Bank Size, Credit and the Sources of Bank Market Risk

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Abstract:

In the first of three papers examining bank risk, we examine equity and loan portfolio characteristics of publicly-traded bank holding companies. Unlike the pattern for non-financial firms, we find that betas of large banks are two to five times greater than the betas of small banks. In explaining this, we note that regulation imposes an effective cap on banks' equity volatility. Because the portfolios of small banks are less diversified, this cap has a greater effect on small banks than large banks. But we reject the hypothesis that small banks lower their equity volatility through lower leverage. Instead, we find that the reduced ability of small banks to diversify forces them to either pick borrowers whose assets have relatively low risk or make loans that are backed by relatively more collateral.

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I. Introduction

This paper investigates the relationship between firm size and equity risk for publicly traded commercial banks. The results reveal that regulation affects the lending and investment choices of small banks differently than it affects these choices for large banks. The systematic risk of bank equity returns is positively related to bank size. The median beta for very small banks (those in the smallest decile of market capitalization of NYSE non-financial firms) is 0.4 while the median beta for very large banks (those in the largest decile) is 1.2. These differences in systematic risk are a consequence of differences in lending behavior. Small banks appear to make safer loans than large banks. As a result, individual loans at small banks exhibit less sensitivity to market movements (and other risk factors) than large bank loans. However, due to small banks' inability to diversify, the total equity risk at large and small banks is the same.

The cross-sectional variation in banks' betas differs substantially from the corresponding cross-sectional variation for non-financial firms. Chan and Chen (1988) estimate a correlation of -0.988 between the log of market capitalization and beta for all non-financial firms. High betas for small firms are consistent with the argument of Berk (1995) that investors place a discount on firms with high systematic risk. Roll (1988) finds a negative correlation between the size of nonfinancial firms and their idiosyncratic equity volatility, but casts doubt on the notion that diversification accounts for this pattern. The small firm stock returns from Fama and French (1993) are much more volatile than are the large firm stock returns. The median monthly equity volatility for the smallest decile of firms is 15.8% while for the largest decile is 7.2%.

There are a number of potential explanations for the cross-sectional relationship between equity risk and size in the banking industry. First, the banking industry is highly regulated and subject to any frictions that accompany this regulation. Second, banks have greater leverage than most non-financial firms. Third, lending at small and large banks may target different types of borrowers. For instance, Berger et al. (2001) found that large banks are better at evaluating 'hard' information loan applicants and 'small banks are better at evaluating 'soft' information loan applicants. By 'soft' information they mean "informationally difficult credits, such as firms that do not keep formal financial records." Petersen and Rajan (2001) find empirical evidence that small banks lend to more localized firms than do large banks. However, none of these findings predict differences in the systematic risk of small versus large banks. One could imagine a story for some of these results that suggest differences in idiosyncratic risk but it is difficult to make a connection to differences in systematic risk. In fact, many studies implicitly assume that bank betas are invariant to size and use them as a measure of overall bank risk. Most recently Brooks et al. (1997) examine the mean and variance of bank betas as a means of gauging the risk of banks across different regulatory time periods. Their study was similar in spirit to previous studies by Allen and Wilhelm (1988), Aharony et al. (1988), Millon-Cornett and Tehranian (1989) and Dickens and Philippatos (1994).

This paper presents substantial circumstantial evidence that banks' response to regulation accounts for the equity-size relationships. One key indication is that there is little cross-sectional variation in total stock return volatility. Data reveal that other industries exhibit a far greater degree of dispersion in stock return volatility. A plausible

interpretation of this fact is that regulators effectively limit the exposure of equity holders (and hence subordinated claimholders such as depositors and the FDIC) to fluctuations in the value of each bank's assets. This paper demonstrates that idiosyncratic risk accounts for a larger share of total risk for small banks than for large banks, thus stocks of small banks must face less systematic risk than do stocks for large banks.

Presumably, small banks could lower their equity volatility by taking on relatively less debt than large banks. Yet this paper presents evidence that leverage (equity capital ratios) does not vary by bank size. Thus capital structure differences do not explain the lack of variation in stock return volatility. In addition, leverage ratios that do not vary by size are consistent with the aim of regulatory capital requirements. Another alternative explanation for the invariability of bank stock return volatility is that large banks lend to sectors of the economy that have high levels of systematic risk. However this paper presents evidence that variations in systematic risk at the different lending sectors are not related to the market beta of bank stock.

The explanation that best accounts for the observed size-risk relationships is that, on average, the individual assets held by small banks are less risky than the individual assets held by large banks. The loan charge-off and delinquency rates at large banks are higher than small banks. Cross-sectional regressions reveal that higher charge-off ratios cause higher bank betas. In these regressions, after controlling for charge-offs and other variables, size is no longer significant in explaining a bank's beta. An open question that is discussed is whether small banks garner lower risk loans because they have superior knowledge of borrower risk or whether small banks simply demand more collateral for each loan.

The next section describes the data. Section III examines the relationship between bank size and the stock-price risk. Section IV investigates why bank size and market beta move together. Section V concludes.

II. Data Description

An important aspect of previous studies of bank holding company stock returns is that most focus on a select, small group of bank holding companies for their sample. These bank holding company samples are typically the largest and most easily identifiable as publicly-traded bank holding companies. For instance Brooks et al. (1997) have a sample of "eighteen different depository institutions"; Bundt et al. (1992) look at "twenty-seven large bank holding companies traded on the NYSE or AMEX"; and Allen and Wilhelm (1988) have '38 Federal Reserve member banks, 19 savings and loans, and 16 nonmember banks' in their sample. This study makes use of an original dataset which maps the Federal Reserve Y9C bank holding company database to the CRSP tapes[1]. For every quarter from 1986:2 until 2003:4 a list of bank holding company names, their corresponding asset values and Y9C identifier is created from the Y9C database. This list is then merged with a list from compustat of every publicly-traded company name, their assets and cusip identifier. If a match is found by bank name and asset value the bank is included in the sample as a publicly-traded bank holding company. These quarterly lists are then merged with CRSP via cusip number using the CRSP-Compustat merged database. For each year this yields a much larger cross-sectional sample than previous studies which normally examine fifty or less bank holding companies. The

[1] The creation of this dataset was largely done at the Federal Reserve Bank of San Francisco by Ryan Stever, Judy Peng and Jose A. Lopez. While every effort was made to make a complete mapping between the Y9C database and CRSP, we cannot be completely certain that every publicly-traded bank holding company was mapped. We do feel confident that the dataset is at the least representative of the universe of publicly-traded bank holding companies. All errors are mine alone.

dataset has at least 339 publicly-traded BHCs at each point in time. In addition, these BHCs range in size from American Bancorporation at $31 million in book assets (200 employees) to Citigroup at $1.26 trillion in book assets (over 280,000 employees). This cross-sectional range in publicly traded bank holding company size is important in identifying and examining relationships between BHC size and equity characteristics that previous studies may have missed.

In presenting evidence on bank stock return characteristics there are a number of measures that need to be estimated such as: beta, idiosyncratic risk, size, and total stock return volatility. Total stock return volatility for bank *i* in year *t* is measured as the standard deviation of monthly stock returns from July of year *t-3* to July of year *t*. Following common industry practice individual monthly bank stock returns are calculated from CRSP (Campbell, Lo, and MacKinlay; 1997).

Beta and Fama-French factor loadings are estimated for each bank *i* in year *t* by running two regressions. The first is monthly stock returns minus the risk free rate from July of year *t-5* through July of year *t* on the market return over the risk free rate for the corresponding time period (the coefficient estimate of the market defines beta). The second regression is the same monthly stock returns on the Fama-French factors: the excess market returns, the high-minus-low portfolio and the small-minus-big portfolio[2]. The market is defined as the CRSP value-weighted index of all NYSE, AMEX and NASDAQ firms. Idiosyncratic risk in this study is defined as the standard deviation of the fitted errors from the Fama-French three factor regression. The standard deviation of the fitted errors from the CAPM regression was also used as a definition of idiosyncratic

[2] Fama and French's Benchmark factors were downloaded from http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html#Research

risk and all of the results are robust to either definition. It is required that each bank *i*, time *t* observation has at least 36 months of stock returns available, otherwise the observation is discarded.

While the CAPM (and Fama-French model) is a static model, a bank's systematic risk may change through time. Even though betas estimated in each year have overlapping data samples we require a new beta each year in order to capture any time variation of a bank's systematic risk. This leads to a modeling difficulty – it is implicitly assumed that the last five years of data give an unbiased estimate of a bank's beta. This requires that the beta of the bank did not change over the last five years. Since we are estimating betas for every year this leads to an assumption that beta is constant across all years. We follow the method used in Green et al (2001) by interpreting a bank's beta as changing slowly through time and that while there will be a bias in estimating beta, this bias is minimal given the fact that we want to capture the dynamic aspects of beta through time.

An alternative approach would be to estimate beta based on observations for a single year using daily data. The problem with this approach is that our estimates of beta will vary significantly due to small sample estimation noise rather than due to changes in systematic risk. Increasing the length of time that is used to estimate beta has the advantage of less noise but the disadvantage of obscuring variation due to changes in systematic risk. Different sample periods (10 years to 1 year) were used and the results are robust to the frequency chosen.

The bank *i*, year *t* stock data are combined with bank *i*, December of year *t* balance sheet and loan data from the Y9C database. Loan variables are scaled by total

loans and any other assets are scaled by total assets. Book-to-market is defined as book equity capital (from the Y9C data) divided by market capitalization (from CRSP). An economy wide price-to-earnings ratio is used in some of the time-series regressions discussed later. This price-to-earnings ratio is defined as a 10 year rolling average of all publicly-traded firms' price-to-earnings ratios and is taken from Robert Schiller's website[3].

This study also requires data on loan charge-off and delinquency rates. Data on loan default rates is taken from the Federal Reserve's quarterly release "Charge-Off and Delinquency Rates on Loans and Leases at Commercial Banks". Unfortunately this release does not do a complete break down of delinquency rates by size of commercial bank. This release does however break down delinquency / charge-off rates into two size categories – 100 Largest Banks and All Other (Small). Within each of these size categories delinquency / charge off rates are reported for 10 different loan categories: All Real Estate, Residential Real Estate, Commercial Real Estate, All Consumer, Credit Cards, Other Consumer, Leases, Commercial and Industrial (C&I), Agricultural, and Total.

