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Determinants of Banks' Total Risk: Accounting Ratios and Macroeconomic Indicators

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Honor's Research Paper

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Abstract

During the recent financial crisis, 325 U.S. banks failed whereas only 24 banks failed from 2000-2006. It is important to identify how banks' operations and changes in the economic environment might influence the total risk level faced by U.S. banking institutions in order to avoid the number of bank failures experienced during the recent recession. This study analyzes publicly traded banks in the U.S. from 1978 to 2010. Various accounting ratios and macroeconomic indicators are used as proxies for the effects of individual bank operations and changes in the economic environment. Total risk, as measured by the standard deviation of ROA and ROE, is regressed against the accounting ratios and economic indicators to identify the important sources of total risk. Bank size, the equity to asset ratio, allowance for loan loss ratio, liquidity ratio, loan to asset ratio, growth in real GDP, growth in the money supply and the interest rate spread all appear to be significantly associated with total risk.

I. Introduction

From 2000-2006, only 24 banks failed in the United States, yet from 2007-2010, which was the time that coincided with the recent recession and financial crisis, 325 banks failed in the U.S. (FDIC). Depositors and investors have a significant interest in the health of banking institutions. When a bank fails, depositors stand to lose out on any money that is not insured by the FDIC and equity investors will undoubtedly incur substantial losses. It is important to identify possible determinants of total risk for banking companies in order to avoid the losses associated with a bank's failure. This research paper aims to analyze the association that changes in the economic environment and firm specific accounting ratios have with the total risk level faced by banks. The inclusion of economic indicators as possible sources of total risk for banks is the main contribution of this study.

Some of the existing literature on bank risk looks at how accounting ratios relate to market risk for banks. Market risk is the risk that affects the entire banking industry, such as changes in the economic environment like recessions. Firm-specific risk is the risk that is unique to each individual bank. Sources of firm-specific risk include business and financial risk. Business risk includes risk that arises from a firm's operations like generating a sufficient amount of income to cover operating expenses or even meeting the pension obligations for retirees(Mayo, 2008). Financial risk addresses the risk associated with management's decisions or ability and a company's financial strength (Mayo, 2008). Basically, firm-specific risk is the risk that arises from the operations, performance or managerial decisions at each bank. When added together, market risk and firm-specific risk combine to form total risk. Total risk is the risk measure that is used in this study and it is appropriate because it includes the risks that affect

each individual bank as well as market risk, or the risk that affects the entire banking industry (Agusman et al., 2008).

The results of this research can help to minimize some of the consequences associated with bank failures. If it is found that changes in the economic environment are in fact significantly related to a bank's total risk level, then when indicators suggest the country is going through an economic downturn, banks can adjust their operations accordingly to protect against the higher risk level. Further implications of this study relate to the accounting ratios used as proxies for the various sources of risk for banks. The statistically significant accounting ratios that increase risk can be identified and bank management can closely monitor these measures, or regulators can impose stricter regulations on the values for these metrics. Similarly, the statistically significant ratios that reduce risk can be used as tools to strengthen the financial health of a bank and help it to be more resilient during a recession.

Section II outlines some of the existing research in this area where changes in the economic environment have not been considered as a possible source of total risk for banks. The hypotheses of this study and the variables used in the regression models are explained in Section III. Section IV covers the data and methodology used in this study, Section V covers the results and Section VI contains the conclusions of this research.

II. Literature Review

It has been noted that large, publicly traded institutions possess a large percentage of assets in the banking industry and "present the greatest risk to the deposit-insurance fund and to the stability of the banking system" (Pettway and Sinkey, 1980). The rising number of bank failures in the U.S. is a cause for analyzing the risk of banking companies (Mansur et al., 1993). The risk

level of a banking institution can be determined with the use of accounting data, which is a tool used to distinguish sound from unsound banking (Pettway and Sinkey, 1980).

The majority of studies attempt to identify which accounting and financial ratios prove to be the sources of market risk and total risk. The consensus amongst the literature has been to measure market risk with beta and total risk by the standard deviation of returns (Lee and Brewer, 1985; Jahankhani and Lynge, 1980; Mansur and Zitz, 1993; Pettway, 1976; Agusman et al., 2008) . But in the findings of a comparison study, accounting and financial ratios better explain total risk as opposed to market risk (Jahankhani and Lynge, 1980).

An important distinction about a bank's risk assessment concerns the usefulness of the risk measure for the purpose it is being used. A measure of market risk would be important for an equity investor because the market measure of risk, beta, is useful in determining the riskiness of a particular stock that might be added to an investment portfolio (Agusman et al., 2008). However, a bank regulator would be more concerned with a measure of total risk, like the standard deviation of return on assets or equity, to assess the financial health and risk of default for a banking institution (Agusman et al., 2008). Agusman et al. (2008) addresses these differences in a study analyzing the link between accounting ratios and capital market measures of risk for 46 Asian banks from 1998-2003. In their study, the standard deviation of return on assets is found to be a significant proxy for total risk and the loan-loss-reserves-to-gross-loans variable is significantly related to total risk.

