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Distress classification measures in the banking sector

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Distress classification measures in the banking sector

Abstract

This paper investigates distress classification measures in the banking sector. The power of ten different accounting measures is tested using media coverage as the benchmark for a sample of 1,175 banks which participated in merger and acquisitions or divestiture deals over the past 22 calendar years. According to the results of the study, a bank should be defined as distressed if the ratio of its non-performing loans to total loans is in the two highest deciles of the industry, using a three-year moving average. This measure is typically favored by practitioners, who maintain that other common measures, e.g., those involving provisions for loan losses, are not as accurate as they express only a managerial forecast. Interestingly, measures that capture capital adequacy too often depict the bank as healthy even if it is *de facto* distressed, while measures of asset quality, though highly correlated with each other, tend to overestimate the number of distressed banks.

Key words: Distress classification models; Banking sector; Mergers and Acquisitions; Divestitures.

JEL classification: G21, G28.

Distress classification measures in the banking sector

1 Introduction

‘Leaders of the Group of 20 summit begin their summit in Pittsburgh on Thursday determined to increase the resilience of a financial sector that was brought to its knees last autumn. To this end, the G20 finance ministers, together with the Basel Committee on Banking Supervision, the international body that sets bank capital rules, have called for banks’ mandated minimum capital ratios to be raised and for large banks to hold even more capital. This is an understandable reaction to the financial crisis. But do regulators really know how much capital the banking system needs? The current regulatory capital framework, established by the Basel Committee, provides no empirically justified answer. The Basel framework’s core regulatory capital requirement – that banks hold a minimum of 8 per cent Tier I plus Tier II capital relative to risk-weighted assets – has been in place for more than 20 years.... The regulators thus failed to address the fundamental question of whether this historical amount of capital was sufficient to protect individual banks or the system as a whole. Not surprisingly, given the lack of a solid foundation, regulatory capital requirements have not acted as a binding constraint on the amount of capital banks actually hold.... Large institutions that became distressed during the crisis maintained even greater capital buffers relative to regulatory minimums.... Indeed, a key lesson from the credit crisis is that, regardless of the level at which the minimum is set, regulatory capital, by itself, is not sufficient to prevent large banks from failing. We need to complement regulation with more effective market discipline. This requires better information, which could perhaps be provided by regular stress tests.’

‘Markets Are the Best Judge of Bank Capital’ (Financial Times, September 23, 2009)

The 2008 crisis has had a major impact on the banking industry, emphasizing the need to identify clearly early signs of distress in the financial sector. Financial institutions, banks in the majority of cases, differ from other businesses in that they have different accounting rules, transparency requirements, and economic functions. Banks reconcile the different needs of borrowers and lenders by transforming small size, low risk and highly liquid deposits into larger, riskier, and illiquid loans. In most cases, banks’ assets are longer term and less liquid than their liabilities. If banks were to mark to market their assets frequently, the probability of appearing insolvent would increase significantly (see Amel-Zadeh and Meeks, 2009). In addition, the primary source of operating income for banks is the interest

that they earn through lending. Therefore, conventional accounting indicators of distress, such as interest coverage ratio, cannot be applied to analyze the financial soundness of banks. As a result, when considering financial institutions, it is necessary to devise a definition of distress which takes into account their fundamentally different characteristics.

The accounting measures used in the literature can be broadly divided into three groups:¹

- i) Capital adequacy or capitalization indicators: Tier 1 Capital, Tier 2 Capital, and leverage ratios (see, e.g., Wheelock and Wilson, 2000);
- ii) asset quality indicators: non-performing loans to total loans and provision for loan losses to total loans (see, e.g., Elsas, 2007);
- iii) multivariate indicators, including trigger points (see, e.g., Wirnkar and Tanko, 2008).

The existing literature on distress within the financial sector hence does not provide a universally accepted classification tool to distinguish between healthy institutions and those that are likely to experience financial distress. In fact, there has been no systematic analysis of the different distress measures, their degrees of accuracy, and the ways in which they are related to each other. The aim of this paper is to eliminate this deficiency in the existing literature on this topic.

The main objective of this study is thus to identify the most accurate, consistent, and simple accounting measure(s) of distress that can be used to distinguish between healthy and financially unsound institutions. The construction of reliable and consistent measure(s) of distress would allow for the identification of distressed financial institutions before they became insolvent (for example, via the implementation of early warning systems), while

¹ It should be noted that any liquidity measures of the soundness of financial organizations have been excluded from the groups since the liquidity of these institutions can fluctuate considerably over short periods of time and is typically the last accounting measure to be affected by distressed conditions, when the organization is on the verge of bankruptcy.

minimizing the potential costs associated with financial distress, on both micro and macro levels. The ability to identify banks that are at risk of default accurately and in a timely manner would also help in the targeting of audits and make the allocation of scarce bank monitoring resources more efficient. The identification of those banks that require examination and potential intervention could then complement the on-site bank monitoring process. More reliable measures of distress could also assist in the assessment of the degree of success and relative efficiency of the different approaches to dealing with distress (e.g., mergers and acquisitions (M&A), government intervention, filing for Chapter 11).

In light of the high media exposure of merger and acquisition deals in banking, this paper uses a sample of 1,175 banks which participated in M&A or divestiture deals in the banking sector over the past 22 calendar years to analyze the different accounting indicators of distress that have been adopted by academics, practitioners, and regulators. Since information about banks that are at risk of default is confidential, this study relies on media information to determine the degree of accuracy of each accounting measure as a distress classification tool. The media measure is thus used to determine the banks within the baseline sample which are *de facto* distressed (see, e.g., Poghosyan and Cihak, 2009). This approach is due to the fact that the accounting measures analyzed in this study involve a degree of subjectivity with regards to the way they present the financial health of banks. For example, asset quality indicators such as the ratio of the provision for loan losses to total loans reflect managerial anticipations of future economic conditions and events (see also Laeven and Valencia, 2008), while the majority of capitalization indicators analyzed in this study present the regulatory perspective on how distress should be defined when considering financial institutions. Although media information may inadvertently be influenced by the subjectivity of journalists, in fact they tend to present the middle-ground perspective with regards to the

financial health of a given bank when compared to the perspectives of managers and regulators.