Calculating individual bank loan delinquency rates from the Federal Reserve Y9 database is not a straight-forward process. Banks do not directly report delinquent loans. A bank first makes allowances for loan losses, then once a loan is deemed delinquent, the loan is 'charge-offed' from the allowances category. Finally a portion of the loan may be recovered, the bank can then add back the recovered amount to the loan loss allowance category. The Federal Reserve's quarterly release does not reveal how their delinquency

[3] http://aida.econ.yale.edu/~shiller/data.htm has downloadable stock market data used in Schiller's book "Irrational Exuberance".

rate is calculated. They do, however, report a description of how charge-off rates are calculated without referring specifically to any variables in the y9 database. The following is taken from the Federal Reserve Board website…

> Charge-off rates for any category of loan are defined as the flow of a bank's net charge-offs (gross charge-offs minus recoveries) during a quarter divided by the average level of its loans outstanding over that quarter. Charged-off loans are reported on schedule RI-B and the average levels of loans on schedule RC-K.

Thus charge-off rates as a fraction of total loans are calculated for each BHC in each year as charge-offs (reported as item BHCK4635 in the Y9 database) minus recoveries (BHCK4605) divided by total loans/leases (BHCK2122).

Although this study refers to 'large' and 'small' banks as distinct groups there is no dividing line which defines a bank as large or small. The relationship between bank size and beta is examined as continuous rather than discrete. Following Chan and Chen (1988) and Fama and French (1993) size in year t is measured as the log of market capitalization for bank i on July 31 of year t. In order to form size portfolios and present summary statistics by bank size, each year the sample is divided into 10 size deciles. The deciles are created by sorting the NYSE banks by market capitalization and estimating decile breakpoints based on these banks. All banks (including those in AMEX and NASDAQ) are then allocated into each of these deciles based on the NYSE breakpoints. Estimating the breakpoints using NYSE banks avoids swamping all of the size deciles with small banks (the number of small banks is far greater than the number of large banks). For purposes of comparing this study with previous studies, the size breakpoints are also estimated by sorting all NYSE non-financial firms by market capitalization. Again each bank is allocated into a size decile using the NYSE non-financial firm breakpoints. Table I presents summary statistics of the bank holding company sample

from year 2000 based on both definitions of the size decile groups. Table I reveals that when using NYSE non-financial firm breakpoints there are 11, 14 and 19 banks in the largest three deciles while using NYSE bank only breakpoints there are 7, 9 and 8 banks in the largest three deciles. Since the NYSE non-financial firm breakpoints result in a more balanced grouping (and therefore more reliable estimates for the larger deciles) further results in this paper are reported using these breakpoints. However all results are robust to either definition of size decile.

III. Bank Equity Characteristics

This section describes the relationship between bank size and equity risk. First, differences between systematic risk (market beta) and idiosyncratic risk at large and small banks are documented and tested. Evidence is given that these differences are not caused by differences in equity capitalization. Second, circumstantial support is given that regulators place an implicit cap on the level of total equity risk at banks regardless of bank size. Tests show that the standard deviation of monthly stock returns does not vary by bank size. A comparison of cross-sectional dispersion in the volatility of stock returns at banks and other industries is made revealing that banks have remarkably little variation in total equity risk. Finally, it is shown that as a side effect of this regulatory environment, small banks have a much greater proportion of their equity volatility coming from idiosyncratic risk than from systematic risk.

Table II presents median bank stock return characteristics by bank size decile. For each variable the median is calculated for each size decile in years 1986 to 2003 and the median over these years is reported. Beta, as estimated from the CAPM and the Fama-French three factor model, increases nearly monotonically by size decile. The

smallest size decile has a CAPM beta of 0.36 while the largest has a CAPM beta of 1.22. There is no specific pattern by size to the standard deviation of monthly stock returns. The fourth size decile has the smallest equity volatility with 7.19% while the first and tenth size deciles have equity volatility of 7.77% and 8.59% respectively. Idiosyncratic risk falls with bank size. The group with the largest root mean squared error from the Fama-French three factor regression is the first size decile. Size deciles seven through ten have the smallest idiosyncratic risk.

These relationships are made more formal by performing annual cross-sectional (unequal variance) difference of mean tests between large and small banks equity characteristics. For the purpose of these tests large banks are defined as those in size deciles 7, 8, 9, and 10 while small banks are defined those in size deciles 1,2,3, and 4. For the first series of tests the null hypothesis is that beta (from the CAPM) at small banks is greater than the beta of large banks. This null hypothesis is rejected every year. For the second series of tests the null hypothesis is that the root mean squared error from the Fama-French three factor regression at large banks is less than at small banks. The null is again rejected in each year. For the final cross-sectional test the null hypothesis is that the standard deviation of monthly stock returns at large banks is equal to the standard deviation of monthly stock returns at small banks. In all of the years except 1996 to 1998 and 2000 to 2003 the null is accepted. In 1996 to 1998 the equity volatility at large banks is significantly smaller than at small banks and in 2000 to 2003 the opposite occurs – large banks have significantly greater equity volatility. Table III reports the results of these tests.

What role does regulation play in these relationships? The fact that stock return volatility does not vary by bank size is one piece of evidence that regulators impose limits on equity risk. If regulators enforce restrictions on the level of banks' equity volatility – either explicitly or implicitly – then one implication would also be that the cross sectional dispersion in bank equity volatility should be smaller than that for unregulated firms. In order to test this hypothesis the standard deviation of monthly stock returns is calculated for all non-financial firms in the CRSP database (in the exact same manner as it was calculated for the banking industry). Firms are then divided into industry groups based on SIC code[4]. Levene F-Tests for equality of variance between the banking and the other industries are conducted on the time series (1986 to 2002) of cross-sectional variances of the standard deviation of monthly stock returns. The banking industry has significantly less cross-sectional dispersion of equity volatility than any of the other industries. Indeed the mean dispersion from 1986 through 2005 in the banking industry is 2.66% while all the other industries have a mean standard deviation of equity volatility of at least 8.32%! For the retail trade industry, the industry closest in size to the banking industry (5,007 firm-year observations versus 4,116 firm-observations respectively), the F-Statistic is 9.92 which rejects the null of equal variance in equity volatility at any significance level. Table IV reports annual dispersion in the standard deviation of monthly stock returns by industry and the corresponding F-statistics testing the equality of variance to the banking industry.

[4] The following industry definitions are used for all publicly traded companies: Mining – SIC code between 1000 and 1499, Construction – SIC code between 1500 and 1999, Manufacturing – SIC code between 2000 and 3999, Transportation/Communication – SIC code between 4000 and 4999, Retail Trade – SIC code between 5200 and 5999, Service – SIC code between 7000 and 8999, Mining – SIC code between 9000 and 9999.

This evidence suggests that regulation imposes restrictions on the equity volatility or total risk of banks. If there is a cap on equity volatility and small banks are less diversified than large banks then it follows that they will be forced to deal with superfluous idiosyncratic risk. It remains to be shown that the portfolios of small banks are less diversified than the portfolios of large banks. There are a number of different ways large banks achieve superior diversification. Consider a simplified model of a bank. The bank's only assets are N different loans. Each loan has returns that are systematic and idiosyncratic. Let the beta of loan i be denoted β_i and denote the market value of each loan at time t as $V_{i,t}$. Then it follows that the beta of the bank's total loan portfolio will be

$$\beta_p = \frac{\sum_{i=1}^{N} V_{i,t}\beta_i}{\sum_{i=1}^{N} V_{i,t}}$$

and if the total return of the bank's assets are generated by the following process

$$R_{A,t} = \beta_P R_{M,t} + \varepsilon_I$$

then the bank's total (asset) risk is then

$$\sigma_A = \beta_P \sigma_M + \sigma_I$$

Now assume that the idiosyncratic component of each loan held by the bank is independent (a strong assumption and one that will be dropped), then the idiosyncratic component (ε_I) of the bank's loan portfolio has mean zero and variance

$$\sigma_I^2 = \frac{\sum_{i=1}^{N} V_{i.t}\sigma_i^2}{\left(\sum_{i=1}^{N} V_{i,t}\right)^2} \text{ and when } V_{i,t} = V_t \text{ for all i } \sigma_I^2 = \frac{\sigma_i^2}{N}$$

Thus one way a bank can lower idiosyncratic volatility (and thus total volatility) is to simply increase the number of loans it holds.

Now consider the case where each loan again has the same value and all loans have a correlation to each other of ρ. Now the idiosyncratic risk of the bank's assets is given by

$$\sigma_I^2 = \frac{\sigma_i^2}{N} + \frac{N-1}{N}\rho\sigma_i^2 \approx \frac{\sigma_i^2}{N} + \rho\sigma_i^2$$

Finally keep the same assumptions as above except that there are two types of loans, A and B. Type A loans have correlations with each other of ρ, type B loans also have correlations with each other of ρ, but a single type A loan and single type B loan have correlation of $\rho_{A,B.}$ Then the bank's idiosyncratic asset return is given by

$$\sigma_{I,P}^2 = \frac{\sigma_i^2}{N} + \frac{(N_A(N_A-1)+N_B(N_B-1))}{N^2}\rho\sigma_i^2 + 2\frac{N_A N_B}{N^2}\rho_{A,B}\sigma_i^2$$

$$\approx \frac{\sigma_i^2}{N} + \frac{N_A^2+N_B^2}{N^2}\rho\sigma_i^2 + 2\frac{N_A N_B}{N^2}\rho_{A,B}\sigma_i^2$$

$$= \frac{\sigma_i^2}{N} + \rho\sigma_i^2 + 2\frac{N_A N_B}{N^2}(\rho_{A,B}-\rho)\sigma_i^2 \le \frac{\sigma_i^2}{N} + \rho\sigma_i^2 \quad \text{if } \rho_{A,B} \le \rho$$

Thus if a bank can choose to make loans in either group or both the total idiosyncratic risk of the bank will be less whenever a bank has more types of loans to choose from. Keeping this in mind it is important to note that regulators (state and federal) enforce lending limits on all banks that declare that banks may not make loans in total to any single borrower greater than ten percent of bank equity capital and surplus. In addition there are other laws which essentially prohibit small banks from lending to large firms[5].

