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J. Barrow

Kennesaw State University, jbarrow5@kennesaw.edu

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A MODEL FOR THE INTERVENTION OF A FINANCIAL CRISIS

Janice M. Barrow, Kennesaw State University

ABSTRACT

This paper builds a model for intervention and/or mitigation of a financial crisis by first identifying those conditions precedent to a systemic based financial crisis, and then outlining a process to integrate firm specific and systematic risk into a comprehensive strategic model. A simple application of the model was able to identify significant outliers. For example, using 2006 to 2010 data, Capital One Financial Corporation was identified for intervention from as early as 2006. This corporation received \$3.56 billion of the Emergency Economic Stabilization Act Federal bailout funds.

JEL: G01 - Financial Crises, G28 - Government Policy and Regulation

KEYWORDS: Systematic risk, financial crisis, banking, reform, failure, regulation, capital, interconnectedness, macro-prudential, micro-prudential

INTRODUCTION

In hindsight, regulators and analysts, alike, have been able to identify several factors that led to the Financial Crisis that began in 2007 (Poole, 2010b). The causes presented include factors such as: inadequate regulation; duration mismatch; federal subsidy of housing; federal subsidy of debt financing; moral hazard; interconnectedness of institutions; and unmanaged systematic risk (Lal, 2010; Poole, 2010a; Poole, 2010b; Scott 2010; Leondis, 2010; Ennis and Keister, 2010). Unfortunately, historically, bank regulations tend to be passed in response to various crises rather than to prevent them from occurring although there is no doubt that financial institutions play an integral role in the functioning of the economy and should be given priority (Barth et al. 2010; Holowecky et al. 2010). Therefore, going forward, the important question that needs to be answered is: *In foresight, how can we prevent or mitigate future financial crises, and what regulation is required?*

The remainder of the paper attempts to answer that question. The next section is a continuation of the review of the literature introduced here in the introduction. The literature review focuses on identifying conditions precedent to a financial crisis, and then on building a model to prevent or mitigate future crises. The following section presents data and analysis of a simple application of the model. The final section summarizes the paper and makes recommendations for further research.

LITERATURE REVIEW AND MODEL DEVELOPMENT

In reviewing the literature, prevention solution options presented include recommendations to: alter capital requirements; change clearing houses usage requirements; alter the way insolvent institutions are resolved; continue emergency lending by the Fed, and restructure the regulatory system All such solutions have been argued to be burdensome and ineffective to prevent a systematic risk based crisis (Scott, 2010). In his paper, Scott concentrated on reviewing the literature on the relevant recommendations of the Committee on Capital Markets Regulation (CCMR) and The United States Treasury as well as pending congressional legislation. The CCMR is an independent, nonpartisan research organization founded in 2005 to improve the regulation of United States capital markets. It consists of 30 leaders from the investor community, business, finance, law, accounting and academia (CCMR, 2011).

Evidence of the ineffectiveness of the proposed solutions is seen in the failure of Basel II, the recommendations on banking laws and regulations issued by the Basel Committee on Banking Supervision created by the central bank Governors of the Group of Ten nations passed in 2004. The Basel III documents submitted in 2009 attempt to answer the question of “What regulation is required?” and its provisions include: changes in the definition of capital; revisions to counter party credit capital standards; new global leverage ratio; explicit capital buffer standards; and new global liquidity standards (Holbrook, 2010). Among other things, these provisions are an attempt to improve the regulation of the financial system but still leave significant systematic risk exposure which is one of the main factors that helped cause the crisis in the first place (Boerner, 2010; Holbrook, 2010; Weber, 2010; Triana, 2010). For example, Berger et al (2008) show that Bank Holding Companies (BHC) had been actively managing their capital ratios, had set targets substantially above regulatory minima and make rapid adjustments towards those targets. Even the new regulatory requirements under Basel III would not have been adequate to prevent the crisis. Triana (2010) further shows that Basel III: permits higher leverage (higher risk); has flawed risk measures; and restricts opportunities for higher potential returns – increases risks and lowers returns.

If these solutions presented are indeed ineffective and/or incomplete then the use of early, reliable indicators to signal trouble and trigger intervention could prove invaluable. The next step then is to provide valuable information in answering the question of how to prevent or mitigate future financial crisis by focusing on managing systematic risk and by developing a model that identifies factors that can signal trouble and trigger intervention.

Conditions Precedent of the Financial Crisis

There have been many factors identified in the cause of the financial crisis that began in 2007 and there is no clear consensus as to whether regulatory reform would serve to prevent such a crisis from recurring. However, there is consensus on the following three conditions precedent:

Large losses from lending and securitization: This is macro systematic risk related to over-exposure in an upswing of a credit cycle and being overly risk averse in a down cycle (Stucke, 2010). Risk build-up in an expansion is countercyclical (Weber, 2010).

