

How Effective is Global Financial Regulation?

The Basel Accords' Role in Mitigating Banking Crises

Robert Andreas Nowak

Professor Connel R. Fullenkamp, Faculty Advisor

Professor Michelle Connolly, Seminar Instructor

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Abstract

After the Global Financial Crisis 2007-2010, the effectiveness of global financial regulation, as promoted by the Basel Committee on Banking Supervision, has been questioned. Conventional minimum capital requirements like the tier capital ratio seem to have failed in reducing the risk of bank failures. In light of the Basel III Accord, new and potentially better financial ratios are being developed to prevent future banking crises from happening. This paper compares bindingness and effectiveness characteristics of capital and liquidity ratios from the Basel I and III frameworks. It entails a series of descriptive and regression analyses to examine these ratios' power to detect and mitigate bank failures. Surprisingly, the current tier capital ratio seems to denote an effective measure of bank failures in contrast to two newly developed measures, the common equity ratio and the net stable funding ratio.

JEL classification: F1, G21, G28

Keywords: Banking Crisis; capital ratio; liquidity ratio; tier capital ratio; net stable funding ratio; Basel I Accord; Basel II Accord; Basel III Accord; minimum capital requirement; bank failure; bank risk

I. Introduction

Financial crises have always been seen as painful constituents of the economic system we find ourselves in. Whether it was the British Credit Crisis in 1772, the Latin American Debt Crisis in the early 1980s or the bursting of the dot-com bubble in 2001, financial crises led to economic recessions, high unemployment and low consumer confidence levels. However, none of these crises have come close to the economic declines caused by major bank failures. Crises like the Great Depression in the 1930s and the current Global Financial Crisis of 2007-2010 were particularly characterized by major bank failures that brought global economies unprecedented instability. The latter redefined in particular what people thought of as “banking crisis” and incited authors like Richard A. Posner to write books titled *A Failure Of Capitalism: The Crisis of '08 and the Descent into Depression*. In 1988 the Basel Committee on Banking Supervision developed a framework of rules - known as the Basel Accord - to establish minimum capital requirements that should ensure banks’ stability. Nevertheless, breakout of the Global Financial Crisis in 2007 calls attention to potential deficiencies of the Basel Accord of 1988. Did global financial regulation fail or were there other factors in play that majorly contributed to the crisis? This research paper deals with the general effectiveness of global financial regulation and tries to answer the question of whether current and future global financial regulation mitigate banking crises.

The assumed lack of proper financial regulation has often been blamed for the occurrence of bank failures. Proponents of stricter financial regulation argue that a lax banking system promotes unnecessary risk-taking, consequently endangering the economy and society as a whole. However, opponents of financial regulation highlight the idea of a free-market system in which companies, such as banks, operate more profitably when unconstrained. Regarding the

debate about the issue of financial regulation, it is important to take a look at the effectiveness of the financial regulation established by the Bank of International Settlements (henceforth BIS).

This research paper addresses three questions in particular:

*1) **Bindingness:** Do the Basel Accords represent a regulatory framework that banks view as legally and economically binding?¹*

*2) **Effectiveness:** Does global financial regulation, as represented by the Basel Accords, actually mitigate bank failures?*

*3) **Future Effectiveness:** In light of the development of the Basel III Accords, how effective are new regulatory measures expected to be?*

Research papers and books have been written on methods to predict banking crises (Barrel et al. 2010, Ayuso 2002, etc.), on the pros and cons of global financial regulation (Bryan J. Balin 2008, Tarullo 2008, etc.), on the cyclicity of capital ratios (Drumond 2009, de Bondt and Prast 1999, Bernauer and Koubi 2002; etc.), and the effect of capital ratios on bank failures (Estrella et al. 2000, Martinez-Miera 2008, König 2010, etc.). According to previous empirical findings, current capital ratios tend to be pro-cyclical and negatively correlated with bank failures.² This research paper investigates the comparative characteristics of present and future financial ratios as metrics to mitigate bank failures. Specifically, my research paper proposes to analyze the relationship between the historical occurrence of bank failures in G-10 countries and the countries' adherence to the Basel I and III minimum requirements to test both present and future effectiveness of the Basel Accords. I use descriptive and regression analyses to find answers for the three afore-mentioned questions.

¹ Regulations represent a "binding constraint" if they are confining the agent's optimization problem, i.e. if the agent would be able to find a more efficient allocation in the absence of the constraint.

² Pro-cyclicity denotes a positive correlation with the overall state of the economy.

II. Literature Review

In previous research and analyses, many authors have dealt with the fundamental ideas of bank failures, capital ratios and the effectiveness of the Basel Accords as a regulatory framework – both quantitatively and qualitatively. These academic papers and articles can be divided into four categories.

1. *Predicting banking crises:* Copious research has been done in the area of finding ways to predict banking crises using financial soundness indicators (Molina 2001, Cole et al. 1998, Anari et al. 1999). One example can be seen in Barrell et al. (2010), who use multivariate regressions to analyze possible causal effects of bank capital, bank liquidity and property prices on the probability of bank failure. With a logit regression model the authors found out that they are able to predict 60 to 66.6% of the banking crises defined by the IMF. Moreover, Ayuso et al. (2002) investigate how the business cycle affects Spanish banks' propensity to hold capital buffers. They find that an increase of 1 percentage point in GDP growth can reduce capital buffers by 17%. These papers take an empirical approach to understand how macroeconomic indicators affect a bank's capital levels and financial health.

2. *Policy Interests:* A second strain of papers analyzes financial regulation per se and considers its practical relevance (Copelovtich et al. 2007, Balin 2008). Bryan J. Balin (2008) presents, analyzes and critiques the effectiveness of the regulatory requirements established by the Basel I and II Accords. He criticizes the fact that the Basel Accords exclude emerging markets from capital obligations and that they do not meet specific needs for emerging markets. Banks in emerging markets are thus put into a difficult position. On the one hand, the adoption of Basel I and II requirements will likely improve banks' status as transparent and controlled institutions. This could help the banks to increase their deposit base, but also lead to excessive

risk-taking. On the other hand, being reluctant to adopt the Basel requirements would deteriorate banks' international recognition. Additionally, Daniel Tarullo (2008) challenges the notion that bank capital regulations are a beneficial policy for financial stability. Banks in G-10 countries usually hold capital in excess of the 8% minimum requirements because it allows them to maximize their return on capital and minimize the cost they would incur in case of an economic downturn. Papers in this category take a policy-related and theoretical approach to argumentatively comment on regulatory frameworks.

3. *Cyclical nature of capital ratios:* This type of papers highlights the cyclical nature of minimum capital requirements, and addresses the question of bindingness. Ines Drumond (2009) demonstrates the effect of Basel capital requirements on “pro-cyclical tendencies of banking” – banks' proneness to increase banking activities when the economy is booming and to decrease them when the economy is receding.³ Earlier papers like Bondt and Prast (1999) emphasize that even in the absence of government regulation and supervision banks tend to hold a certain “normal” amount of capital. Bernauer and Koubi (2002) perform an empirical analysis and conclude that financial regulators seem willing to allow average capital to asset ratios to fall during recessions to prevent worsening macroeconomic conditions – findings that contest the idea of bindingness. Finally, Juliusz Jablecki (2009) examines how banks reacted to the minimum capital requirements postulated by the Basel I Accord. He concludes that, although banks held more tier capital on their balance sheet, especially American banks became increasingly active in arbitraging on high capital levels by using securitization techniques – a process called regulatory capital arbitrage.⁴

³ Ines Drumond (2009)

⁴ Please refer to pp.11-12 for a detailed explanation of regulatory capital arbitrage.

4. *Capital ratios and bank failure*: A fourth type of papers specifically focuses on the effect of capital ratios on bank failures. David Martinez-Miera (2008) developed a theoretical model about the effect of regulatory capital requirements on the risk of bank failure, taking into account the optimal response of banks to different loan rates. Additionally, Philipp Johann König (2010) focuses on the theoretical effect of bank liquidity requirements on bank failures. In earlier conducted research, Estrella et al. (2000) perform an empirical analysis to test the effectiveness of different bank capital ratios as predictors of bank failure. As a result of their study, simple ratios such as leverage ratios or capital to gross revenue ratios can predict bank failures as well as the tier capital ratio. Hence, the authors emphasize the usefulness of simple capital ratios in regulatory frameworks.

My own research synthesizes the ideas and findings from all four literature categories. I test the tier capital ratio's bindingness characteristics for a global dataset (category 3), perform regression analyses to test the effectiveness of capital and liquidity ratios as predictors of bank failures (category 4), and use macroeconomic indicators as control variables for bank risk (category 1). Finally, I take a policy related stance by discussing the advantages and disadvantages of Basel I and III regulatory ratios (category 3).⁵ I base my research on Estrella et al. (2000, 2002) by regressing regulatory ratios on the risk of bank failure, but extend the paper's scope of research. Because of the preliminary nature of the Basel III Accords, empirical research on Basel III capital requirement has been very limited. The BIS conducted a quantitative impact study on banks to test the impact of new capital adequacy standards.⁶ It found out that, based on 2009 year-end data, banks satisfied most requirements except for e.g. a 7% common equity ratio

⁵ Regulatory ratios are financial ratios developed to deliberately influence an institution's balance sheet composition and financial risk-profile.