The findings of the study show that the most appropriate accounting measure of distress is the ratio of non-performing loans to total loans. This result is in line with many practitioners who consider this measure as the best indicator of bank distress since it does not incorporate the future expectations of management, e.g., contained in provisions for loan losses. An additional finding is that accounting ratios which measure the asset quality of banks seem to be highly correlated with each other and tend to overestimate the number of distressed banks, whereas measures which capture the capital adequacy of banks have a tendency to severely underestimate the number of distressed banks.

The remainder of the paper is organized as follows: Chapter 2 provides a review of the literature on distress classification measures; Chapter 3 describes the sample as well as the methodology used in the study; Chapter 4 discusses the empirical results; Chapter 5 provides some robustness checks; and Chapter 6 concludes.

2 Literature Review

Academics, practitioners, and regulators have all used several methods to identify distressed financial institutions. A macro definition of distress within the financial sector is provided by Elebute (1999). According to this author, distress in the banking sector is observed when a fairly reasonable proportion of banks are unable to meet their obligations to customers, owners, and the economy, as a result of weakness in financial, operational and/or managerial capabilities, which renders them either illiquid or insolvent. Heffernan (2005) provides a micro definition of bank failure according to which “a bank is deemed to have

‘failed’ if it is liquidated, merged with a healthy bank (or purchased and acquired) under central government supervision/pressure, or rescued with state financial support.”

The literature on distress in the financial sector identifies three broad categories of distress indicators which capture both macro and micro level information and reflect both qualitative and quantitative information with regards to the financial health of banks. The first category comprises of accounting measures based on balance sheet and income statement information. The second category includes measures which reflect market prices of financial assets such as bank subordinated debt and equity. The third category of distress classification tools consists of measures which capture the economic environment in which financial institutions operate. Since the objective of this study is to identify the most accurate, simple and reliable accounting measures of distress that can be used on a micro level to categorize individual financial institutions as healthy or distressed, this literature review concentrates on the accounting measures of financial distress.

An analysis of the existing literature suggests that there are three main groups of accounting measures that have been utilized by academics in the past in order to distinguish between healthy and distressed banks. The first category of accounting measures captures information about the capital adequacy of financial institutions and their degree of capitalization. The second group reflects information with regards to the asset quality of banks and the third is based on multivariate analysis and combines information about different aspects of the financial position of banks, such as their liquidity, asset quality, capital adequacy, leverage, and managerial quality and efficiency (see, for example, Martin, 1977, Hwang et al., 1997, Logan, 2000, Heffernan, 2003, Curry et al., 2003, Elsas, 2007, Koetter et al., 2005, and Wrinkar, 2009). These studies are not reviewed here since they are beyond the scope of the main analysis of distress classification measures in this paper.

2.1 Capitalization Measures

Under the Basel Accord, every bank is required to hold a certain amount of capital in order to be able to face potential losses in the future. Under Basel II, the Tier 1 Capital ratio has to be at least 4%, whereas the Total Capital ratio has to be at least 8%.² A significantly undercapitalized bank is considered to present either a Total Capital ratio lower than 6% or a Tier 1 Capital ratio lower than 3%.

Wheelock and Wilson (2000) attempt to identify the financial characteristics that influence the likelihood of a financial institution being acquired or failing. The authors define a bank as failed if it was closed by the Federal Deposit Insurance Corporation (FDIC) during the period under consideration. However, since some banks were allowed by the FDIC to remain in operation even if in default, the study adopts a second measure of bank distress defined as a proxy for the Tier 1 Capital ratio. In this way, a bank is categorized as distressed if the ratio of total equity capital less goodwill divided by total assets is less than 2%. The use of 2% as a threshold is based on the FDIC Improvement Act of 1991 which requires regulators to close or impose prompt corrective action on any bank whose equity ratio falls below that level.

In light of the recent financial crisis, however, many practitioners have started to question the ability of the Tier 1 Capital ratio to accurately predict the health of banks, suggesting that a better measure of capital adequacy should be the Tangible Common Equity ratio (TCE

² Tier 1 Capital = Permanent Shareholder's Equity + Disclosed Reserves – Goodwill.

Tier 2 Capital = Loss Reserves + Revaluation Reserves + Hybrid Instruments + Subordinated Long Term Debt.

Total Capital Ratio = (Tier 1 Capital + Tier 2 Capital) / Risk Weighted Assets.

ratio).³ The TCE ratio does not include intangible assets and preferred equity and, therefore, is smaller than the Tier 1 Capital ratio and a useful tool to identify those banks that issue substantial preferred equity (e.g., banks involved in government bailouts). In this way, there have been recent efforts by regulators to amend the capital adequacy measures used. For instance, recently, regulators mentioned the possibility that a Tier 1 Common Equity Ratio could be included in the Basel II accord, though there is no general agreement on what the optimal level of the TCE ratio should be. As Roubini (2009)⁴ points out, regarding the outcome of the Supervisory Capital Assessment Plan: “The regulators estimated equity needs of the 19 banks based on a TCE ratio of 4% (as a percent[age] of tangible assets). However, even 4% implies a leverage ratio for these banks of 25. The IMF instead – properly – considered a scenario where the TCE ratio is increased to 6% that is equivalent to a leverage ratio of 17 that represents the average leverage ratio for all US banks in the mid-1990s before leverage shot up in the latest credit bubble...”

