

**Bank Regulation, Profitability, and Lending:
An Analysis of Systemically Important Banks pre-2007-09 Financial Crisis**

by Maryam Mashaie

1512679

Department of Economics of the University of Ottawa
in partial fulfillment of the requirements of the M.A. Degree
Supervisors: Professors Patrick Leblond and Maral Kichian

ECO 6999

December 2013

Acknowledgements

I would like to thank my co-supervisors, Professors Patrick Leblond and Maral Kichian for sharing their knowledge, discussions, and suggestions for this paper. A small acknowledgement as this does no justice to how grateful I am for their support. Thanks also go to Professor David Longworth for introducing me to such an interesting topic. I would also like to extend thanks to my work and colleagues at the Canadian Air Transport Security Authority for providing me the opportunity to work, learn, and apply my newfound knowledge throughout the years. And finally, my deepest love and thanks to my family for supporting me in reaching this final step.

Abstract

Poor regulation and supervision have been noted as contributing factors to the recent financial crisis. The objective of banking regulation is to increase a bank's solvency and liquidity in order to better absorb financial and economic shocks and to create a stable financial sector. The "public interest view," represented by governments acting on behalf of the public, strive to generate a stable financial sector, while the "private interest view," represented by banks and lobbyists, claim that regulations impede banking activities, its ability to be profitable and provide lending opportunities, thereby adversely impacting economic growth. Admati et al. (2010) argue that under higher capital regulations, banks would be able to make better, more socially optimal lending decisions, while maintaining the same lending levels. Using this idea, this paper demonstrates that under regulatory standards that promote financial and economic stability, banks can still be profitable and engage in lending activities. Using an econometric model loosely based on Beltratti and Stulz (2012), bank-specific determinants (based on Basel III recommended regulations) and regulation-specific determinants are used to determine the effect on bank profitability, thereby impacting a bank's lending to support economic growth. The analysis was performed on systemically important banks in the period leading up to the 2007-09 financial crisis. Overall, it was found that Tier 1 capital is positively related to bank profitability and leverage is negatively related to bank profitability. Interestingly, the deposit ratio is negatively related to profits and the liquidity ratio is not significant. The results for the regulatory-specific determinants are conflicting regarding profitability. While the results imply that greater supervisory power implies higher bank profitability, tighter restrictions on bank activities decrease profitability. The resulting estimated equation predicts that under Basel III regulations, banks can still be profitable, continue lending activities, and contribute to economic growth.

Table of Contents

Acknowledgements.....	i
Abstract.....	ii
1. Introduction.....	1
2. Literature Review.....	3
2.1 Why Does Bank Regulation Matter?	3
2.2 Capital Requirements and Lending.....	4
2.3 Trade-off Between Financial Stability and Economic Growth?	6
2.4 Global Banking Regulations and the Basel Accords	6
2.5 Basel III: Capital Regulation, Liquidity, and Leverage	8
2.6 Basel III Critique.....	12
2.7 Bank Regulation in Canada, United States, and Europe.....	14
3. Methodology, Model, and Data	16
3.1 Methodology	17
3.2 Model	17
3.3 Data.....	22
4. Empirical Analysis.....	24
4.1 Empirical Analysis on ROA for All Banks.....	25
4.2 Empirical Analysis on ROA for Canada, United States, and Europe	28
4.3 Empirical Analysis on ROE for All Banks	29
4.4 Empirical Analysis on ROE for Canada, United States, and Europe.....	31
4.5 Prediction for Basel III.....	31
5. Conclusion	33
Appendix.....	34

List of Tables

Table 1 – Model variables, definitions, and sources	18
Table 2 – Number of systemically important banks as of December 31, 2007 by country	22
Table 3 – Descriptive statistics	24
Table 4 – OLS results using ROA as dependent variable, 2003-2007	26
Table 5 – OLS results using ROE as dependent variable, 2003-2007	30
Table A 1 – OLS regression results with no regulatory and macroeconomic variables with year fixed effects using ROA as dependent variable, 2003-2007	36
Table A 2 – OLS regression results with no regulatory and macroeconomic variables with year fixed effects using ROE as dependent variable, 2003-2007	37
Table A 3 – OLS regression results with no regulatory and macroeconomic variables with country fixed effects using ROA as dependent variable, 2003-2007	38
Table A 4 – OLS regression results with no regulatory and macroeconomic variables with country fixed effects using ROE as dependent variable, 2003-2007	39
Table A 5 – Correlation Coefficient	40
Table A 6 – Collinearity Diagnostics using ROA.....	41
Table A 7 – Collinearity Diagnostics using ROE	42

1. Introduction

The 2007-09 financial crisis demonstrated that economic stability depends on financial stability (Jenkins and Thiessen, 2012). From a macroeconomic perspective, the financial sector acts as the intermediary between investors and firms, where there is a transfer of capital to the economy's production. These in turn serve to produce employment and output, often used to describe the relative "health" of a country's economy. Negative shocks to the economy have an adverse effect on these macroeconomic indicators, and as such render an economy vulnerable to recession, or in extreme cases, depression.

Econometric analysis has demonstrated that banks produce a first-order impact on economic development (Barth et al., 2006). When banks provide loans to firms, this encourages entrepreneurship and consequently economic growth. Poor financial sector health impedes banks from providing loans, thereby reducing economic growth (Beltratti and Stulz, 2012).

Banks have the potential for failure due to the following two risks: solvency risk, where a bank's liabilities is greater than its assets, and liquidity risk, where a bank is unable to easily convert its assets into cash to pay off creditors. Because of the interconnectedness of the financial sector and information contagion,¹ these risks spread rapidly through the financial sector causing instability. The 2007-09 financial crisis was a combination of many systemically important financial institutions' (SIFIs²) undercapitalization and lack of liquidity, especially in the mostly unregulated shadow banking system³ (Acharya et al., 2011). In times of financial stress, banks may be obliged to sell off assets to generate more liquidity. During the recent financial crisis, many banks needing to generate liquidity were funded with short-term debt, and were forced to engage in costly fire sales, further depressing asset prices, leading to liquidity spirals. This effect is greater for banks that have higher leverage (Acharya et al., 2011; Basel Committee on Bank Supervision [BCBS] 2011; Beltratti and Stulz, 2012).

Poor regulation and supervision have been noted as contributing factors to the recent financial crisis. Reducing the differences in country banking regulations and "creating a more level playing field" were motivating factors behind the Basel initiatives (Ongena et al., 2013). A stable banking sector directly

¹ See Appendix for further explanation on bank interconnectedness and information contagion.

² See Appendix for further explanation on Too-Big-To-Fail and SIFIs.

³ There is no agreed-upon definition of the shadow banking system. Loosely speaking, the shadow banking system is everything that is not part of the conventional banking system, such as non-bank loan originators, investment banks, hedge funds, private equity funds, etc. Most estimates would place the shadow banking system prior to the financial crisis as being far larger than the conventional banking system (Blinder 2013).

benefits economic growth and development; however, banks do not always function in this beneficial manner (Barth et al., 2013). Martin and Parigi (2013) claim that since regulation lowers profits, banks may be induced to use financial innovation (such as structured finance in the form of pooling and tranching assets) to evade these regulations, even at the expense of social welfare. Banks will claim that regulations impede its ability to be profitable and to provide loans to consumers and firms. Policymakers' response to crises is to implement new regulatory reforms to mitigate future systemic risk, as was done with Basel III at an international level and The Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank Act hereafter) in the United States. The BCBS advocates best practices for a sound financial sector. Basel III was released in 2010 with new rules defining capital, increasing the risk weights of some assets, introducing capital buffers and liquidity rule management as well as recommending a leverage ratio. All this has been done with the objective to have more capital to absorb losses in times of financial stress. The transition period for banks to achieve these levels is from January 2013 to 2019 (Quaglia 2013; BCBS 2011).

Much has been written regarding governments' role in regulating commercial bank activities since banks' risk-taking behaviour has economic implications and contributes to financial instability. Studies have shown that bank activity restrictions negatively affect bank efficiency⁴ and capital regulations increase bank stability since capital requirements and stringency reduce bank risk-taking behaviour (Ongena et al., 2013; Barth et al., 2013). Better bank performance is believed to be dependent on higher capital adequacy requirements, since banks', depositors', and creditors' incentives will be aligned to reduce the risk (Admati et al., 2010). As such, these are public interest benefits; whereas the private interest view opposes these capital requirements making the common claim that equity is expensive. The private interest view also claims that other regulatory restrictions, such as limiting a bank's activities, could reduce a bank's diversification, thereby decreasing its franchise value and reducing incentives for efficient behaviour (Beltratti and Stulz, 2012). This would imply a negative relationship between regulation and profitability. An additional problem is that fewer restrictions on bank activity may lead to moral hazard and more risky behaviour.

⁴ A common method to capture bank efficiency is to use data envelopment analysis (DEA) (Lee and Chih, 2013). The inputs to this analysis often include total deposits and other types of funding, fixed assets, personnel expenses as labour, and a loan-loss provision to capture risk (Barth et al. 2013). Many of these inputs are used as determinants to bank profitability; therefore, an assumption is being made that bank efficiency positively affects bank profits and as such bank profitability will be used as a proxy for bank efficiency.

This paper aims to see if Basel III requirements and bank regulations negatively affect bank profitability, thereby restricting a bank's ability to provide loans to the economy and contribute to economic growth. To determine this, an econometric model loosely based on the Beltratti and Stulz (2012) models, which analyses bank performance during the 2007-09 financial crisis, is used. Where the aforementioned models use stock prices to measure banks performance, the model in this paper uses return on assets (ROA) and return on equity (ROE) as bank profitability measures.

The rest of the paper is structured as follows: Section 2 is the related literature review and describes global banking regulations and presents a high-level description of the regulatory frameworks of Canada, the United States, and Europe, Section 3 outlines the methodology, model, and data used, Section 4 describes the empirical analysis and the prediction for Basel III, and Section 5 summarizes the findings and concludes the paper.