Risk is said to be strongly influenced by a bank's management decisions and those decisions can be reflected in a bank's financial statements which make accounting ratios a viable proxy for such decisions (Jahankhani and Lynge, 1980; Lee and Brewer, 1985). A study of 95 commercial banks and bank holding companies from 1972 to 1976 finds that the dividend payout ratio,

variability of deposits and earnings, the equity to total asset ratio, loan loss reserves ratio and a liquidity measure are all statistically significant in predicting a measure of total risk (Jahankhani and Lynge, 1980). In fact, the accounting ratios used in this study are able to explain 43% of the variation in total risk for a bank as opposed to 25% of the variability in market risk, suggesting that accounting ratios are better predictors of total risk measures than market risk measures (Jahankhani and Lynge, 1980).

Another comparison study of 44 U.S. banks from 1979-1982 finds that accounting ratios demonstrate more consistent results in relation to total risk despite a slight change in the model. The equity to asset ratio, foreign income, foreign deposit exposure, volatile liabilities and the net position of market rate assets are all significantly related to total risk (Lee and Brewer, 1985).

In a study of 59 U.S. banks from 1986-1990, only the cash and due from banks liquidity ratio proves to be significant in relation to total risk (Mansur and Zitz, 1993). Variables that are significant in some time periods are not always found to be significant in studies of different time periods. The equity to deposit and loan loss reserve variables are insignificant in this study while significant in others. Mansur and Zitz (1993) attribute the difference in results across studies to the use of different banks and different ratios. A study spanning a longer time period could help mitigate some of the variation in the results of the existing literature that can be attributed to looking at different time periods.

An overview of the literature shows that the economy has not been considered a source of risk for banking companies. Also, many studies are concerned with how financial ratios are related to market risk, or the risk that cannot be mitigated by an investor through diversification. The goal of the current study is not only to include the economy as a source of risk for banks, but also to use a measure of total risk instead of market risk. Market risk does not incorporate firm-

specific risk. Firm-specific risk is the risk that is unique to each bank and it is caused by management decisions, policies and operations. A measure of total risk not only accounts for market risk, it also accounts for firm-specific risk which is important when looking at banks because different banks use different assets with different risk levels and they have different lending qualifications.

III. Hypothesis, Methodology and Variables

The literature discussed above leads to the general hypothesis that changes in the economic environment, as measured by macroeconomic indicators, are significantly related to total risk, in addition to bank decisions, which are reflected in accounting ratios from financial statement data. The model being used to test this hypothesis is:

$$SDROE = \beta_0 - \beta_1 Size - \beta_2 Equity/Asset + \beta_3 Loan\ Loss - \beta_4 Liquidity + \beta_5 Loan/Asset$$
$$- \beta_6 Dividend\ Payout - \beta_7 GDP\ Growth +/- \beta_8 M2\ Growth$$
$$+ \beta_9 Interest\ Rate\ Gap + \varepsilon_i$$

where the trailing three year standard deviation of return on equity (SDROE) is the dependent variable and it serves as a measure for total risk. An alternative measure of total risk is the trailing three year standard deviation of return on assets (SDROA) which will also be used in this study as a means to test the robustness of the results. These trailing three year standard deviation of return variables measure the volatility in a banking firm's earnings ratios in an attempt to capture the total risk level for a bank that is not affected by short term fluctuations. The data are analyzed in four different models: 1) the base model, 2) a model with fixed-effects for time, 3) a model with fixed-effects for each firm and 4) then a model with fixed-effects for both time and each firm. The fixed-effect variables are dummy variables designed to capture any unobserved characteristics that are unique to each year and each firm. To measure the fixed-effects of time in

this study, a dummy variable is used for each year resulting in a total of 33 time fixed-effect variables for each of the 33 years in this study. The variables measure the unobserved characteristics that are unique to each distinct time period and which cannot be captured by other variables in the model. Historically, banks have attempted to mask their true risk levels by temporarily lowering their debt just before the end of a reporting period which results in a skewed representation of their true risk level (Kelly et al., 2010). The time fixed-effect variables can highlight any specific years that exhibit substantially higher risk levels, particularly those leading up to the recent financial crisis. The firm fixed-effect variables are used to capture the unobserved characteristics, such as management decisions and corporate culture, which are unique to each individual firm and yet, impact the total risk level faced by that bank. Such important factors cannot be accounted for with any quantitative metric, so a dummy variable is used to capture the cumulative effect of these factors on total risk. Each of these models will be analyzed using linear regressions to test the significance of each model and the individual variables.

Table 1 provides variable definitions and the expected signs. The independent variables represent accounting data from financial statements and macroeconomic indicators to reflect changes in the economic environment. All the variables reflect quarterly values.

Size

The size variable is the log of total assets for each bank. The expected relationship between bank size and total risk is negative. Large banks tend to be more diversified which allows them to engage in riskier and potentially more profitable lending without increasing risk because of a diversification advantage (Demsetz and Strahan, 1997). Likewise, smaller firms face greater risk because they are not as diversified, which helps mitigate risk.