[5] For example see California State Law on lending limits at http://www.leginfo.ca.gov/cgi-bin/displaycode?section=fin&group=01001-02000&file=1220-1239.

However, it is altogether common that large banks make loans to both large and small firms. Thus large banks in essence, have a larger pool of firms in which they may lend and thus a larger universe than small banks in which to diversify. Our simple model shows us that there are two ways that large banks can lower their total idiosyncratic risk and small banks cannot - large banks will have both a larger number of loans and have more groups to choose from in making loans.

An empirical implication of large banks' superior loan diversity is that a portfolio of large banks should not exhibit a reduction in idiosyncratic risk over one large bank's idiosyncratic risk as much as a portfolio of small banks reduction in idiosyncratic risk over one small bank's idiosyncratic risk. In other words if small banks have a greater proportion of their risk coming from idiosyncratic risk then a portfolio of small banks should eliminate the added idiosyncratic risk and result in less total risk. If large banks are fully diversified then a portfolio of large banks should have roughly the same idiosyncratic risk as a single large bank. This implication is tested by forming annual size portfolios using the size deciles described earlier. Monthly stock returns for each annual size portfolio are calculated by taking the equally-weighted mean stock return of all banks within each size decile. Finally regressions of 5 years of monthly portfolio returns on the three Fama-French factors are run for each annual size portfolio. These regressions yield factor loading estimates and fitted residuals. As with individual banks, the idiosyncratic risk for each annual size portfolio is measured as the standard deviation of the fitted error terms from the Fama-French regression. Since the sample spans 1986 to 2003 and each year has 10 different size portfolios, in total 180 portfolio regressions are run. Table V reports the mean estimates, by size portfolio, of these annual

regressions. One obvious fact is that the small bank size portfolios exhibit less idiosyncratic risk than the large bank size portfolios. The mean root mean squared error from the Fama-French regressions is 2.4% for the smallest decile and 3.8% for the largest decile. Total risk also increases by bank portfolio size from a low of 3.74% for the smallest size decile to a high of 6.96% for the largest size decile. Recall that prior to portfolio formation idiosyncratic risk decreased with size and total risk was constant across size. The results in Table V give strong evidence that small banks hold portfolios with a higher proportion of idiosyncratic risk than do large banks. Table V reveals that when small banks diversify their loan portfolios the resulting total risk is less than when large banks fully diversify.

This section described in detail differences between systematic risk (market beta) and idiosyncratic risk at large and small banks. Beta is positively correlated with bank size. Idiosyncratic risk is negatively correlated with bank size. Table I shows us that equity capital does not vary by bank size thus these differences are not caused by differences in equity capitalization at large and small banks. Support was given for implications of an implicit cap on the level of total equity risk by regulators. Tests show that the standard deviation of monthly stock returns does not vary by bank size. A comparison of cross-sectional dispersion in the volatility of stock returns at banks and other industries show that banks have remarkably little variation in total equity risk. Evidence was given that of this total risk, small banks have a higher proportion coming from idiosyncratic risk than large banks.

IV. The Correlation of Bank Size and Market Beta

This section addresses the question of why bank size and market beta move together. A simple model will be presented in order to develop the relationship between the beta of individual loans and assets held by the bank and the underlying asset risk of the borrower. This model reveals four possible reasons for why the beta of small banks is smaller than the beta of large banks. First, large banks may hold less equity capital (more leveraged) than small banks. As indicated before there is no evidence of this and in regressions of beta on controls and equity capital, equity capital is insignificant in explaining beta. Second, it may be that large and small banks make similar types of loans with similar lending terms (such as collateral, information, etc.) but that small non-financial firms simply have smaller asset betas than large non-financial firms. If this is the case and small banks lend exclusively to small firms, then even if all other aspects of each loan are identical to loans at large banks, small banks will have a smaller beta than large banks. However, there is no support that small non-financial firms have smaller asset betas. Third, large banks may lend to different sectors than small banks. For instance, small banks may make relatively more credit card loans than small banks. If credit card borrowers have lower market betas than other borrowers than it follows that small banks have smaller market betas. This hypothesis is tested by regressing bank market betas on loan portfolio characteristics and bank size. If size is insignificant in this regression then the size phenomena is explainable by the fact that banks of different size lend to different sectors. Fourth, small banks may lend to similar sectors and asset types as large banks but they make less risky loans. They may require more collateral per loan or have superior information on borrower risk. Support for this hypothesis is found by

examining loan charge-off and delinquency rates at large and small banks. Small banks charge-off less and have less delinquent loans than large banks. This is especially true for types of loans in which the bank can require more collateral. Finally we test whether loan charge-offs at banks is superior to size in predicting bank market beta. A cross-sectional regression is run of average bank beta on the average of loan portfolio characteristics, average size and average loan charge-offs. Average loan charge-offs is significant, size is not thus giving strong evidence that small banks make loans of similar types but less risk per loan than large banks.

The first relationship to examine is the relationship between leverage, asset beta and equity beta. In general, the value of a firm is just the aggregate value of each of the firm's investments. It then follows that the beta of a firm's equity should reflect a weighted average beta of each of the firm's projects and the firm's debt. This is most easily seen by considering a firm's assets as a portfolio of debt and equity – that is assets equals debt plus equity. One can then solve for the beta of the firm's equity and find:

$$\beta_E = \frac{\beta_A - \left(\frac{D}{D+E}\right)\beta_D}{\frac{E}{D+E}} \qquad (1)$$

where β_E is the beta of the firm's equity, β_A is the beta of the firm's assets, D is the value of the firm's debt and E is the value of the firm's equity. While this formula may be helpful for most firms, for banks it is difficult to interpret. Banks are, by the nature of their business, highly leveraged. Even if leverage is important in determining the beta of a bank's equity, the relationship is made even more obscure by the fact that a bank's capital structure is highly governed and monitored by the regulations established by the Bank for International Settlements (BIS) which the U.S. adopted as their capital

requirements in 1989. Thus there is little fluctuation in the capital structure of most publicly traded banks. Referring back to Table I we can see that capital structure does not vary systematically by bank size.

Equation 1 reveals that the beta of each bank's assets (for banks this can be interpreted as loans) will also be a factor in determining a bank's equity beta. Thus if large banks select loan portfolios that consist of assets that tend to have higher betas than those loans selected by small banks, cateris parabis large bank's would have higher equity betas. Thus the second hypothesis to test is: after controlling for leverage and the systematic differences in the types of assets to which small and large banks lend (respectively), there is no systematic relationship between a bank's size and equity beta. If this hypothesis is rejected, then even after controlling for portfolio selection and leverage of the bank, bank size is still related to a bank's equity beta. Thus both hypotheses – that leverage explains the market beta-size relationship and sector lending explains the market beta-size relationship - are rejected if in the following regression size is significant:

$$\begin{aligned}\beta_{i,t} &= b_{0t} + b_{1t}(size_{it}) + b_{2t}(equity\ capital_{it}) + \bar{b}_{3t}(loans\ held\ in\ each\ category_{it}) \\ &\quad + b_{4t}(assets\ in\ each\ class_{it}) + b_{5t}(controls) + \varepsilon_{it}\end{aligned}$$

This regression is run for every year of the sample. The loan categories used are: construction and land development loans; real estate loans secured by farmland; loans to other depository institutions; real estate loans secured by nonfarm, nonresidential properties; loans to finance agricultural production; commercial and industrial loans; credit card loans; loans to foreign governments and other official institutions; and 'other' loans. Each of the loan categories is divided by bank total assets in order avoid capturing size effects and only capture changes in systematic risk due to relative differences in

lending. In addition to loans, a bank's assets consist of investments and cash. Thus a bank's beta is also determined by the types of investments it holds. For instance, a bank may want to hedge against the risk of interest rates falling. The bank can then purchase an inverse floater option to hedge against this risk. Thus, if large banks tend to hold more of these types of derivative contracts it may have an effect on the beta of large banks which is not present in the beta of small banks. Thus it is necessary to control for any of these trading contracts which a bank may own. The FR Y9-C has information on individual bank holdings of derivatives in interest rate contracts, foreign exchange contracts, equity security contracts and commodity and other contracts. The net exposure in each of these contracts is included in the annual regressions. In order to control for other investments, a bank's total trading assets, trading liabilities and maturity GAP[6] (as reported in the Y9-C) scaled by total assets are also included as controls in the regression. Table VII summarizes beta's hypothesized explanatory variables.

Appendix Table 1 reports the results of these regressions. In each year size is significant. The smallest size t-statistic is 4.76 in 1996. In 1989 through 1997 equity capital is negative and significant but in the other years it is either not significantly different from zero or positive and significant (1993 and 2003). Thus large banks do not have large betas because they hold less equity capital. Maturity GAP is positive and significant in all of the regressions meaning banks more exposed to interest fluctuations have higher betas. Trading assets is positive and typically significant (as expected). Some of the loan categories are significant and with the expected signs (for example real

[6] Following Flannery and James (1984) maturity GAP is defined as the absolute value of assets that mature or re-price within a year minus liabilities that mature or re-price within a year divided by the total assets of the BHC.

estate loans is typically negative and significant) but they are certainly not the main factor in determining beta as size is strongly significant.

As a robustness check the same hypotheses are tested by running the same regressions on the above explanatory variables except this time not including size in the regression. The errors are then calculated from this regression and regressed on each bank's corresponding size. If the size coefficient is significant both hypotheses are rejected. This second test is superfluous and is included only to demonstrate the robustness of the results. Although not reported in a table the null hypotheses are again rejected in the alternative test. The size t-statistics in these tests are again all greater than four.