2. Literature Review

2.1 Why Does Bank Regulation Matter?

The objective of banking regulation is to increase a bank's solvency and liquidity and to create a stable financial sector (BCBS 2011). Although there is agreement between regulators, bankers, and academics that stricter regulation will lead to banking stability, there is no consensus with regards to the impact on bank profitability (Admati and Hellwig, 2013; Lee and Chih, 2012). According to Barth et al. (2013), there is no clear prediction of bank regulations on bank efficiency. There are two conflicting views on this area: the "public interest view" and the "private interest view," where the former is represented by governments acting on behalf of the public's best interest to generate a stable financial sector and the latter is represented by a minority that claims bank regulations impede banking activities and stall economic growth (essentially claiming a trade-off between financial stability and economic growth, as Admati and Hellwig [2013] declare).

The more a bank borrows, the greater the likelihood that its debts cannot be repaid. The impact for the financial system is further magnified if the bank is a SIFI. In the lead-up to the recent financial crisis, many SIFIs in the United States and Europe were highly leveraged, where borrowed funds financed 97% of their assets. Most of these SIFIs avoided bankruptcy by receiving taxpayer-funded government bailouts. The Lehman Brothers bankruptcy on September 15, 2008 severely disrupted the global financial system. Stock prices dropped, money market funds froze, banks refused loans to each other, and banks engaged in costly fire sales. Within two weeks of Lehman Brothers' collapse, many systemically

important banks in the United States and Europe faced insolvency (Admati and Hellwig, 2013). Governments and central banks were forced to inject liquidity in the market, by guaranteeing the debts, to prevent a complete collapse of the global financial system. Over this two week period, it became apparent how interconnected the global financial system had become.

The ensuing recession in the United States, often referred to as the Great Recession or the Great Depression 2.0, witnessed the worst job loss and GDP decline since the Great Depression of the 1930's (Blinder 2013). The US economy is still experiencing a weak recovery and its low inflation exit strategy has been extended until mid-2014. Canada came out relatively unscathed from the recent financial crisis, which has led to declarations that the Canadian regulatory framework should be for the world to follow (Leblond 2011; Longworth 2013). In addition to having strong regulation and supervision in its financial sector, the following have been cited as other reasons for financial stability in Canada: mortgage financing, banker conservatism, concentration of the banking system, and less reliance on wholesale finance (Leblond 2013b).

Based on a recent study by Barth et al. (2013) covering 4,050 bank observations representing 72 countries from 1999 to 2007, it was found that restrictions on banking activities negatively impact bank efficiency and stringent capital regulation positively impact bank efficiency. These opposing effects are something to be considered by policymakers. Strengthening official supervisory power also showed a positive impact on bank efficiency, but only for countries that had experienced and independent supervisory authorities. Also banks that had more transparent information and financial disclosure also showed a positive impact on banking efficiency. Much has been studied and written on bank efficiency; however, according to Barth et al. (2013), no comprehensive studies on the effect of bank regulation, supervision, and monitoring on bank efficiency exist. The reason, as explained, is due to limited data availability which impedes creating meaningful measures to represent banking regulation.⁵

2.2 Capital Requirements and Lending

The private interest view claims that higher capital requirements would have negative impacts on bank lending decisions, thereby inhibiting economic growth. Admati et al. (2010) claim that this is false and higher leverage (i.e. lower capital) distorts bank lending decisions because of governance and information frictions. This can lead to worse lending decisions, creating too much or too little lending that does not

⁵ Barth et al.'s (2013) paper conduct one such comprehensive study using data from 2004, 2006, and 2008 World Bank surveys on banking regulation and supervision.

achieve social optimum. Banks with lower leverage (i.e. higher capital) make better lending decisions since they are less likely to invest in risky assets.

A credit crunch (when lending activities completely stop since banks no longer have certainty that loans will be repaid by other banks or corporations) occurs when banks are undercapitalized. Should banks have sufficient capital, there would be no reason to forego profit-generating lending opportunities.

From the private interest perspective, two arguments drive the thought that increased capital requirements negatively impact bank lending: (1) banks with less capital will reduce lending, and (2) lending criteria are associated to how banks fund their loans, and as such, lending becomes more restrictive the greater the loans are financed with equity. The first argument is based on the belief that with a fixed amount of capital, regulatory requirements can only be met if loans and other asset purchases are reduced. Banks need not scale back on these activities and can support the same levels of lending, by either issuing more equity or expanding their balance sheets.⁶ The second argument is rooted in the belief that changes to capital requirements will make previously profitable loans unprofitable, since these loans would be funded differently by the banks. For example, Admati et al. (2010) and Blinder (2013) explain how banks used off-balance sheet entities, such as structured investment vehicles (SIVs), without backing them with capital, to invest in mortgage-backed securities in the period leading up to the recent financial crisis. Essentially, banks used legal and accounting gimmicks to avoid some capital requirements by using off-balance sheet entities mostly residing in the unregulated shadow banking sector, earning basis points and consequently profits. Clearly, banks would not have been profitable if they were regulated to hold equity against these assets, and in fact would have made losses on these assets. These operations were highly risky and profitable, until the mortgage-backed securities market started to collapse in August 2007.

Appropriate lending decisions may involve reducing some lending that may be beneficial in the public interest view. From the economy's perspective, the goal is not to increase lending activities, but to have an appropriate amount of lending that limits overall risk. Excessive risk-taking should be avoided to achieve social optimum.

⁶ Banks may choose not to issue more equity as this can be interpreted by the market as a negative signal of a bank's health or may lead to "debt overhang." These issues can be addressed if a regulator places further regulations to restricting bank payouts and issue new equity.

2.3 Trade-off Between Financial Stability and Economic Growth?

Since banks are the financial intermediaries between investors and firms, banks claim that financial regulation will dampen their lending ability, thereby directly impacting economic growth. This private interest view claims there is a trade-off between financial stability and economic growth. Naturally, bankers and lobbyists will make this claim so as to not reduce banks profits; however, Admati and Hellwig (2013) claim that the benefits to a sound financial system are large and the costs are hard to find, essentially claiming there is no trade-off. As explained further in the next section below, Admati et al. (2010) claim that higher capital requirements do not limit banking activities and, in fact, banks can maintain existing assets and liabilities and reduce leverage by issuing more equity and expanding their balance sheets. Barth et al. (2013) suggest that a trade-off may exist where tighter regulations on bank activities imply negative impacts to bank efficiency, while more stringent capital requirements imply minimal positive impact on bank efficiency; as such, a trade-off may appear between bank soundness and efficiency, which could be translated to decrease bank profits, which could impact a bank's lending decisions to other banks, firms, and consumers.

2.4 Global Banking Regulations and the Basel Accords

After the collapse of West German-based Herstatt Bank and New York-based Franklin National Bank in 1974, it became evident that financial crises were no longer domestic issues. The same year, the Basel Committee on Banking Supervision (BCBS) was established at the Bank for International Settlements (BIS) in Basel, Switzerland to address the increasing internationalization of banks in the 1970s.⁷ The BCBS realized that international coordination of banking regulation was required to mitigate systemic risk and spillovers to other economic sectors and countries. The 1975 Basel Concordat introduced the first set of international bank regulations defining home and host country responsibilities (Acharya et al., 2011; Lall 2009b). While having no formal authority since its creation in 1974, the BCBS has become the recognized authority to establish international banking regulatory standards (Acharya et al., 2011).

The 1988 Basel Capital Accord (Basel I hereafter) was the result of international regulators coming together to coordinate a set of international banking regulations with a focus on guidelines for sufficient

⁷ The BCBS initially consisted of the Group of Ten (G10) consisting of eleven countries (Belgium, Canada, France, Germany, Italy, Japan, the Netherlands, Sweden, Switzerland, the United Kingdom and the United States), plus Spain and Luxembourg. Today, BCBS committee members belong to bank supervisory authorities and central banks from the G20 countries (OECD Statistics Portal 2013).

capital. Basel I required banks to have a ratio of at least 8% of capital to risk-weighted assets,⁸ meaning that a bank needed to hold 8% in capital of a loan's value. The intent was that if countries abided by these regulations set out in Basel I, then participating countries would allow banks to operate in their countries. Most countries adopted Basel I.

By the late 1990s, banks were complaining that Basel I's regulatory requirements to hold capital to back loans was unfavourable to their operations and the economy. Additionally, the simplistic risk-weights made it that, for example, loans were not treated differently between borrowers. These issues incentivized banks to engage in regulatory arbitrage (Lall 2009b). As such, Basel I was reviewed and Basel II was released in 2004 and provided a more detailed set of flexible rules, which came to be known as the three "pillars" of banking supervision. Pillar 1 concerns the set of hard rules for minimum capital requirements, pillar 2 concerns the regulations for official bank supervision, and pillar 3 concerns market discipline and information disclosure standards for banks in reporting to regulators. Of the three pillars, pillar 1 is the most important and pillar 3 is the least developed (Barth et al. 2006; Admati and Hellwig, 2013).

Although meant to ensure a sound and stable financial sector, promote competitiveness, and more readily address risk, under Basel II, banks were again engaging in regulatory arbitrage by creating high leverage, shifting risks to others, and using flawed risk models, all to evade the regulatory requirements to have a safe amount of capital to absorb shocks. In 2007, at the start of the financial crisis, many SIFIs around the world only had a 2 to 3% capital to assets ratio. This low level of capital barely acted as a shock absorber and was a contributing factor to the crisis.

In the wake of the 2007-09 financial crisis, leaders at the 2009 G20 London Summit committed to address system risk and mitigate future financial crises. This commitment would include items such as a formal legislative framework, policies to address liquidity and capital to make financial institutions more resilient to shocks, accountability, and tools to measure systemic risk. These items contribute to a macroprudential framework.⁹ As a result, in 2010 the BCBS released Basel III: A Global Regulatory Framework for More Resilient Banks and Banking Systems. Its intent is to strengthen capital and liquidity rules to increase a bank's resiliency and to absorb financial and economic shocks, and to contain the effects of those shocks within those sectors, thereby mitigating spillover to the real economy (BCBS 2011). Basel III is structured similarly to Basel II, having the same three pillars, but further refining and strengthening the guidelines and targets and introducing a formal international liquidity ratio.