Interconnectedness: This is macro systematic risk related to the failure of one significant institution, which can cause or contribute to the failure of other significant institutions; and the possibility that one exogenous shock may cause or contribute to the failure of multiple significant financial institutions (Scott, 2010).

Loss of Confidence: This is macro systematic risk related to the level of financial transactions that are not regulated and/or protected, the level of uninsured deposits, credit default risk exposure, innovations such as information technology or information asymmetry (Scott, 2010; Poole, 2010a). Ennis and Keister (2010) conclude that financial crises have a self-fulfilling component and that the banks’ operating structure makes them susceptible to runs and so they are innately fragile.

Modeling Considerations

This paper contends that the measures of those conditions precedent can serve to provide early warning signals of changes in systematic risk and be used in conjunction with regulatory reform to trigger pre-crisis intervention. Additionally, according to Allen and Saunders (2004) U.S. banking regulators have contended that 15-20 major banks and 5-10 major securities firms dominate critical financial markets, therefore as global financial markets consolidate and harmonize the possibility of contagion risk

increases. However, this smaller list of key players could provide a more narrowly focused intervention/mitigation strategy.

The hypothesis broadly stated, therefore, is:

$$\text{Decision to intervene} = f(\text{credit countercyclical risk, interconnectedness, loss of confidence}) \quad (1)$$

Allen and Saunders (2004) define pro-cyclicality as system-wide operational losses triggered by contagion across linked financial intermediaries. They surveyed the effects of pro-cyclicality on risk measures and found that, whereas a fundamentally strong institution can often recover from market and credit risk, it may be impossible for it to recover from certain operational risk events. Therefore, the main concerns are the low frequency/high severity risk events, which occur quite infrequently, consistent with the conditions precedent.

Franz (2010) has shown that the stock market has been highly consistent in predicting economic expansions and contractions. Additionally, Tsai and Chang (2010) have also shown that since macroeconomic factors are affected by government actions, macroeconomic and firm specific factors must be dealt with separately. Their model establishes financial factors, market variables and macroeconomic variables, to successfully predict financial distress.

A review of the literature relating to procyclicality tendencies of banking shows how banking capital requirements along with monetary policy actually results in the amplification of exogenous shocks. One key factor affecting the magnitude of the procyclical effect is measured by the composition of the banks' asset portfolio (Drumond, 2009). This would then be combined with a measure of macroeconomic policy to estimate the systematic risk associated with procyclical effects.

Measures of interconnectivity relate to size and so identification of those major banks and securities firms, that dominate the market, is critical.

The factors leading to loss of confidence have to do with the innate fragility of the banking system and can be measured by the leading indicators such as the movement of the stock market as well as bank specific risk factors in their operating environment.

Recommended Process

Step 1: Utilize a financial distress prediction model to identify firm specific risks such as a discrete-time hazard model like the multi-period logit model, which has been used successfully to estimate the significant parameters in predicting financial distress (Tsai and Chang, 2010, Shumway 2001; Barrow, 1993). The assumed functional form of the logit model is the logistic function:

$$\Pr [Y_i=1] = P_i = (1/(1+e^{-W_i})), \quad i = 1 \dots N \quad (2)$$

Where,

$$W_i = b_0 + \sum_{j=1}^m b_j x_{ij} \quad (3)$$

is the logit transformation and is a linear combination of the independent variables and a set of coefficients $b_j = (b_1, b_2, \dots, b_m)$ that can be estimated. N is the number of observations; x is the value of the j th variable of the i th observation; and Y_i is a dependent variable that represents the final outcome: $Y_i = 1$ for failed institutions, $Y_i = 0$ for non-failures.

For this application, it is assumed that there is some linear combination of the independent variables that is positively related to financial distress. If W_j exists, it is an index of that institution's propensity to fail or become solvent.

Step 2: The parameters from Step 1 can then be used to identify problem financial in conjunction with a predetermined distress cut-off point.

Step 3: To address the issues of interconnectivity and pro-cyclicality, the next step is to identify the large financial institutions that have a significant impact on economic activity.

Step 4: Closely monitor those institutions identified in Step 3 for vulnerability.

DATA ANALYSIS

There were two key sources of banking data. The first is from Wharton Research Data Services (WRDS), a web-based business data research service from The Wharton School at the University of Pennsylvania. Their Bank Regulatory Database contains five databases for regulated depository financial institutions. These databases provide accounting data for bank holding companies, commercial banks, savings banks, and savings and loans institutions. Their data comes from the required regulatory forms filed for supervising purposes. The second source of data is from the National Information Center (NIC), a central repository of data about banks and other institutions for which the Federal Reserve has a supervisory, regulatory, or research interest, including both domestic and foreign banking organizations operating in the United States. Their web site provides access to NIC data, allowing the public to search for detailed information about banking organizations.