The annual regressions can also be grouped together to make one panel regression. Due to the changes in the FR Y9-C database over the last 17 years we are not able to run one panel regression for our entire 18 year sample (1986-2003). The data on derivative contract holdings and loans to other financial institutions are not available until 1996. The data on construction and land development loans, real estate loans secured by farmland, real estate loans secured by nonfarmland, nonresidential properties, credit card loans, and 'other' loans are not available until 1991. Thus three different time periods are used: a) 1996-2003 b) 1991-2003 and c) 1986-2003. In order to control for macroeconomic conditions that may affect beta, the risk-free rate, the volatility of the risk-free rate and an economy wide price to earnings ratio are included in the panel regression. The volatility of the risk-free rate is measured as the standard deviation of the monthly risk-free rate over the 12 months within a given year *t*. The economy wide price

to earnings ratio is a ten year rolling average of all publicly-traded firms price to earnings ratio taken from Robert Schiller's website.

Table VII reports the results from the panel regression. Due to the nature of the panel data used, t-statistics are estimated using Rogers standard errors and allow clustering of errors by individual bank holding companies (Petersen, 2005). Size has a t-statistic of 16.66 – thus the null hypotheses are rejected. The risk-free rate causes banks to have high betas as evidenced by the positive coefficient on the risk-free rate and a t-statistic of 27.02. As one would expect, a more volatile risk-free rate also causes banks to have higher betas. Finally when the economy wide price to earnings ratio falls bank beta tends to fall as well.

Finally Table VIII reports the panel regression test results when size is excluded from the initial regression. As a reminder the residuals from the panel regression are regressed on bank size in order to perform an even stronger test to determine if, after for controlling for hypothesized explanatory variables, size is still significant in determining a bank's beta. Table VIII reveals that in the panel regression with all of the available variables (Sample A) the t-statistic on size is still significant at over the 99% significance level for the t-distribution.

In equation 1 the asset beta of banks is an important factor in determining a bank's equity beta. It has been shown that bank lending to different sectors does not cause the beta-size relationship. However an alternative hypothesis involving asset beta is the possibility that the asset beta at large non-financial firms is naturally higher than at small non-financial firms. If small banks are forced to lend only to small firms then if small firms naturally have relatively low systematic risk, small banks would also have

less systematic risk. A priori there is no reason to believe that this is the case but it should be ruled out as a hypothesis. In order to test this hypothesis quarterly data from 1976 to 2002 is gathered from compustat on all non-financial firms' outstanding debt and market capitalization. For each quarter *j*, year *t* and non-financial firm *i* the standard deviation of monthly stock returns is estimated using data from CRSP from quarter *j*, year *t-3* to quarter *j*, year *t*. Then using the data on book value of debt, monthly equity volatility, the risk-free rate and market capitalization the total market value of each firm is estimated using the Merton model[7].

Every non-financial firm in compustat from 1976:1 to 2002:4 now has a quarterly series of estimated market value of assets. The quarterly return on assets for each of these firms is then defined as: $r_{i,A}$ = *(market value assets)*$_t$ */(market value assets)*$_{t-1}$ *-1*, *(t = the end of quarter date)*. The following regression is run for each firm using all of the firm's observations from 1976:1 to 2002:4.

$$r_{A,i,t} = \alpha_i + \beta_{A,i}(r_{m,t} - r_{f,t}) + \eta_{i,t}$$

where r_m and r_f are the market and risk-free rates (as defined previously) and η_i is mean zero noise.

Each non-financial firm now has an estimated asset beta ($\beta_{A,i}$). Each non-financial firm's market capitalization (for the purpose of portfolio formation) is defined as mean market capitalization over all the firm's quarterly observations on compustat from 1976 to 2002. The sample is then divided into size deciles using this measure of

[7] Merton (1974) uses a firm's data on book debt, market equity value, market equity volatility and the risk-free rate to solve for the market value of the firm's assets and asset volatility. This involves solving two simultaneous equations that are isomorphic to the Black and Scholes option pricing model with market capitalization equal to the option price, book debt equal to the strike price and the risk-free rate equal to the risk-free rate. The most familiar use of Merton's model is the first step in calculating Moodys-KMV's expected default frequency for each firm.

size. Again deciles are estimated using NYSE only firms to estimate breakpoints. For each size decile the mean and standard deviation of asset beta are calculated and presented in Table IX. The mean asset beta for the smallest decile is of non-financial firms is 1.13 while the largest decile's mean beta is .83. While these results are approximations to actual asset betas it does appear that asset beta is actually negatively correlated with firm size. Thus differences in non-financial firms' asset betas do not appear to cause small banks to have less systematic risk. Recall the reason for estimating non-financial firm betas was to investigate the possibility that small bank borrowers may have higher asset betas. If this is true and all other aspects of lending are the same and large and small banks then this would at least be a partial explanation to why small banks have small market betas. In fact given the results from Table IX one would expect that small banks would have more systematic risk than large banks.

Equation 1 detailed three ways a bank could lower their market beta. One way was to hold more equity capital, two was to lend to low beta sectors and three was to lend to firms with low asset betas. There is no evidence that small banks use any of these methods to achieve a low market beta. In order to gain a more thorough understanding of a bank's market beta it is necessary to consider what happens once a bank has chosen an asset to lend to - the beta of that position will be a function of the terms and size of the loan.

For example, consider Bank X and Bank Y. The Widget LLC is an all-equity firm that wishes to change it's debt to equity ratio. Widget's equity is currently worth $100 million. They go to both Bank X and Bank Y in search of a loan. Bank X is willing to offer Widget LLC a loan that has a face value equal to $30 million while Bank

Y is only willing to offer Widget LLC a loan that has a face value of $20 million. The loan Bank X is willing to make would most likely have a higher beta (and more idiosyncratic risk) than the loan Bank Y would make. Thus if Bank X makes all of their loans in this manner and Bank Y does the same, cateris parabis Bank X's equity would have a higher beta than Bank Y. Now this relationship is developed mathematically via the work of Galai and Masulis (1976).

Galai and Masulis develop a model that combines the option pricing model of Merton with the CAPM. They list a set of assumptions for which the CAPM and the option pricing model can be derived. What is of importance here is not the absolute truth of these assumptions or of the individual models but the relationship between the two which highlight the dynamics of equity and debt betas, leverage, and other facets of corporate structure.

Galai and Masulis begin with a CAPM world in which Equation 1 holds. In this world they then price European-type options using the perfect hedge methodology of Black and Scholes (1973) to derive

$$E = VN(d_1) - Ce^{-r_f T} N(d_2) \qquad (2)$$

where E is the value of a European call option, V is the current value of the corresponding underlying asset, σ^2 is the variance of the percentage returns of V, D is the exercise price, T is the time to expiration, r_f is the risk-free rate of return and N(x) is the standard normal cumulative density function. d_1 and d_2 are as usual:

$$d_1 = \frac{\ln(V/D) + (r_f + .5\sigma^2)T}{\sigma\sqrt{T}}$$

$$d_2 = d_1 - \sigma\sqrt{T}$$

Now, as in Black and Scholes (1973), the equity of a firm is viewed as a European call option on the firm's assets with strike price equal to the face value of the firm's debt. Galai and Masulis then use this partial equilibrium value of the equity to find the equilibrium value of the firm using the CAPM. Galai and Masulis state,

> "Given the current market value of the firm V, Black-Scholes tells us the equilibrium value of the equity; however, this does not require that V be the equilibrium value of the firm…"

So finally assuming a constant systematic risk of the firm's underlying assets (β_v), it is found in equilibrium that

$$\beta_E = N(d_1)\frac{V}{E}\beta_V \tag{3}$$

$$\beta_D = N(d_1)\frac{V}{D}\beta_V \tag{4}$$

From these relationships one finds that $\partial\beta_D/\partial V<0$, $\partial\beta_D/\partial C>0$ and $\partial\beta_D/\partial r_f<0$, while $\partial\beta_D/\partial\sigma^2$, $\partial\beta_D/\partial T$ can be either less than, equal to or greater than 0 respectively.

Galai and Masuli's model illuminates that when banks make new loans – besides what types of assets they lend to, the only unambiguous parameter they have left to work with in determining the β of individual loans is the face value of each loan. This leads to the hypothesis that small banks have less systematic risk than large banks due to cross-sectional variation in loan default risk (less collateral per loan).

As an example of how collateralization affects the beta of an individual loan consider a firm with a standard deviation of asset growth equal to 40% per year and asset value worth $100 million. If a bank offers this firm a five year loan of $40 million, the bank's resulting beta on this loan (assuming the bank has a 10% capitalization level) is 1.

Now if the same bank were to offer this firm a five year loan of only $29 million the bank's resulting beta would now be .6.

What are the implications of the null hypothesis that large banks make loans at lower collateralization levels than small banks? This hypothesis can be interpreted in a number of different ways. Collateral may mean a more thorough knowledge of the borrower's ability to repay or promised assets recovered by the bank in the event of a default. The most obvious way to test the hypothesis would be to gather individual loan data from small and large banks. This data would ideally identify the type of asset the loan is made to, the value of that asset, the loan amount and the status at expiration of the loan (default, recovery, etc.). This type of data, however, is not available.

One implication of the null is that, other things being equal, default rates should be higher at large banks than small banks. If large banks lend more aggressively and extend more credit than small banks, on average their loans should have a lower success rate. The first test of this hypothesis is to calculate mean delinquency and charge-off rates for each of the loan / size categories and then calculate a difference of means t-statistic. If the t-statistic is significant the null hypothesis is rejected and the conclusion is that large banks make riskier loans than small banks.

Table X reports the average loan default rates for the 100 largest commercial banks and small commercial banks. Table XI reports average charge-off rates for the same bank categories. Delinquency rates at large banks are higher than delinquency rates at small banks. For all the loans and leases banks make, the largest 100 have on average a .7% higher delinquency rate per quarter and a .3% higher charge-off rate per quater. Total charge-off rates at large banks are .28% greater than at small banks. Small banks

charge off .47% less commercial real estate loans per quarter and .36% less 'other consumer' loans than large banks. The only categories for which small banks do not have lower delinquency/charge-off rates is credit card loans, leases and C&I loans. Difference of mean t-tests for each of the loan categories reveals that large banks never have a significantly lower charge-off rate than small banks. The fact that credit card loans, leases and C&I loans are the only loans for which small and large banks have similar delinquency rates adds further (albeit informal) evidence to the fact that small banks require more collateral per loan. Credit card loans are the least likely for which small banks can require more collateral than large banks since credit cards inherently have zero collateral backing them. In addition, information on the risk of individual consumers is unlikely to vary from bank to bank. Thus when small banks do not have the ability to require more capital there is no difference between lending at small and large banks. For leases, the law dictates that the bank must retain ownership of the asset so that in this case the small bank loses the ability to change the collateral backing the loan. So it is not surprising that similar delinquency rates at small and large banks are observed for leases. The difference of mean results in Table XII reveals that the hypothesis that large and small banks have the same loan charge-off rates is rejected. Similarly, Table XIII reports the difference of means tests for loan delinquency rates. These results support the rejection of the null hypothesis.