⁶ BIS (2010): Basel III: International framework for liquidity risk measurement, standards and monitoring; <http://www.bis.org/publ/bcbs188.htm>

level and a 100% net stable funding ratio level.⁷ My research takes the BIS's results into account and strongly focuses on understanding how powerful global financial regulation is. It entails an unprecedented comparative analysis of the bindingness and effectiveness characteristics of selected Basel I and Basel III capital ratios using individual bank balance sheet data from all G-10 countries in the time frame 1989-2007. I use multivariate regression analyses with future financial ratios and historical bank balance sheet data to investigate the potential impact of new regulatory metrics.

⁷ The common equity ratio and net stable funding ratio are described in further detail in Section III.

III. Theoretical Framework

The importance of regulating bank capital reserves

The Global Financial Crisis 2007-2010 has often been referred to as a “banking crisis” because it mainly involved insolvencies of banks and financial institutions that led to an economic recession. A bank failure occurs when a bank is unable to meet debt obligations to its creditors and depositors due to its inability to generate enough cash, either through its own operations or through the sale of its assets.⁸ Banks mainly generate revenue by lending out depositors’ money and collecting interest payments on them. However, the historical infrequency of bank runs, the belief in ever-increasing housing prices in the period from 2000 to 2007, the industrial and individual demand for property, and banks’ greediness to increase their profits, motivated banks to loan out large multiples of their held deposits to subprime borrowers and to assume exorbitant leverage. Then, when housing prices fell and banks’ loans became worthless, depositors panicked and demanded their deposited money. The depositors’ claim on their money caused many banks to file for bankruptcy as their excessive loan positions were not backed up by cash on their balance sheets (A sample bank balance sheet is presented in Appendix A1). In this process, bank assets were either liquidated (e.g. Lehman Brothers), acquired (e.g. Bear Sterns, Merrill Lynch) or bank debt was reorganized. This caused banks to drastically curb their lending activities – illiquidity, capital freeze and economic downturn were the consequence. Banks therefore need capital buffers and reserves to stay liquid and able to pay back their obligations to their depositors instantly. *Graph 1* on page 9 illustrates the huge jump in excess reserves held by banks as the Global Financial Crisis 2007-2010 was unwinding.⁹

⁸ FDIC Homepage, www.fdic.gov

⁹ Not only banking, but also shadow banking played a major role in fostering an environment of risk-taking and excessive lending. Shadow banks are non-depository financial institutions like investment banks, hedge funds or money

Adequate levels of capital reserves (cash buffers) are important to ensure bank stability. In 1988 the BIS established the *Basel I Accord*, a framework of rules to regulate bank capital. As arguably the most important component of this accord, the *tier 1 capital ratio* and *total tier capital ratio* were established as metrics to measure bank stability. The BIS distinguishes two types of capital, tier 1 capital and tier 2 capital. Tier 1 capital (“core” capital) consists of the most liquid and reliable capital on a bank’s balance sheet and is required to be at least 4% of risk-weighted assets. Tier 2 capital (“supplementary” capital) consists of less reliable capital on a bank’s balance sheet. It for instance includes subordinated debt which, in case of bankruptcy, has to be paid back before any of the components of tier 1 capital. Total tier capital (tier 1 + tier 2 capital) is set to be at least 8% of risk-weighted assets and is referred to as “tier capital ratio” throughout the paper.

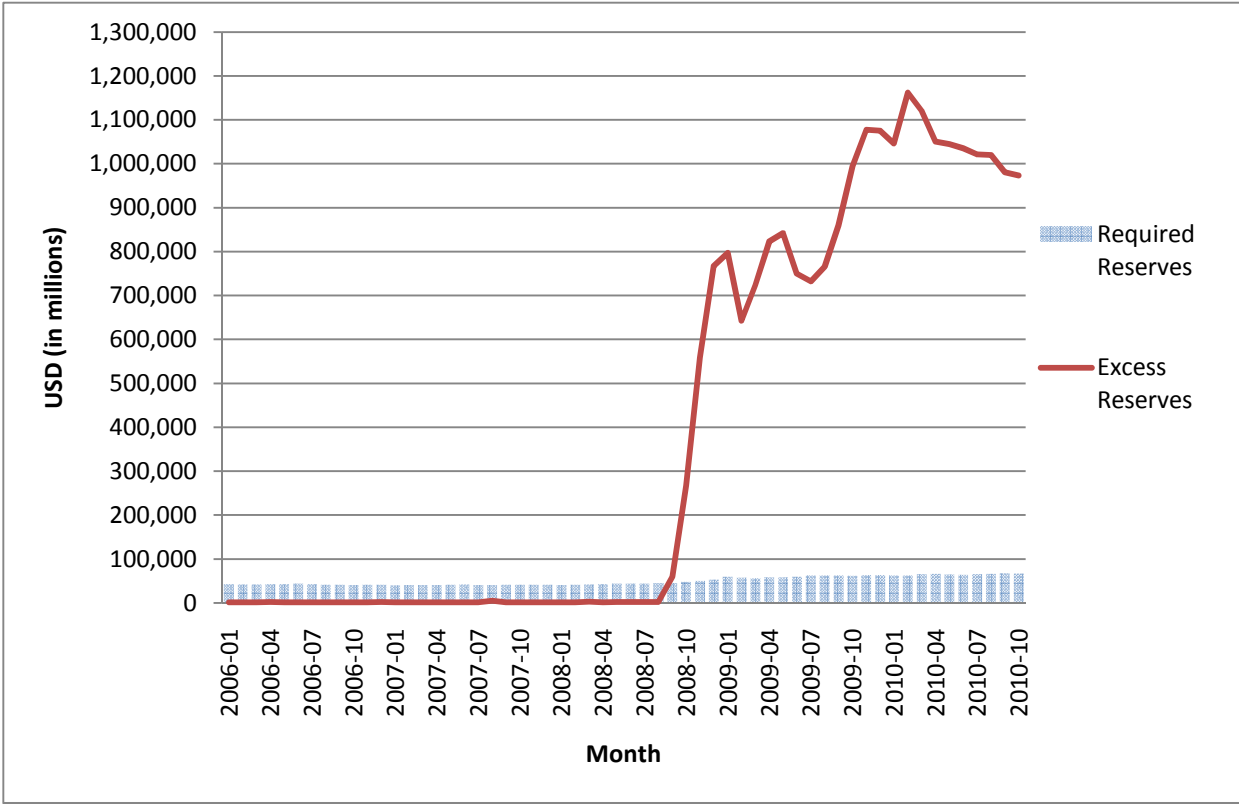
Hence, the Basel I Accord defines the following minimum capital requirements that banks should adhere to as:

1. Total Tier capital ratio $\geq 8\%$
2. Tier 1 capital ratio $\geq 4\%$

New regulatory ratios (capital and liquidity ratios) are planned to be included in the Basel III Accords whose effectiveness on the banking system is still unclear. In my empirical analysis, I use the already established tier capital ratio as a benchmark to compare new capital and liquidity measures to.

market funds which are not subject to the same safety regulations as depository banks. In a speech on June 9, 2008 Timothy F. Geithner, former President of the Federal Reserve Bank of New York, stated that during the boom in the early 2000s dramatic growth in the share of assets outside of the traditional banking sector occurred. Additionally, non-banking institutions’ focus on financing long-term illiquid assets with short-term assets made them very vulnerable to a potential client run on the non-bank system.

Graph 1: Required Reserves and Excess Reserves for U.S. Banks (2006-2010)



Sources: Federal Reserve Statistical Release H.3 2011

a) Bindingness

Legal bindingness

To be effective bank stability metrics, the regulatory ratios should represent *binding legal constraints*. Binding legal constraints denote a regulation whose violation and in compliance leads to legal enforcement and prosecution. In 1992 the G-10 countries were the first to implement the Basel Accord regulations into law (Japan implemented the regulations in 1996), and thus made it mandatory for banks and financial institutions in these countries to report tier capital ratios and adhere to minimum requirements.¹⁰ Table A2 in Appendix A illustrates the minimum requirements for the total tier capital ratio in the G-10 countries. Although countries have sovereign authority to decide whether or not to implement the capital ratios, Table A2 shows that the minimum tier capital ratio requirement of 8% was established very consistently across the G-10 countries.