The NIC has a Bank Holding Company Peer Groups report that contains a summary of peer group financial data and a listing of Bank Holding Companies (BHCs) in each Peer Group. BHCs with assets over \$500 million are classified into one of nine tiers. Tier 1 consists of BHCs with consolidated assets of \$10 Billion and over. Given that only the top 20 or so financial institutions dominate the financial markets, the top tier 1 banks with consolidated assets of \$100 billion were selected for review. Table 1 shows 22 institutions that met the criteria. These are the main institutions to monitor in addressing the interconnectedness and pro-cyclicality systematic risks considerations and therefore, the key financial institutions that should play a major role in the financial crisis intervention or mitigation process. Note, however, that the number is not static.

Fundamental company data was provided by Capital IQ, a business owned by the Standard and Poors Company and accessible from WRDS. Capital IQ provides market data across all major quoted markets including equity, mutual funds, fixed income, indices, commodities, currencies, and rates. Equity pricing data includes close, open, bid, ask, mid, low, best, high price values along with volume, splits, dividends, ticker, exchange information, short interest data, and VWAP for select markets. Upon retrieving the data it was discovered that due to various reasons, such as reorganizations (TD Bank Holding Company, U.S. Bankcorp, Ally Financial Inc. and Citizens Financial Group) or is privately held (Taunu Corporations), there were only 17 BHCs with complete market price data for analysis.

Following on Franz (2010), it is assumed that the stock market is consistent in anticipating economic cycles. To confirm this assumption, S&P 500 index monthly data was compared with the adjusted stock prices for the 17 banks using the Pearson product-moment correlation coefficient (r). It ranges from +1 to -1. A correlation of +1 means that there is a perfect positive linear relationship between variables. Table 2 and Figure 1 show the results for the five-year period reviewed, 2006 to 2010.

Based on the “Rule of Thumb” shown in Table 3, there was a very strong correlation between the variables during the period 2006 and 2010, inclusive with no outliers. The period 2006 was chosen to establish a base correlation before the financial crisis that began in 2007. There was a high correlation between the variables with an outlier exception of Capital One Financial Corporation that had a correlation coefficient of -0.471 and was the recipient of \$3.56 billion of the Emergency Economic Stabilization Act Federal bailout in the form of a preferred stock purchase. (WRDS, 2010). The same analysis was done on 2010 to have current data. The correlations in 2010 were moderate, on average, with the outlier exception of Bank of America Corporation, which had a correlation coefficient of -0.0857. It lost \$2.24 billion for 2010 as gradual improvements in its core banking business were offset by charges linked to its disastrous 2008 acquisition of Countrywide Financial (WDRS, 2010). Figure 1 shows the correlation results as well as the magnitude of the outliers, banks number eleven and one, respectively.

Table 1: BHCs with consolidated assets of \$100 Billion and above as of 12/31/2010

Rank	Institution Name	Location	Total Assets 12/31/2010 (\$'000)
1	Bank of America Corporation	Charlotte, NC	\$2,268,347,377
2	JPMorgan Chase & Co.	New York, NY	\$2,117,605,000
3	Citigroup Inc.	New York, NY	\$1,913,902,000
4	Wells Fargo & Company	San Francisco, CA	\$1,258,128,000
5	Goldman Sachs Group, Inc.,	New York, NY	\$911,330,000
6	Morgan Stanley	New York, NY	\$807,698,000
7	MetLife, Inc.	New York, NY	\$730,905,863
8	Taunus Corporation	New York, NY	\$372,556,000
9	HSBC North America Holdings Inc.	New York, NY	\$343,699,907
10	U.S. Bancorp	Minneapolis, MN	\$307,786,000
11	PNC Financial Services Group, Inc., The	Pittsburgh, PA	\$264,414,112
12	Bank Of New York Mellon Corporation, The	New York, NY	\$247,222,000
13	Capital One Financial Corporation	Mclean, VA	\$197,503,411
14	Td Bank Us Holding Company	Portland, ME	\$176,972,361
15	SunTrust Banks, Inc.	Atlanta, GA	\$172,875,298
16	Ally Financial Inc.	Detroit, MI	\$172,011,000
17	State Street Corporation	Boston, MA	\$158,890,975
18	BB&T Corporation	Winston-Salem, NC	\$157,081,396
19	American Express Company	New York, NY	\$146,005,718
20	Citizens Financial Group, Inc.	Providence, RI	\$129,969,527
21	Regions Financial Corporation	Birmingham, AL	\$132,399,290
22	Fifth Third Bancorp	Cincinnati, OH	\$111,006,778