Finally in order to show a more robust relationship between size, beta and loan delinquency rates a regression is run of market beta on loan delinquency rate, size and bank portfolio characteristics. If the coefficient on loan delinquency rate is significant the null hypothesis that large and small banks lend at the same collateralization rates is

rejected. There is a timing problem with this regression in the sense that it is unclear when beta should adjust to past, present or future charge-offs. That is, when do markets incorporate the risk of a loan into the equity characteristics of the bank. Since it is impossible to know the average duration of each bank's loan portfolio and when the risk of their loans unfolds it is impossible to know the appropriate time scale to run this regression. In addition there are cyclical components to charge-offs. There may be time periods where small banks have high loan delinquency rates but large banks do not. This will result in running an erroneous regression. The solution to these problems is to take the time average of beta, charge-offs and all of the other bank control variables and regress the time average of beta on the time average of the other variables. Since the hypothesis is a cross-sectional hypothesis this regression will give us an unbiased estimate of the relationship between beta, size and charge-offs. The null-hypothesis is again that banks, regardless of size, make loans of similar risk. Under the null hypothesis large banks and small banks will have similar loan charge-off ratios. When we regress mean beta on average loan charge-offs as a ratio of total loans, average bank assets, and other explanatory variables (used previously) the coefficient of loan charge-offs will be zero under the null. The regression to test the hypothesis is:

$$\begin{aligned}\overline{\beta}_i &= b_0 + b_1(\overline{size}_i) + b_2(\overline{equity\ capital}_i) + b_3(\overline{loans\ held\ in\ each\ category}_i) \\ &\quad + b_4(\overline{assets\ in\ each\ class}_i) + b_5(\overline{controls}) + b_6(\overline{ch\arg eoffs}_i) + \varepsilon_i\end{aligned}$$

The mean of each of the variables in the regression is taken from 1994 to 2003 (this is the longest time period for which all of the explanatory variables are available). It is required that each bank have at least four years of continuous observations to be included in the regression. Standard errors are Huber-White robust standard errors. Table XIV presents the results of this regression. The null hypothesis is rejected as the total charge-

offs t-statistic is 4.21. In addition the coefficient on size is positive but no longer significant (this is not the case if charge-offs is left out of the regression). Thus the factor that drives large banks to have higher systematic risk is the fact that they make riskier loans within each loan type. This regression also reveals (once again) that equity capital is not a factor in determining a bank's market beta. The coefficient is negative but is not significantly different from zero.

V. Conclusion

This paper has presented strong circumstantial evidence that regulators (and/or shareholders) place a limit on the total risk of each bank's assets regardless of size. Small banks have more risk inherent in their loan portfolio because they cannot diversify away idiosyncratic risk as well as large bank. This inability to diversify comes about a number of different ways – for example; less total loans held, less diversity in borrower type (they do not have access to large borrowers) and geographic restrictions (small banks tend to be more localized). Because their total risk is limited by regulation they must find a way to eliminate the superfluous idiosyncratic risk (which large banks do not have). Small banks do not accomplish this through equity capitalization or by lending to different sectors in the economy. While the type of loans (credit card, commercial, etc.) has been shown to affect a bank's market beta, after controlling for the loan sector each bank lends to, size is still strongly significant in predicting bank beta. Further, evidence suggests small bank borrowers do not have higher market betas than large bank borrowers. This was shown by constructing asset betas for all non-financial firms and finding that small non-financial firms (likely small bank borrowers) do not have higher asset betas. Small banks, however, do make 'safer' loans on average than 'large' banks.

This has the effect of reducing idiosyncratic risk (as desired) and substantially reducing systematic risk. These results suggest a possible explanation for the co-existence of large and small banks. Small banks are able to secure 'safer' loans (either due to their superior knowledge of borrower risk or borrower preference for small banks) but at the cost of less diversity in their loan portfolio. Further research needs to be done to determine not only how small banks secure less risky loans but also what role this plays in the equilibrium co-existence of large and small banks.

REFERENCES

Aharony, Joseph, Saunders, Anthony and Itzhak Swary, "The Effects of DIDMCA on Bank Stockholders' Returns and Risk," *Journal of Banking and Finance* 12 (1988): 317-331.

Akhavein, Jalal D., Allen N. Berger, and David B. Humphrey, "The Effects of Megamergers on Efficiency and Prices: Evidence from a Bank Profit Function," *Review of Industrial Organization* 12 (1997).

Allen, Paul R., and William J. Wilhelm, "The Impact of the 1980 Depository Institutions Deregulation and Monetary Control Act on Market Value and Risk: Evidence from the Capital Markets," *Journal of Money, Credit and Banking* 20:3 (August 1988): 364-380.

Berger, Allen N., "The Profit-Structure Relationship in Banking," *Journal of Money, and Banking*, 27 (May 1995a): 404-31.

Berger, Allen N., Diana Hancock, and David B. Humphrey, "Bank Efficiency Derived from the Profit Function," *Journal of Banking and Finance* 17 (April 1993): 317-47.

Berger, Allen N., and Timothy H. Hannan, "Using Measure of Firm Efficiency to Distinguish among Alternative Explanations of the Structure-Performance Relationship," *Managerial Finance*, (1996).

Berger, Allen N., and David B. Humphrey, "Megamergers in Banking and the Use of Cost Efficiency as an Antitrust Defense," *Antitrust Bulletin* 37 (Fall 1992): 541-600.

Berger, Allen N., David B. Humphrey, and Lawrence B. Pulley, "Do Consumers Pay for One-Stop Banking? Evidence from an Alternative Revenue Function," Working Paper, Department of Finance, Florida State University, Tallahassee, FL (November 1995).

Berger, Allen N., Nathan H. Miller, Raghram G. Rajan, and Jeremy C. Stein, "Does Function Follow Organizational Form? Evidence from the Lending Practices of Large and Small Banks," Working Paper, Federal Reserve Board, Washington D.C. (March 2003).

Berk, Jonathan, "A Critique of Size Related Anomalies," *Review of Financial Studies* 8 (1995): 275-286.

Bliss, Robert and Mark J. Flannery, "Market Discipline in the Governance of U.S. Bank Holding Companies: Monitoring vs. Influencing," NBER Working Paper 2001.

Brooks, Robert D., Faff, Robert W., and Yew Kee Ho, "A New Test of the Relationship Between Regulatory Change in Financial Markets and the Stability of Beta Risk of Depository Institutions," *Journal of Banking and Finance* 21 (1997): 197-219.

Bundt, Thomas P., Cosimano, Thomas F. and John A Halloran, "DIDMCA and Bank Market Risk: Theory and Evidence," *Journal of Banking and Finance* 16 (1992): 1197-1193.

Chan, K.C., and N. Chen. "An Unconditional Asset Pricing Test and the Role of Firm Size as an Instrumental Variable for Risk," *Journal of Finance* 43 (June 1988): 309-325.

DeJong, Douglas and Daniel W. Collins. "Explanations for the Instability of Equity Beta: Risk-Free Rate Changes and Leverage Effects," *Journal of Financial and Quantitative Analysis* 20:1 (March 1985): 73-94.

Diamond, Douglas W., "Financial Intermediation and Delegated Monitoring," *Review of Economic Studies* 51 (July 1984): 393-414.

Diamond, Douglas W., "Monitoring and Reputation: The Choice between Bank Loans and Directly Placed Debt," *Journal of Political Economy*, 99 (August 1991): 689-721.

Fama, Eugene F., and Kenneth R. French, "The Cross-Section of Expected Stock Returns," *Journal of Finance* 47 (June 1992): 427-465.

Flannery, M. J. and C. M. James, 1984, "Marker Evidence on Effective Maturity of Bank Assets and Liabilities," *Journal of Money, Credit and Banking* 16, 435-445.

Galai, Dan and Ronald W. Masulis, "The Option Pricing Model and the Risk Factor of Stock," *Journal of Financial Economics* 3 (1976): 53-81.

Green, Edward J., Jose A. Lopez and Zhenyu Wang, "The Federal Reserve Banks' Imputed Cost of Equity Capital," Working Paper, Federal Reserve Bank of San Francisco, San Francisco, CA (July 2001).

Grossman, Sanford and Oliver D. Hart, "The Costs and Benefits of Ownership: A Theory of Vertical and Lateral Integration," *Journal of Political Economy* 94 (August 1986): 691-719.

Hannan, Timothy H., "Bank Commercial Loan Market and the Role of Market Structure: Evidence from Surveys of Commercial Lending," *Journal of Banking and Finance*, 15 (February 1991): 133-149.

Krainer, John and Jose A. Lopez, "Incorporating Equity Market Information into Supervisory Monitorning Models," Working Paper, Federal Reserve Bank of San Francisco, San Francisco, CA (June 2002).

Merton, Robert C., 1974, "On the Pricing of Corporate Debt: The Risk Structure of Interest Rates," *Journal of Finance* 29, 449-470.

Million-Cornett, Marcia H., and Hassan Tehranian, "Stock Market Reactions to the Depository Institutions Deregulation and Monetory Control Act of 1980," *Journal of Banking and Finance* 13 (1989): 81-100.

Petersen, Mitchell A., 2005, "Estimating Standard Errors in Finance Panel Data Sets: Comparing Approaches," NBER and Kellogg School of Management Working Paper.

Petersen, Mitchell A., and Raghuram G. Rajan, "The Effect of Credit Market Competition on Lending Relationships," *Quarterly Journal of Economics*, 110 (May 1995).