Table 1: Variable Definitions and Expected Signs

Variable	Formula	Definition	Expected Sign
Size	Log of Total Assets	Accounts for the size of a banking institution	-
Equity Asset	Total Shareholder Equity / Total Assets	Identifies the percent of assets that shareholders contribute	-
Loan Loss	Allowance for Loan Losses / Gross Loans	The percent of loans a bank does not expect to collect upon	+
Liquidity	Cash and Due from Banks / Total Assets	A measure of a bank's ability to absorb unexpected changes in its asset and liability accounts	-
Loan Asset	Gross Loans / Total Assets	The percent of total assets which are held in loans outstanding	+
Dividend Payout	(Common Stock Dividends + Preferred Stock Dividends) / Net Income	Management's expectations about future net income	-
GDP Growth	GDP of the Current Quarter / GDP of the Previous Quarter	The quarterly growth in GDP	-
M2 Growth	Money Supply of the Current Quarter / Money Supply of the Previous Quarter	The quarterly growth in Money Supply (M2)	+/-
Interest Rate Gap	Yield on the 10 year Treasury Bond - Federal Funds Rate	Measures the interest rate spread between the 10 year Treasury and the Federal Funds Rate	+
SDROE	The standard deviation of the three year trailing return on equity		Dependent
SDROA	The standard deviation of the three year trailing return on assets		Dependent

Equity to Asset Ratio

This variable is the ratio of total shareholder equity to total assets. This variable identifies the percent of total assets which shareholders contribute. It is expected that a negative relationship exists between the equity to asset ratio and total risk because a larger percentage of operations are funded by raised capital rather than borrowed funds, which are accompanied by the added cost of interest expense (Pettway, 1976; Jahankhani and Lynge, 1980; Agusman et al.,

2008). This variable was found to be perfectly correlated with the equity to deposit ratio which has also been used in the literature, but this study opts to use the equity to asset ratio due to its more frequent use as observed by the author of this study.

Allowance for Loan Losses

The allowance for loan losses serves as a proxy for credit risk. It represents the percent of a bank's loans that are expected to result in losses due to slow payment and default. It is an indicator of the quality of a bank's loan portfolio. A larger ratio indicates that a greater percent of a bank's loans are bad and expected to default, meaning the bank will not get repaid and the loan becomes a loss (Mansur and Zitz, 1993). Thus, it is anticipated that a positive relationship with total risk exists for this variable.

Liquidity

The liquidity variable is the ratio of cash and due from banks to total assets. As its name indicates, it is a proxy for liquidity risk because this variable measures the percent of assets which are held in very liquid and short term assets like cash. It is believed that a higher ratio, which indicates greater liquidity, translates into less total risk, so liquidity is expected to be negatively related to total risk (Agusman et al., 2008; Jahankhani and Lynge, 1980; Mansur and Zitz, 1993). Firms that maintain higher levels of liquidity are expected to be able to absorb unexpected losses in the short run, due to a greater amount of liquid assets available, and avoid the risk of illiquidity.

Loan to Asset Ratio

This is a proxy for liquidity risk and it measures the percent of assets which are held in outstanding loans (Mansur and Zitz, 1993). A high ratio is an indicator of potential liquidity issues because loans are not usually callable and they tie up funds which could otherwise be held

in more liquid assets, like cash, and used to address unexpected losses. It is expected that the loan to asset ratio is positively related to total risk because the issuance of loans reduces the amount of capital available to meet short term or unexpected obligations which might give rise to liquidity issues (Agusman et al., 2008; Mansur and Zitz, 1993). This variable was found to be highly correlated with the loan to deposit ratio, but much like the equity to asset ratio, and because of the more frequent use of the loan to asset ratio in prior studies, it is used in this study.

Dividend Payout

This ratio is calculated as the percent of net income paid out in dividends. This variable is expected to reflect the bank management's expectations about future net income because most firms want to achieve stable dividends and they set the dividends to be paid amount at a value which they are confident they can cover with net income (Lee and Brewer, 1985). Thus, firms that have a higher dividend payout ratio are more confident that they can generate higher levels of net income and cover the dividends paid amount. It is expected that a higher ratio, which means a firm's management is confident they can consistently generate sufficient levels of net income, will lead to less total risk and thus, exhibit a negative relationship.

GDP Growth

GDP Growth is the first of the macroeconomic indicator variables. It reflects changes in the economic environment as it measures the quarterly change in real GDP. This variable has been used as a proxy for economic activity as a ratio of less than one indicates a decline in economic activity (Jokipii and Milne, 2007). It is expected that banks will face greater risk during periods of contracting economic activity, so the GDP Growth variable is expected to be negatively related to total risk.