2.2 Asset Quality Measures

A useful accounting measure used by practitioners to identify financially vulnerable banks is the so-called Texas ratio which was developed by Gerard Cassidy and others at RBC Capital Markets. This ratio is calculated by dividing total non-performing assets by TCE plus loan loss reserves and was initially used to analyze troubled Texas banks during the 1980s. This indicator has been utilized by many practitioners in the current financial crisis to

³ TCE ratio = (Total Equity – Intangible Assets – Goodwill – Preferred Equity) / Tangible Common Assets.

⁴ <http://thenonexpert.blogspot.com/2009/05/on-stress-tests-and-reality-checks.html>.

differentiate between healthy and distressed banks. The ratio classifies a bank as distressed when its value is equal or above 1 (100%).

Another set of accounting measures which captures the asset quality of banks is based on provision for loan losses (LLP). These measures are directly linked to credit risk, which represents the major source of business risk in small banks. In a study of the savings and cooperative banking sector of Germany, Elsas (2007) defines a bank as distressed if it is placed in the two highest deciles of loan loss provisions for two subsequent years (deciles of loan loss provisions standardized by total loans to non-financial institutions are constructed in the cross-section of banks on a yearly basis). A similar approach is adopted by Sahut and Mili (2009), who use the highest quartile of loan loss provisions over two subsequent years as a measure of distress. However, many practitioners, along with some academics (see Laeven and Valencia, 2008) consider non-performing loans to total loans a better indicator of distress as it does not include the future expectations of management which are contained in the provision for loan losses.

2.3 Multivariate Measures

Most studies that develop multivariate measures of distress are typically based on two types of econometric analysis, namely discriminant analysis and logit/probit analysis. The determinants of bank distress on the basis of which the various logistic models are estimated include the ratios of total equity to total assets, loan loss provision to total loans, total costs to total income, profit before taxes to total equity, liquid assets to total assets, and interest expenses to deposits. These studies are not presented here since their analysis is not directly pertinent to the objectives of this paper. The multivariate analysis approach in this paper follows the “trigger points” methodology adopted by Poghosyan and Cihak (2009), who

analyze the causes of banking distress in the EU banking sector. The study is based on a sample of 5,708 banks from the 25 EU countries and covers the period 1996 – 2007. The results of the study define a set of thresholds (‘trigger points’) based on capitalization, asset quality, and profitability that can be used to identify healthy from weak banks.

The analysis of the existing literature on distress classification tools within the financial sector and the causes of distress thus suggests that there is no agreement with regards to which is the most appropriate, simple, and reliable measure that could be used in order to distinguish between financially sound and vulnerable banks. It is the objective of this study to address this issue and identify accounting measure(s) that could be used on a consistent basis in order to recognize banks which are in distress.

3 Data and Methodology

This study uses data on M&A and divestiture deals in the banking sector from the Bloomberg database. The sample is global and comprises completed deals only. The search criteria do not include any specific constraints, apart from limiting the observations of targets, acquirers, and sellers to public companies within the banking industry. Financial information is taken on the announcement date of each deal and one year prior from the Bureau van Dijk database (BvD). Information from the BvD database is also used in order to estimate industry averages. Data on leverage, profitability, non-performing loans to total loans, provision for loan losses to total loans, Tier 1 Capital ratio and Total Capital ratio is collected for each bank included in the sample.

The sample of banks that is examined consists of all completed M&A and divestiture deals over the period 1987 – 2008. The rationale behind the choice of M&A and divestiture deals as the basis of the sample is to ensure that sufficient media coverage is available in

order to construct the benchmark media measure. The sample of analyzed banks consists of a sub-sample of 472 M&A deals and a sub-sample of 581 divestiture deals. The M&A sub-sample consists of 472 targets and 472 acquirers or a total of 944 banks. The divestitures sub-sample consists of 581 sellers (banks which divest a branch or business unit), 581 acquirers (banks which buy a branch or business unit from the seller banks), and 581 targets (the entity that is being sold/divested). In order to ensure that the results of the analysis are accurate and consistent, only those banks for which all of the required financial information is available are included in the final sample of this study. Consequently, the total number of banks analyzed for the purpose of this study is limited to 1,175 banks which participated in M&A or divestiture deals over the period 1987 – 2008.

The accounting measures that this study analyzes can be divided into four groups on the basis of the different information that these ratios capture. Group 1 consists of Measure 1, or the so-called trigger points. It is a multivariate measure of distress in the sense that it reflects information with respect to different characteristics of banks such as profitability, asset quality, and capitalization. Measures 2 to 7 inclusive are members of the second group of accounting ratios that capture information related to the asset quality of banks. Group 3 includes Measures 8 to 10 inclusive. The accounting ratios in this group reflect information with respect to the capitalization of banks. Group 4 consists of Measure 11, which is the benchmark media distress classification tool. It is expected that measures which belong to a particular group will behave in a similar manner and provide consistent results with regards to the number of banks that they identify as healthy or distressed. As such (see also Table 1):

Measure 1 is defined as ‘Trigger points’ and is based on indicators of capitalization, asset quality, and profitability (Poghosyan and Cihak, 2009). Total shareholder equity divided by total assets or the so-called leverage ratio is used to proxy for the degree of bank

capitalization. It is expected that distressed banks will have substantially lower leverage ratios relative to healthy banks. Loan loss provision divided by total loans is adopted as a proxy for asset quality. This ratio is likely to be significantly higher for distressed banks relative to healthy banks. Income available to common shareholders divided by total shareholder equity (ROE) is used in order to measure profitability. It is expected that distressed banks will have very low or negative ROE ratios. On the basis of these trigger points, a bank is classified as distressed if its ROE is below -37.9%, its leverage ratio is below 2.7% or its loan loss provision to total loans is above 14.3%. It should be noted that for a bank to be classified as distressed it is necessary that only one of these conditions is met.