Rhoades, Stephen A., "Market Share as a Source of Market Power: Implications and Some Evidence," *Journal of Economics and Business* 37 (1985): 343-63.

Stein, Jeremy C., "Information Production and Capital Allocation: Decentralized versus Hierarchical Firms," *Journal of Finance*
57 (October 2002): 1891-1920**.**

Table I
Sample Summary Statistics by Size Decile

Table 1 reports the median of various variables for year 2000 by size decile for all of the publicly-traded bank holding companies in our sample. Following Fama-French (1993) size deciles are created using only the banks/non-financial firms listed on the NYSE. Size decile bins are created in two ways: using all non-financial firms (thus replicating Fama-French size decile bins) and using only bank holding companies. Equity capital is equity capital reported in the Federal Reserve Y9-C database divided by total assets. Loans to assets is total loans reported in the Y9-C divided by total assets. Assets and market capitalization are reported in thousands of dollars.

	Using Only Banks for Size Decile Markers					Using All Firms for Size Decile Markers				
Size Decile	Number of BHCs	Equity Capital	Loans to Assets	Assets	Market Cap	Number of BHCs	Equity Capital	Loans to Assets	Assets	Market Cap
1	222	8.34%	0.681	$536,807	$59,002	136	8.44%	0.687	$378,376	$37,232
2	41	8.27%	0.661	$2,010,757	$314,543	62	8.44%	0.674	$939,090	$99,357
3	21	8.06%	0.625	$4,537,343	$589,694	40	8.04%	0.655	$1,593,474	$213,327
4	19	8.36%	0.673	$6,743,404	$1,123,735	25	8.27%	0.661	$2,269,726	$357,931
5	9	7.44%	0.681	$7,201,944	$1,494,942	17	7.96%	0.599	$4,340,846	$542,831
6	13	8.96%	0.705	$12,108,116	$2,028,830	13	8.36%	0.689	$5,454,388	$862,336
7	10	8.15%	0.712	$30,428,008	$3,870,157	22	8.10%	0.677	$8,593,502	$1,377,656
8	7	8.49%	0.721	$43,406,554	$7,019,527	11	9.13%	0.715	$15,401,100	$2,072,545
9	9	8.21%	0.533	$60,896,000	$17,063,971	14	8.15%	0.703	$32,549,708	$4,343,333
10	8	7.70%	0.564	$243,763,500	$51,378,973	19	7.98%	0.578	$81,530,000	$21,748,310

Table II
Characteristics of Stock Returns by Size Decile

Figure 1 reports the median of annual estimates by size decile for all publicly-traded bank holding companies in the sample from 1986 through 2003. Size deciles are created using only the banks/non-financial firms listed on the NYSE. These decile bins are created in two ways: using all non-financial firms (thus replicating Fama-French size decile bins) and using only bank holding companies. Standard deviation of equity return is the standard deviation of monthly stock returns. Beta is the estimated coefficient from annual regressions of the last 5 years of individual bank stock excess returns on the CRSP value-weighted index return. The Fama-French factors are the coefficient estimates from annual regressions of the last 5 years of individual bank stock excess returns on the three Fama-French factors and the FF residual standard deviation is the root mean squared error from this regression. Rm-Rf is the CRSP value-weighted index return minus the risk-free rate. HML is the Fama-French portfolio long 'high' book-to-market firms, short 'low' book-to-market firms. SMB is the Fama-French portfolio 'long' small firms, 'short' big firms.

	Using Only Banks for Size Decile Markers						Using All Firms for Size Decile Markers					
			Fama-French Factors						Fama-French Factors			
Size Decile	Std. Dev of Equity Return	Beta	Rm-Rf	HML	SMB	FF Residual Std. Dev	Std. Dev of Equity Return	Beta	Rm-Rf	HML	SMB	FF Residual Std. Dev
1	7.77%	**0.39**	**0.61**	0.66	0.38	7.39%	8.03%	**0.36**	**0.55**	0.62	0.34	7.72%
2	7.66%	**0.59**	**0.80**	0.69	0.50	6.87%	7.44%	**0.36**	**0.60**	0.70	0.39	7.07%
3	7.30%	**0.66**	**0.84**	0.68	0.49	6.44%	7.84%	**0.55**	**0.76**	0.73	0.46	7.31%
4	7.19%	**0.80**	**1.01**	0.67	0.41	5.96%	7.66%	**0.63**	**0.81**	0.64	0.51	6.80%
5	7.37%	**0.87**	**1.08**	0.73	0.32	6.13%	7.30%	**0.63**	**0.78**	0.72	0.54	6.50%
6	7.54%	**0.93**	**1.16**	0.79	0.31	5.94%	7.27%	**0.72**	**0.90**	0.69	0.53	6.26%
7	7.45%	**0.99**	**1.21**	0.64	0.21	5.69%	7.39%	**0.89**	**1.08**	0.67	0.32	6.09%
8	7.89%	**1.15**	**1.37**	0.67	0.04	5.97%	7.46%	**0.95**	**1.17**	0.78	0.31	5.85%
9	7.98%	**1.14**	**1.33**	0.67	-0.04	5.92%	8.00%	**1.05**	**1.30**	0.71	0.14	5.97%
10	8.59%	**1.25**	**1.49**	0.78	-0.21	6.06%	8.31%	**1.22**	**1.46**	0.73	-0.26	5.99%

Table III
Risk and BHC Size

Table III presents the results of annual difference of mean t-tests comparing equity characteristics of large and small banks. Large banks are defined as those banks in year t that have market capitalization greater than 70% of all non-financial firms' market capitalization while small banks are defined as those banks that have market capitalization less than 30% of all non-financial firms market capitalization. For each year/bank observation: systematic risk or beta is measured by a regression of 5 years of monthly excess stock returns on market (CRSP value-weighted index) excess returns, idiosyncratic risk is defined as the standard deviation of the residual from a regression of 5 years of monthly excess stock returns on the standard three Fama-French factors (excess market returns, HML and SMB); and total risk is measured by the standard deviation of 3 years of individual monthly stock returns. The systematic risk, idiosyncratic risk, and total risk columns reports the cross-sectional difference of mean t-statistic for each of these measures.

Year	# of Small BHCs	# of Large BHCs	Systematic Risk H_0: $\beta_{Large}>\beta_{Small}$ T-Stat	Idiosyncratic Risk H_0: $\sigma_{\varepsilon,Large}>\sigma_{\varepsilon,Small}$ T-Stat	Total Risk H_0: $\sigma_{Large}>\sigma_{Small}$ T-Stat
1986	91	31	7.57	-4.40	-0.05
1987	88	32	7.87	-4.36	-0.36
1988	88	32	7.01	-4.14	-1.01
1989	96	32	7.51	-3.01	0.18
1990	105	35	8.38	-3.19	0.58
1991	96	34	6.55	-2.79	-0.24
1992	96	31	10.41	-2.46	0.00
1993	86	33	10.26	-3.04	-0.63
1994	231	39	13.79	-3.39	-0.19
1995	244	37	12.27	-4.51	-0.92
1996	269	39	10.44	-6.53	-3.53
1997	261	38	8.91	-7.52	-3.89
1998	259	36	11.34	-8.31	-2.30
1999	269	36	13.46	-4.42	0.29
2000	303	34	9.42	-2.49	3.39
2001	235	26	7.77	-2.74	2.97
2002	307	30	7.41	-2.87	3.02
2003	309	29	6.47	-2.14	3.60

Table IV
Risk Dispersion in Various Industries

Table IV compares the cross-sectional monthly standard deviation of equity volatility in the banking industry to six other commonly studied industries. Industry assignments were made by SIC code. Equity volatility for each firm was measured as the standard deviation of monthly stock returns over year t, t-1 and t-2. For each industy / year the cross-sectional standard deviation of the monthly stock return standard deviation is reported in the corresponindg industry column / year row. The F-Statistic reported is a time-series difference of standard deviations test of the banking industry versus the industry in the corresponding column. *Df banking* denotes the number of observations in the banking industry whilie *df industry* denotes the number of observations in the comparable industry.

Year	Banking	Construction	Manufacturing	Mining	Retail Trade	Services	Transportation
1986	1.77%	6.95%	7.61%	9.34%	5.34%	7.92%	6.21%
1987	1.82%	6.78%	7.79%	13.09%	6.19%	8.46%	6.53%
1988	2.11%	4.86%	6.41%	11.17%	6.70%	7.41%	7.25%
1989	2.03%	6.09%	6.76%	7.90%	7.34%	9.80%	6.69%
1990	1.81%	4.92%	8.61%	9.73%	7.60%	10.58%	6.50%
1991	3.29%	9.13%	11.03%	9.63%	8.35%	11.12%	9.63%
1992	4.27%	16.33%	15.95%	11.42%	8.41%	12.39%	9.95%
1993	4.38%	10.19%	14.86%	13.17%	7.52%	10.79%	11.89%
1994	4.29%	10.58%	7.90%	11.20%	7.40%	8.18%	10.76%
1995	4.03%	11.40%	8.01%	8.07%	6.90%	8.70%	7.45%
1996	3.09%	5.99%	10.42%	9.38%	7.10%	10.06%	7.68%
1997	2.57%	6.34%	10.03%	9.84%	6.76%	10.16%	8.12%
1998	1.65%	11.40%	8.01%	10.65%	6.27%	9.07%	8.12%
1999	1.76%	12.95%	10.33%	10.61%	14.24%	13.18%	11.76%
2000	1.96%	9.85%	14.14%	8.63%	15.60%	15.66%	13.38%
2001	2.04%	16.11%	15.03%	7.21%	10.69%	16.01%	10.49%
2002	2.38%	9.01%	10.69%	6.55%	8.99%	12.41%	11.37%
F-Statistic		**12.37**	**14.22**	**12.54**	**9.92**	**17.37**	**10.99**
df banking		4,116	4,116	4,116	4,116	4,116	4,116
df industry		1,040	34,228	4,921	5,007	12,297	6,723

Table V
BHC Size Portfolio Risk Characteristics

Table V reports the mean of annual estimates from two seperate regressions of portfolio returns on excess market returns and the Fama-French factors. Each year bank size portfolios are created using size buckets from all non-financial firms. Size for all non-financial firms is measured with market capitalization and decile markers are estimated using only firms on the NYSE. Each bank is placed into the size bucket with the corresponding market capitalization decile boundaries. Monthly stock return series for each size portfolio are then formed by taking the mean monthly stock return over all banks within each size bucket. For each year the size portfolios have a time-series of monthly returns for which the standard deviation of returns is calculated, a beta is estimated by regressing excess returns on the market excess return and a regression using the Fama-French factors is also run. Below is the mean (across time) of each of these estimates for each size bucket.