Despite the G-10 countries' political, legal and economic similarities, countries might differ with respect to the stringency with which they control, penalize and persecute failure to comply to regulatory requirements. Table A3 in Appendix A presents selected supervisory measures and sanctions per G-10 country. Most G-10 countries require reporting of regulatory noncompliance if detected by a supervisor. However, there are no specific actions or clear rules that supervisors must follow if an infringement is detected. No country except Switzerland and Japan has automatic mechanisms in place which lead to penalties, and no country except the USA requires public formal enforcement actions in case of an infringement. This means that in most cases banks possess a certain degree of negotiation power due to the countries' leniency of

¹⁰ The Group of Ten (G-10) refers to the group of countries which have agreed to participate in the General Arrangements to Borrow (GAB). These countries include Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, the United Kingdom and the United States. The name G-10 still remained even after the eleventh member Switzerland joined the Group in 1964.

capital requirement supervision.¹¹ Even in the USA, a country with relatively strict capital ratio rules, banks can have total tier capital ratios below 8% for a certain time period. In case a bank's capital ratios drop below the required levels, it has to initiate a capital restoration plan within 45 days. If it fails to comply to the restoration plan, it can face lending restrictions and be seized in the worst case.¹²

Economic bindingness

To be useful in improving bank stability, the regulatory ratios should also represent *binding economic constraints*. For tier capital ratios to be binding economic constraints, banks would maximize their profits subject to the tier capital ratio constraint. Economic constraints denote barriers which limit an agent's maximization problem and force him to choose a different action than he would in the absence of the constraint.

Do the two minimum tier capital requirements actually represent an economic constraint for banks? On the one hand, banks are generally inclined to hold low levels of capital because they can increase their profits by giving out as many loans as possible. Excess capital on a bank's balance sheet means that a bank foregoes future profits. Lending activities are financed primarily through the deposits that customers put into the banks. However, these deposits are insured against losses by government agencies. Since a bank knows that its creditors will be paid back by the government in case of a default, it has incentives to lend out excessively and engage in too much risk taking.

On the other hand, banks might be inclined to hold higher tier capital ratios because of *incentive* and *risk sharing* mechanisms.¹³ Minimum capital requirements force banks to

¹¹ World Bank Survey III (2008)

¹² FDIC Homepage, www.fdic.gov

¹³ Gale, Özgür 2004, p. 2

maximally lend out 92% of their deposits and keep the required 8% tier capital ratio in place. If the respective bank has to write off loans, experiences declining market demand for credit or other unexpected events, a capital requirement can help the bank to easily pay out clients' deposited money: adherence to the minimum capital requirements provides some headroom to master a crisis. High tier capital ratios can also improve a bank's reputation. Investors and potential depositors might put more faith into banks with higher tier capital ratios and thus choose to invest with the respective bank. Hence, banks and financial institutions might have some incentives to voluntarily hold higher capital levels. A further aspect revolves around the concept of *regulatory capital arbitrage* which describes banks' activities to artificially increase their tier capital ratios by reducing their share of risky assets. Especially in the forefront of the financial crisis, banks found ways to polish their balance sheets by investing in securitized products. How does securitization make it possible for banks to increase their regulatory capital ratio levels? In securitization, illiquid and heterogeneous loans are repackaged and combined into liquid bonds. These liquid and seemingly secure bonds are made up of a large number of very risky bonds according to the idea that the chance of all risky bonds failing at once is relatively small. It was thus believed that securitizing mortgage loans would reduce a bank's risk exposure and hence "produce" a high tier capital ratio. However, the hidden positive correlation between the large number of risky bonds contributed to the financial crisis when single bond prices started to drop in 2006/2007.¹⁴ Thus, from a regulatory capital arbitrage perspective, banks could easily boost their tier capital ratios and please the regulators by exploiting the covert risk of securitization.

In essence, banks do not face clear-cut and strict legal and economic constraints with respect to minimum capital requirements. Therefore, we could expect regulatory ratios to drop

¹⁴ Brent Ambrose et al. (2003); Dai Junxun et al. (2007)

below the required levels in repeated instances, thus undermining their power as effective indicators of bank failures: Section V deals with a descriptive analysis of bindingness to test if the tier capital ratios and newly developed ratios actually constrain banks.

b) Effectiveness

The tier capital ratio as a metric for bank stability

To see how well the tier capital ratio serves as an indicator of a bank's risk of failure, it is important to understand a ratio's components and calculation. The tier capital ratios are calculated as follows:

$$(1) \quad \text{Tier 1 capital ratio} = \frac{\text{Tier 1 capital}}{\text{Risk - weighted assets}} \geq 4\%$$

$$(2) \quad \text{Total tier capital ratio} = \frac{\text{Tier 1 capital} + \text{Tier 2 capital}}{\text{Risk - weighted assets}} \geq 8\%$$

The BIS distinguishes two types of tier capital in the numerator:

- a) Tier 1 capital (core capital) consists of common stock, preferred stock and disclosed reserves on a bank's balance sheet.
- b) Tier 2 capital (supplementary capital) consists of undisclosed reserves, asset revaluation reserves, loan-loss reserves, hybrid capital instruments and subordinated debt on a bank's balance sheet.

The common denominator consists of the sum of risk-weighted assets that a bank holds on its balance sheet. The BIS postulates that first, each balance sheet item is assigned to one of five risk categories, second, the capital required for each asset based on the risk weighting is calculated, and third, the amounts are then added together to yield the total minimum capital to be held by a bank. The Basel I risk-weighting categories are:

- 0% weighting for cash and claims on central governments/ central banks/ OECD countries, etc.

- 0-50% weighting for claims on domestic public sector entities (at national discretion)
- 20% weighting for claims on multilateral development banks, OECD banks, etc.
- 50% weighting on mortgage loans
- 100% weighting on claims on the private sector, non-OECD central governments/ central banks etc.¹⁵

This capital ratio is considered a solid measure of bank stability despite some deficiencies. The tier capital ratio was developed to primarily address credit risk and thus disregards other types of risk such as operational risk and market risk. These two types of risk are included in the tier capital ratio calculation of the recently ratified Basel II Accord.

Measuring the risk of bank failure

Failures have large negative impacts on the economy and can be deemed the trigger for the outbreak of the Global Financial Crisis 2007-2010. Hence, a bank's risk of becoming insolvent has to be captured effectively. One indicator of overall bank insolvency is the 'number of bank failures per country per year'. Estrella et al. (2000) and Barrell et al. (2010) use this measure in their regression analyses. An extension to this measure is looking at the occurrence of a 'bank failure on the firm level'. In a regression model this could be represented by a dummy variable that would be equal to 1 if a bank failed in a given year and 0 if it survived. Failing and surviving banks could then be individually matched with independent variables.

¹⁵ Tarullo (2008)

A regression model to test a metric's effectiveness as an indicator of bank failure

We can perform a natural log-log GLS (random effects) panel regression analysis to test how well metrics for bank stability predict bank failures. The natural log-log form of the regressing model presents both dependent and independent variables as percentage changes. A dummy dependent variable of 'bank failure on the firm level' presents a reasonable measure of a bank's probability to fail. This variable will be regressed against the regulatory capital and liquidity ratios according to Basel I and Basel III.

Omitted variable bias might present a major problem to the regression analysis. We cannot be completely sure that the respective regulatory ratio is the only variable that might have a causal relationship with the dependent variable. Maybe a significant effect might come from other macroeconomic factors. The following control variables seem to significantly affect the risk of bank failure:

- a) **GDP Growth Rate:** In difficult economic conditions, i.e. when the GDP growth rate is negative, we might expect the number of bank failures to increase, and vice versa. Hence, we would expect GDP growth rate to have a negative relationship with the number of bank failures.*
- b) **Real Interest Rates:** Real interest rates influence customer demand for bank loans as well as a bank's ability to loan out money and generate profits.*
- c) **Stock Market Change:** When stock market prices go up, the market valuation for equities increases, making corporations more prone to pursue growth strategies like mergers and acquisitions. These transactions can be financed by borrowing money from banks. When stock market prices decrease, the market valuation for equities decreases, making corporations less interested in growth projects like merger and acquisition transactions.*

Banks will likely lend out less money to these corporations. Although this would probably not cause a bank to fail, it would still exacerbate a bank's ability to do business. I expect a negative relationship between the stock market change variable and risk of bank failure.

d) Unemployment: *If many people are unemployed, banks have fewer customers to lend out money to due to customers' low creditworthiness and generally low deposit levels. This will impede banks' ability to do business. On the other hand, if few people are unemployed, more people will earn money and banks will have more deposits and more customers to lend out money to due to their customers' higher creditworthiness. This will increase a bank's ability to do business and lower the probability that it might fail. I expect a negative relationship between unemployment and risk of bank failure.*

e) Country-Specific Effects: *In a dataset that includes banks from different countries, country-specific effects might capture cultural, political or legal characteristics of countries.*

f) Consumer Confidence: *Consumer confidence reflects the degree of optimism about the state of the economy. High consumer confidence raises consumer spending. Low consumer confidence lowers demand and contributes to economic downturns. I expect a negative relationship between consumer confidence and risk of bank failure.*

g) Housing Prices: *Especially in the forefront of the Global Financial Crisis 2007-2010 the market value of real estate increased dramatically. Banks' real estate assets were thus worth more and could be used as high-worth collateral in case of bankruptcy. Similarly, low real estate valuations denote low values of collateral in case of bankruptcy. I expect housing prices to have a negative relationship with the risk of bank failure.*

h) Price-Earnings Ratio of Bank: *The price-earnings ratio compares the market value of a company's stocks to the company's ability to generate profits. High price-earnings ratios*

highlight positive expectations about a firm's future earnings growth and can even suggest overvaluation of a company. I expect the price-earnings ratio to have a positive relationship with the risk of bank failure: the more overvalued a firm's stock, the more capital a firm can raise by issuing additional shares, thus improving its risk profile.