⁸ Risk weights are intended to assess equity requirements relative to risks in investments; realistically, the risk weights are more influenced by politics and the bank's self-interest. See critique on risk weights in section 2.6.

⁹ See Appendix for further explanation on macroprudential framework.

2.5 Basel III: Capital Regulation, Liquidity, and Leverage

Through Basel III, the BCBS has set minimum requirements for capital, liquidity, and leverage for financial institutions. These requirements are intended to act as buffers for banks to be able to withstand a shock to the financial sector and to reduce spillover effects to the rest of the real economy. Capital regulation has represented a significant focus in Basel II and III. Under Basel III, liquidity will have internationally regulated standards for the first time (BSBC 2011).

Capital Regulation

Capital regulation represents the amount of equity a bank must hold against its assets.¹⁰ The goal for capital regulation is for banks to absorb losses in times of stress and to remain solvent by ensuring that the bank has enough equity.¹¹

According to Basel III (BCBS 2011), regulatory capital is represented by the following three types of capital, representing total capital:

- Tier 1 Common Equity Capital;
- Tier 1 Additional Capital;
- Tier 2 Capital.

Where Tier 1 Common Equity Capital must be at minimum 4.5% of risk-weighted assets (RWA) at all times, total Tier 1 capital must be at minimum 6.0% of RWA at all times, and total capital must be at minimum 8.0% of RWA. The regulatory percentages imposed on bank capital represent the amount of *equity* that the bank needs to hold against its assets.

Another indirect benefit of tighter capital regulation is a reduced risk for illiquidity, which can cause insolvency, since depositors should not be concerned about losing their money. If a bank has better ability

¹⁰ Note that in the banking sector, the term *capital* refers to the money that the bank receives from its shareholders if the bank is publicly owned or from its owners if it is privately owned, plus all profits. In other words, capital is the *unborrowed* money that belongs to the bank. In all other economic sectors, the term *equity* is used (Admati and Hellwig 2013). Either term will be used within context in this paper.

¹¹ A bank is considered solvent if its assets are greater than its liabilities; if the reverse happens, then it is considered insolvent. Bank insolvency is a bank failure and will either lead to a government bail out or bankruptcy. Basic arithmetic shows that a drop in asset value greater than regulatory percentages renders a bank insolvent if the bank only held the minimum requirement.

to absorb losses in times of stress, the effects from information contagion and interconnectedness is also reduced (Admati and Hellwig, 2013).

Knowing that banks use borrowed money and equity to invest in assets, higher capital requirements should also incentivize banks to be more risk-averse. Greater equity will mean that the banks' shareholders or owners will bear more risk and consequently be responsible for more risk-taking behaviour (Admati and Hellwig, 2013; Barth et al., 2013).

Recent literature, such as Barth et al. (2013), has noted that higher capital requirements in the public interest view possibly ignores the associated costs, such as higher barriers to entry or government rent extraction. In other words, regulations have the potential to be structured so as to give discretion to the regulators, and thus bargaining power for rent seeking increases. Private interest proponents argue that unless the benefits of higher capital requirements exceed the costs, the stringent regulatory requirements negatively affect the economy. As such, the effect of capital regulation on bank efficiency remains an empirical question.

Liquidity

The recent financial crisis has demonstrated that capital alone does not suffice to maintain financial stability and that a strong liquidity base is also necessary (BCBS 2011); however, until Basel III's release in 2010, liquidity standards were not internationally established.

Liquidity can be defined as the bank's assets that can be easily converted to cash. As specified in Bank of Canada (2012), this generally comprises of cash and equivalent and secured short-term loans. A bank can become illiquid when these assets, normally used for funding, suddenly become withdrawn and other assets cannot be easily converted to cash.¹²

Liquidity issues are common in banking (Admati and Hellwig, 2013). A lot of banks' debts are short-term; however, many of their assets are long-term loans and investments. If a bank's lender is unwilling

¹² A bank can be illiquid, but still solvent; however, due to information contagion and interconnectedness, often times a bank may quickly become insolvent when faced with illiquidity (Blinder 2013).

to extend credit, then the bank will have to resort to costly fire sales to pay off its liabilities.¹³ Engaging in fire sales may lead to a bank's inability to repay current and future debts, i.e. insolvency (Acharya 2010).

To alleviate illiquidity, most central banks act as lenders of last resort, where banks can post assets deemed as collateral-worthy and borrow from the central bank. The lender of last resort acts on the premise that a bank only has liquidity problems; it is deemed solvent because its assets are sound. This will enable the bank to not resort to fire sales and spares the risk of an insolvency crisis. It should be noted, however, that stigmatization occurs when it is known that a bank relies on a central bank's lending facilities. Through information contagion, it may be known that a bank relied on the central bank for liquidity, thereby creating doubt about the bank's solvency.

At the early stages of the 2007-09 financial crisis, liquidity issues arose when bank lenders withdrew funding, leading to a credit-crunch and essentially "freezing" the market for liquid assets (Admati and Hellwig, 2013). As a result, many central banks were forced to respond to this need for liquidity by being the lender of last resort in the market by purchasing certain bank assets, thereby implying government guarantees on those assets. This response "unfroze" the market and allowed the flow of liquidity (and the economy) to resume.

To ensure that banks have sufficient liquidity to withstand short and long-term stress periods, Basel III introduced the following liquidity ratios (BCBS 2011):

- Liquidity Coverage Ratio (LCR)
- Net Stable Funding Ratio (NSFR)

The above ratios each serve separate but complementary purposes. The LCR aim is to ensure that banks have sufficient liquidity over a 30-day period in stress times. The NSFR has a longer-term objective for banks to fund activities with more stable funding, limit reliance on short-term funding, and encourage liquidity risk assessment across on and off-balance sheets. Additionally, the NSFR is meant to ensure banks meet contingent liquidity needs resulting from off-balance sheet commitments over a one year period.

Leverage

Leverage represents how much a bank borrows to invest in assets and is often defined as multiple of total assets to equity (or debt to equity ratio). For example, for Canadian banks the debt to equity cannot

¹³ The extension of short-term credit usually means that debt gets renewed or rolled over.

exceed 20 to 1 (or a leverage ratio of 5%). For this paper, the former definition will be used in the econometric analysis.

As a crisis nears, banks have a tendency to struggle to maintain regulatory capital requirements, and as such, may be forced into fire sales, which can further depress asset prices in a market that already has excessive downward pressure on asset prices; this occurred during the recent financial crisis where the market forced banks to reduce their leverage (Acharya 2010). To address excessive leverage, Basel III introduced a leverage ratio that has a regulatory standard of a minimum 3% level of Tier 1 equity relative to total on and off-balance sheet assets. The leverage ratio has the following objectives (Acharya 2010; Admati and Hellwig, 2013; BCBS 2010):

- Eliminate the banks' excessive leverage in order to avoid forced reduction of leverage leading to possible fire sales and liquidity spirals that may destabilize the financial sector;
- A "backstop" to eliminate extreme cases of risk-weighting approach.

In the 2007-09 financial crisis, while there was excessive build-up of leverage on many US and European banks' balance sheets, strong risk-based capital ratios were also maintained. To address this issue, Basel III introduced a minimum leverage ratio (capital to total assets) and a minimum capital ratio (capital to risk-weighted assets), as noted above.

In times of credit expansion, high leverage magnifies a bank's return on equity (ROE), though not necessarily its return on assets (ROA). In the financial sector, ROE is a traditional profitability measure, even though it is misleading. Bank managers have incentive to increase ROE as it is traditionally tied to performance pay; a higher ROE will lead to a higher bonus pay. A higher ROE implies lower bank equity and greater risk, thereby rendering a bank vulnerable to financial shocks (Admati and Hellwig, 2013; Admati et al., 2010). Economizing on equity (or increasing debt financing) was a strategy used by banks to increase leverage to further drive up ROE.

High leverage can distort lending decisions; as such banks with less leverage take less risk and make better lending decisions (Admati et al., 2010). Leading up to the financial crisis, it was shown that banks were highly leveraged because of cheap debt, accommodating monetary policy, and access to wholesale funding markets (Agur 2013).

Basel III states that when a bank is establishing capital regulations, these requirements are best to be countercyclical such that in times of economic expansion, the bank's capital is increasing and can be drawn upon if needed should the economy be in contraction. However, as a crisis looms near, banks generally have a hard time maintaining the regulatory minimum requirements and are forced to either engage in costly fire sales or raise equity, which increases risk of liquidity spiral. Asset volatility is high during a crisis and low during normal/expansion time, and as such, is very countercyclical. So if capital requirements are relaxed during a crisis time, banks will have more incentive to take greater risk. Countercyclical capital requirements are meant to reduce this issue (Acharya 2010).

2.6 Basel III Critique

Although well intended to mitigate systemic risk, Basel III has come under scrutiny. The November 2010 Financial Times article "Healthy Banking System is the Goal, not Profitable Banks" signed by 22 prominent academics criticizes Basel III as flawed and insufficient to prevent future financial crises from re-occurring.¹⁴ In addition to explaining why using risk-weights, contingent capital, and taxes is flawed, it is emphasized in this letter that the simplest way for banks to reach financial stability is by increasing capital requirements.

Additionally, regulations that allow for equity requirement calculations to be fine-tuned using quantitative risk models and stress tests can be manipulated. Past experience from flawed regulatory frameworks have caused banks to provide less loans to small and medium sized firms, thereby dampening economic activity. As Acharya et al. (2011) state, "... most sovereign regulatory bodies have recognized what a disaster Basel II was," and according to the above-mentioned letter, Basel III may have a similar outcome.