M2 Growth

This variable measures the quarterly growth in the money supply. Banks generate profit off of interest income they receive from issuing loans. As M2 grows, and more money circulates in the economy, banks should be able to make more loans and generate more profits which will help them accumulate reserves that can be used to improve the credit quality and financial strength of the bank. Larger profits would allow a bank greater financial flexibility to use extra reserves as a buffer against liquidity problems or for the purpose of deleveraging. Such an argument would suggest that growth in the money supply is negatively related to total risk, but a strong argument can also be made for the contrary. The Federal Reserve sometimes chooses to inject money into the economy during periods of uncertainty in an effort to build confidence. So when markets are volatile and confidence is low amongst individuals, the Fed can opt for monetary "easing" which might suggest that growth in M2 occurs during highly volatile or high risk periods. This argument would suggest a positive relationship exists between total risk and growth in the money supply and thus, an anticipated relationship between growth in M2 and total risk cannot be determined.

Interest Rate Gap

The interest rate gap is the spread, or difference, between the yield on the 10 year U.S. Treasury bond and the federal funds rate at the end of each quarterly period. The yield on the 10 year Treasury bond is a benchmark for long term interest rates while the federal funds rate reflects the rate that member banks charge each other for overnight loans (short term). This variable captures the inflation risk present in the economy (Snyder, 2005). When uncertainty about inflation arises, it tends to have more influence over long term interest rates instead of short term rates. As the risk of inflation becomes more serious, investors will demand a higher

yield on long term investment options because of the influence that inflating prices could have in a ten year period. On the other hand, a fear of inflation might not cause the same increase in short term interest rates because of the lesser degree of influence that inflation can have in the short run versus the long run. It is expected that a larger spread between short term and long term rates will indicate greater uncertainty about inflation and thus, be positively related to total risk.

IV. Data

The data used in this study comes from the Wharton Research Data Services (WRDS) online database at the University of Pennsylvania's Wharton School of Business. This study includes a sample of 326 U.S. banks that are analyzed over the quarterly periods from 1978-2010. The banks used in this study are publicly traded and classified as Major Banks of the Finance Industry by the Nasdaq Exchange. This study does not follow all 326 companies for each quarter from 1978-2010. Some companies were not incorporated in 1978 and do not enter the study until the 1980's, 1990's or 2000's while other companies appear in the study from the very beginning but then leave the study when they are acquired or fail. By allowing for the inclusion of companies that are present for only a fraction of the time period of this study, the risk of having the results of this study influenced by a survival bias can be overcome. Only 21 companies are represented in every year of the study, but if this study were limited to only these 21 companies it would not capture what occurred at struggling or failing institutions that were acquired by other banks or left to fail. Because of the trailing nature of the SDROE variable, the included companies in this study must have been incorporated for at least three years so that this variable could be calculated. Thus, companies that enter at some point after 1978 are beginning their fourth year of incorporation when they appear in this study because they first need to record three years of return on equity and asset data.

V. Results

The summary statistics for the independent variables are presented in **Table 2** and the regression results of this study can be found in **Table 3**.

Table 2: Summary Statistics

Variables	Minimum	Maximum	Mean	Std. Deviation
Size	6.875	11.374	8.381	0.684
Equity/Asset	0.003	0.262	0.087	0.023
Loan Loss	0	0.114	0.015	0.008
Liquidity	0	0.410	0.049	0.050
Loans/Asset	0	.948	0.560	0.267
Dividend Payout	-1.999	1.997	0.275	0.359
GDP Growth	0.980	1.039	1.006	0.007
M2 Growth	0.996	1.057	1.014	0.008
IR Gap	-6.060	3.850	1.476	1.513
SDROE	7.16E-05	4.011	0.019	0.107
SDROA	3.73E-06	0.326	0.001	0.004

For the purpose of the interpretation of the results, Model 1 is used. In this model the core variables are regressed against total risk (SDROE) without the use of time or firm fixed-effect variables. Regression results are also included for the four models with the trailing three year standard deviation of return on assets (SDROA) as the dependent variable. The inclusion of these models is a test for the robustness of the results because SDROA has also been used as an alternative measure of total risk (Agusman et al., 2008).

The coefficient on the size variable is negative and statistically significant. This suggests that larger firms, or those with more total assets, experience less total risk. The results of Model 1 produce the expected negative relationship between bank size and total risk. In the SDROE regressions, the negative relationship was a consistent result except in Model 3, but the

coefficient for size in that model was statistically insignificant. The results for this variable are the opposite when using a regression with the SDROA as the dependent variable. In these models, size has a positive and significant result with total risk. When comparing the regressions with the different dependent variables, larger banks experience less volatility with respect to return on equity, but greater volatility with respect to return on assets.

The equity to asset ratio yielded the expected sign and was statistically significant in all models. The relationship between this ratio and total risk is negative, meaning that firms who utilize more equity to finance their operations experience less total risk. This seems intuitive because equity capital is cheaper than the alternative of borrowed money which comes with the added cost of interest expense. Firms that can raise more funds instead of having to borrow them should have greater financial flexibility and be more financially sound than banks that borrow large sums of money and are obligated to make large interest payments, even if they might be operating at a loss.

The coefficient for the allowance for loan loss ratio is statistically significant in all models and it has the expected positive sign. This ratio is positively related to total risk for banks. As a measure of the expected losses and actual loan write-offs in a bank's loan portfolio, these results suggest that banks who estimate larger losses on loans will face more risk because the quality of their loan portfolio is not as good.

