.15)	0.16 (0.61)	-0.25 (-0.78)	0.16 (0.66)	-0.08*** (-2.61)	-0.03 (-0.48)	0.13 (0.52)	-0.32 (-1.06)	-0.07 (-0.39)
Total loans to total assets						0.13 (0.57)	0.70* (1.73)	0.61 (1.36)	0.16 (0.39)	-0.53 (-1.49)
C&I loans to total loans						0.47* (1.69)	0.003 (0.01)	0.40 (0.73)	0.38 (0.81)	1.07 * (1.94)
Consumer loans to total loans						-1.88*** (-6.48)	-1.46*** (-3.14)	-2.07*** (-3.32)	-2.14*** (-5.12)	-2.04*** (-5.21)
Fee income to total income						2.52*** (5.20)	2.09*** (3.12)	0.54 (0.68)	3.35*** (4.65)	3.47*** (3.59)
Core deposits to total assets						0.24 (0.89)	0.69 (1.60)	-0.43 (-0.85)	-0.36 (-0.72)	0.51 (1.14)
Large CDs to total assets						3.08*** (5.80)	3.57*** (4.21)	2.51** (2.47)	2.02** (2.14)	3.66*** (3.51)
R^2	0.18	0.22	0.15	0.20	0.20	0.21	0.26	0.19	0.23	0.25
N	10819	2798	1989	2792	3240	10819	2798	1989	2792	3240

***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

Table 4: Comparing Net Charge-offs between Publicly Traded and Non-Publicly Traded Banking Organizations

CHARGEOFF (ratio of net charge-offs to total loans) is regressed on public dummy, firm characteristics, time-effect dummies Not reported), and Federal Reserve District dummies (not reported). Robust t-statistics are in parentheses.

	All Obs.	Size 1	Size 2	Size 3	Size 4	All Obs.	Size 1	Size 2	Size 3	Size 4
Public ownership	0.05 (1.30)	0.03 (0.41)	0.03 (0.74)	0.18** (2.40)	0.14 (1.32)	0.05 (1.41)	0.02 (0.24)	0.02 (0.50)	0.15** (2.00)	0.13 (1.34)
Log of total assets	0.02 (0.95)	0.03 (0.57)	0.21 (1.44)	-0.17 (-1.23)	-0.08 (-0.66)	-0.04* (-1.71)	-0.06 (-0.89)	0.14 (1.02)	-0.21 (-1.62)	-0.20* (-1.71)
Total loans to total assets						0.13 (0.95)	0.49 (1.47)	0.23 (1.15)	-0.002 (-0.01)	-0.15 (-1.00)
C&I loans to total loans						0.59*** (3.46)	-0.08 (-0.27)	0.62** (2.27)	0.95*** (3.83)	0.91*** (3.18)
Consumer loans to total loans						0.91** (2.24)	1.89** (2.29)	0.83 (1.58)	0.29 (1.49)	0.18 (0.85)
Fee income to total income						2.88*** (2.72)	4.95** (2.01)	2.27* (1.77)	1.41*** (3.36)	2.31*** (3.03)
Core deposits to total assets						-0.24 (-1.36)	-0.36 (-0.99)	-0.41 (-1.45)	-0.35 (-1.43)	-0.18 (-0.82)
Large CDs to total assets						1.44*** (3.27)	2.77** (2.56)	1.24*** (2.68)	0.52 (1.01)	0.86** (2.15)
R^2	0.14	0.11	0.15	0.20	0.20	0.19	0.24	0.21	0.22	0.24
N	10820	2798	1991	2792	3239	10820	2798	1991	2792	3239

***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

Table 5: Comparing ROA Volatilities between Publicly Traded and Non-Publicly Traded Banking Organizations

SDROA (standard deviation of ROA) is regressed on public dummy, firm characteristics, time-effect dummies (not reported), and Federal Reserve District dummies (not reported). Robust t-statistics are in parentheses.