Capital Requirements Too Low

Some arguments state that the Basel III requirements put in place as a response to the financial crisis are barely an improvement to its predecessor, Basel II (Admati and Hellwig 2013; Acharya et al. 2011). Although there is a consensus among the public and private interest views that stricter financial regulations are necessary to ensure financial stability and mitigate systemic risks, Admati and Hellwig (2013) claim the following points: (1) Basel III still has weaknesses that, once again, will incentivize

¹⁴ List of academics noted in references.

banks to engage in regulatory arbitrage, as was done in Basel II, (2) there is no legitimate reason for Basel III capital requirements to be so low and these requirements reflect the political and bank influences on policy debates, (3) at such low equity requirements, bank failures and crises are bound to re-occur. Academics have advocated for much higher equity requirements, more along 20-30% of the banks' total non-risk weighted assets, would make the banks more resilient to shocks, can cope with shocks on their own without needed bail-out support and may only need to rely on occasional liquidity support. The claim is also made that the banking system is just as fragile as prior to the 2007-09 financial crisis and the Basel III requirements don't look likely to have mitigated the crises had such regulations existed back then.

Admati and Hellwig (2013) further claim that it is not clear that even if Basel III had been adopted prior to the 2007-09 financial crisis it would have prevented the crisis from happening. Basel III's weaknesses can be attributed to intense lobbying by banks (Admati and Hellwig, 2013; Lall 2012) against regulations. Bankers and lobbyists claim that increasing equity implies a reduction in bank lending, which would hurt the economy. Concerns such as these have led to pressures that weaken Basel III. Such weaknesses include a long transitional period (2019 instead of immediate implementation to have banks increase equity). It was believed that enforcing the Basel III regulations to increase equity too aggressively would lead to a credit crunch and negatively impact the economy, so low bank equity was not dealt with right away and led to the financial instability in the United States in 2011 (Admati and Hellwig, 2013).

Risk Weighting

Risk weights are intended to assess equity requirements relative to risks in assets; realistically, the risk weights are more influenced by politics and the bank's self-interest. Risk-weighting assesses the risk of each of a bank's assets "scientifically" and then equity requirements are determined based on these assessments. As of Basel I, regulators are still in search of representative risk weights. As of the mid-1990s, regulators have allowed banks to use their own models to assess risk since it is believed they have the most relevant information about their assets. Banks were therefore able to concentrate their investments in assets where risk weight manipulation was easy (thereby economizing on equity), such as in mortgage-related securities in the United States. By having as little as possible equity, banks were able to raise ROE (Admati and Hellwig, 2013). Regulations incorporating a bank's own risk assessment can thus lead to an increase in systemic risk, as the global financial crisis exemplifies (Acharya 2009).

What Constitutes Liquidity

Admati and Hellwig (2013) ask what kinds of assets can sufficiently be called liquid? Technically, all assets on a balance sheet, excluding cash, can suddenly turn illiquid leading to a credit-crunch. A credit-

crunch often leads to government intervention through where liquid is injected into the system (for example by purchasing some of the bank's illiquid assets or by guaranteeing these assets so that they can be used as collateral against loans) in order to allow the banks and, therefore, unfreeze the market. However, government guarantees are harmful to the economy since these insolvent or near-insolvent zombie banks continue to operate, thereby prolonging a financial crisis.

2.7 Bank Regulation in Canada, United States, and Europe

Interesting debates arise regarding bank regulation: (1) whether countries should create single or multiple supervisory authorities and (2) whether countries should adopt similar or different standards for bank regulations, and (3) whether supervisory role should be a central bank mandate. The literature on the single versus multiple supervisory authorities is conflicted, where a strong advantage of a single authority removes competition between the multiple supervisors, while proponents of a multiple supervisors stress the "competition in innovation" among the multiple supervisors (Barth et al. 2006). Agur (2013) argues that multiple bank regulators increase the potential for arbitrage, which benefits banks at the expense of consumers. Most countries have single supervisory authorities. Some countries are linked together through regional or religious groupings, such as the European Union (EU) or Islamic finance, and in such cases, will come together to jointly decide upon bank regulation (Barth et al., 2006).

The issue to assign central banks the responsibility of bank supervision also has advantages and disadvantages. A strong case in its favour is that the central bank has access to pertinent information, can react quickly, and can act as a lender-of-last-resort to respond in times of economic stress. On the other hand, should a central bank have the responsibility of acting as a bank supervisor, there arises the conflict of interest between the mandates for monetary policy and financial (Barth et al., 2006). This may be more pronounced during economic downturn when a central bank may be tempted to pursue looser or more expansionary monetary policy to encourage bank lending activities to continue; however, it may not be beneficial to the overall economy who have come to expect long-term stability through monetary policy. In the majority of countries, the central bank plays some supervisory role.

Canada has a single regulatory supervisor, the Office of the Superintendent of Financial Institutions (OSFI), which supervises all financial institutions in Canada. The World Economic Forum rated Canadian banks as the soundest in the world six years in a row, from 2008 to 2013. According to Longworth (2013), strengths in the Canadian regulatory framework can be attributed to the following: early adoption of Basel II and its full implementation by November 2007, learning culture/constant improvement, an emphasis on a principle-based approach where banks understand the principles behind the rules leading to

more conservative banking, and regulations that constrained the growth of residential mortgage credit. Bank deposits are less subject to runs when a bank is stressed; therefore, higher deposit ratios can reinforce bank stability, as was the case for Canada during the recent crisis. Canadian banks operate conservatively and tend to fund more assets with deposits as opposed to short-term loans (Brean et al., 2011; Leblond 2013a). Other examples of Canadian banking conservatism are evident through OSFI's higher Tier 1 capital, risk-weighted capital and lower leverage rules than those mandated in Basel III. Additionally, Canadian banks hold more capital and choose lower leverage levels, contrasting many US and European banks (Longworth 2013).

The United States has three banking regulators: the Office of the Comptroller of the Currency (OCC) for nationally chartered banks, the Federal Reserve (Fed) for state-chartered member banks, and the Federal Deposit Insurance Corporation (FDIC) for state-chartered non-Fed members). This structure existed prior to the financial crisis, and it was decided to effectively remain as a three-regulator system after the crisis.

Many of the regulations in the United States that were established after the Great Depression were dismantled in the 1970s and 1980s, citing counter productivity due to high interest and exchange rates, and competition from foreign banks (Admati and Hellwig, 2013). In the decade and a half leading up the recent financial crisis, the US was under severe banking deregulation (Blinder 2013); two significant acts, the Riegle-Neal Interstate Banking and Branching Efficiency Act (Riegle-Neal hereafter) of 1994 and the Gramm-Leach-Bliley Act (GLBA hereafter) of 1999 significantly contributed to this (Barth et al., 2010). Riegle-Neal contributed to removing geographic restrictions on banking as well as increasing the likelihood of bank mergers. The GLBA increased the activities to which the banks could engage, effectively repealing sections of the Glass-Steagall Act that was put in place as a result of the Great Depression of the 1930's. As a response to the recent financial crisis, the United States adopted the Dodd-Frank Act in 2010, with the intent to identify and regulation systemic risk, propose an end to too-big-to-fail, expand the Fed's authority and responsibility, prevent or limit bail-outs, instantiate the Volker Rule (i.e. prohibits a bank from engaging in proprietary trading), and the regulating derivatives (Acharya et al. 2011). Although the lawmaking phase of Dodd-Frank Act was completed in 2010, the rulemaking and practical implementation phase is in its early stages and has already proven to be a big challenge (Blinder 2013).

Since the Euro was introduced in 1999, the European Central Bank (ECB) has been responsible for monetary policy of the participating European Monetary Union (EMU) countries, but not bank regulation (i.e. no direct regulatory mandate, Acharya 2010), which has remained with the individual EMU countries. In fact, the ECB is independent from the EMU and by law is forbidden to lend to EMU

governments, implying that the eurozone has no officially recognized lender of last resort, so when an EMU government owes euros, there is no assurance that the debt can be paid (Admati and Hellwig, 2013). To address bailouts in the United States, the Troubled Asset Relief Program (TARP) was authorized at approximately 4.7% GDP. In the end, approximately 3% was lent, and all was paid back with interest. With no official lender of last resort, European parliaments were approving country-by-country ad-hoc bailouts to prevent bank collapses (Blinder, 2013). For EU countries, the domestic supervisory model proved to be a challenge for cross-border banking. In the period leading up the financial crisis, there is some evidence that in order to attract and retain financial institutions, domestic regulations could not be so restrictive (Agur 2013). Since the late 1950's, the EU has been working to achieve harmonized regulation to create a single financial services market in Europe (Barth et al., 2006; Barth et al., 2012; Grossman and Leblond, 2012; Grossman and Leblond, 2011). In mid-September 2013, the European Parliament approved the creation of a Single Supervisory Mechanism (SSM) which is a step towards a banking union in the EU and would be under the responsibility of the ECB (Leblond 2013b).

The recent financial crisis demonstrated that weaknesses existed in macroprudential oversight in the EU as well as the shortcomings in cooperation between member countries' regulatory authorities. After the recent financial crisis, the EU adopted new regulatory initiatives (Grossman and Leblond, 2012; Leblond 2013b). Once Basel III was agreed upon internationally, it was incorporated into EU regulatory legislation (Quaglia 2013).

Based on the information in the literature review, the potential effects of Basel III on bank profitability will be analyzed in the following section. Using an econometric model with pre-crisis data whereby Tier 1 capital, leverage, and liquidity (for which Basel III contains regulatory requirements) along regulatory and macroeconomic variables will be used to explain the effects on bank profitability. As discussed above, it is assumed that increases in bank profitability also increases bank lending activities. The aim of the analysis is to demonstrate that banks can still be profitable under regulatory requirements and continue lending activities, thereby contributing to economic growth.

3. Methodology, Model, and Data

To determine the effects of Basel III on bank profitability, this paper uses an econometric model loosely based on the one used by Beltratti and Stulz (2012) which was used to determine bank performance using stock returns during the 2007-09 financial crisis. The model used in this paper focuses on determining

bank profitability from ROA and ROE and using as explanatory variables Basel III's regulatory requirements related to Tier 1 capital, liquidity, and leverage, regulatory variables, and macroeconomic variables. Since Basel III has a phase-in period until 2019 and consequently, it is too early to determine its impact, the data is taken on an annual basis in the pre-crisis period from 2003 to 2007. With the estimated equation a simplistic prediction is made to determine if Basel III will allow the systemically important banks in the dataset to be profitable.