Measure 2 is defined as the ratio of loan loss provision to total loans based on a one-year industry average. According to this measure, a bank is classified as distressed if it is in the highest two deciles of its industry (Elsas, 2007).

Measure 3 is defined as the ratio of loan loss provision to total loans based on a two-year industry moving average. According to this indicator, a bank is defined as distressed if the measure is in the highest two deciles of the industry. A two-year horizon has been adopted to smooth the measure over time.

Measure 4 is defined as loan loss provision to total loans based on a three-year industry moving average. According to this indicator, a bank is distressed if this measure is in the highest two deciles of the industry. Similarly to the previous indicator, a three-year horizon has been adopted to smooth the measure over time.

Measure 5 is defined as the ratio of non-performing loans to total loans, and is used to measure the degree of credit risk and asset quality of banks. This measure is favored by practitioners and has also been highlighted by Poghosyan and Cihak (2009). It is expected that this ratio will be significantly higher for distressed banks relative to healthy banks. A

bank is defined as distressed if this measure is in the highest two deciles of its industry, based on a 1-year industry average.

Measure 6 is defined as non-performing loans to total loans based on a two-year industry moving average. According to this indicator, a bank is defined as distressed if this measure is in the highest two deciles of the industry.

Measure 7 is defined as the ratio of non-performing loans to total loans based on a three-year industry moving average. According to this indicator, a bank is defined as distressed if this measure is in the highest two deciles of the industry.

Measure 8 is defined as the Total Capital ratio. This ratio equals total capital divided by risk-weighted assets. Total capital is the sum of permanent shareholders' equity, disclosed reserves, loss reserves, revaluation reserves, hybrid instruments, and subordinated long-term debt, less goodwill. According to this measure, a bank is classified as distressed if this ratio is less than 8% (Basel II).

Measure 9 is defined as the Tier 1 Capital ratio, and equals the sum of permanent shareholders' equity and disclosed reserves less goodwill divided by risk-weighted assets. A bank is defined as distressed if this ratio is below 4% (Basel II).

Measure 10 is the so-called leverage ratio. A bank is defined as distressed if this ratio is lower than 2% (Wheelock and Wislon, 2000).

Measure 11 is the benchmark ratio which is based on media information. A bank is catalogued as distressed when it is possible to define it this way on the basis of world media information contained in the Nexis database (Poghosyan and Cihak, 2009).

Detailed searches are performed on each bank in the Nexis database in line with the methodology adopted by Poghosian and Cihak (2009). The Nexis database contains over 12,000 news sources, newspapers, newsletters, magazines and trade journals with over 250

newswires updated continuously, many within minutes of publication. Searches are performed on each of the 1,175 banks which constitute the baseline sample, for each year, using a combination of the bank's name and a set of key words designed to capture distressed situations.⁵ When a search gives at least one reference to distress for a particular bank in the year in consideration, the news associated with this bank is further examined to ensure that this information is in fact related to the given bank being distressed. As a result, the risk of incorrectly classifying a bank as distressed is minimized. This strategy results in 57 banks identified as distressed.

In order to measure the power of each ratio to distinguish distressed from healthy banks, it is assumed that the banks that were *de facto* distressed in our sample are those identified by the media information measure. It is considered that the media measure is the most objective benchmark measure that is readily available to use for the purposes of this analysis. This is due to the fact that accounting measures will tend to be influenced by managerial anticipations of future economic conditions. Furthermore, these measures can be manipulated by management in order to misrepresent the financial soundness of their organization or smooth earnings. In addition, regulatory measures, such as the Total Capital and Tier 1 Capital ratios can also be influenced by the perceptions of the agencies that have devised them. For example, these ratios are typically criticized for overstating the financial health of banks. Consequently, these regulatory measures are expected to underestimate the number of banks that are actually distressed.

In order to determine the degree of accuracy of the accounting measures analyzed in this study, it is necessary to identify a method that facilitates the comparison of these measures to

⁵ The key words used are: 'rescue,' 'bailout,' 'financial support,' 'liquidity risk,' 'liquidity support,' 'government guarantee,' 'government intervention,' 'distress,' 'failure,' and 'troubled.'

the benchmark media information measure in a comprehensive and formal manner. Therefore, for every accounting measure, the study identifies a threshold above or below which each bank is classified as distressed or healthy. Accordingly, a dummy variable is constructed for each accounting measure. This dummy variable is assigned a value of '1' if the bank is classified as distressed according to the given accounting measure, and '0' otherwise.

The study estimates industry averages for the accounting measures, based on provision for loan losses and non-performing loans in order to ensure that the financial health of banks, is analyzed relative to appropriate benchmarks. Accounting measures for the banking industry as a whole are calculated with the use of one-, two-, and three-year moving averages, in order to ensure that any potential effects of the economic cycle on the size of the examined accounting ratios are controlled. In order to estimate industry values for each accounting measure for each year over the period 1987 – 2008, all the banks included in the BvD database are included.⁶

The data analysis uses descriptive statistics and paired correlation matrices in order to capture the classification power of each accounting measure. In addition, interviews with practitioners are conducted in order to gather qualitative data on the degree of usefulness of each accounting measure as a distress classification tool.

⁶ It should be noted that only those categories of banks that are present in the baseline sample are included in order to construct industry averages. The categories that are included consist of bank holding and holding companies, central banks, commercial banks, cooperative banks, investment banks, finance companies, and savings banks.

4 Results

4.1 Correlation Analysis

Since the primary objective of this study is to identify the most appropriate measure(s) of distress, it is of particular interest to find the measure which displays the highest correlation with the benchmark media measure. The strength of the association between each accounting measure and the benchmark media measure is regarded as an indication of the reliability and accuracy of the examined distress classification tools. Through the calculation of the linear association between the different measures, their overall 'goodness of fit' is evaluated. The paired correlations 'account' for the overall accuracy of each accounting measure by simultaneously capturing information related to the proportion of correctly and incorrectly identified healthy and distressed banks by each accounting measure.