	All Obs.	Size 1	Size 2	Size 3	Size 4	All Obs.	Size 1	Size 2	Size 3	Size 4
Public ownership	0.01 (1.12)	-0.004 (-0.23)	0.004 (0.15)	0.06*** (2.71)	0.04 (1.31)	0.01 (1.09)	0.0002 (0.01)	-0.004 (-0.19)	0.06** (2.45)	0.04 (1.52)
Log of total assets	-0.01 (-1.61)	-0.004 (-0.28)	-0.02 (-0.27)	-0.08 (-1.23)	-0.05 (-1.31)	-0.02*** (-2.76)	-0.01 (-0.72)	-0.001 (-0.01)	-0.10 (-1.52)	-0.04 (-1.27)
Total loans to total assets						0.08*** (2.91)	0.08* (1.78)	0.06 (0.83)	0.08 (1.27)	0.06 (1.22)
C&I loans to total loans						0.10** (2.48)	-0.04 (-0.79)	0.17** (2.54)	0.24* (1.82)	0.12* (1.86)
Consumer loans to total loans						-0.08* (-1.93)	-0.13** (-2.26)	-0.006 (-0.07)	0.05 (0.38)	-0.15** (-2.42)
Fee income to total income						0.30*** (3.76)	0.40** (2.58)	0.15 (1.56)	0.27** (2.47)	0.34*** (2.69)
Core deposits to total assets						0.05 (1.19)	0.02 (0.24)	0.13 (1.50)	-0.14 (-1.18)	0.14** (2.17)
Large CDs to total assets						0.16** (2.39)	0.13 (1.04)	0.01 (0.08)	0.18 (1.34)	0.32** (2.33)
R^2	0.08	0.11	0.13	0.15	0.09	0.12	0.15	0.18	0.21	0.18
N	1464	477	234	316	437	1464	477	234	316	437

***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

Table 6: Comparing ROE Volatilities between Publicly Traded and Non-Publicly Traded Banking Organizations

SDROE (standard deviation of ROE) is regressed on public dummy, firm characteristics, time-effect dummies (not reported), and Federal Reserve District dummies (not reported). Robust t-statistics are in parentheses.

	All Obs.	Size 1	Size 2	Size 3	Size 4	All Obs.	Size 1	Size 2	Size 3	Size 4
Public ownership	0.64 (1.37)	0.97 (0.99)	-0.02 (-0.04)	1.48** (2.02)	0.53 (1.04)	0.62 (1.29)	1.32 (1.12)	-0.23 (-0.48)	1.33 * (1.69)	0.53 (1.27)
Log of total assets	-0.09 (-0.62)	-0.40 (-0.57)	0.17 (0.10)	-2.07 (-1.24)	-1.61* (-1.88)	-0.29 * (-1.73)	-0.68 (-0.86)	0.50 (0.32)	-2.53 (-1.41)	-1.44 * (-1.86)
Total loans to total assets						3.09 *** (2.71)	1.80 (0.67)	2.90 * (1.71)	5.34 (1.47)	2.14 ** (2.32)
C&I loans to total loans						0.76 (0.86)	-2.76 (-1.28)	2.72 ** (1.99)	3.27 (1.63)	1.40 (1.10)
Consumer loans to total loans						-1.93 (-1.47)	-4.49 * (-1.66)	-1.30 (-0.76)	3.06 (0.74)	-3.08 ** (-2.54)
Fee income to total income						8.93 *** (2.64)	15.63 * (1.90)	2.29 (1.19)	6.36 * (1.66)	9.47 *** (2.86)
Core deposits to total assets						2.78 * (1.93)	6.23 (1.23)	2.95 (1.58)	-2.19 (-0.87)	2.94 ** (2.56)
Large CDs to total assets						7.77 ** (1.99)	13.87 (1.39)	0.71 (0.30)	8.70 (1.30)	4.37 ** (2.06)
R^2	0.05	0.07	0.15	0.14	0.09	0.08	0.10	0.20	0.18	0.19
N	1464	477	234	316	437	1464	477	234	316	437

***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

Table 7: Comparing Capitalization between Publicly Traded and Non-Publicly Traded Banking Organizations

CAPITAL (ratio of equity to total assets) is regressed on public dummy, firm characteristics, time-effect dummies (not reported), and Federal Reserve District dummies (not reported). Robust t-statistics are in parentheses.