3.1 Methodology

To determine the effects of bank regulation on bank profitability, bank-specific, regulatory-specific, and macroeconomic-specific explanatory variables were input into an econometric model. A correlation analysis was performed to ensure multicollinearity did not exist among the explanatory variables. Ordinary Least Squares (OLS) is used for the analysis to determine the impact of Tier 1 capital and liquidity ratios, leverage, regulatory variables, and macroeconomic variables on bank profitability for systemically important banks around the world.

3.2 Model

The econometric model used for bank profitability analysis has the following linear form:

$$Y_{itk} = c + \sum_{j=1}^J \beta_j X_{it}^j + \sum_{l=1}^L \beta_l X_{kt}^l + \sum_{m=1}^M \beta_m X_{kt}^m + \varepsilon_{itk}$$

where:

- Y_{itk} is the dependent variable representing bank i 's profitability at time t for country k , with $i = 1, \dots, N$, $t = 1, \dots, T$, $k = 1, \dots, K$
- c is the constant term (intercept)
- X_{it}^j are the bank-specific explanatory variables
- X_{kt}^l are the regulatory-specific explanatory variables
- X_{kt}^m are the macroeconomic explanatory variables
- ε_{itk} is the error term

Table 1 below indicates all the variables, definitions, and notations of the above-mentioned model.

Table 1 – Model variables, definitions, and sources

Variable	Definition	Source
Dependent variable		
Profitability, ROA	Return on assets	Bloomberg
Profitability, ROE	Return on equity	Bloomberg
Bank-specific determinants		
Tier 1 Capital Ratio	Tier 1 capital to risk-weighted assets	Bloomberg
Leverage	Total assets to total equity	Bloomberg
Liquidity Ratio	Cash and equivalent to total assets	Bloomberg
Deposit Ratio	Customer deposits to total assets	Bloomberg
Credit Risk	Total loans to total assets	Bloomberg
Regulatory-specific determinants		
Official	An index of a country's bank supervisory agency's power	Beltratti and Stulz
Capital	An index of a country's regulatory oversight of bank capital	Beltratti and Stulz
Restrict	An index of a country's regulatory restrictions on bank activities	Beltratti and Stulz
Macroeconomic determinants		
Concentration	Assets of the three largest banks in each country to total assets of national banking system in 2006	Beltratti and Stulz
Gross Domestic Product growth	A country's annual GDP growth rate	UNData

The model will be run separately for ROA and ROE as the dependent variable:

$$ROA_{itk} = c + \beta_1(\text{Tier 1 Capital Ratio}_{it}) + \beta_2(\text{Leverage}_{it}) + \beta_3(\text{Liquidity Ratio}_{it}) + \beta_4(\text{Deposit Ratio}_{it}) + \beta_5(\text{Credit Risk}_{it}) + \beta_6(\text{Official}_{tk}) + \beta_7(\text{Capital}_{tk}) + \beta_8(\text{Restrict}_{tk}) + \beta_8(\text{Concentration}_{tk}) + \beta_8(\text{GDP growth}_{tk}) + \varepsilon_{itk}$$

$$ROE_{itk} = c + \beta_1(\text{Tier 1 Capital Ratio}_{it}) + \beta_2(\text{Leverage}_{it}) + \beta_3(\text{Liquidity Ratio}_{it}) + \beta_4(\text{Deposit Ratio}_{it}) + \beta_5(\text{Credit Risk}_{it}) + \beta_6(\text{Official}_{tk}) + \beta_7(\text{Capital}_{tk}) + \beta_8(\text{Restrict}_{tk}) + \beta_8(\text{Concentration}_{tk}) + \beta_8(\text{GDP growth}_{tk}) + \varepsilon_{itk}$$

Dependent variables

Return on Assets (ROA) and Return on Equity (ROE) are often used as proxies to measure bank profitability (Ongena et al., 2013; Dietrich and Wanzenried, 2011). ROA is an indicator of profitability relative to total assets and is a good measure of a bank's ability to produce profits. ROA is dependent on policy decisions and uncontrollable factors such as the economy and regulations (Sufian and Habibullah, 2009); however, ROA does not capture off-balance sheet activities (a common occurrence during the recent financial crisis) and may not be representative for all the banks in the dataset. ROE is the shareholders' return on their equity and is ROA multiplied by the assets to equity ratio¹⁵. Although ROE is deeply embedded in the banking culture, it is a flawed measure of profitability (Admati and Hellwig, 2013). A higher ROE is associated with higher leverage. Bankers strive for higher ROE since often times, it is linked to performance pay and, as such, they will have incentive to take risk. Average ROE will decrease if more equity is used to fund assets and the lower return may compensate shareholders for the risk they would have been exposed to otherwise. A declining profit trend may signal sustainability of banks (Klomp et al., 2012).

Since both measures are used in the banking sector and, as noted above, the model will be run separately for ROA and ROE as the dependent variables using the same explanatory variables. These variables are taken directly from Bloomberg.

¹⁵ From Admati et al. (2010), $ROE = (ROA \times A - r \times D)/E$, where ROA is return on assets, A is assets, E is equity, D is debt, and r is the after-tax interest rate on D.

Bank-Specific Determinants

Tier 1 Capital Ratio is the ratio of Tier 1 capital to risk-weighted assets. The recent financial crisis demonstrated that many banks around the world were severely undercapitalized. As defined in the literature review in section 2, Tier 1 capital is considered to be more loss-absorbing capital compared to Tier 2 as it is the first type of capital to be used up during a financial crisis and acts as a buffer to prevent the bank from becoming insolvent. This variable is taken directly from Bloomberg.

Leverage represents the ratio of assets to equity, where the equity represents the amount of debt a bank uses to acquire assets. Up until Basel III's release, no international regulations existed on leverage. This newly introduced regulation includes on and off-balance sheet activities. The recent financial crisis demonstrated that many banks around the world were highly leveraged. Using the balance sheet leverage ratio definition in Bank of Canada (2012), this variable was calculated using other similar variables obtained from Bloomberg. Since the definition used is assets to equity, it will be considered a multiplier and not a ratio and will be referred to Leverage hereafter. This definition only refers to the *balance sheet* financials reported in Bloomberg. In the period leading up to the recent financial crisis, many banks were engaging in off-balance sheet and shadow-banking activities where often there was little or no regulation; as such, Leverage may not be representative of all actual leverage.

Liquidity Ratio is the bank's liquidity ratio. The higher this ratio, measuring the amount of liquidity a bank holds, the better position it will be in to absorb any adverse economic shock. Although there were many liquidity ratios available in Bloomberg, the definitions did not appear to fully capture the meaning intended for this paper. As such, the Liquidity Ratio definition will be based on Bank of Canada (2012). Although Bloomberg does not have the exact variables used by OSFI (and consequently the Bank of Canada), a similar definition is calculated and used.

Deposit Ratio: As done in Beltratti and Stulz (2012), to characterize a bank's liabilities, the Deposit Ratio represents the ratio of customer deposits to total assets. The Deposit Ratio is calculated using variables extracted from Bloomberg. It is expected that banks with a higher Deposit Ratio have higher profitability since these banks' assets would be funded with less debt and more capital; banks with more capital tend to make better lending decisions and are better able to absorb economic shocks (Admati et al., 2010).

Credit Risk: To characterize the asset side of bank's balance sheet, Credit Risk is used and is defined as the ratio of loans issued by the bank to its total assets. Often times, the loan-loss provisions to loans is used for this variable; however, another ratio used to measure credit risk and produce similar results is total loans to total assets (Naceur and Omran, 2011; Athanasoglou et al., 2008).

Regulatory-Specific Determinants

The regulatory variables used in the model come directly from Beltratti and Stulz (2012), who in turn use the same variables that were initially created by Caprio et al. (2007) from the 2007 Bank Regulation and Supervision Survey database conducted by the World Bank (Caprio et al., 2007). Each of the Official, Capital, and Restrict variables is an index based on a subset of questions from this survey where a Yes answer adds to the index value. Although a country's regulations may provide flexibility to banks and their operations, the regulators may restrict the banks from that flexibility. It is important to note that the regulatory indices reflect a country's formal rights to regulate, not necessarily if those rights were practiced or enforced (Beltratti and Stulz, 2012). Supervisory independence is necessary to ensure a well-functioning bank sector, since it allows for insulation from political influence. Despite its importance, not much is known on its relationship to bank profitability (Barth et al., 2013). In Barth et al.'s (2013) study on bank efficiency, increased official supervisory power does not imply increased bank efficiency; however, increased supervisory power independence increases bank efficiency for certain countries.

Official is the index for a country's official supervisory power based on a set of 14 survey questions. These questions include a supervisor's right to meet with, request, and information from auditors and the right to intervene in a bank's operations and shareholder rights.

Capital is the index for a country's restrictions and regulatory oversight on bank capital based on a set of nine survey questions. These questions include the types of assets that count as capital and if the supervisor can verify these assets.

Restrict is the index for a country's regulatory restrictions on bank activities relating to securities market, insurance, real estate activities, and owning non-financial firms.

Macroeconomic Determinants

Concentration represents the ratio of total assets of the country's three largest banks to the total assets of the country's banking sector. Beltratti and Stulz (2012) use Concentration as a proxy for bank franchise value. Studies suggest that decreasing bank franchise value acts as an incentive for banks to increase risk (Gertler et al., 2012).

Growth Domestic Product (GDP) annual growth rate is used as an exogenous explanatory variable. Given that economic growth is related to bank soundness and profitability, it is expected that GDP growth rate will be positively related to profitability (i.e. ROA and ROE in the model).