The paired correlations between the accounting measures and the benchmark media measure are presented in Table 2. The results indicate that the most accurate classification measure(s) of distress are those based on total shareholder equity to total assets and non-performing loans to total loans, using one-, two-, and three-year industry moving averages. Total shareholder equity to total assets is a measure of the capital adequacy of a given bank. This measure is expected to be highly correlated with the media benchmark measure since it represents the amount of capital that a bank can use as a buffer in order to offset unexpected losses due to sudden falls in its asset values. The fact that the measures based on non-performing loans to total loans are among the measures with highest correlation to the media benchmark measure is in line with the information acquired from interviews that have been conducted with practitioners. These interviews suggest that measures based on non-performing loans are those most often used outside the academic realm. In addition, the

results suggest that comparing non-performing loans to total loans with industry deciles calculated with a three-year moving average is more accurate than with a simple one- or two-year moving average.

The findings also show that, within the asset quality group, accounting measures based on provision for loan losses are less consistent and reliable relative to measures based on non-performing loans. These results could be explained by the fact that measures based on provision for loan losses are overly dependent on management's future expectations and could be subject to accounting manipulation. For example, the provision for loan losses will be higher if management adopts a more conservative approach to estimating expected losses. Management can also manipulate the size of the provision for loan losses in order to misrepresent the financial soundness of their organization or smooth earnings.

Based on the results of the analysis, major groups of accounting measures can be identified which tend to predict distress in a consistent manner as indicated by the paired correlations between these measures. Upon examination of the correlation matrix presented in Table 2, it is noticed that measures based on provision for loan losses and non-performing loans tend to behave in a similar manner. This observation could be explained by the fact that these measures capture similar financial information about banks and can be related to the overall asset quality of banks. Furthermore, the analysis reveals that the accounting measures which reflect the capital adequacy of banks have very low or negative correlations with each other. A possible explanation for these results could be the fact that capital adequacy measures severely underestimate the number of distressed banks relative to the media benchmark measure.

4.2 Accuracy of Accounting Measures

Table 3 presents expectation-prediction tables for each accounting measure relative to the media benchmark indicator. The results presented in the table indicate the number of banks that are correctly or incorrectly identified as healthy or distressed based on each accounting measure. Since the primary objective of this paper is to find the simplest, most accurate and consistent measure of bank distress, it is of particular importance to identify the accounting measure which results in the highest number of banks correctly identified as distressed and the lowest number of banks incorrectly identified as healthy. This is due to three key characteristics of banks and the banking system which differentiates them from the rest of the economy. Firstly, banks play a pivotal role in the economy of a given country by transferring financial capital from economic agents with surplus funds to economic agents with deficit funds. In addition, the sound functioning of the banking system is founded on the basis of the confidence of the customers of banks in the financial stability of these financial institutions. In order to maintain this confidence in the banking system, it is necessary to be able to identify accurately and in a timely manner those banks that are at risk of default. Thirdly, due to the nature of the banking system, the bankruptcy of one bank can trigger contagion effects within the financial sector resulting in the collapse of the entire system. These three characteristics of the financial system imply that the inability to identify reliably distressed banks could lead to severe loss of welfare for society and significant value erosion for the economy as a whole. Therefore, it could be argued that the ability to identify accurately banks at risk of default is more important than the ability to identify accurately healthy banks. Consequently, those accounting measures which result in the highest number of correctly identified distressed banks and the lowest number of banks incorrectly identified as healthy are considered the most accurate and reliable distress classification indicators.

Table 3 demonstrates that the accounting measures which result in the highest number of banks correctly identified as distressed are those based on non-performing loans to total loans. The measures based on one-, two-, and three-year moving averages each correctly identify 20 banks as distressed. A potential explanation for these findings could be the fact that these ratios reflect the credit risk faced by a bank, which is the most important source of commercial bank losses and the most common reason for bank failures.

In addition, the results presented in Table 3 show that measures of capital adequacy such as Tier 1 and Total Capital Ratios result in the lowest number of correctly identified distressed banks. These measures also result in the highest number of correctly identified healthy banks. These findings could be explained by the fact that regulatory measures of capital adequacy are set too low and consequently fail to identify those financial institutions that are at risk of default. Another explanation for these results could be that, in order to calculate the Tier 1 and Total Capital ratios, it is necessary to calculate the risk-weighted assets of banks. The weights that are used to calculate these risk-weighted assets are relatively arbitrary and not determined by an explicit risk model (this is true for the period under consideration of this study). Furthermore, it can be proven that supervisory agencies have a limited ability to recognize or penalize ‘bad’ banks when the amount of required capital is dependent upon the degree of risk reported by these banks. Consequently, it may be necessary to devise more ‘risk-insensitive’ measures of capital adequacy, in order to overcome the shortcomings of the Tier 1 and Total Capital ratios (Poghosyan and Cihak, 2009). It can be concluded that current regulatory measures of capital adequacy should not be used as a reliable distress classification tool and should not be adopted to make decisions or develop policies that aim at preventing financial distress and/or minimizing its costs. These findings suggest that the measures used by regulatory institutions to identify banks at risk of

default need to be revised and that it is necessary to use indicators of bank distress with a higher predictive power such as measures of asset quality.

Table 4 shows an analysis of the predictive power for each accounting measure. The first column of the table presents the percentage of distressed banks identified by each accounting measure out of the total number of examined banks. When comparing the number of banks that are classified as distressed according to each accounting measure relative to the benchmark media measure, it appears that the ratios which reflect information about the asset quality of banks, such as those based on provision for loan losses or non-performing loans, overestimate the number of distressed banks. In contrast, the accounting ratios which measure the capital adequacy of banks, such as the total shareholder equity to total assets, Total Capital, and Tier 1 Capital ratios, appear to underestimate the number of distressed financial institutions. These results support the *a priori* expectation that accounting measures which belong to the same group will behave in a similar manner and provide consistent results.