- i) Risk-premium:** *The risk-premium denotes the difference between the rate of return on a 10-year corporate bond and a 10-year government bond and represents a banks' risk of not being able to pay back its obligations. A high premium signifies that a corporation is expected to be more likely to become insolvent than a corporation with a premium. Hence, I expect this control variable to have a positive relationship with the risk of bank failure.*

With these specifications, the regression model to test for effectiveness is presented in equation

(3) below:

$$(3) \ln(\text{BF})_{it} = \ln \beta_0 + \beta_1 \ln(\text{regulatory ratio})_{it} + \beta_2 \ln(\text{GDP growth})_{jt} + \beta_3 \ln(\text{Interst rate})_{jt} \\ + \beta_4 \ln(\text{Stock market change})_{jt} + \beta_5 \ln(\text{Unemployment})_{jt} + \beta_6 \ln(\text{Country})_{jt} \\ + \beta_7 \ln(\text{Consumer confidence})_{jt} + \beta_8 \ln(\text{Housing prices})_{jt} \\ + \beta_9 \ln(\text{Risk - premium})_{it} + \beta_{10} \ln(\text{Price - Earnings ratio of Bank})_{it}$$

Note: t = "calendar year" for 1989 ≤ t < 2008; i = "company"; j = "country"; BP = "bank failure"

I expect banks with higher regulatory ratios to have a lower probability to fail. Hence a statistically significant negative coefficient on the regulatory ratio would demonstrate the effectiveness of regulation.

c) Future Effectiveness

The Basel II Accord and its attempt to improve the tier capital ratio

After the Global Financial Crisis 2007-2010 the tier capital ratio as established by the Basel I Accord was blamed for not adequately measuring bank stability. Consequently, the Basel II Accord was drafted in 2004 and implemented by G-10 countries in December 2008. Whereas the Basel I Accord tier capital ratio only captured credit risk, the Basel II Accord tier capital ratio also includes measures of operational and market risk. The minimum capital requirement levels of 4% tier 1 capital ratio and 8% total tier capital ratio were kept.¹⁶ Despite revisions of the tier capital ratio, there are several factors that made me choose the tier capital ratio as specified by the Basel I Accord. First, Basel II expanded the definition of risk-weighted assets by allowing banks to choose among three different approaches of how to risk-weight their assets, hence adding an arbitrary factor to reporting standards. This exacerbates comparability of reported tier capital ratios between banks. Second, there is a time gap between my dataset and the Basel II tier capital ratio reporting. Third, the controlling variables for my regression analysis should adjust for operational and market risk effects.

The Basel III Accord and the introduction of new metrics for bank stability

Economic regulators realized that the tier capital ratio set by the Basel I and II Accords was probably not effective enough to protect the banking system against potential failures. Also, banks' "exploitation" of high tier capital via regulatory capital arbitrage demanded stricter rules for banks. In recent talks the BIS established a transition schedule for Basel III specifications. This schedule is illustrated in Table 1. The minimum **common equity to assets ratio** (henceforth

¹⁶ Tarullo (2008)

common equity ratio) presents one of the new metrics of bank stability. In 2019 banks will be expected to hold common equity of at least 7% to total bank assets. The BIS plans to keep the tier 1 and total tier capital ratios, but wants to increase the minimum tier 1 capital requirement to 6% by 2015. Three new ratios: a liquidity coverage ratio, a leverage ratio and a net stable funding ratio are planned to be implemented.

Table 1: Preliminary Schedule for Basel III Implementation

| | Transitional Agreements towards Basel III Implementations | | | | | | | | |
|---|---|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
| Min. Common Equity Capital Ratio | | | 3.5% | 4.0% | 4.5% | 4.5% | 4.5% | 4.5% | 4.5% |
| Capital Conservation Buffer | | | | | | 0.6% | 1.3% | 1.9% | 2.5% |
| Min. Common Equity + Conservation Buffer | | | 3.5% | 4.0% | 4.5% | 5.1% | 5.8% | 6.4% | 7.0% |
| Min. Tier 1 Capital Ratio | 4.0% | 4.0% | 4.5% | 5.5% | 6.0% | 6.0% | 6.0% | 6.0% | 6.0% |
| Min. Total Capital Ratio (Tier1+2) | 8.0% | 8.0% | 8.0% | 8.0% | 8.0% | 8.0% | 8.0% | 8.0% | 8.0% |
| <u>New ratios:</u> | | | | | | | | | |
| Liquidity coverage ratio | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| Leverage ratio | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |
| Net stable funding ratio | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD | TBD |

Source: Basel III Compliance Professionals Association

The common equity ratio as a metric for bank stability

There are several deficiencies of the tier capital ratio. First, it relies on a rather arbitrary and only consensus-based risk-weighting of assets. Second, its risk-weighted approach also assumes that asset risk remains constant over time, an assumption that is often made in finance, but that can easily turn out to be wrong. One example is real estate which was misleadingly considered a safe bet right before the Global Financial Crisis 2007-2010. Consequently, the BIS developed a minimum requirement for the common equity ratio to force banks to hold a certain

amount of high quality capital on their balance sheet.¹⁷ Compared to the tier capital ratio, the calculation of the common equity ratio is relatively simple. It is just the ratio of tangible common equity and total assets on a bank's balance sheet. This ratio emphasizes the importance of high quality capital that a bank should hold.

$$(4) \quad \text{Common equity ratio} = \frac{\text{Tangible common equity}}{\text{Total assets}}$$

$$= \frac{\text{Equity} - \text{Intangible assets} - \text{Goodwill} - \text{Preferred stock}}{\text{Total assets}}$$

The net stable funding ratio as a metric for bank stability

Generally, banks have different options to receive funding, but they will most likely choose the most inexpensive ones. Because debt is cheaper than equity, companies are inclined to receive funding via credit than via equity investments.¹⁸ However, a company will be contractually obliged to pay back the credit by some maturity date. If it cannot service its debt or interest payments, the creditor can force the company to file for bankruptcy – a bank failure occurs. As one of the newly developed liquidity ratios, the net stable funding ratio is designed to promote a secure medium and long-term funding of assets. It is defined as the ratio of a bank's available amount of stable funding divided by the required amount of stable funding. The purpose of this ratio is to ensure that risky assets are funded with at least a minimum amount of stable liabilities. According to current specifications, the ratio should be no lower than 100%. The formula for calculating the net stable funding ratio is presented in (5).

¹⁷ Common equity can be considered high-quality capital because it is the purest form of capital. It represents the portion of bank assets which has no contractual commitment for repayment. In contrast, tier 2 capital includes subordinated debt which has to be repaid by some maturity date (D. J. Elliott 2010, p.1)

¹⁸ Debt is cheaper than equity because creditors have a prior claim on the debtor's assets if it goes bankrupt. Also, interest payments for the debtor are tax deductible and reduce interest expenses

(5) Net stable funding ratio

$$= \frac{\text{Tier 1 capital} + \text{Tier 2 capital} + w_1(\text{retail deposits}) + w_2(\text{wholesale deposits})}{w_3(\text{trading securities}) + w_4(\text{Bonds}) + w_5(\text{Gold}) + \text{all other assets}}$$

The factor w_i denotes the risk weightings of the components. For the purpose of testing future effectiveness, I perform a regression analysis on both the common equity ratio and the net stable funding ratio on historical data.¹⁹

¹⁹ Basel Committee on Banking Supervision (2010): Basel III: International framework for liquidity risk measurement, standards and monitoring

IV. Data and Model Adjustments

Banks and financial institutions

For my analyses, I use bank balance sheet data from the COMPUSTAT Global FTP database for the time period 1989-2007. I limit my analysis to the G-10 countries because of their relatively elaborate data reporting and comparability. The companies included in the dataset are public, internationally active banks and financial deposit holding institutions in the countries under consideration.