	All Obs.	Size 1	Size 2	Size 3	Size 4	All Obs.	Size 1	Size 2	Size 3	Size 4
Public ownership	1.62** (2.54)	0.64 (0.67)	0.64 (0.67)	3.47*** (2.95)	2.62 (1.55)	1.74*** (2.75)	0.92 (0.94)	0.11 (0.12)	3.03*** (2.61)	2.80* (1.74)
Log of total assets	0.25 (0.76)	1.24** (2.12)	1.24** (2.12)	-5.09** (-2.30)	-3.49 (-1.64)	-0.28 (-0.84)	0.34 (0.59)	6.44 *** (2.71)	-5.02 ** (-2.24)	-4.52** (-2.11)
Total loans to total assets						-3.89* (-1.95)	5.85 (1.53)	0.46 (0.13)	-5.75* (-1.69)	-12.57*** (-3.98)
C&I loans to total loans						6.41*** (2.89)	9.02** (2.06)	6.38 (1.39)	5.09 (1.38)	5.18 (1.51)
Consumer loans to total loans						-3.76 (-1.62)	-1.34 (-0.32)	-10.96*** (-2.81)	-1.85 (-0.38)	-4.22 (-1.23)
Fee income to total income						23.14*** (5.08)	36.44*** (5.37)	24.77*** (3.16)	13.87** (2.02)	17.00** (2.26)
Core deposits to total assets						8.56*** (3.47)	7.63* (1.67)	3.13 (0.66)	13.75*** (3.39)	9.64** (2.27)
Large CDs to total assets						-2.02 (-0.49)	-6.27 (-0.79)	1.22 (0.16)	2.27 (0.34)	1.30 (0.19)
R^2	0.09	0.11	0.20	0.09	0.05	0.12	0.16	0.23	0.12	0.09
N	10821	2798	1991	2792	3240	10821	2798	1991	2792	3240

***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

Table 8: Comparing Capitalization between Publicly Traded and Non-Publicly Traded Banking Organizations, Controlling for Credit Risk

CAPITAL (ratio of equity to total assets) is regressed on public dummy, firm characteristics, bad loan ratio, time-effect dummies (not reported), and Federal Reserve District dummies (not reported). Robust t-statistics are in parentheses.

	All Obs.	Size 1	Size 2	Size 3	Size 4
Public ownership	1.75*** (2.76)	0.89 (0.92)	0.15 (0.15)	3.018*** (2.61)	2.82 * (1.75)
Bad loans to total loans	0.14 (1.11)	0.25 (0.92)	0.21 (0.84)	0.04 (0.19)	0.14 (0.67)
Log of total assets	-0.27 (-0.81)	0.35 (0.61)	6.41*** (2.70)	-5.01** (-2.23)	-4.51** (-2.10)
Total loans to total assets	-3.95** (-1.98)	5.67 (1.47)	0.07 (0.02)	-5.76* (-1.69)	-12.20*** (-3.95)
C&I loans to total loans	6.36*** (2.85)	9.02** (2.06)	6.38 (1.38)	5.08 (1.37)	5.04 (1.47)
Consumer loans to total loans	-3.50 (-1.49)	-0.98 (-0.23)	-10.51*** (-2.66)	-1.77 (-0.36)	-3.94 (-1.15)
Fee income to total income	22.76*** (4.95)	35.93*** (5.23)	24.56*** (3.09)	13.74** (2.00)	16.52** (2.20)
Core deposits to total assets	8.55*** (3.47)	7.46 (1.63)	3.33 (0.71)	13.76*** (3.38)	9.57** (2.27)
Large CDs to total assets	-2.39 (-0.58)	-7.15 (-0.90)	1.06 (0.14)	2.19 (0.33)	0.80 (0.12)
R^2	0.12	0.17	0.23	0.12	0.09
N	10819	2798	1989	2792	3240

***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

Table 9: Comparing Bankruptcy Risk between Publicly Traded and Non-Publicly Traded Banking Organizations

Z-SCORE (measuring probability of bankruptcy) is regressed on public dummy, firm characteristics, time-effect dummies (not reported), and Federal Reserve District dummies (not reported). Robust t-statistics are in parentheses.