			Fama-French Factors			
Size Portfolio	Std Dev of Portfolio Return	Portfolio Beta	Rm-Rf	HML	SMB	FF Residual Std. Dev
1	3.74%	0.58	0.70	0.75	0.70	2.40%
2	4.28%	0.71	0.84	0.77	0.61	2.20%
3	4.33%	0.73	0.87	0.78	0.52	2.28%
4	4.95%	0.82	1.00	0.73	0.47	2.70%
5	5.40%	0.89	1.11	0.73	0.41	3.02%
6	5.80%	0.97	1.19	0.81	0.36	3.12%
7	5.88%	0.99	1.20	0.67	0.25	3.17%
8	6.47%	1.14	1.40	0.72	0.11	3.82%
9	6.83%	1.20	1.41	0.68	0.06	3.82%
10	6.96%	1.28	1.48	0.81	-0.26	3.81%

Table VI
Variable Definitions

Table VI reports the variables used in the regressions of beta on bank holding company characteristics. Each of these variables is taken from the Federal Reserve's Y9C database on bank holding companies. The estimated annual betas for each bank (time t beta is estimated using the time t-5 to t excess bank and market returns) are then linked to these time t items from the Y9C database. In the regressions the loan variables are scaled by total loans and any other assets are scaled by total assets.

Variable Name	Definition	Variable Name	Definition
Size	Log of Market Capitalization	Other	Other types of loans
Construction	Construction and land development loans	IR Derivatives	Total notional amount of interest rate derivatives held
Farm	Real estate loans secured by farm land	FE Derivatives	Total notional amount of foreign exchange derivatives held
Bank	Loans to depository institutions	EQ Derivatives	Total notional amount of equity derivatives held
Real Estate	Loans secured by non-farm real estate	Equity Capital	Total equity capital
Farm Production	Loans to finance agricultural production and other loans to farmers	Leverage	Subordinated notes and debentures
U.S. C&I	Commercial and industrial loans to U.S. addresses	Maturity GAP	Assets that mature in 1 year minus liabilities that mature in 1 year
Foreign C&I	Commercial and industrial loans to non U.S. addresses	Trading Assets	Total trading assets
Credit Card	Credit card and related plan loans	Trading Liabilities	Total trading liabilities
Foreign	Loans to foreign goverments and official institutions		

Table VII
Full Sample Regression Results

Table VII reports the results of the panel regressions of beta on bank variables taken from the Federal Reserve's Y9C database and various macroeconomic control variables. Sample A is all publicly traded bank observations from 1986 through 2003, Sample B is all publicly traded bank observations from 1994 through 2003 and Sample C is all publicly traded bank observations from 1996 to 2003. To be included in the sample each bank must have at least 3 years of monthly stock return data. Beta is estimated for each bank each year by regressing the last 5 years of monthly excess stock returns on the excess market return (the market is the CRSP value-weighted index). The risk-free rate is taken from Ken French's website on risk-free rates. Economy P/E is a rolling 10 year average all publicly-traded firms' price-to-earning ratio taken from Robert Schiller's website on stock price data. The volatility of the risk-free rate is the annual standard deviation of the monthly risk-free rate. For each variable row 1 reports the coefficient estimate and row 2 reports the corresponding T-statistic.

Variable	Sample A	Sample B	Sample C
Intercept	-0.29	-0.59	-1.30
	0.14	0.14	0.07

Table VIII Continued on Next Page

Variable	Sample A	Sample B	Sample C
Size	0.09	0.10	0.13
	16.66	19.30	32.58
Real Estate	-0.47	-0.39	
	-4.64	-3.88	
Farm Real Estate	-1.48	-2.00	
	-3.48	-5.22	
Bank	-1.64		
	-2.32		
Nonres. Real Estate	-0.31	-0.36	
	-5.37	-6.03	
Farm Production	-0.96	-0.65	-1.43
	-2.79	-1.97	-6.09
C&I	-0.46	-0.45	-0.05
	-4.23	-4.15	-1.19
Credit Card	0.32	0.42	
	2.11	2.85	
Other Consumer	-1.10	-1.09	
	-9.05	-9.25	
Foreign	-1.98	-0.84	0.38
	-0.65	-0.33	0.66
Int. Rate Contracts	0.44		
	2.38		
FE Contracts	-0.02		
	-0.02		
Equity Contracts	0.06		
	0.05		
Equity Capital	0.30	0.16	0.21
	1.88	0.95	1.25
Debentures	-0.10	-0.31	0.50
	-0.15	-0.42	0.89
Maturity GAP	0.12	0.17	0.28
	3.47	5.05	9.35
Loans to Assets	-0.11	-0.05	-0.23
	-2.03	-0.98	-5.14
Trading Assets	1.15	0.81	
	2.71	2.25	
Trading Liabilities	-3.43	-1.97	
	-2.36	-2.70	
Risk Free Rate	0.10	0.09	0.07
	27.02	28.95	25.16
Book to Market	-0.11	-0.10	-0.06
	-8.24	-7.13	-5.47
Economy P/E	-0.01	-0.01	0.00
	-8.85	-8.60	-6.60
Volatility of Risk Free Rate	0.18	0.11	0.01
	6.85	5.50	0.29
Observations	2559	3236	4450
R-Squared	49.96%	46.49%	41.22%

Table VIII
Full Sample Test Results

Table VIII reports the results of the regression of the fitted errors from the panel regressions of beta on bank variables (not including size) taken from the Federal Reserve's Y9C database and various macroeconomic control variables on size. Sample A is all publicly traded bank observations from 1986 through 2003, Sample B is all publicly traded bank observations from 1994 through 2003 and Sample C is all publicly traded bank observations from 1996 to 2003. To be included in the sample each bank must have at least 3 years of monthly stock return data. The panel regressions are described in Table VII. Row 1 reports the estimated coefficients for the size and intercept variables and row 2 reports the corresponding t-statistic. Standard errors for the t-statistics are Rogers' robust standard errrors that allow for clustering by bank.

	Sample A			Sample B			Sample C		
	Intercept	Size	R-Squared	Intercept	Size	R-Squared	Intercept	Size	R-Squared
Estimate	-0.55	0.04	4.3%	-0.66	0.05	4.7%	-1.17	0.08	12.3%
T-Stat	-10.74	10.86		-12.64	13.03		-24.70	25.03	

Table IX

Table IX reports the mean and standard deviation of individual asset betas for each non-financial firm within the given size deciles. Size deciles are created by estimating breakpoints using only NYSE firms. Size is definied as the mean quarterly market capitalization of each firm from 1976 to 2002. Quarterly market asset values are estimated for each firm using the merton model (compustat provides the quarterly market cap, book debt and risk-free rate values and quarterly equity volatilities are estimated for each firm using the previous 3 years monthly stock return data). Each firm's time series of market value of assets is then used to estimate a quarterly return on assets series. Firm i's return on assets is then regressed on the CRSP value-weighted index minus the risk-free rate. The estimated coefficient on the market excess return is the firm's estimated asset beta.

	Size Decile									
	1	2	3	4	5	6	7	8	9	10
Number of Non-financial firms	9,401	4,200	3,594	3,471	3,290	3,354	3,621	3,922	4,109	4,577
Mean Asset Beta	1.13	1.09	1.08	1.03	0.99	0.94	0.85	0.85	0.80	0.83
Std. Dev. Asset Beta	0.95	0.92	0.97	0.90	0.87	0.79	0.59	0.68	0.68	0.76

Table X
Loan Delinquency Rates

Table X reports mean quarterly loan delinquency rates from 1985 to 2004 at large (100 largest) and small (all other) commercial banks. Delinquency rates are taken from the Federal Reserve's "Charge-Off and Delinquency Rates on Loans and Lease at Commercial Banks" quarterly release.

	Mean Delinquency Rates(%)			*Mean Delinquency Rates(%)*	
Loan Category	**Large Banks**	**Small Banks**	*Loan Category*	**Large Banks**	**Small Banks**
All Loans	3.93	3.22	Credit Card	4.61	4.66
All Real Estate	4.35	3.03	Other Consumer	3.33	2.45
Residential Real Estate	2.37	2.27	Leases	1.56	1.85
Commercial Real Estate	5.61	3.02	C&I	3.50	3.59
All Consumer	3.90	3.04	Agricultural	5.34	3.00

Table XI
Loan Charge-Off Rates

Table XI reports mean quarterly loan charge-off rates from 1985 to 2004 at large (100 largest) and small (all other) commercial banks. Loan charge-off rates are taken from the Federal Reserve's "Charge-Off and Delinquency Rates on Loans and Lease at Commercial Banks" quarterly release.

	Mean Charge-Off Rates(%)			*Mean Charge-Off Rates(%)*	
Loan Category	**Large Banks**	**Small Banks**	*Loan Category*	**Large Banks**	**Small Banks**
All Loans	1.01	0.73	Credit Card	4.23	4.79
All Real Estate	0.49	0.29	Other Consumer	1.12	0.77
Residential Real Estate	0.18	0.12	Leases	0.49	0.70
Commercial Real Estate	0.79	0.32	C&I	0.91	0.93
All Consumer	2.39	1.75	Agricultural	0.72	0.73

Table XII
Difference of Means Tests - Loan Charge-Off Rates

Table XII reports the results of difference of means tests for large and small bank quarterly loan charge-off rates. Charge-off rates are taken from the Federal Reserve's "Charge-Off and Delinquency Rates on Loans and Lease at Commercial Banks" quarterly release. The sample of loancharge-off rates is from 1985:1 through 2004:2.