Observational and regression analysis

I use the total tier capital ratios as reported by banks and financial institutions in the COMPUSTAT Global FTP database and calculate common equity and net stable funding ratios with the data provided by the database. I define tier capital ratios according to the Basel I Accord because the database only reaches until 2007 (Basel II Accord was implemented in 2008) and due to ambiguities relating to the Basel II risk-weighting of assets. For the controlling variables, I use World Bank Statistical Services from which I collect data on yearly GDP growth rates, real interest rates and unemployment rates. I estimate stock market changes by the percentage change in major equity indices of the respective countries in the time period 1989-2007. The equity indices were collected from Yahoo Finance and include the BEL20, TSX60, SMI, CAC40, DAX30, FTSE 100, FTSE MIB, Nikkei225, AEX, OMX 30 and S&P 500. As measures of consumer confidence and housing prices I use major consumer confidence indices and housing price indices of the respective countries. As index levels vary from index to index, I rebase all

index levels to 1988 = 100 to capture changes. For the risk- premium and price/earnings measures I collected Bloomberg data on a company level.

Measures for risk of bank failure

Due to lacking data about “Number of bank failures” per G-10 country for the large historical set of 1989-2007, I use three balance sheet metrics that are considered reliable measures of bank failures. By using a multiple measures of bank failure, I account for variation in significance across regulatory metrics. Also, some bank failure metrics might be better predictors than others.

One measure of bank risk, the **Texas Ratio**, has been developed by RBC Capital Markets. It denotes a metric to determine the overall credit troubles experienced by financial institutions.²⁰ It compares the total value of risk loans to the total funds available to bank *i* at time *t*:

$$(6) \quad \text{Texas ratio}_{it} = \frac{\text{Real estate assets}_{it} + \text{Nonperforming loans}_{it}}{\text{Loan loss reserves}_{it} + \text{Common equity}_{it}}$$

Because of multi-collinearity the texas ratio in the regression analysis in Section V has been adjusted to exclude “Common Equity”.

Excessive loan growth is a second measure of bank failures. Studies performed by Sinkey and Greenawalt (1991), Clair (1992), Keeton (1999) and Berger et al. (2004) provide empirical

²⁰ Kurt R. Jesswein (2009)

evidence that loan growth may lead to future loan losses.²¹ The faster loan growth is, the higher loan losses are predicted to be and the higher a bank's risk to fail. Excessive loan growth is calculated by subtracting aggregate country j's loan growth from company i's loan growth between calendar year t-1 to t.²²

$$(7) \quad \text{Excessive loan growth}_{i,t-t_1} = \text{Company loan growth}_{i,t-t_1} \\ - \text{Aggregate country loan growth}_{j,t-t_1}$$

As a third measure I use a **Nonperforming Loan Ratio**. Banks earn money by lending out customer deposits as loans. If the number of nonperforming loans increases, it puts a bank in greater risk of bankruptcy. I calculate this ratio in the following way:

$$(8) \quad \text{Nonperforming loan ratio}_{it} = \frac{\text{Nonperforming nonaccrual loans}_{it}}{\text{Total loans}_{it}} \\ + \frac{\text{Nonperforming restructured loans}_{it}}{\text{Total loans}_{it}}$$

Estimating the net stable funding ratio

The COMPUSTAT Global FTP database contains data to calculate the net stable funding ratio on a company basis. To compensate for lacking data, I approximate some components using aggregate country data to proxy for the respective company-specific value. Using the appropriate risk-weightings in (5) the net stable funding ratio can be written as:

²¹ Daniel Foos et al. (2009)

²² Aggregate country loan data is collected from the OECD Statistical database.

(9) Net stable funding ratio

$$= \frac{\text{Tier 1 capital} + \text{Tier 2 capital} + 0.85(\text{retail deposits}) + 0.5(\text{wholesale deposits})}{0.05(\text{trading securities}) + 0.2(\text{Bonds}) + 0.5(\text{Gold}) + \text{all other assets}}$$

The following components are calculated using data provided by the COMPUSTAT Global FTP database:

Tier 1 capital_{it}: *Common stock_{it} + Preferred stock_{it} + Total reserves_{it}*

Tier 2 capital_{it}: *Reserves for credit losses_{it} + subordinated debt_{it} + Revaluation reserves_{it}*

Retail deposits_{it}: *Customer demand deposits_{it} + Customer savings deposits_{it}
+ Customer time deposits_{it}*

Wholesale deposits_{it}: *Total deposits_{it} – Retail deposits_{it}*

Trading securities: *Short-term investment assets_{it}*

All other assets: *Total assets_{it} – Short-term investment assets_{it} - Bonds_{it}*

COMPUSTAT does not provide **bonds held by banks as investment assets**. Hence, I approximate this component by multiplying country-specific bond to asset ratios with the total amount of assets held by a bank in a given year. I collect bond and total asset data for a country *j* at time *t* from the OECD Statistical database. I then multiply this ratio by total assets for company *i* at time *t*. Equation (9) shows this calculation:

$$(10) \quad \text{Bonds held by banks as investment assets}_{it} \approx \frac{\text{Bonds held as investment}_{jt}}{\text{Total Assets}_{jt}} * \text{Total Assets}_{it}$$

Unfortunately, neither the COMPUSTAT Global FTP database nor any other database I scanned records a bank's **gold held as investment asset**. Taking the lacking data into account

and assuming that on average gold makes up a minuscule proportion of bank assets, I do not include gold held as an investment in my estimation.

This approximation should be considered as an attempt to estimate a future regulatory ratio using data that banks currently report. As the prospective implementation date of 2018 comes closer, I expect banks to report data relevant for a proper calculation of this metric.

V. Results

Part A: Descriptive Analysis

Overview

This analysis mainly focuses on descriptive findings to understand bindingness and global compliance for Basel regulations. It consists of two parts: part a) takes a look at public banks' behavior to report and abide by tier capital ratio regulations before and after legal implementation in the respective country. Part b) focuses on the total number of violations during the time span 1989-2007 out of all the banks that reported the necessary balance sheet data. Furthermore, it compares actual minimum tier capital ratio violations with hypothetical violations of the new Basel III ratios, as per the preliminary schedule in Table 1, assuming they were effective between 1989 and 2007.

a) Reporting and adherence to tier capital ratio requirement

Table 2 presents banks' reporting and adherence behavior towards tier capital ratios. According to the COMPUSTAT dataset the number of banks that actually reported tier capital ratios rose from 170 before to 367 after implementation – an increase from 0.46% to 1.41% as a percentage of all banks in the respective country. This result makes sense since banks were not legally required to report tier capital before implementation. Nevertheless, banks increased their reporting of Basel requirements – an observation that speaks in favor of bindingness of reporting. Similar results can be seen with respect to the number of banks that reported lower than minimum capital ratios before and after legal implementation. Whereas a total of 31 banks (18% of reporting banks per country) did not satisfy capital requirements before Basel I, only 9 banks (2% of reporting banks per country) reported capital ratios lower than 8% after Basel I was

legally implemented in the respective G-10 country. **Although these results refute an interpretation of the total tier capital ratio as a binding constraint, the large drop in incompliance clearly emphasizes constraining characteristics of the tier capital ratio.** Yet, due to relatively lax supervision and sanctioning measures, as well as various economic incentives favoring high levels of capital, it is unsure whether bindingness results from a legal or economic constraint per se.

Table 2: Reporting and Adherence to Total Tier Capital Requirements (1989-2007)

| | BEL | CAN | CHE | DEU | FRA | GBR | ITA | JPN | NED | SWE | USA | Total |
|--|-----|------|------|-----|------|------|-----|-----|-----|-----|------|------------|
| # of banks to report total tier capital ratios | | | | | | | | | | | | |
| Before legal implementation (# of banks) | 1 | 10 | 1 | 0 | 8 | 7 | 0 | 79 | 1 | 5 | 58 | 170 |
| <i>% of total institutions per country</i> | 1% | n.a. | < 1% | 0% | < 1% | n.a. | 0% | 52% | 1% | 4% | < 1% | 0.46% |
| After legal implementation (# of banks) | 7 | 11 | 9 | 15 | 15 | 13 | 13 | 79 | 5 | 6 | 194 | 367 |
| <i>% of total institutions per country</i> | 8% | n.a. | 3% | 1% | 1% | n.a. | 2% | 58% | 4% | 5% | 1% | 1.41% |
| # of banks to fall below total tier requirement | | | | | | | | | | | | |
| Before legal implementation (# of banks) | 0 | 7 | 0 | 0 | 2 | 1 | 0 | 14 | 0 | 1 | 7 | 31 |
| <i>% of reporting banks per country</i> | 0% | 70% | 0% | - | 25% | 14% | - | 18% | 0% | 20% | 12% | 18% |
| After legal implementation (# of banks) | 0 | 0 | 0 | 3 | 2 | 0 | 2 | 1 | 0 | 0 | 1 | 9 |
| <i>% of reporting banks per country</i> | 0% | 0% | 0% | 20% | 13% | 0% | 15% | 1% | 0% | 0% | 1% | 2% |