	All Obs.	Size 1	Size 2	Size 3	Size 4	All Obs.	Size 1	Size 2	Size 3	Size 4
Public ownership	12.73 (1.01)	35.87* (1.92)	23.05 (0.84)	-67.92*** (-2.79)	-17.53 (-0.57)	14.54 (1.16)	31.93* (1.76)	30.12 (1.08)	-62.28*** (-2.64)	-11.21 (0.706)
Log of total assets	11.25** (2.20)	-2.82 (-0.21)	69.96 (0.80)	46.32 (0.59)	33.00 (0.90)	15.96*** (3.03)	-0.56 (-0.04)	59.19 (0.66)	50.07 (0.66)	32.54 (0.94)
Total loans to total assets						-138.6*** (-4.52)	-98.96 (-1.49)	-119.94 (-1.38)	-88.56* (-1.72)	-186.7*** (-3.52)
C&I loans to total loans						-35.94 (-0.79)	132.37* (1.67)	-97.87 (-0.62)	-85.13 (-1.13)	-154.7*** (-3.27)
Consumer loans to total loans						69.17* (1.87)	78.63 (1.28)	-125.82 (-1.13)	205.10** (2.48)	61.75 (0.95)
Fee income to total income						-216.0*** (-3.28)	-161.48 (-1.50)	-86.23 (-0.61)	-305.9*** (-2.83)	-303.77 (-1.44)
Core deposits to total assets						-51.77 (-1.12)	-110.05 (-1.15)	-27.89 (-0.21)	59.67 (0.78)	-27.95 (-0.41)
Large CDs to total assets						-148.5** (-2.12)	-203.2 (-1.64)	2.09 (0.01)	-100.48 (-0.81)	-178.14 (-1.49)
R^2	0.14	0.16	0.16	0.20	0.19	0.17	0.17	0.18	0.26	0.27
N	1464	477	234	316	437	1464	477	234	316	437

***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.

Table 10: Comparing Supervisory Ratings between Publicly Traded and Non-Publicly Traded Banking Organizations

BOPEC rating is regressed on public dummy, firm characteristics, time-effect dummies (not reported), and Federal Reserve District dummies (not reported). Robust t-statistics are in parentheses.

	All Obs.	Size 1	Size 2	Size 3	Size 4	All Obs.	Size 1	Size 2	Size 3	Size 4
Public ownership	0.10*** (2.86)	0.02 (0.37)	0.12 *** (2.10)	0.21*** (2.78)	0.32*** (3.28)	0.09** (2.47)	0.02 (0.36)	0.09* (1.68)	0.18** (2.37)	0.25*** (2.67)
Log of total assets	-0.05*** (-2.91)	0.01 (0.33)	-0.03 (-0.24)	-0.04 (-0.28)	-0.30*** (-2.16)	-0.07*** (-4.03)	-0.01 (-0.17)	-0.01 (-0.11)	-0.10 (-0.66)	-0.35*** (-2.70)
Total loans to total assets						0.93*** (8.08)	0.72*** (2.90)	1.18*** (5.35)	0.90*** (4.46)	0.94*** (5.43)
C&I loans to total loans						0.18 (1.34)	-0.09 (-0.36)	-0.15 (-0.54)	0.31 (1.29)	0.45** (2.13)
Consumer loans to total loans						-0.54*** (-4.05)	-0.44* (-1.84)	-0.39 (-1.58)	-0.49** (-2.21)	-0.76*** (-3.14)
Fee income to total income						1.38*** (5.78)	1.39*** (3.87)	0.63* (1.82)	1.28*** (3.30)	2.17*** (4.28)
Core deposits to total assets						-0.26* (-1.81)	-0.42 (-1.52)	-0.26 (-0.98)	-0.44* (-1.70)	-0.19 (0.2389)
Large CDs to total assets						0.86*** (3.29)	1.32*** (3.17)	0.72 (1.46)	0.39 (0.75)	0.89** (2.12)
R^2	0.12	0.13	0.14	0.14	0.15	0.17	0.18	0.19	0.18	0.23
N	9403	2532	1821	2487	2563	9403	2532	1821	2487	2563

***, **, * indicate significance at the 1%, 5%, and 10% level, respectively.