The liquidity ratio exhibits a positive relationship with total risk which is the opposite of what is expected. It is expected that banks who hold excess liquidity will face lower risk because they have greater financial flexibility to meet unexpected charges or losses in the short run. However, all of the regression models, with both dependent variables, suggest that the opposite

is true; excess liquidity actually increases a banking firm's total risk. It has been argued that firms who hold excess liquidity make inefficient use of the excess capital. Excess capital is

Table 3: Regression Results

	SDROE				SDROA			
Variables	1	2	3	4	1	2	3	4
(Constant)	1.00	0.009	0.625	0.025	0.034	-0.009	0.015	-0.01
	*4.686***	*0.03*	*3.194***	*0.1*	*4.371***	*-0.884*	*1.963**	*-1.043*
Size	-0.009	-0.01	0.004	-0.009	.000	.000	.000	.000
	*-6.596***	*-7.592***	*1.571*	*-2.675***	*-5.167***	*-5.361***	*3.156***	*-0.91*
Equity/Asset	-0.417	-0.501	-0.958	-1.098	-0.005	-0.008	-0.017	-0.021
	*-10.696***	*-12.614***	*-19.174***	*-21.349***	*-3.597***	*-5.372***	*-8.593***	*-10.846***
Loan Loss	2.472	2.213	2.801	2.3	0.112	0.099	0.113	0.092
	*22.150***	*18.717***	*24.641***	*18.583***	*27.520***	*22.880***	*25.865***	*19.293***
Liquidity	0.094	0.093	0.219	0.22	0.005	0.004	0.008	0.006
	*4.665***	*4.138***	*9.075***	*8.070***	*6.454***	*4.628***	*8.159***	*6.003***
Loans/Asset	0.027	-0.012	0.049	0.04	0.002	0.001	0.001	0.001
	*6.739***	*-1.877*	*9.668*	*4.888***	*11.316***	*3.941***	*6.961***	*2.290**
Dividend Payout	-4.781E-6	-7.183E-6	-4.377E-6	-6.376E-6	-2.55E-7	-3.32E-7	-2.00E-7	-2.708E-7
	-0.517	*-0.78*	*-0.544*	*-0.794*	*-0.751*	*-0.986*	*-0.644*	*-0.876*
GDP Growth	-0.657	-0.089	-0.441	-0.12	-0.023	-0.001	-0.013	-0.001
	*-4.992***	*-0.484*	*-3.764***	*-0.775*	*-4.783***	*-0.168*	*-2.968***	*-0.165*
M2 Growth	-0.267	0.2	-0.209	0.209	-0.01	0.012	-0.005	0.012
	*-2.270**	*1.327*	*-2.012**	*1.603*	*-2.349**	*2.160**	*-1.204*	*2.470**
IR Gap	0.003	.000	0.001	.000	.000	-2.85E-5	.000	.-1.329E-5
	*4.469***	*-0.219*	*2.703***	*-0.106*	*8.206***	*0.549*	*7.004***	*0.263*
Time Fixed-effect	No	Yes	No	Yes	No	Yes	No	Yes
Firm Fixed-effect	No	No	Yes	Yes	No	No	Yes	Yes
Adjusted R square	0.049	0.058	0.291	0.298	0.072	0.083	0.234	0.243
F Value	90.563	24.515	20.222	19.125	135.334	35.283	15.316	14.749

The top number for each variable is the regression coefficient.
The italicized number is the t-statistic for each variable.
Due to space limitation, the regression coefficients for each fixed-effect variable are not included their effects are summarized in the analysis.
* significant at the .05 level
** significant at the .01 level

allocated to weak business segments which reduces the resources available for the better performing segments (Shim, 2010). Thus, it is not unexpected that excess liquidity will be positively related to total risk due to the resulting inefficiencies.

In Model 1, the loan to asset ratio has the expected positive sign and is statistically significant. This ratio is positively related to total risk for banks. Loans are not liquid assets and banks who have a large amount of loans outstanding relative to their total assets might face a greater risk because illiquid assets cannot be used to address unexpected charges in the short run. The results for this variable were fairly consistent except in Model 2, when accounting for the fixed-effects of time. In Model 2, the relationship between the loan to asset ratio and total risk became negative but the result was statistically insignificant.

The coefficient for the dividend payout ratio never yields any significant results. It is expected that this ratio is negatively related to total risk because this ratio can reflect management's expectations about future net income. Dividend amounts are declared in advance of when they are issued, and higher dividend payout ratios could be an indicator that management is more confident that they can generate enough net income to cover the dividends paid amount. In most of the models, the coefficient was negative for the dividend payout ratio meaning it is negatively related to total risk, but the results were highly insignificant.

The relationship between changes in the economic environment and total risk is statistically significant. As expected, growth in real GDP is negatively related to total risk. As an indicator of cyclical activity in the economy, it appears that declines in real GDP lead to greater total risk for banks. Likewise, periods of expanding economic output coincide with lower levels of risk for banks.