Source: COMPUSTAT Global FTP database

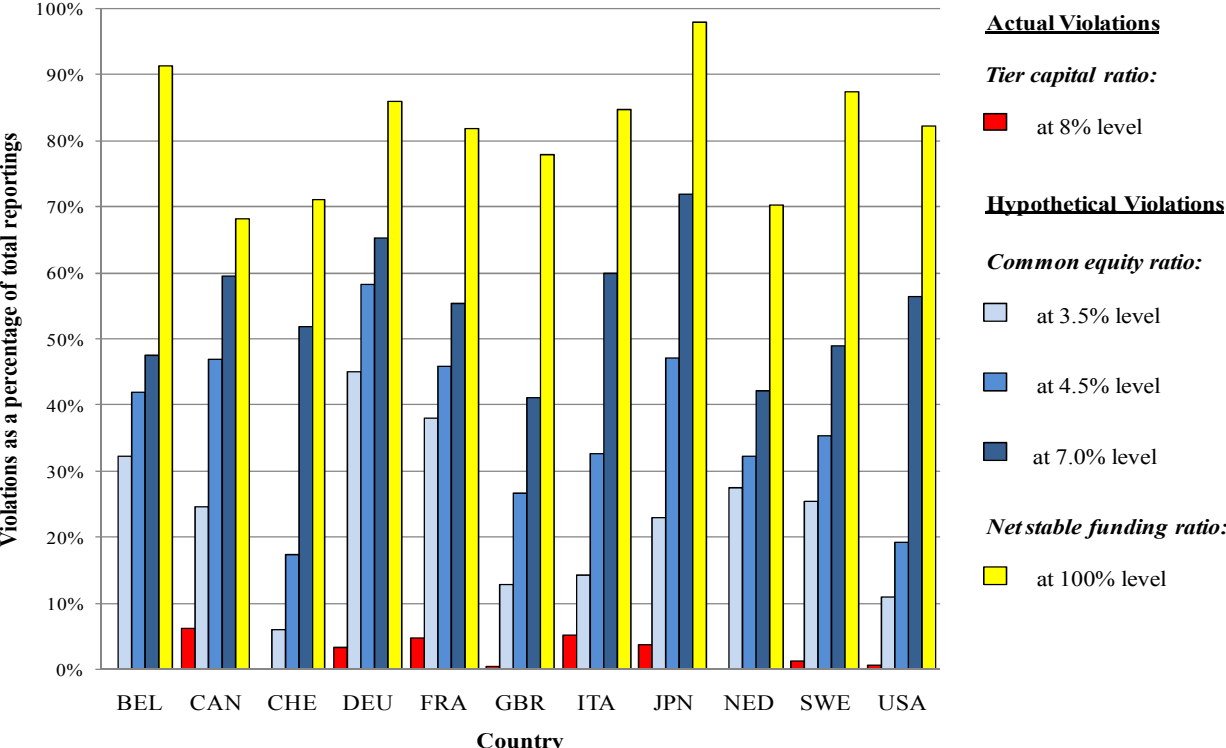
b) Instances of actual and hypothetical minimum requirement violations

Graph 2 compares instances of minimum requirement violations (as a percentage of total ratios reported) across the tier capital ratio, the common equity ratio and the net stable funding ratio. Tier capital ratio violations denote actual violations during 1989-2007, common equity ratio and net stable funding ratio violations denote hypothetical violations, assuming minimum requirements were in place between 1989 and 2007. Graph 2 distinguishes three hypothetical common equity ratio minimum requirements according to Table 1: one at the 3.5% level

(planned implementation by 2013), one at 4.5% (planned implementation by 2015), and one at 7% (planned implementation by 2019). The net stable funding ratio requirement is set to be greater than or equal to 100%. We see that on average, only 2% of total G-10 country reportings between 1989 and 2007 were violations of the minimum tier capital ratio standard. In contrast, hypothetical violations for common equity ratios on average range from 20% for a 3.5% standard via 34% for a 4.5% standard to as high as 59% for a 7% standard. For the net stable funding ratio we can even perceive an average violation rate of 84%. Despite the fact that banks did not face a constraint during the time period under consideration, the results still show the importance of making a capital ratio mandatory. Compared to the common equity ratio and the net stable funding ratio, **the tier capital ratio's low violation rate emphasizes the ratio's constraining characteristics and usefulness as a regulatory measure.** Additionally, these results support the BIS's claim that the common equity ratio and the net stable funding ratio need minimum requirement levels that banks should consider when making decisions. The findings also suggest economically constraining characteristics with the new regulatory ratios. Whereas relatively few banks would have violated common equity ratios at the 3.5 or 4.5% level during 1989-2007, ca. 60% of banks would have violated the 7% minimum level that the BIS plans to establish by 2019. Banks seem to view low common equity ratios as profit maximizing, possibly because high quality equity capital is expensive. **With a 7% rule in place, we could therefore expect banks to adjust their current behavior regarding their equity holdings, and potentially constrain their profit-seeking activities to meet the requirement.** Finally, looking at net stable funding ratio violations with a hypothetical violation rate of 84% on average, we can expect the minimum net stable funding ratio requirement to put an economic constraint on banks. Banks

would be forced to pay close attention to the quality and levels of their funding in the medium and long-term.

Graph 2: Instances of Minimum Requirement Violations (Actual and Hypothetical) As a Percentage of Ratios Reported in G-10 Countries during 1989 -2007



Source: COMPUSTAT Global FTP database

Part B: Regression Analysis

The regression results are presented in Table 4 on page 38. These results include all three previously mentioned ways to measure the probability of bank failure using bank balance sheet data. For each of these ways the independent variables tier capital ratio, common equity ratio and net stable funding ratio are tested for statistical significance. Table 3 summarizes the main results.

Table 3: Summary regression results

Coefficient Signs and Statistical Significance of Basel Capital Ratios per Bank Risk Metric

| | Texas Ratio | Excessive Loan Growth | Nonperforming Loan Ratio |
|------------------------------|-------------|-----------------------|--------------------------|
| Tier Capital Ratio (%) | Negative** | | Negative* |
| Common Equity Ratio (%) | Positive*** | | Positive*** |
| Net Stable Funding Ratio (%) | | | |

Note: ***, **, * indicate that coefficients are statistically significant at the 1%, 5% and 10%-level.

Regressing the natural log of the texas ratio and the nonperforming loan ratio on the natural log of the tier capital ratio, we get statistically significant results at the 5% level and 1% level, respectively. The regressions show negative coefficients on the tier capital ratio, a result which seems reasonable. If we increase the tier capital ratio, a bank will have higher capital levels on its balance sheet which create a capital buffer in case the bank experiences negative shocks. This makes the bank able to lend out more loans and earn interest on them. A higher amount of lending dilutes the proportion of loans that can become nonperforming. Hence, the likelihood of a bank defaulting due to loan losses decreases both the texas ratio the nonperforming loan ratio. **These results imply that the total tier capital ratio indeed denotes**

an effective metric for bank risk from a regulatory perspective. With R-Squared statistics of 0.42 and 0.91 for the texas ratio and nonperforming loan regressions respectively, the model seems to explain the variation in tier capital ratios between banks quite well. The lacking significance for excessive loan growth might be attributed to missing data or an insufficient set of data points.

A regression of the same dependent variables on the natural log of the common equity ratio yields very surprising results. The common equity ratio coefficients are statistically significant at the 1% level, but show positive signs. This means that increasing the common equity ratio would actually lead to a higher risk of bank failure – an outcome that should not be favored by the BIS. A possible explanation of this observation could relate to a bank’s propensity to take on excessive risks if it holds large amounts of capital. Since the descriptive analysis implies that banks optimally hold low levels of common equity, increased common equity levels could raise a bank’s confidence and justify excessive risk taking. Also, regulatory capital arbitrage could have artificially increased the common equity ratio as bank would be inclined to engage in securitization activities and covertly increase risk. **Hence, the results suggest that the common equity ratio is not an effective metric for bank risk from a regulatory perspective.** Since this ratio has not been implemented yet, one reason for this surprising result might be banks’ stronger focus on the tier capital ratio rather than on the common equity ratio. From the descriptive analysis we know that banks tend to abide by the tier capital requirements.

As a new bank stability measure, the net stable funding ratio does not yield significant regression results in all three regressions – **it does not appear to be an effective metric for bank risk from a regulatory perspective.** It is important to remember that the lacking statistical significance could be due to the fact that the net stable funding ratio used in the regressions is

merely an approximation. Naturally, these estimations can include errors. Further papers might explore the true significance levels of the net stable funding ratio coefficients in various regression analyses once the necessary data become publicly available. Moreover, I ran regression analyses using 1 and 2-year lags between the dependent and independent variables to potentially control for timing differences between a bank's reporting of regulatory ratios and it actually feeling the impact. However, this method yielded very similar results.