3.3 Data

All data were obtained via Bloomberg, UNData, Worldbank, and Beltratti and Stulz paper to create a balanced panel dataset for a six-year period leading up to the recent financial crisis on an annual basis from 2003 to 2007.¹⁶ As in Beltratti and Stulz (2012), the following criteria were used to create the dataset: banks with total assets of at least US\$50 billion as of December 31, 2007, deposits to total assets ratio of at least 20%, and loan to total assets of at least 10%.¹⁷ Table 2 below lists all the countries and number of banks comprising this dataset.

Table 2 – Number of systemically important banks as of December 31, 2007 by country

Country	Number of banks
Australia	4
Austria	3
Belgium	1
Brazil	5
Canada	6
China	6
Denmark	1
France	4
Germany	5
Greece	4
Hong Kong	5
India	2
Ireland	3
Israel	2
Italy	11
Japan	24
Malaysia	2
Netherlands	1

¹⁶ 2003 is the year before Basel II was implemented. September 15, 2008 is the day US bank Lehman Brothers failed (Blinder 2013).

¹⁷ The Dodd-Frank Act considers a bank to be systemically important if total assets are at least US\$50 billion. The December 31, 2007 cut-off date was used since this is considered to be the start of the recent financial crisis when, on August 9, 2007, French bank PNB Paribas halted customer withdrawals on its subprime mortgage funds, essentially calling into question bank solvency and signalling the start of panic in the subprime mortgage market (Blinder 2013). This was also further evidenced by the increase in the London Interbank Offer Rate (LIBOR) (i.e. short-term lending rates at which large banks lend to each other) two days after August 9, 2007.

Norway	1
Portugal	4
Singapore	3
South Africa	4
South Korea	8
Spain	7
Sweden	4
Switzerland	2
Taiwan	1
Turkey	3
United Kingdom	9
United States	27
Total	162

Table 3 below shows the descriptive statistics. Variables ROA, ROE, Tier 1 Capital Ratio, Liquidity Ratio, Deposit Ratio, Credit Risk, Credit Risk, and GDP Growth are represented by percentages. Leverage is a multiple. Official, Capital, and Restrict are index values which are represented by integer values in the data set. Interestingly, the minimum Tier 1 Capital Ratio is 4.35, which is consistent with Beltratti and Stulz (2012), almost meeting the Basel III regulatory requirement for 2013. As well, the minimum Leverage value is negative as represented by one Chinese bank in the dataset that had negative total shareholder equity for 2003 and 2004.

Table 3 – Descriptive statistics

Variable	Number of observations	Mean	Standard deviation	Minimum	Maximum
Dependent variable					
ROA	775	0.89	0.69	-4.02	4.61
ROE	758	15.25	12.59	-91.02	86.42
Bank-specific determinants					
Tier 1 Capital Ratio	631	8.59	2.28	4.35	24.82
Leverage	788	16.50	8.49	-9.98	75.96
Liquidity Ratio	788	10.05	7.25	0.15	48.78
Deposit Ratio	788	56.77	18.91	20.03	126.27
Credit Risk	788	58.23	14.89	13.09	94.77
Regulatory-specific determinants					
Official	773	10.72	2.44	5.00	14.00
Capital	773	5.61	1.57	2.00	9.00
Restrict	773	9.55	2.46	4.00	15.00
Macroeconomic determinants					
Concentration	788	0.53	0.18	0.27	0.95
GDP growth	788	3.47	2.44	-0.91	14.20

4. Empirical Analysis

The model described in section 3.2 follows Beltratti and Stulz’s (2012) Panel B results (using regressions with regulation variables) with the exception ROA and annual data is used to measure bank profitability, instead of stock returns and monthly data to measure bank performance. For robustness, the regression is repeated using ROE. For the most part, the results obtained in this paper are consistent with the results in the aforementioned article.

Correlation Analysis

A correlation analysis and a test for multicollinearity were performed to determine the strength of the linear relationship between the variables; these results are shown in Tables A5, A6, and A7 in the appendix. A noticeable positive correlation exists between the dependent variable ROA and the explanatory variable Tier 1 Capital Ratio and a noticeable negative relationship between ROA and Leverage. The same observation exists when looking at ROE for the same two explanatory variables. By looking at the correlation coefficients, there does not appear to be strong linear relationships between the

explanatory variables (Hill et al., 2001); however, when viewing the condition index and proportion of variation for Credit Risk (43 and 0.5 respectively), there may be an indication of multicollinearity. Knowing that multicollinearity does not violate the classical assumptions on OLS and the coefficients will still be best, linear, unbiased, estimates (BLUE), the analysis was pursued (Brooks 2008).

Sensitivity Analysis

As noted in Beltratti and Stulz (2012), country effects could matter in the regression results however including them would induce multicollinearity. Thus, regressions with and without country fixed effects were conducted in Beltratti and Stulz (2012) (see, Table 4, Panels A and B, respectively). We follow a similar strategy: in our baseline regressions we therefore omit country effects because of multicollinearity concerns, however, for each of ROA and ROE, we also conduct some sensitivity analyses where we estimate a regression without regulatory-specific and macroeconomic variables, but including year and/or country fixed effects. The results are reported in Tables A1, A2, A3, and A4 in the appendix. These confirm, as in Beltratti and Stulz (2012), that bank characteristics do depend on regulatory-specific and macroeconomic variables. For example, looking at the regression results for ROA as the dependent variable for all banks, the parameter estimates for the constant term, Tier 1 Capital Ratio, and Leverage are similar to their values in the baseline case and are significant, while the Liquidity, Deposit, and Credit Ratio parameter estimates vary between positive and negative values. The ROE regression results are also similar. As such, Tables 4 and 5 with no fixed effects will be used for the analysis henceforth.

4.1 Empirical Analysis on ROA for All Banks

Tables 4 and 5 below show the results from the OLS regression. The *t*-test will be used for individual tests of significance on the explanatory variables, using a 5% significance level and the decision rule to reject the null hypothesis if $t \geq 1.96$ or $t \leq -1.96$. The *p*-values are in parentheses and * indicates significance. Note that Canada and United States have constant values for explanatory variables Official, Capital, Restrict, and Concentration and as such were not included in these country regressions.

Tier 1 Capital Ratio has a positive and significant coefficient, judging that a one percentage increase in the Tier 1 Capital Ratio will increase ROA by approximately 0.08%. Studies demonstrate that banks with high profitability maintain high capital ratios (Beltratti and Stulz, 2012; Dietrich and Wanzenried, 2011; Naceur and Omran, 2011).

Table 4 – OLS results using ROA as dependent variable, 2003-2007

Variable	All banks	Canada	United States	Europe
Intercept	0.47808* (0.0446)	0.63350 (0.6585)	0.59107 (0.2114)	-0.86834* (0.001)
Tier 1 Capital Ratio	0.08257* (<.0001)	0.01632 (0.5755)	0.14011* (<.0001)	0.07406* (<.0001)
Leverage	-0.03072* (<.0001)	0.00526 (0.8574)	-0.0408* (0.0011)	-0.01088* (<.0001)
Liquidity Ratio	0.00051 (0.8637)	0.00097 (0.9772)	-0.00912 (0.1263)	0.00473 (0.1458)
Deposit Ratio	-0.00562* (<.0001)	-0.00979 (0.7556)	-0.00237 (0.4338)	0.00514* (0.0163)
Credit Risk	0.00473* (0.0057)	0.01030 (0.5741)	0.00484 (0.1915)	0.00397* (0.0149)
Official	0.03954* (<.0001)	- -	- -	0.01279 (0.1821)
Capital	-0.01859 (0.1328)	- -	- -	0.00309 (0.7888)
Restrict	-0.01022 (0.236)	- -	- -	0.03281* (0.0006)
Concentration	-0.326* (0.0054)	- -	- -	-0.07352 (0.5465)
GDP growth	0.06072* (<.0001)	0.02953 (0.7708)	-0.01142 (0.8271)	0.13398* (<.0001)
Num observations	618	30	125	281
Adjusted R^2	0.4208	-0.2006	0.2645	0.4639
F -statistic	45.83*	0.19	8.43*	25.23*

Leverage has a negative and significant coefficient, judging that higher leverage (i.e. higher borrowing) increases risk and thereby reduces profitability; however, this would be counterintuitive since it would be expected that higher leverage gives higher incentive for risk-taking behaviour and would result in higher bank profitability. For the regression results, a one percentage increase in Leverage would decrease ROA by approximately 0.03%. This may be justified reasoning that shareholders would likely be content with a lower return and having to bear less risk, which is consistent with the Modigliani-Miller theorem (Admati et al., 2010; Miles et al., 2012); however, in the period leading up to the recent financial crises, it became

known that banks were highly leveraged and engaging in more risky behaviour, and making them highly profitable in the short term. Because bank managers' performance pay is based on higher ROE, banks had incentive to increase leverage and risk to increase ROE. ROE is a measure that bank managers can influence for it to increase. This is not the case for ROA, since ROA is influenced by bank policy decisions, economic factors, and regulations, and is more representative of a bank's true profitability. As such, a negative Leverage is realistic when looking at ROA.

Liquidity Ratio's coefficient is positive but not significant. This result is consistent with Beltratti and Stulz (2012). It is expected that more liquidity will increase bank profitability, as is shown from the results where a one percentage increase to the Liquidity Ratio increases ROA by almost 0.0005%. Having sufficient liquid assets is beneficial to a bank in times of crisis and acts as a shock absorber. Insufficient liquidity may threaten bank survival (Klomp et al., 2012)

Deposit Ratio has a negative and significant coefficient. This is surprising as it would be expected that an increase in deposits would make a bank better off and more profitable. As stated in Beltratti and Stulz (2012), banks that relied more on deposits for asset financing before the crisis fared well during the crisis, so it can be expected that having a higher Deposit Ratio benefits a bank in a period leading up to and during a financial crisis. Since bank deposits are less subject to runs when a bank is stressed, higher deposit ratios can reinforce banks stability, as was the case for Canada in during the recent crisis. Banks that rely on attracting non-deposit funding may lead to bank instability (Klomp et al., 2012). As related to the regression results, a possible explanation for a negative Deposit Ratio could be that in the years leading up the financial crisis, debt was cheaper than deposits since the cost to banks to borrow was very low and, as such, banks had more incentive to reduce deposits in the short-term.