Table 4 also presents the percentage of distressed banks, the total number of banks correctly identified as either distressed or healthy by each accounting measure, the percentage of banks correctly identified as either healthy or distressed out of the total number of banks, the percentage of correctly identified distressed banks out of the total number of distressed banks within the analyzed sample - or the so-called 'sensitivity' of each measure - and the percentage of correctly identified banks as healthy out of the total number of healthy banks - or the so-called 'specificity' of each measure. As previously explained, for the purposes of this study, the most crucial assessment of the accuracy and reliability of each accounting measure is that of sensitivity.

According to the measure of sensitivity of each accounting ratio, the ratios based on non-performing loans to total loans are the best indicators of bank distress. In addition, the

measures based on provision for loan losses to total loans are shown to be relatively more accurate compared to capital adequacy or multivariate measures of bank distress. The former measures constitute the group of accounting ratios which reflect the asset quality of financial institutions. These accounting measures capture information about the degree of credit risk faced by financial institutions and consequently present a more accurate indication of the financial health of banks.

Finally, the results presented in Table 4 re-confirm the finding that measures of capital adequacy are less reliable and inconsistent indicators of the financial soundness of banks.

The above-presented findings confirm the *a priori* expectation that the accounting ratios within each group of measures will behave in a similar and consistent manner. The measures within the asset quality group appear to be more accurate relative to those within the capitalization and multivariate groups since they result in the highest percentage of correctly identified distressed banks.

5 Robustness Checks

In order to evaluate the reliability of the baseline analysis adopted in this study, it is necessary to perform certain robustness checks with regards to the sample selection techniques and the methodology employed.

Since the benchmark measure of distress is based on media information, it is possible that some banks, in particular the smaller ones, may attract less media attention. As a result, a bank that is distressed may be incorrectly classified as healthy if the media does not report any information on it. In addition, it is expected that larger banks will receive higher media exposure relative to small and medium-size banks. Consequently, the presence of banks which are too large or too small in the baseline sample could introduce a bias to the results.

To assess the degree of robustness of the sample selection techniques with regards to bank size, it is necessary to perform the analysis separately with a sub-sample of medium-size banks. The proxy for size that is employed is the total value of bank assets.

In order to perform these robustness tests, a sample which excludes those observations in the highest and lowest quartile of banks in terms of asset value is constructed. The paired correlations between the dummies included in the sample are then re-estimated. The only correlations between the benchmark measure and the accounting measures that are significant are those based on total shareholder equity to total assets and non-performing loans to total loans. Consequently, the findings associated with the baseline sample of banks appear robust with regards to the sample selection techniques and methodology adopted in the study.

6 Conclusion

The recent financial crisis has highlighted the need to identify measure(s) of the degree of soundness of financial institutions that can be used in order to separate distressed from healthy organizations, identify potentially vulnerable banks well in advance of the occurrence of insolvency, and assess the efficiency and financial consequences of existing methods of dealing with distress. Since the characteristics of banks are fundamentally different from those of non-financial institutions, conventional measures of distress such as the interest coverage ratio cannot be used when analyzing them. According to the existing literature, there is no universally accepted definition and measure of financial distress that can be applied to banks. This paper identifies the most accurate, reliable, simple, and consistent distress classification tool that can be used based on accounting measures of the financial soundness of banks. Media information on each bank is used as a benchmark in order to evaluate the goodness of fit of each distress measure. The results of the study show that the

most adequate and consistent measures of distress are those based on non-performing loans to total loans. In addition, the results show that the use of a three-year industry moving average provides a better benchmark for distress relative to one- and two-year industry averages. The findings also demonstrate that measures related to the asset quality of banks tend to overestimate the number of distressed banks, and measures related to the capital adequacy of banks tend to underestimate that of distressed banks. The results of the study appear robust with regards to the sample selection techniques and methodology employed in order to perform the analysis.

This study identifies the most accurate accounting measure on the basis of which banks can be classified as healthy or distressed. As such, market-related indicators which are naturally volatile, in particular during banking crises (as banks rarely fall alone), have been overlooked. An interesting area for further research includes a comparative analysis of the different types of government policies that can be devised to deal with distress in the financial sector and the relative performance and effectiveness of these policies both in the short- and long-term using accounting and market-related indicators.

References

Alashi, S. (1993) 'Bank Failure Resolution: The Main Option'. *NDIC Quarterly*, 3 (2), pp. 41 - 58.

Amel-Zadeh, A., Meeks, G. (2009) 'Bank Failure, Mark-to-Market and the Financial Crisis'. Working Paper, [Online].

Available at: <http://ssrn.com/abstract=1494452>.

[Accessed December 1, 2009]

Barth, J. et al. (2001) 'Bank Regulation and Supervision: What Works Best?'. *Bank for International Settlements Working Paper*, [Online].

Available at: <http://www.bis.org/bcbs/events/b2ealev.pdf>.

[Accessed September 5, 2009]

Bernanke, B. et al. (1996) 'The Financial Accelerator and the flight to quality'. *The Review of Economics and Statistics*, 33(1), pp. 1 - 15.

Curry, T., Elmer, P., Fissel, G. (2003) 'Using Market Information to Help Identify Distressed Institutions: A Regulatory Perspective'. *FDIC Banking Review*, 15(3), pp. 1 – 16.

Demirguc-Kunt, A., Detragiache, E. (2005) 'Cross-country Empirical Studies of Systemic Bank Distress: A Survey'. *IMF Working Paper* No. 05/96, [Online].

Available at: <http://ssrn.com/abstract=888142> (Social Science Research Network).