Table 4: Regression results

Random Effects (GLS) Regression Analysis of Bank Risk Measures on Bank Regulatory Ratios in G-10 Countries (1989-2007)

| <i>Dependent Variable:</i> | ln Texas Ratio (%) | | | | ln Excessive Loan Growth (%) | | | | ln Nonperforming Loan Ratio (%) | | | |
|---|---------------------|---------------------|----------------------|---------------------|------------------------------|------------------|------------------|--------------------|---------------------------------|---------------------|---------------------|---------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| ln Tier Capital Ratio (%) | -1.41 *** (3.32) | | | -1.48 *** (2.98) | 0.56 (0.75) | | | 2.50 * (1.90) | -1.16 * (1.67) | | | -0.63 (1.04) |
| ln Common Equity Ratio (%) | | 0.72 *** (3.12) | | 0.46 (1.54) | | -0.20 (0.58) | | -0.41976 (1.22) | | 1.85 *** (3.64) | | 1.83 *** (3.45) |
| ln Net Stable Funding Ratio (%) | | | 0.07 (0.99) | 0.00 (0.09) | | | 0.21 (0.90) | 0.27 (1.11) | | | 0.11 (0.69) | 0.06 (0.38) |
| ln Stock Market Change (%) | -1.06 *** (3.06) | -0.65 (1.44) | -1.88 *** (4.06) | -1.56 *** (4.40) | 0.13 (0.28) | 0.05 (0.11) | 0.34 (0.75) | -0.07 (0.15) | -0.44 (0.35) | 0.43 (0.45) | 4.43 (1.30) | 3.47 (1.14) |
| ln Interest Rate (%) | -0.18 (0.32) | -0.30 (0.42) | -0.55 (0.60) | -0.02 (0.02) | -1.9 (1.08) | -2.3 (1.30) | -0.49 (0.29) | -2.50 (1.34) | -1.5 (0.54) | -0.2 (0.10) | 21.49 (1.40) | 15.86 (1.16) |
| ln Unemployment Rate (%) | -4.10 (1.58) | -3.79 (1.17) | -8.30 * (2.00) | -4.18 (1.27) | -11 (1.52) | -10.8 (1.53) | -3.8 (0.55) | -9.7 (1.34) | -7.0 (0.59) | -2.5 (0.33) | 127.4 (1.43) | 92.2 (1.15) |
| ln GDP Growth (%) | -0.34 (0.86) | -0.61 (1.26) | 0.28 (0.49) | 0.28 (0.59) | -1 (1.06) | -0.9 (0.81) | -0.20 (0.20) | -0.36 (0.34) | -1.4 (0.75) | -1.1 (0.87) | 23.99 (1.46) | 16.70 (1.13) |
| ln Risk Premium (%) | -0.05 (0.30) | 0.03 (0.13) | 0.60 *** (2.66) | 0.19 (1.07) | 0.22 (0.53) | 0.23 (0.56) | 0.46 (1.08) | -0.07 (0.15) | -0.10 (0.19) | 0.25 (0.54) | 0.01 (0.02) | 0.48 (0.83) |
| ln CCI (%) | 11.97 *** (2.57) | 6.57 (1.09) | 18.54 *** (2.62) | 16.31 *** (2.98) | 12.54 (1.09) | 8.40 (0.67) | 2.19 (0.19) | -0.06 (0.00) | 4.80 (0.27) | 0.01 (0.00) | -136.49 (1.42) | -106.83 (1.24) |
| ln Housing Index (%) | -0.58 *** (2.65) | -0.82 *** (2.99) | -0.09 (0.31) | -0.27 (1.10) | 0.13 (0.33) | 0.30 (0.77) | -0.12 (0.29) | -0.18 (0.40) | -0.50 (0.81) | -1.37 ** (2.38) | 0.51 (0.88) | 0.36 (0.59) |
| ln Price-Earnings Ratio of Bank | -0.61 *** (2.72) | -1.31 *** (5.80) | 0.26 (0.97) | -0.49 ** (2.13) | 0.22 (0.69) | -0.40 (0.87) | -0.30 (0.57) | -0.41 (0.77) | -2.28 *** (2.98) | -2.35 *** (4.00) | -2.02 *** (2.98) | -3.12 *** (4.22) |
| ln Constant | -67.21 ** (2.38) | -44.21 (1.23) | -106.17 ** (2.39) | -88.10 ** (2.56) | -101.36 (1.38) | -81.05 (1.03) | -22.93 (0.32) | -28.26 (0.36) | -46.00 (0.39) | -15.44 (0.19) | 1,154.14 (1.43) | 859.76 (1.19) |
| 11 Country Dummy Variables (not presented) | | | | | | | | | | | | |
| # obs | 174 | 182 | 98 | 94 | 76 | 78 | 57 | 49 | 130 | 139 | 96 | 78 |
| # groups | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 6 | 6 |
| # obs per group, min | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 |
| # obs per group, avg | 24.9 | 26 | 14 | 13.6 | 10.9 | 11.1 | 8.1 | 7 | 18.6 | 19.9 | 16 | 13 |
| # obs per group, max | 47 | 49 | 27 | 26 | 27 | 27 | 21 | 19 | 41 | 44 | 34 | 26 |
| Prob > chi2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.23 | 0.01 | 0.08 | 0.00 | 0.00 | 0.01 | 0.00 |
| R-sq within | 0.19 | 0.24 | 0.21 | 0.32 | 0.12 | 0.08 | 0.27 | 0.21 | 0.16 | 0.33 | 0.21 | 0.41 |
| R-sq between | 0.42 | 0.49 | 0.04 | 0.33 | 0.85 | 0.91 | 0.90 | 0.98 | 0.91 | 0.98 | 0.96 | 0.98 |
| R-sq overall | 0.27 | 0.27 | 0.30 | 0.48 | 0.21 | 0.19 | 0.37 | 0.35 | 0.18 | 0.38 | 0.24 | 0.45 |

Note: ***, **, * indicate that coefficients are statistically significant at the 1%, 5% and 10%-level.

VI. General Discussion

In the aftermath of the Global Financial Crisis 2007-2010, the BIS's development of new regulatory ratios appears to be a prudent idea at first glance. If more minimum capital and liquidity ratios are imposed, banks might be forced to operate in a less risky way. My research shows that not all proposed regulatory ratios seem to be effective measures to decrease bank failures. Relating to the three initial questions outlined on page 2, I can conclude the following about characteristics of global financial regulation:

Conclusion 1: Global financial regulation is not binding, but constraining

Bindingness seems to be partially satisfied. Capital ratios are not strictly legally binding on a global level because supervision and sanctioning appear to be quite lax in G-10 countries. Additionally, capital ratios do not represent strict economically binding constraints, primarily due to the effects of regulatory capital arbitrage as discussed by Jablecki (2009), Brent Ambrose et al. (2003) and Dai Junxun et al. (2007). However, capital ratios present constraining characteristics for banks, both legally and economically. My descriptive analysis shows a legal implementation effect in that 197 more banks in G-10 countries reported tier capital ratios after implementation. This represents an increase from 0.46% to 1.41% as a percentage of all banks in the respective country. Furthermore, the number of banks reporting lower than 8% tier capital ratios dropped from 18% before to only 2% after legal implementation. Hypothetical violations of proposed minimum requirements for the common equity ratio and net stable funding ratio in the time span 1989-2007, assuming they would have been valid, ranged from 20% to 59% for various minimum common equity ratios and 84% for a minimum net stable funding ratio standard. These findings suggest that the imposition of minimum common equity and net stable

funding ratio requirements might be *economically constraining* for banks and would induce a change in banks' behavior.

Conclusion 2: Current global financial regulation is effective in mitigating the risk of bank failures

Multivariate random effects (GLS) regressions of bank risk metrics on the tier capital ratio, as defined by the Basel I Accord, show an expected statistically significant negative relationship at the 1% and 10% level. We can conclude with reasonable certainty that the tier capital ratio serves as an effective regulatory tool to mitigate banking crises.

Conclusion 3: The common equity ratio and net stable funding ratio might be inefficient in mitigating the risk of bank failures

Multivariate random effects (GLS) regressions of bank risk metrics on the common equity ratio surprisingly show a highly statistically significant positive relationship. This result suggests that imposing a common equity ratio minimum requirement might backfire as a regulatory tool since it would increase bank failures in my model. Several aspects can support this finding. First, high hypothetical violation rates for new capital measures show that previously banks did not care much about having high common equity ratios. If we assume that banks generally operate in a profit-maximizing fashion, minimum common equity ratios would impede banks' profit maximization behavior and making banking activities more costly for them. Second, higher levels of capital might justify banks' move towards even more risk-taking, hence increasing their risk to fail. Third, my regression might have uncovered the hidden hazards of regulatory capital arbitrage whose effects strongly contributed to the occurrence of the Global Financial Crisis 2007-2010. Nevertheless, it is important to take into account that regression

analyses were performed on historical data and might not capture the real effects of new capital measures. Also, missing data in the COMPUSTAT Global FTP database might have contributed to the observed outcomes.