The anticipated effect of the growth in the money supply variable could not be determined *ex ante,* but the results indicate that this variable is negatively related to total risk. Perhaps, the injection of money into the economy by the Federal Reserve helps minimize the risk of illiquidity. When the money supply increases, banks have access to more capital which they can use to issue loans. The issuance of loans generates profit for banks which they can hold as cash reserves to improve liquidity or to deleverage and reduce interest expense. Either of these purposes could reduce total risk because they improve the financial strength of a bank.

Results for the interest rate spread variable are statistically significant and produce the expected positive relationship with total risk. A larger spread between the 10 year Treasury bond and the Federal Funds rate can signal growing concern about future inflation rates. Inflation is a source of risk because it reduces the purchasing power of money which is why long term investors would demand an inflation premium, or a higher yield on long term securities, to compensate them for the chance that price levels in the economy could go up.

These macroeconomic indicators yield the expected and significant results in most models that do not control for time. The inclusion of both economic variables and year fixed-effect variables leads to highly insignificant results. The year fixed-effect variables aim to capture the unobserved characteristics that are present in each year of this study that could influence the total risk level for a bank. Financial regulations and the economic environment can change from year to year. Measures like the Basel Accords can be implemented which can influence a bank's operations and indirectly, their risk level. Likewise, the recent troubles in the housing market that helped trigger the financial crisis could lead to a very significant change in the risk level that banks faced in the last couple of years. But the growth in money supply and real GDP variables might also capture some of the effects of time through naturally increasing

trends in these values. Over the 33 year period of this study, there might exist a natural growth in money supply or real GDP as technological advances help improve productivity and economic output improves and it could lead to problems with multicollinearity. The reason that the economic variables changed significance so much with the inclusion of the time fixed-effect variables might be due to too much overlapping of the captured effects of these variables.

The year fixed-effect variables created some disturbances in the results for the economic variables and the loan to asset ratio, but they also yielded some interesting results. The time fixed-effect dummy variable for the year 2007 was left out of all regressions so that it could be used as a benchmark for comparison purposes. The fixed-effect for each year before 2007 all had negative coefficients suggesting that there was more risk in 2007 than in any of the other years. Likewise, the coefficients for 2008, 2009 and 2010 all yielded positive coefficients suggesting that each of those years was more risky than 2007. These years coincide with the financial crisis, and due to the severe nature and volatility of that time period, it is expected that these years would display the highest risk. the results for these year fixed-effect variables remain consistent across the models.

For the firm fixed-effects, the dummy variable for Bank of America was left out of this regression for comparison purposes. The unobserved characteristics at JPMorgan Chase produce a negative relationship with total risk suggesting that the company is less risky than Bank of America. However, when controlling for time and firm fixed-effects, the JPMorgan Chase fixed-effect variable is no longer significant. On the other hand, Berkshire Bancorp appears to be the most risky bank, since the unobserved characteristics present at this bank lead to 1.072 increase in the SDROE, which is by far the most for any bank in this study. The TrustCo Bank of New York appears to be the least risky bank in this study as the unobserved characteristics present at

this institution lead to a 0.042 decline in the SDROE, which is the smallest coefficient for a bank in this study. The results for the firm fixed-effect variables in Model 4 are consistent with the results of Model 3, except for a small number of firms.

VI. Conclusion

The regression results support the hypothesis of this study that changes in the economic environment significantly affect the total risk level faced by U.S. banks. Growth in real GDP, growth in the money supply and the spread between the yield on the 10 year Treasury note and Federal Funds Rate in the U.S. are significantly related to a bank's total risk. The changing economic environment as a source of bank risk has been overlooked in other studies, but appears to be relevant based on the results of this study.

In this study, bank size, the equity to asset ratio, allowance for loan loss ratio, liquidity ratio, loan to asset ratio, growth in real GDP, growth in the money supply and the interest rate spread all appear to be significantly related to total risk. The size of a bank, allowance for loan loss ratio, loan to asset ratio and the equity to asset ratio yield results that were consistent with prior research (Agusman et al., 2008; Jahankhani and Lynge, 1980; Mansur and Zitz, 2003; Lee and Brewer, 1985). However, the Dividend Payout ratio and the liquidity ratio are found to be significant in other studies, but the dividend payout ratio is statistically insignificant and the liquidity ratio is significant but with the opposite sign from what is expected and supported by prior research. The difference in these results might be explained by the difference between this study and others. Other research that is mentioned in this paper use 44, 59 and 95 banks while this study uses a unique data set of 326 banks and spans 30 years as opposed to four. Perhaps, these ratios have had different effects on total risk, especially in the last decade, which is not included in prior studies.

As for future research, the influence of changes in the economic environment can be applied to market risk, the other major risk topic of research studies. Accounting data have been tested against both market and total risk. Changes in the economic environment can be regressed against measures of market risk to determine if a relationship exists there as well. Also, because this study includes companies that entered in later periods and left in earlier periods, it overlooks some of the effects associated with mergers and acquisitions. For instance a company might become incorporated in 1989, but then become acquired by a larger bank in 1994. If sufficient data is available, a study could be conducted to analyze how mergers and acquisitions affect the total risk level for banks.