This table shows the 22 Tier 1 Bank Holding Companies with assets of \$100 billion or more, taken from the list of top 50 BHCs. There were 34 institutions with consolidated assets over \$50 billion. Source: <http://www.ffiec.gov/nicpubweb/nicweb/Top50Form.aspx>

Table 2: The Pearson’s Correlation Coefficient for the S&P 500 and Our Top Banks

Period/Variable	Average <i>r</i> for the 17 banks	<i>n</i>
Monthly statistics 2006-2010	0.836	60
Monthly statistics 2006	0.728	12
Monthly statistics 2010	0.581	12

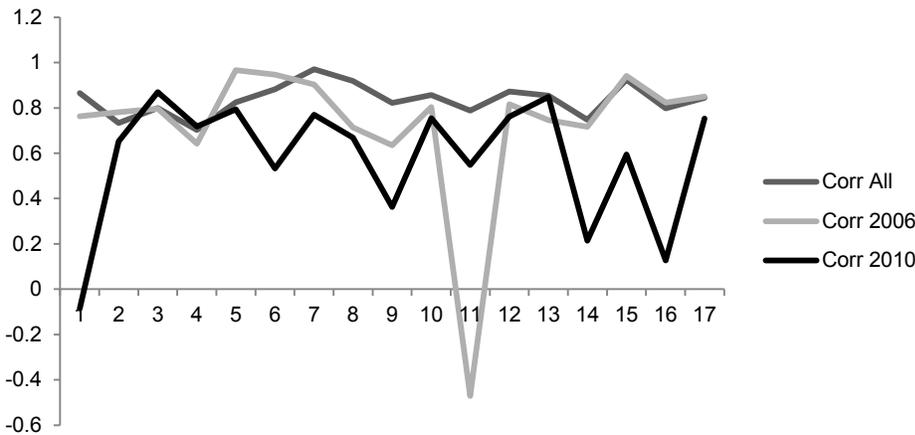
This table shows the results of the correlation analysis between the S&P 500 indices and the adjusted stock price for the 17 BHCs for the three time-periods indicated.

Table 3: Rule of Thumb for Interpreting the Size of a Correlation Coefficient

Size of Correlation	Interpretation
0.90 to 1.00 (-0.90 to -1.00)	Very high correlation
0.70 to 0.90 (-0.70 to -0.90)	High correlation
0.50 to 0.70 (-0.50 to -0.70)	Moderate correlation
0.30 to 0.50 (-0.30 to -0.50)	Low correlation
0.00 to 0.30 (0.00 to -0.30)	Little if any correlation

Source: Hinkle DE, Wiersma W, Jurs SG. (1998). *Applied Statistics for the Behavioral Sciences, 4th ed.* Boston, Houghton Mifflin Company.

Figure 1: Plot of the Correlation Coefficients for the 17 Institutions by Rank



This figure 1 shows the correlation coefficient (*r*) between the monthly S&P 500 indices and the stock price of the top 17 banks using 2006 to 2010 data, 2006 data and 2010 data. The outlier in 2006 was Capital One Financial Corporation and the outlier in 2010 was Bank of America Corporation.

CONCLUSION

This paper reviewed the literature on the causes of financial crises and many solution ideas, including those recommended by Basel III submitted in 2009, the Group of Ten’s Basel Committee on Banking Regulation. The suggestions presented were found to be either ineffective or incomplete. After closely reviewing the proposals and analyses submitted by regulators and analysts, there seemed to be consensus on three key systematic risk factors: large losses from lending and securitization; interconnectedness; and loss of confidence. A four-step process is then presented. Critical to the process is the ability to predict firm specific risks separate from macroeconomic risks. A simple application of the model using 2006 to 2010 data showed how, for example, Capital One Corporation could and should have been flagged for intervention from 2006, before anyone had an idea of the crisis to come. In addition, the model has flagged Bank of America Corporation, using the 2010 data.

The application of the model used only one variable, however the full application of the model could use several variables in a more complex intervention matrix. Further study and extensions of the findings of

this paper could integrate the four steps, and using all relevant variables, such as bank specific risk factors, in a comprehensive strategy for intervention and mitigation of future financial crises.

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BIOGRAPHY

Dr. Janice Barrow has a Ph.D. in Finance from the University of Houston – University Park. She is the Associate Director of Executive Education Programs, a faculty member of the Department of Economics, Finance and Quantitative Analysis, of the Coles College of Business, and a member of the Graduate Faculty at Kennesaw State University. She can be contacted by email at: jbarrow5@kennesaw.edu