[Accessed September 5, 2009]

Elebute, K. (1999) 'The Role of External Auditors in Resolving Distress'. *This Day Newspaper*, [Online].

Available at: <http://www.freewebs.com/bizadmin/publication4.htm>.

[Accessed September 5, 2009]

Elsas, R. (2007) 'Preemptive Distress Resolution Through Bank Mergers'. Working Paper, [Online].

Available at: <http://ssrn.com/abstract=967306> (Social Science Research Network).

[Accessed September 5, 2009]

Heffernan, S. (2003) 'Bank Failures'. *Modern Banking*, 2nd ed. West Sussex: John Wiley & Sons Ltd, pp. 351 – 406.

Hwang, D., Y., Lee, C., Liaw, K. (1997) 'Forecasting Bank Failures and Deposit Insurance Premium'. *International Review of Economics and Finance*, 6(3), pp. 317 – 334.

King, T., Nuxoll, D., Yeager, T. (2006) 'Are the Causes of Bank Distress Changing? Can Researchers Keep Up?'. *Federal Reserve Bank of St. Louis Review*, pp. 57 – 80.

Koetter, M. et al. (2005) 'Accounting for Distress in Bank Mergers'. *Deutsche Bundesbank Discussion Paper Series 2*, [Online].

Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=811525 (Social Science Research Network).

[Accessed September 5, 2009]

Laeven, L., Valencia, F. (2008) 'Systemic Banking Crises: A New Database'. *International Monetary Fund Working Paper*, [Online].

Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1278435 (Social Science Research Network).

[Accessed September 5, 2009]

Logan, A. (2000) 'The Early 1990s Small Bank Crisis; Leading Indicators'. *Financial Stability Review*, December, London: The Bank of England, pp. 130 – 145.

Office of Comptroller of the Currency. (1988) 'Bank Failure: An Evaluation of the Factors Contributing to the Failure of National Banks'. *Federal Reserve Bank of Chicago Working Paper*, [Online].

Available at: <http://www.occ.treas.gov/bankfailure.pdf>.

[Accessed September 5, 2009]

Olugun, S. (1994) 'Bank Failures in Nigeria: Genesis, Effects and Remedies'. *CBN Economic and Financial Review*, 32 (10), pp. 512 - 521.

Poghosyan, T., Cihak, M. (2009) 'Distress in European Banks: An Analysis Based on a New Data Set'. *International Monetary Fund Working Paper*, [Online].

Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1356465.

[Accessed September 5, 2009]

Sahajwala, R., Van den Bergh, P. (2000) 'Supervisory Risk Assessment and Early Warning Systems'. *Basel Committee on Banking Supervision Working Paper*, [Online].

Available at: http://www.bis.org/publ/bcbs_wp4.pdf.

[Accessed September 5, 2009]

Sahut, J., Mili, M. (2009) 'Determinants of Banking Distress and Merger as Strategic Policy to Resolve Distress'. *Working Paper*, [Online].

Available at: <http://ssrn.com/abstract=1343814> (Social Science Research Network).

[Accessed September 5, 2009]

Whalen, G., Thomson, J. (1988) 'Using Financial Data to Identify Changes in Bank Condition'. *Federal Reserve Bank of Cleveland Economic Review*, 2(1), pp. 17 – 26.

Wheelock, D., Wilson, P. (2000) 'Why Do Banks Disappear? The Determinants of U.S. Bank Failures and Acquisitions'. *The Review of Economics and Statistics*, 82(1), pp. 127-138.

Wirnkar, D. (2009) 'CAMEL Based Derived W-score Function for Banks Performance Evaluation: An Urgent Necessity'. Working Paper, [Online].

Available at: <http://ssrn.com/abstract=1355043> (Social Science Research Network).

[Accessed September 5, 2009]

Wirnkar, D., Tanko, M. (2008) 'CAMEL(S) and Banks Performance Evaluation: The Way Forward'. Working Paper, [Online].

Available at: <http://ssrn.com/abstract/=1150968> (Social Science Research Network).

[Accessed September 5, 2009]

Table 1: Distress classification measures

Groups	Measures	VARIABLE	DESCRIPTION
Trigger Points	MEASURE 1	Capitalization, ROE, Asset quality	This measure, developed by Poghosian and Cihak (2009), defines the trigger points of Total shareholder equity / Total Assets (2.7%), Net Income available to common shareholders / Total shareholder equity (-37.9%), and Provision for loan losses / Total loans (14.3%) above/below which a bank can be classified as distressed.
	MEASURE 2	Provision for loan losses / Total loans (1-year industry average)	Similarly to Elsas (2007), a bank is defined as distressed if the measure is in the highest two deciles of the industry. Industry deciles are calculated using values of the current year.
Asset Quality	MEASURE 3	Provision for loan losses / Total loans (2- year industry moving average)	This measure considers a 2-year moving average when calculating industry deciles of Provision for loan losses / Total loans. A bank is defined as distressed if the measure is in the highest two deciles of the industry.
	MEASURE 4	Provision for loan losses / Total loans (3-year industry moving average)	This measure considers a 3-year moving average when calculating industry deciles of Provision for loan losses / Total loans. A bank is defined as distressed if the measure is in the highest two deciles of the industry.
	MEASURE 5	Non-performing loans / Total loans (1-year industry average)	In line with practitioners, this measure defines distress by looking at Non-performing loans as a proportion of Total loans. A bank is defined as distressed if the measure is in the highest two deciles of the industry.
	MEASURE 6	Non-performing loans / Total loans (2-year industry moving average)	This measure considers a 2-year moving average when calculating industry deciles of Non-performing loans / Total loans. A bank is defined as distressed if the measure is in the highest two deciles of the industry.
	MEASURE 7	Non-performing loans / Total loans (3-year industry moving average)	This measure considers a 3-year moving average when calculating industry deciles of Non-performing loans / Total loans. A bank is defined as distressed if the measure is in the highest two deciles of the industry.
	MEASURE 8	Total shareholder equity / Total assets	Following Wheelock and Wilson (2000), a bank is distressed if its Equity / Assets ratio is lower than 2%
Capital Adequacy	MEASURE 9	Total Capital ratio	The Capital adequacy ratio is imposed by the Basel Accord and banks must maintain a minimum ratio of Total capital to Risk-weighted assets of 8%. Total capital is the sum of permanent shareholder equity, disclosed reserves, loss reserves, revaluation reserves, hybrid instruments, and subordinated long-term debt less goodwill.
	MEASURE 10	Tier 1 Capital ratio	The Capital adequacy ratio is imposed by the Basel Accord and banks must maintain a minimum ratio of Tier 1 Capital to Risk-weighted assets of 4%. Tier 1 Capital equals the sum of permanent shareholder equity and disclosed reserves less goodwill.
Media	MEASURE 11	Media information	A bank is catalogued as distressed based on world media information contained in the Nexis database.