Appendix 1: List of Banks included in this Study

1st Source Corp
ACNB Corp
Alliance Bankshares Corp
Alliance Financial Corp
American National Bankshares Inc
American River Bankshares
Ameris Bancorp
AmeriServ Financial Inc
Ames National Corp
Annapolis Bancorp Inc
Arrow Financial Corp
Associated Banc-Corp
Auburn National BanCorp Inc
BancFirst Corp
Bancorp Inc (The)
Bancorp of New Jersey Inc
Bancorp Rhode Island Inc
BancorpSouth Inc0
BancTrust Financial Group Inc
Bank of America Corp
Bank of Commerce Holdings
Bank of Granite Corp
Bank of Hawaii Corp
Bank of Marin Bancorp
Bank of New York Mellon Corp (The)
Bank of South Carolina Corp
Bank of the Carolinas
Bank of the Ozarks
Banner Corp
Bar Harbor Bankshares
BB&T Corp
Berkshire Bancorp Inc
BNC Bancorp
BOK Financial Corp
Boston Private Financial Holdings Inc
Bridge Bancorp Inc
Bridge Capital Holdings
Britton & Koontz Capital Corp
Bryn Mawr Bank Corp
C&F Financial Corp
Cadence Financial Corp
Camden National Corp
Cape Bancorp Inc
Capital Bank Corp
Capital City Bank Group
Cardinal Financial Corp
Carolina Bank Holdings Inc
Carrollton Bancorp
Cascade Bancorp
Cascade Financial Corp
Cathay General Bancorp
Center Bancorp Inc
Center Financial Corp
Centerstate Banks of Florida Inc
Central Bancorp Inc/MA
Central Pacific Financial Corp0
Central Valley Community Bancorp
Central Virginia Bankshares Inc
Centrue Financial Corp
Century BanCorp Inc
Chemical Financial Corp
Cheviot Financial Corp
Citizens & Northern Corp
Citizens First Corp
Citizens Holding Co
Citizens Republic Bancorp Inc
City Holding Co
City National Corp
CNB Financial Corp/PA
CoBiz Financial Inc
Colony Bankcorp Inc
Columbia Banking System Inc
Comerica Inc
Commerce Bancshares Inc
Commercefirst Bancorp Inc
Commercial National Financial Corp
Commonwealth Bankshares Inc
Community Bank Shares of Indiana Inc
Community Bank System Inc0
Community Capital Corp
Community Central Bank Corp0
Community Partners Bancorp
Community Trust Bancorp Inc
Community West Bancshares
Crescent Financial Corp
Cullen/Frost Bankers Inc
CVB Financial Corp
Dearborn Bancorp Inc
DNB Financial Corp
Eagle Bancorp Inc
East West Bancorp Inc0
Eastern Virginia Bankshares Inc
ECB Bancorp Inc
Elmira Savings Bank FSB (The)
Emclaire Financial Corp
Encore Bancshares Inc
Enterprise Bancorp Inc/MA
Enterprise Financial Services Corp
Evans Bancorp Inc
F0N0B0 Corp
Farmers Capital Bank Corp
Fauquier Bankshares Inc
Fidelity Bancorp Inc
Fidelity Southern Corp
Fifth Third Bancorp
Financial Institutions Inc
First BanCorp (Puerto Rico)
First Bancorp Inc/ME (The)
First Bancorp/NC
First Bancshares Inc (The)/MS
First Busey Corp
First Business Financial Services Inc
First California Financial Group Inc
First Capital Bancorp Inc/VA
First Citizens Banc Corp
First Citizens BancShares Inc
First Commonwealth Financial Corp0
First Community Bancshares Inc
First Community Corp
First Federal of Northern Michigan Bancorp Inc
First Financial Bancorp0
First Financial Bankshares Inc
First Financial Corp/IN
First Financial Service Corp
First Horizon National Corp