Global financial regulation is faced with the difficult task to improve risk management in the banking system and help prevent a second disastrous banking crisis from happening. As an early relict of regulation, the tier capital ratio has been shown to be an effective metric to mitigate banking crises. Nevertheless, it does not prevent banking crises from happening because financial regulation is not strictly binding. Having stronger supernatural enforcement mechanisms that are consistent and strictly binding in the BIS's member countries might improve adherence to regulatory ratios. Furthermore, regulatory capital arbitrage presents a problem for financial regulators because banks are able to circumvent the regulatory burden. New regulatory ratios might alleviate this problem. Yet, the BIS's plan to establish and introduce new capital and liquidity ratios is an ambitious task and entails the risk that some financial metrics might not yield the desired effect. As presented in this paper, the common equity ratio and the net stable funding ratio do not seem to mitigate banking crises effectively. It is possible that this unexpected effect, which was tested on historical data, captures the hidden effects of regulatory capital arbitrage. A suggestion for regulators would thus be to inhibit banks' securitization practices and making new regulatory requirements legally and economically binding.

VII. Appendix

Appendix A – Theoretical Framework

Table A1: Total tier capital requirements per G-10 country

| Assets | Liabilities + Owners' Equity |
|------------------------------|------------------------------|
| Reserves | Deposits |
| Cash | Transaction deposits |
| Federal deposits | Savings accounts |
| Loans | Certificates of deposit |
| Consumer loans | Other deposits |
| Business loans | Other liabilities |
| Investment Securities | Bank loans |
| Treasury securities | Federal reserve loans |
| Federal funds | Equity |
| | Net worth |

Table A2: Total tier capital requirements per G-10 country

Source: World Bank Survey III – June 2008

| Capital Regulations | BEL | CAN | CHE | GER | FRA | GRB | ITA | JPN | NED | SWE | USA |
|---|------|--|------|--|---------------|------|------|---------------------------------------|------|------|------|
| What is the minimum capital to asset ratio requirement? | 8.0% | 8%, after 1999: Tier 1 is 7% and Tier 1+2 is 10% | 8.0% | 8 % (12,5% for the first three years of establishment) | Not Available | 8.0% | 8.0% | 8% (for internationally active banks) | 8.0% | 8.0% | 8.0% |

Table A3: Supervisory and sanctioning measures per G-10 country

Source: World Bank Survey III – June 2008

| Supervision and Sanctions | BEL | CAN | CHE | GER | FRA | GRB | ITA | JPN | NED | SWE | USA |
|--|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| If an infraction of any prudential regulation is found in the course of supervision, must it be reported? | Yes | Yes | Yes | Yes | N/A | Yes | Yes | N/A | Yes | Yes | Yes |
| Are there mandatory actions that the supervisor must take in these cases? | No | No | Yes | No | No | No | Yes | N/A | Yes | No | Yes |
| Are there any mechanisms of cease and desist type orders, whose infraction leads to the automatic imposition of civil and penal sanctions on the banks directors and managers? | No | No | Yes | No | No | No | No | Yes | No | No | No |
| Are bank regulators/supervisors required to make public formal enforcement actions, which include ceaseand desist orders and written agreements between a bank regulatory/supervisory body and a banking organization? | No | No | No | No | No | Yes | No | No | No | No | Yes |

Table A4: Actual and hypothetical violations of minimum requirements between 1989 and 2007

Source: COMPUSTAT Global FTP

| | BEL | CAN | CHE | DEU | FRA | GBR | ITA | JPN | NED | SWE | USA | Total |
|---------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|--------------|
| ACTUAL VIOLATIONS | | | | | | | | | | | | |
| Tier Capital Ratio | | | | | | | | | | | | |
| Total # of reporting | 49 | 174 | 55 | 152 | 306 | 199 | 38 | 873 | 59 | 74 | 1,983 | 3,962 |
| Total # of violations (<8%) | 0 | 11 | 0 | 5 | 15 | 1 | 2 | 34 | 0 | 1 | 13 | 82 |
| % of reporting | 0% | 6% | 0% | 3% | 5% | 1% | 5% | 4% | 0% | 1% | 1% | 2% |
| HYPOTHETICAL VIOLATIONS | | | | | | | | | | | | |
| Common Equity Ratio | | | | | | | | | | | | |
| Total # of reporting | 229 | 368 | 652 | 768 | 541 | 817 | 677 | 2,013 | 102 | 220 | 2,654 | 9,041 |
| Total # violations (<3.5%) | 74 | 91 | 40 | 347 | 206 | 106 | 97 | 465 | 28 | 56 | 294 | 1,804 |
| % of reporting | 32% | 25% | 6% | 45% | 38% | 13% | 14% | 23% | 27% | 25% | 11% | 20% |
| Total # violations (<4.5%) | 96 | 173 | 114 | 448 | 248 | 218 | 221 | 951 | 33 | 78 | 511 | 3,091 |
| % of reporting | 42% | 47% | 17% | 58% | 46% | 27% | 33% | 47% | 32% | 35% | 19% | 34% |
| Total # violations (<7%) | 109 | 219 | 338 | 502 | 300 | 336 | 406 | 1,449 | 43 | 108 | 1,499 | 5,309 |
| % of reporting | 48% | 60% | 52% | 65% | 55% | 41% | 60% | 72% | 42% | 49% | 56% | 59% |
| Net stable funding ratio | | | | | | | | | | | | |
| Total # of reporting | 451 | 349 | 673 | 848 | 957 | 2,802 | 789 | 2,921 | 317 | 302 | 2,598 | 13,007 |
| Total # violations (<100%) | 412 | 238 | 479 | 730 | 784 | 2,185 | 669 | 2,859 | 223 | 264 | 2,138 | 10,981 |
| % of reporting | 91% | 68% | 71% | 86% | 82% | 78% | 85% | 98% | 70% | 87% | 82% | 84% |

Bibliography:

Ambrose, B. (2003): *Does Regulatory Capital Arbitrage or Asymmetric Information Drive Securitization?*

Anari, A. and J. Kolari, J. Mason (1999): *Bank Asset Liquidation and the Propagation of the U.S. Great Depression*

Ayuso, J. and D. Pérez, J. Saurina (2002): *Are Capital Buffers Pro-Cyclical? Evidence from Spanish Panel Data*

Balin, B. J. (2008): *Basel I, Basel II, and Emerging Markets: A Nontechnical Analysis*

Barrell, R. and E. P. Davis, D. Karim, I. Liadze (2010): *Bank regulation, property prices and early warning systems for banking crises in OECD countries*

Basel Committee on Banking Supervision (1988): *International Convergence of Capital Measurement and Capital Standards*

Basel Committee on Banking Supervision (2004): *Basel II: International Convergence of Capital Measurement and Capital Standards: a Revised Framework*

Basel Committee on Banking Supervision (2010): *Basel III: International framework for liquidity risk measurement, standards and monitoring*; <http://www.bis.org/publ/bcbs188.htm>

Bernauer, T. and Vally Koubi (2002): *Banking Regulation in Hard Times: Business Cycles, Bank Capital, and the Bank Failure - Credit Crunch Dilemma*

de Bondt, G.J. and H.M. Prast (1999): *Bank capital ratios in the 1990s: cross-country evidence*

Cole, R. A. (1998): *Predicting bank failures using a simple dynamic hazard model*

Copelovitch, M. S. and D. A. Singer (2007): *Conflicting Mandates: Central Banks, Regulation, and Inflation*

Drumond, I. (2009): *Capital Requirements, Business Cycle Fluctuations And The Basel Accords: A Synthesis (2009)*

Estrella, A. and S. Park, S. Peristiani (2000): *Capital Ratios as Predictors of Bank Failure*

Foos, D. and L. Norden, M. Weber (2009): *Loan Growth and Riskiness of Banks*

Gale, D. and O. Özgür (2004): *Are Bank Capital Ratios Too High or Too Low? Risk Aversion, Incomplete Markets, and Optimal Capital*

Geithner, T. F. (2008): *Reducing Systemic Risk in a Dynamic Financial System*

Jablecki, J. (2009): *The impact of Basel I capital requirements on bank behavior and the efficacy of monetary policy*

Jesswein, K. R. (2009): *Bank Failure Models: A Preliminary Examination of the "Texas" Ratio*

Junxun, D. and W. Guan (2009): *The Game between Securitization and Capital Regulation*

König, P. J. (2010): *Liquidity and Capital Requirements and the Probability of Bank Failure*

Martinez-Miera, D. (2008): *Capital requirements and Bank Failure*

Molina, A. C. (2001): *Predicting bank failures using a hazard model: the Venezuelan banking crisis*

Tarullo, D. K. (2008): *Banking on Basel: The Future of International Financial Regulation*