Table 2: Paired correlations between accounting measures and the media benchmark

	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10
M1		0.609	0.616	0.616	0.536	0.531	0.528	0.231	0.077	0.010
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.008	0.737
M2	0.609		0.966	0.966	0.772	0.766	0.772	0.133	0.061	0.034
	0.000		0.000	0.000	0.000	0.000	0.000	0.000	0.037	0.240
M3	0.616	0.966		0.977	0.798	0.792	0.798	0.135	0.062	0.037
	0.000	0.000		0.000	0.000	0.000	0.000	0.000	0.035	0.210
M4	0.616	0.966	0.977		0.777	0.777	0.778	0.135	0.062	0.037
	0.000	0.000	0.000		0.000	0.000	0.000	0.000	0.035	0.210
M5	0.536	0.772	0.798	0.777		0.971	0.966	0.153	0.051	0.054
	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.082	0.067
M6	0.531	0.766	0.792	0.777	0.971		0.977	0.152	0.050	0.052
	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.084	0.075
M7	0.528	0.772	0.798	0.778	0.966	0.977		0.109	0.051	0.055
	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.080	0.059
M8	0.231	0.133	0.135	0.135	0.153	0.152	0.109		0.332	0.071
	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000	0.015
M9	0.077	0.061	0.062	0.062	0.051	0.050	0.051	0.332		-0.007
	0.008	0.037	0.035	0.035	0.082	0.084	0.080	0.000		0.822
M11	0.010	0.034	0.037	0.037	0.054	0.052	0.055	0.071	-0.007	
	0.737	0.240	0.210	0.210	0.067	0.075	0.050	0.015	0.822	

Notes: The table shows the size of the paired correlations between the accounting and media measures, and the corresponding significance levels (p-values presented below each correlation) based on the sample of 1,175 banks. ‘M1,’ ‘M2,’ ... ‘M11’ stand for Measure 1, Measure 2... Measure 11, respectively. The correlations which are statistically significant at the 5% or 1% significance levels are highlighted. Measure 10 is omitted from the table since no paired correlations could be estimated with the other measures.

Table 3: Expectation-Prediction analysis of each accounting measure

Panel A: Measure 1		
Predicted	Actual	
(number)	Healthy	Distressed
Healthy	978	49
Distressed	140	8

Panel B: Measure 2		
Predicted	Actual	
(number)	Healthy	Distressed
Healthy	913	43
Distressed	205	14

Panel C: Measure 3		
Predicted	Actual	
(number)	Healthy	Distressed
Healthy	917	43
Distressed	201	14

Panel D: Measure 4		
Predicted	Actual	
(number)	Healthy	Distressed
Healthy	917	43
Distressed	201	14

Panel E: Measure 5		
Predicted	Actual	
(number)	Healthy	Distressed
Healthy	846	37
Distressed	272	20

Panel F: Measure 6		
Predicted	Actual	
(number)	Healthy	Distressed
Healthy	843	37
Distressed	275	20

Panel G: Measure 7		
Predicted	Actual	
(number)	Healthy	Distressed
Healthy	849	37
Distressed	269	20

Panel H: Measure 8		
Predicted	Actual	
(number)	Healthy	Distressed
Healthy	1,111	55
Distressed	7	2

Panel I: Measure 9		
Predicted	Actual	
(number)	Healthy	Distressed
Healthy	1,117	57
Distressed	1	0

Panel J: Measure 10		
Predicted	Actual	
(number)	Healthy	Distressed
Healthy	1,118	57
Distressed	0	0

Table 4: Prediction Power of each accounting measure

	Percentage of Distressed Banks	Number of Correct Predictions	Percentage of Correct Predictions	Sensitivity	Specificity
Measure 1	13%	986	84%	14%	87%
Measure 2	19%	927	79%	25%	82%
Measure 3	18%	931	79%	25%	82%
Measure 4	18%	931	79%	25%	82%
Measure 5	25%	866	74%	35%	76%
Measure 6	25%	863	73%	35%	75%
Measure 7	25%	869	74%	35%	76%
Measure 8	1%	1,113	95%	4%	99%
Measure 9	0%	1,117	95%	0%	100%
Measure 10	0%	1,118	95%	0%	100%
Measure 11	5%	1,175	100%	100%	100%

Notes: 'Percentage of Distressed Banks' represents the percentage of banks identified as distressed out of the total number of examined banks by each accounting measure. 'Number of Correct Predictions' equals the sum of correctly identified healthy and distressed banks by each accounting measure relative to the media benchmark measure. The 'Percentage of Correct Predictions' presents the percentage of correctly identified healthy and distressed banks out of the total number of examined banks. The measure of sensitivity identifies the percentage of correctly identified distressed banks out of the total number of de facto distressed banks included in the sample. The measure of specificity identifies the percentage of correctly identified healthy banks out of the total number of de facto healthy banks.