Credit Risk's coefficient is positive and significant. Banks with high Credit Risk have more loans and fewer securities. A higher Credit Risk would suggest more risk for the bank and lower profitability in the long-term (Athanasoglou et al., 2008). A possible reason for the positive coefficient result could be that the interest earned from loans is a very high source of bank profits, and a positive relationship between Credit Risk (i.e. loans) and bank profitability is possible. Once the financial crisis erupted, it was known that many banks were highly leveraged, and this was associated to higher profits possibly due to many parts of the banking sector operating under the unregulated shadow-banking sector, where profits could be made easily and many off-balance sheet financial statements were reported. This may be the case when looking at the coefficient, it is positive; therefore, we expect that as Credit Risk increases by one unit, ROA will increase by almost 0.005%.

Of the regulatory variables, there is no convincing evidence that tighter regulations are associated with higher bank profitability. *Official* is the only explanatory variable that has a positive coefficient and is significant. This is consistent for the most part with Barth et al. (2013), who show that official supervisory power is positively associated to bank efficiency in countries with independent advisory authorities. *Capital* has a negative coefficient and is not significant. Barth et al. (2013) show a weak positive association between capital regulation and bank efficiency. *Restrict* has a negative coefficient and is not significant. Barth et al. (2013) show that tighter restrictions on bank activities negatively affect profitability, whereas Beltratti and Stulz (2012) find the opposite result. Ongena et al. (2013) show that countries with stricter regulation have higher ROA and are on average more stable, which can be considered conflicting with other studies where higher restrictions on bank activities are negatively associated with bank stability and increases the chance of banking crises or another study that no supporting evidence exists that better regulation and supervision lead to more sound banks (Klomp and Haan, 2012).

Concentration has a negative coefficient and significant. This result is consistent with Beltratti and Stulz (2012).

GDP growth is positive and significant and reflects a one percentage increase in GDP growth associated with a 0.06% increase in ROA. This is expected since economic growth increases household and firm lending demand which increases bank activities and profitability (Albertazzi and Gambacorta, 2009).

4.2 Empirical Analysis on ROA for Canada, United States, and Europe

A regression analysis was performed separately for each of Canada, United States, and Europe using ROA as the dependent variable.

Unlike the United States and Europe, Canada was able to resist the strong economic shock of the recent financial, attributable to its robust regulatory framework. As such, it would be expected that the constant (i.e. Intercept in Table 4 above), Tier 1 Capital and Liquidity Ratios and Leverage to be positive, which is the case; however, the Deposit Ratio, Credit Risk, and GDP Growth coefficients are the opposite signs (negative versus positive and vice-versa) than would be expected. Of some reassurance is that by looking at the *t*-values, these coefficients are not significant. Further the adjusted- R^2 and *F*-statistic would also suggest that the sample size is too small for Canada to report reliable results for this paper.

As for the United States, the coefficients for Tier 1 Capital and Liquidity Ratios and Leverage are significant, as expected where higher Tier 1 Capital is positively associated to higher ROA and higher

leverage implies that banks are borrowing more and engaging in excessive risk-taking, thereby reducing ROA. Surprisingly, Liquidity and Deposit Ratios and GDP growth coefficients are negative while the Credit Risk coefficient is positive, though none are statistically significant.

Since EU member countries are likely to fall under a harmonized regulatory framework, as noted in the literature review in section 2, the EU member countries in the dataset were grouped to perform the analysis. Looking at the coefficients for Tier 1 Capital, Leverage, Liquidity, Deposit Ratios, Credit Risk, and GDP Growth all are consistent with the results for all banks. Although the regulatory explanatory variables Official, Capital, and Restrict are all positive, only Restrict is significant. This is an interesting result, since as stated earlier, restricting bank regulations appears to have a negative effect on ROA, which is consistent with result the result for all banks.

4.3 Empirical Analysis on ROE for All Banks

As was done for the above analysis on ROA, an analysis was conducted using ROE as the dependent variable where individual tests of significance are carried out on the explanatory variables and using the same decision rules as noted above. As noted above in section 3.2, ROE is a flawed measure of a bank's overall performance; nonetheless, since it is a commonly used measure of profitability in the banking sector, the analysis is conducted here.

The differences between the regressions are as follows: the adjusted R^2 values for ROA and ROE are 0.4208 and 0.1531, respectively, which suggests the goodness-of-fit for the ROE regression is weaker than for ROA. Other notable differences are: (1) all the coefficients of the explanatory variables and intercept are higher for the positive coefficients when ROE is the dependent variable compared to ROA, (2) all the coefficients which are negative for ROA became more negative, implying a further decrease to ROE, (3), the Tier 1 Capital coefficient is positive but is not significant, which may be expected since banks that wanted higher ROE had to decrease capital and increase leverage, (4) Liquidity Ratio and Credit Risk now have negative coefficients and Concentration now has a positive coefficient, and Credit Risk and Concentration are significant in the ROA analysis, not in ROE.

As with the ROA analysis, there is conflicting results between the Official, Capital, and Restrict explanatory variables, implying that there is no strong evidence to suggest that regulatory requirements and supervision together affect bank profitability and lending activities. The only consistency between ROA and ROE results for these three regulatory variables is that the Capital coefficient is negative and not significant, implying that the type of assets the regulator counts as capital and verification on these assets may negatively impact bank profitability. Official and Restrict coefficients are positive and

negative respectively for both ROA and ROE; however, the significance of these explanatory variables differs between the two analyses.

The reasons for these differences in regression results may be explained as follows: whereas ROA depends on bank policy decisions, uncontrolled economic factors, and is a better assessment of a bank's risk profile (Athanasoglou et al., 2006; Klomp and Haan, 2012), ROE ignores the risk associated with high leverage where unusually high profits may mean excessive risk-taking.

Table 5 – OLS results using ROE as dependent variable, 2003-2007

Variable	All banks	Canada	United States	Europe
Intercept	26.96139* (<.0001)	14.69090 (0.6774)	-1.72089 (0.7497)	-6.68031 (0.2941)
Tier 1 Capital Ratio	0.45548 (0.1468)	0.43318 (0.5467)	1.36658* (0.0006)	0.71606 (0.0864)
Leverage	-0.35582* (<.0001)	0.75996 (0.2979)	0.54328* (0.0002)	-0.05735 (0.3766)
Liquidity Ratio	-0.10099 (0.1806)	-0.23235 (0.7811)	-0.07916 (0.2452)	0.00212 (0.9785)
Deposit Ratio	-0.1603* (<.0001)	-0.26796 (0.7295)	-0.04437 (0.2013)	-0.00196 (0.9697)
Credit Risk	-0.02167 (0.6179)	0.11709 (0.7949)	0.05463 (0.1978)	0.00962 (0.807)
Official	0.19190 (0.3844)	-	-	0.66788* (0.0044)
Capital	-0.59063 (0.0601)	-	-	-0.11875 (0.6717)
Restrict	-0.52095* (0.0178)	-	-	0.28304 (0.2182)
Concentration	5.36339 (0.0713)	-	-	4.57261 (0.1233)
GDP growth	1.42497* (<.0001)	0.13005 (0.9584)	-0.03959 (0.9472)	2.82116* (<.0001)
Num observations	614	30	125	281
Adjusted R^2	0.1531	-0.1923	0.1446	0.2804
F -statistic	12.08*	0.22	4.49*	11.91*

4.4 Empirical Analysis on ROE for Canada, United States, and Europe

A regression analysis was performed separately for each of Canada, United States, and Europe using ROE as the dependent variable.

The results and analysis would be the same for Canada as noted above when ROA is used as the dependent variable, with the exception that the Liquidity Ratio's coefficient is now negative. In any case, the Liquidity Ratio coefficient is not significant in this model for all banks or separately for Canada, United States (excluding for ROA), and Europe, which is also consistent with Beltratti and Stulz (2012) results. In any case, as noted in the analysis for ROA, the sample size is too small for Canada to report reliable results for this paper.

As for the United States, the results are similar to the ROA analysis noted above with the exception that the constant term is negative and the coefficient for Leverage is now positive. A positive and significant Leverage coefficient can be expected since the more borrowing a bank performs to fund assets, the more the ROE increased, as was the case leading up to the financial crisis in the United States.

For the analysis on Europe, the results are noticeably different from the ROA analysis. Only the coefficient for Official and GDP Growth are positive and significant. Where many of the explanatory variables were significant for the ROA analysis, this is not the case for ROE; Tier 1 Capital, Credit Risk, and Restrict coefficients remain positive, but are now not significant. Deposit Ratio and Capital coefficients are now negative but remain non-significant. Concentration coefficient is now positive. These results for Europe may further emphasize that it is not clear that regulation influence profits for countries that belong to a union and want to reach a single financial market

4.5 Prediction for Basel III

The estimated equation can now be used to predict the outcome of Basel III on ROA and ROE.