First M & F Corp
First Mariner Bancorp
First Merchants Corp
First Midwest Bancorp Inc
First of Long Island Corp (The)
First PacTrust Bancorp Inc
First Security Group Inc
First South Bancorp Inc
First United Corp
First West Virginia Bancorp Inc0
Firstbank Corp
FirstMerit Corp
FNB United Corp
FPB Bancorp Inc
Fulton Financial Corp
German American Bancorp Inc
Glacier Bancorp Inc
Glen Burnie Bancorp
Great Southern Bancorp Inc
Green Bankshares Inc
Guaranty Bancorp
Guaranty Federal Bancshares Inc
Hampton Roads Bankshares Inc
Hancock Holding Co
Hanmi Financial Corp
Harleysville Savings Bank
Hawthorn Bancshares Inc
Heartland Financial USA Inc
Heritage Commerce Corp
Heritage Oaks Bancorp
Home Bancshares Inc
Horizon Bancorp
Hudson Valley Holding Corp
Huntington Bancshares Inc
IBERIABANK Corp
Independent Bank Corp
Independent Bank Corp0
Integra Bank Corp
International Bancshares Corp
Intervest Bancshares Corp0
Jacksonville Bancorp Inc/FL
Jeffersonville Bancorp
JPMorgan Chase & Co
KeyCorp
Lakeland Bancorp Inc
Lakeland Financial Corp
Landmark Bancorp Inc
LNB Bancorp Inc
M B T Financial Corp
M&T Bank Corp
Macatawa Bank Corp
MacKinac Financial Corp
MainSource Financial Group Inc
Marshall & Ilsley Corp
Mayflower Bancorp Inc
Mercantile Bancorp Inc/IL
Mercantile Bank Corp
Merchants Bancshares Inc
Metro Bancorp Inc
MetroCorp Bancshares Inc
Mid Penn Bancorp Inc0
Middleburg Financial Corp
MidSouth Bancorp Inc0
MidWestOne Financial Group Inc
Monarch Community Bancorp Inc
Monarch Financial Holdings Inc
MutualFirst Financial Inc
Nara Bancorp Inc
National Bankshares Inc
National Penn Bancshares Inc
NBT Bancorp Inc
New Century Bancorp Inc0
NewAlliance Bancshares Inc
NewBridge Bancorp
Northeast Bancorp
Northern States Financial Corp
Northern Trust Corp
Northwest Bancshares Inc
Norwood Financial Corp0
Oak Ridge Financial Services Inc
Ohio Legacy Corp
Ohio Valley Banc Corp0
Old Line Bancshares Inc
Old National Bancorp
Old Point Financial Corp
Old Second Bancorp Inc
OptimumBank Holdings Inc
Oriental Financial Group Inc
Oritani Financial Corp
Orrstown Financial Services Inc
PAB Bankshares Inc0
Pacific Continental Corp
Pacific Mercantile Bancorp
Pacific Premier Bancorp Inc
PacWest Bancorp
Park National Corp
Parke Bancorp Inc
Patriot National Bancorp Inc
Penns Woods Bancorp Inc
Peoples Bancorp Inc
Peoples Bancorp of North Carolina Inc0
Peoples Financial Corp/MS
Pinnacle Financial Partners Inc
PNC Financial Services Group Inc0
Popular Inc
Porter Bancorp Inc
Premier Financial Bancorp Inc
PremierWest Bancorp
Princeton National Bancorp Inc
PrivateBancorp Inc
Prosperity Bancshares Inc
QCR Holdings Inc
Regions Financial Corp
Renasant Corp
Republic Bancorp Inc
Republic First Bancorp Inc
Rockville Financial Inc
Royal Bancshares of Pennsylvania Inc
Rurban Financial Corp
S&T Bancorp Inc
S0Y0 Bancorp Inc0
Sandy Spring Bancorp Inc
Savannah Bancorp Inc (The)
SCBT Financial Corp
Seacoast Banking Corp of Florida
Severn Bancorp Inc
Shore Bancshares Inc
Sierra Bancorp
Signature Bank

Simmons First National Corp
Somerset Hills Bancorp
Southcoast Financial Corp
Southern Community Financial Corp
Southern Connecticut Bancorp Inc
Southern First Bankshares Inc
Southern National Bancorp of Virginia Inc
Southside Bancshares Inc
Southwest Bancorp Inc
Southwest Georgia Financial Corp
State Bancorp Inc0
State Street Corp
StellarOne Corp
Sterling Bancorp
Sterling Bancshares Inc
Stewardship Financial Corp
Suffolk Bancorp
Summit Financial Group Inc
SunTrust Banks Inc0
Superior Bancorp
Susquehanna Bancshares Inc
Sussex Bancorp
SVB Financial Group
Synovus Financial Corp0
Taylor Capital Group Inc
TCF Financial Corp
Tennessee Commerce Bancorp
Texas Capital Bancshares Inc
TIB Financial Corp
Tidelands Bancshares Inc
Tompkins Financial Corp
Tower Bancorp Inc
Tower Financial Corp
TriCo Bancshares
TrustCo Bank Corp NY
Trustmark Corp
U0S0 Bancorp
UMB Financial Corp
Union Bankshares Inc
Union First Market Bankshares Corp
United Bancorp Inc
United Bancshares Inc/OH
United Bankshares Inc
United Community Banks Inc
United Security Bancshares
United Security Bancshares Inc
United Western Bancorp Inc
Unity Bancorp Inc
Univest Corp of Pennsylvania
Valley National Bancorp
Village Bank and Trust Financial Corp
Virginia Commerce Bancorp
VIST Financial Corp
VSB Bancorp Inc/NY
Waccamaw Bankshares Inc
Washington Banking Co
Washington Trust Bancorp Inc
Webster Financial Corp
Wells Fargo & Co
WesBanco Inc
West Bancorporation Inc
West Coast Bancorp
Westamerica Bancorporation
Western Alliance Bancorporation
Whitney Holding Corp0
Wilber Corp
Wilmington Trust Corp
Wilshire Bancorp Inc
Wintrust Financial Corp0
WSFS Financial Corp
Yadkin Valley Financial Corp
Zions Bancorporation

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