	Total Loans / Leases			All Consumer	
	Large	*Small*		*Large*	*Small*
Mean	1.0147	0.7318	Mean	2.3850	1.7467
Variance	0.2046	0.0642	Variance	0.2881	0.2654
df	77		df	77	
t Stat	7.2374		t Stat	19.4143	
	All C&I			Commercial Real Estate	
	Large	*Small*		*Large*	*Small*
Mean	0.9133	0.9282	Mean	0.7898	0.3222
Variance	0.3145	0.2369	Variance	1.4764	0.1504
df	77		df	53	
t Stat	-0.3688		t Stat	4.0551	

Table XIII
Difference of Means Tests - Loan Delinquency Rates

Table XIII reports the results of difference of means tests for large and small bank quarterly loan delinquency rates. Delinquency rates are taken from the Federal Reserve's "Charge-Off and Delinquency Rates on Loans and Lease at Commercial Banks" quarterly release. The sample of loan delinquency rates is from 1985:1 through 2004:2.

	Total Loans / Leases			All Consumer	
	Large	*Small*		*Large*	*Small*
Mean	3.9278	3.2188	Mean	3.9044	3.0389
Variance	3.1029	1.1454	Variance	0.2108	0.1067
df	77		df	69	
t Stat	7.2608		t Stat	9.3637	
	All C&I			Commercial Real Estate	
	Large	*Small*		*Large*	*Small*
Mean	3.4999	3.5873	Mean	5.6106	3.0231
Variance	3.1738	1.5301	Variance	29.3651	4.0261
df	69		df	53	
t Stat	0.7825		t Stat	5.5236	

Table XIV
Mean Cross-Sectional Regression Results

Table XIV reports the results of a cross-sectional regression of mean beta on the mean of the explanatory variables. For all banks in the sample from 1994 to 2003 beta is estimated using the past 5 years of stock return data and the corresponding return on the CRSP value-weighted index. These annual betas are matched to the corresponding explanatory variables from the Federal Reserve's Y9C database. Finally the mean beta and the mean of each of the explanatory variables is calculated for each bank. The results of the cross-sectional regression of mean beta on the mean of the explanatory variables is reported below. For each explanatory variable the coefficient estimate is reported in the first row and the corresponding T-statistic is reported in the second row (standard errors for the t-statistics are Huber-White robust standard errrors).

Variable	Estimate	Variable	Estimate
Intercept	1.87	Credit Card	0.17
	7.98		0.41
Size	0.32	Other Consumer	-1.34
	1.12		-4.53
Real Estate	-1.22	Foreign	-0.05
	-5.03		-0.02
Farm Real Estate	-2.65	Equity Capital	-0.28
	-3.04		-0.68
Nonresidential Real Estate	-0.86	Maturity GAP	0.34
	-6.55		3.92
Farm Production	-1.60	Total Charge-Offs	10.36
	-2.13		4.21
Commerical and Industrial	-1.25	R-Squared	34.64%
	-4.46	F-Value	28.54

Appendix Table I
Year by Year Regression Results

Appendix Table I reports the results of the annual regressions of beta on bank variables taken from the Federal Reserve's Y9C database. To be included in the sample each bank must have at least 3 years of monthly stock return data. Beta is estimated for each bank each year by regressing the last 5 years of monthly excess stock returns on the excess market return (the market is the CRSP value-weighted index). For each variable in each year row 1 reports the coefficient estimate and row 2 reports the corresponding T-statistic.

Year	Intercept	Size	Real Estate Loans	Farm Real Estate Loans	Bank Loans	Non-Residential Real Estate Loans	Farm Production Loans	C&I Loans	Credit Card Loans	Other Consumer Loans	Foreign Loans	Interest Rate Contracts	FE Contracts	Equity Contracts	Equity Capital	Debentures	Maturity GAP	Loans to Assets	Trading Assets	Trading Liabilities	# of Observations	R-Squared
1986	-2.44	0.17					1.08	0.69			2.33				1.20	-0.19	-0.05	0.56			142	44.25%
	0.41	7.37					0.80	2.59			2.04				0.75	-0.07	-0.31	2.05				
1987	-2.12	0.17					0.55	0.33			1.01				-0.16	1.47	0.17	0.16			140	48.01%
	0.43	8.33					0.48	1.36			0.78				-0.08	0.49	1.16	0.71				
1988	-0.94	0.12					-1.03	0.04			-0.29				-0.48	-1.64	0.16	-0.08			138	36.53%
	0.32	7.19					-0.95	0.17			-0.25				-0.34	-0.67	1.36	-0.40				
1989	-0.85	0.12					-0.66	-0.23			-0.65				-1.81	-7.31	0.06	-0.04			144	35.36%
	0.31	6.99					-0.58	-0.96			-0.47				-1.65	-2.64	0.50	-0.19				
1990	-0.79	0.11					-0.61	-0.27			0.51				-1.37	-2.84	0.23	-0.01			150	34.58%
	0.29	7.23					-0.55	-1.21			0.36				-1.30	-1.82	1.83	-0.05				
1991	-0.76	0.12					-0.79	-0.19			0.95				-1.91	-5.04	0.25	-0.04			144	36.67%
	0.32	6.43					-0.63	-0.76			0.51				-1.24	-3.40	1.92	-0.19				
1992	-0.55	0.13					-2.65	-0.19			-0.91				-5.18	0.77	0.32	-0.18			139	36.30%
	0.36	5.79					-1.70	-0.74			-0.40				-3.21	0.27	2.29	-0.85				
1993	-1.67	0.19					-4.14	-0.07			-4.49				-3.88	4.63	0.55	-0.18			127	44.06%
	0.48	6.33					-1.92	-0.21			-1.01				-1.40	1.11	2.76	-0.56				
1994	-0.78	0.16	-0.24	-3.01		-0.69	0.58	-0.72	0.31	-1.23	-6.17				-3.52	-0.77	0.57	0.07	-0.95	1.00	282	42.69%
	0.76	7.09	-0.42	-2.40		-2.32	0.40	-1.16	0.48	-2.09	-0.80				-2.31	-0.24	3.82	0.30	-0.67	0.32		
1995	-0.96	0.16	0.04	-3.58		-0.61	-0.43	-0.53	0.52	-0.89	-1.48				-4.80	-2.00	0.80	0.20	1.28	-3.51	291	39.66%
	0.79	6.58	0.06	-2.72		-1.96	-0.29	-0.83	0.73	-1.42	-0.17				-3.28	-0.52	4.50	0.75	1.04	-1.34		
1996	-1.36	0.11	1.01	-1.97	-2.77	-0.64	1.32	0.72	1.50	0.10	8.71	-5.76	1.51	-2.01	-0.36	0.85	0.47	-0.35	0.30	6.93	295	27.79%
	0.80	4.76	1.55	-1.25	-1.25	-2.36	0.94	1.03	2.04	0.15	0.63	-1.75	0.47	-0.13	-0.58	0.23	2.83	-1.29	0.24	1.04		
1997	-0.73	0.09	0.33	-1.86	-0.66	-0.01	-0.21	0.45	1.19	-0.78	6.99	-3.37	1.42	-8.22	-0.68	-1.52	0.12	-0.13	2.20	-0.16	288	41.52%
	0.50	5.67	0.82	-1.47	-0.56	-0.08	-0.22	1.01	2.48	-1.78	0.55	-1.82	0.83	-1.07	-1.57	-0.57	1.06	-0.71	2.40	-0.04		
1998	-0.06	0.08	-0.45	-3.99	1.46	-0.18	-0.93	-0.25	0.51	-1.13	0.92	-0.60	-0.92	-4.41	-0.21	-0.92	-0.06	0.10	3.63	-1.34	280	48.37%
	0.40	5.39	-1.42	-2.77	0.57	-1.11	-1.16	-0.72	1.29	-3.11	0.09	-0.71	-0.64	-1.33	-0.51	-0.39	-0.65	0.60	2.67	-0.39		
1999	-0.92	0.11	-0.06	-3.00	6.65	-0.10	0.33	-0.06	0.73	-0.81	-2.69	-1.87	4.58	-0.58	0.88	-0.50	-0.03	0.03	2.26	-3.29	295	51.75%
	0.36	7.56	-0.20	-2.19	1.83	-0.66	0.35	-0.19	1.92	-2.32	-0.26	-0.89	1.02	-0.19	2.29	-0.18	-0.34	0.22	1.66	-0.82		
2000	-0.84	0.12	-0.32	-1.43	0.33	-0.45	-0.90	-0.41	0.44	-0.98	-4.30	0.34	2.91	1.93	0.78	-3.56	0.13	0.01	2.21	-9.28	330	49.42%
	0.33	9.46	-1.27	-1.10	0.12	-3.07	-0.91	-1.58	1.17	-3.12	-0.43	0.08	0.76	0.07	1.83	-2.33	1.41	0.10	1.81	-1.56		
2001	-0.39	0.09	-0.61	0.11	1.45	-0.29	-0.96	-0.52	0.06	-0.82	-2.60	-1.80	1.84	26.22	0.80	-0.12	0.18	0.01	1.56	-4.54	257	51.00%
	0.38	5.52	-2.22	0.09	0.27	-1.85	-0.84	-1.76	0.12	-2.50	-0.39	-0.89	0.36	1.06	1.81	-0.08	1.95	0.07	1.04	-0.85		
2002	0.49	0.07	-1.33	-1.61	-15.16	-0.14	-1.55	-1.16	-0.78	-1.43	0.21	0.34	3.43	-0.98	0.73	0.80	0.08	-0.03	1.85	-7.11	334	46.41%
	0.35	5.64	-4.89	-1.77	-3.12	-1.12	-1.83	-3.90	-1.64	-4.34	0.04	0.49	0.98	-0.08	1.46	0.53	0.97	-0.22	1.41	-1.62		
2003	0.46	0.07	-1.15	-1.53	-2.80	-0.04	-1.20	-1.14	-0.50	-1.29	-2.81	-0.83	0.26	47.77	1.12	0.74	0.12	-0.17	1.13	-7.73	336	52.74%
	0.29	5.79	-5.64	-2.08	-1.71	-0.39	-1.49	-4.76	-1.34	-4.89	-0.50	-1.59	0.10	5.10	3.41	0.54	1.74	-1.63	0.68	-1.37		