Substituting Basel III's January 2019 regulatory Tier 1 Capital Ratio and Leverage along with average pre-crisis values taken directly from the descriptive statistics in Table 3 for Liquidity Ratio, Deposit Ratio, Credit Risk, Official, Capital, and Restrict, Concentration, and GDP growth variables (assumption being that these variables will not be any lower in January 2019), the following results are obtained for ROA and ROE:

$$\begin{aligned}
R\hat{O}A_t &= 0.47808 + 0.08257(\text{Basel III Tier 1 Capital Ratio}_t) - 0.03072(\text{Basel III Leverage}_t) \\
&+ 0.00051(\text{average Liquidity Ratio}_t) - 0.00562(\text{average Deposit Ratio}_t) \\
&+ 0.00473(\text{average Credit Risk}_t) + 0.03954(\text{average Official}_t) - 0.01859(\text{average Capital}_t) \\
&- 0.01022(\text{average Restrict}_t) - 0.326(\text{average Concentration}_t) + 0.06072(\text{average GDP growth}_t) \\
\\
&= 0.47808 + 0.08257(6) - 0.03072(33) + 0.00051(10.05) - 0.00562(56.77) + 0.00473(58.23) + \\
&0.03954(10.72) - 0.01859(5.61) - 0.01022(9.55) - 0.326(0.53) + 0.06072(3.47) \\
\\
&= 0.18
\end{aligned}$$

$$\begin{aligned}
R\hat{O}E_t &= 26.96139 + 0.45548(\text{Basel III Tier 1 Capital Ratio}_t) - 0.35582(\text{Basel III Leverage}_t) \\
&- 0.10099(\text{average Liquidity Ratio}_t) - 0.1603(\text{average Deposit Ratio}_t) \\
&- 0.02167(\text{average Credit Risk}_t) + 0.1919(\text{average Official}_t) - 0.59063(\text{average Capital}_t) \\
&- 0.52095(\text{average Restrict}_t) + 5.36339(\text{average Concentration}_t) \\
&+ 1.42497(\text{average GDP growth}_t) \\
\\
&= 26.96139 + 0.45548(6) - 0.35582(33) - 0.10099(10.05) - 0.1603(56.77) - 0.02167(58.23) + \\
&0.1919(10.72) - 0.59063(5.61) - 0.52095(9.55) + 5.36339(0.53) + 1.42497(3.47) \\
\\
&= 8.13
\end{aligned}$$

When policymakers estimate effects of new regulatory requirements, they must consider the banks' responses and expectations to these changes. Expectations influence economic behaviour, for example, when banks decide on lending opportunities based on expectations of future profitability.¹⁸ This will likely result in different model parameter values. Nonetheless, based on the above results obtained for the model in this paper, it is predicted that banks will still be profitable at the end of Basel III's transition period in January 2019, but not as profitable as in the pre-crisis period when comparing these results to the ROA and ROE average values in Table 3 which are 0.89 and 15.25 respectively.

This counterfactual exercise makes the simplistic assumption that model parameters under Basel III would remain identical to those obtained with data under Basel II. However, as given by the Lucas Critique, we know that this will likely not be the case. The above exercise is only meant to show that if parameters under Basel III are close to their values pre-2019, then banks would still be profitable.

¹⁸ This traditional method of policy evaluation which does not adequately account for economic agent's expectations is known as the Lucas critique (Mankiw and Scarth, 2004).

5. Conclusion

The recent financial crisis demonstrated that many countries did not have an adequate regulatory framework to mitigate systemic risk. Policymakers' response soon after these crises is to put in place more stringent regulations to protect the financial system and economy from further crisis. The private interest claim to this response is that a trade-off exists, where the financial sector and economy may be stable, but at the expense of economic growth since the banks cannot engage in lending activities.

The potential effects of Basel III on bank profitability (and consequently bank lending) is analyzed using an econometric model with pre-crisis data whereby Tier 1 capital, leverage, and liquidity (for which Basel III contains regulatory requirements) along with regulatory and macroeconomic variables. As discussed above, it is assumed that increases in bank profitability also increases bank lending activities. As expected, the results show that positive a Tier 1 Capital Ratio positively contributes to higher profitability. This result should be expected since higher capital is expected to lead to better lending decisions where banks would engage in profit-generating lending opportunities. The results show leverage as negative which seems counterintuitive since in the pre-crisis years, many banks were highly leveraged and highly profitable. These results may explain the long-term behaviour had banks continued with such high leverage, where negative bank profits are to be expected because of losses resulting from excessive risk-taking behaviour. Liquidity is not significant in the results. The regulatory variables Official, Capital, and Restrict are not all consistent, meaning they are not all positive or negative, implying that there is no strong evidence that regulatory supervision and restrictions affect bank profitability and lending activities.

Based on these findings, the estimated equation predicts that banks can still be profitable under regulatory requirements, continue lending activities, and contribute to economic growth.

Appendix

Too-Big-To-Fail

The too-big-to-fail concept asserts that some institutions are too big and too interconnected with other financial institutions domestically and/or internationally, that its failure will have large negative effects on the economy. Governments are very aware of this concept and, although never explicitly defined, often times it is implied that these too-big-to-fail institutions have government financial backing to mitigate adverse effects on the economy, should the need arise. In the recent financial crisis, this was known as a bail-out.

The too-big-to-fail concept is often times associated to moral hazard and stigmatization. Moral hazard can be defined as a bank taking excessive risk knowing that if failure is imminent, a government bail-out will likely be used.

Many systemically importance financial institutions (SIFI) are considered too-big-to-fail. As the name implies, SIFIs are financial conglomerates, commercial banks, investment/non-commercial banks, securities insurance companies that contribute significantly to the economy and its failure would likely cause adverse effects to the economy.

Interconnectedness and Information Contagion

The recent financial crisis demonstrated the interconnectedness of financial markets. Many financial institutions around the world own similar assets. Often times, financial institutions have similar assets or funding models. Banks also take on counterparty risks from other banks since they may loan to each other on the overnight market. If it is known that a bank owns a lot of toxic assets and is in trouble, the market assumes that other banks also have the same toxic assets and are also in trouble. So this interconnection means that a failure of one bank may lead the market to assume uncertainty of other banks. This could lead to credit crunch, illiquidity, fire sales, and insolvency.

For this reason, when countries form macroprudential policies, it is looked at it in terms of the domestic financial institutions, knowing that these policies must account for a global financial market. Because the SIFI are so exposed, shocks are easily transmitted across the entire global financial system. The

interconnectedness and information contagion was very much felt in when financial markets knew of Bear Stearns' insolvency situation in March 2008, and six months after in September 2008, Lehman Brothers filed for bankruptcy ("broke the buck" and no bailout). Within two weeks, 12 of the 13 US SIFIs were in a position to be bailed out (Blinder 2013).

Macroprudential Framework

Much has been written regarding systemic risk and macroprudential policy since the recent financial crisis, yet there is no census on how financial stability should be defined, what constitutes systemic risk, and what determines a solid macroprudential framework. Financial stability can be defined as "the ability of the financial system to withstand stresses and strains and continue to provide financial services" (Jenkins and Thiessen, 2012). Systemic risks are the aggregate financial risks across financial institutions, markets, and countries that threaten real economies. There are two broad categories of systemic risk: resiliency risk (risk to the financial system as a result of shocks) and procyclical risk (risk to the financial system as a result of the expansion in the boom of the boom-bust cycle). Macroprudential policies are meant to address both types of systemic risks, and as such, a macroprudential framework can be defined as a set of policies to ensure financial stability, mitigate systemic risk, and to protect the real economy from severe disruption.

Table A 1 – OLS regression results with no regulatory and macroeconomic variables with year fixed effects using ROA as dependent variable, 2003-2007

Variable	All banks	Canada	United States	Europe
Intercept	0.70473* (0.0303)	2.87041 (0.2918)	0.13004 (0.8686)	-0.81137 (0.0643)
Tier 1 Capital Ratio	0.07316* ($<.0001$)	0.03577 (0.2415)	0.14884* (0.0004)	0.11502* ($<.0001$)
Leverage	-0.01330* (0.0062)	-0.05381 (0.2541)	0.03950* (0.023)	-0.00795 (0.1771)
Liquidity Ratio	0.00568 (0.1615)	0.06568 (0.1719)	-0.01023 (0.5801)	0.00619 (0.1959)
Deposit Ratio	0.00255 (0.3239)	-0.03924 (0.3448)	-0.00030 (0.9148)	0.00856* (0.041)
Credit Risk	-0.00029 (0.9259)	0.01900 (0.5071)	-0.00523 (0.4678)	0.00192 (0.6534)
Num observations	624	30	125	281
R^2	0.8883	0.5323	0.8264	0.7992
F -statistic	24.63*	1.22	13.13*	11.72*

The p -values are in parentheses and * indicates significance at 5%.

Table A 2 – OLS regression results with no regulatory and macroeconomic variables with year fixed effects using ROE as dependent variable, 2003-2007

Variable	All banks	Canada	United States	Europe
Intercept	2.16990 (0.7659)	56.08456 (0.4278)	-13.14703 (0.14)	-14.08673 (0.16)
Tier 1 Capital Ratio	1.67440* ($<.0001$)	1.12109 (0.1652)	1.51564* (0.0012)	2.73388* ($<.0001$)
Leverage	0.17676 (0.1092)	-0.71484 (0.5565)	1.62244* ($<.0001$)	0.15335 (0.255)
Liquidity Ratio	0.06842 (0.4515)	1.53009 (0.2213)	-0.11591 (0.5779)	0.08193 (0.454)
Deposit Ratio	0.05478 (0.3459)	-0.82246 (0.4473)	0.00006 (0.9986)	0.26192* (0.0065)
Credit Risk	-0.09755 (0.1687)	0.27463 (0.7129)	-0.02134 (0.7924)	-0.13526 (0.1678)
Num observations	620	30	125	281
R^2	0.8665	0.4753	0.8043	0.7605
F -statistic	19.95*	0.97	11.34*	9.35*

The p -values are in parentheses and * indicates significance at 5%.

Table A 3 – OLS regression results with no regulatory and macroeconomic variables with country fixed effects using ROA as dependent variable, 2003-2007

Variable	All banks	Canada	United States	Europe
Intercept	0.80264* (0.0235)	3.86032 (0.1858)	0.18517 (0.8153)	-0.42668 (0.3105)
Tier 1 Capital Ratio	0.07433* (<.0001)	0.01162 (0.6964)	0.11394* (0.0043)	0.14486* (<.0001)
Leverage	-0.01407* (0.0076)	-0.00517 (0.8981)	0.02104 (0.2045)	-0.00418 (0.5321)
Liquidity Ratio	-0.00009 (0.9835)	0.02220 (0.6248)	-0.00697 (0.7128)	-0.00437 (0.41)
Deposit Ratio	-0.00366 (0.1762)	-0.04713 (0.2934)	0.00023 (0.9341)	-0.00657 (0.1306)
Credit Risk	0.00389 (0.252)	-0.00172 (0.9534)	-0.00069 (0.9228)	0.01336* (0.0045)
Num observations	624	30	125	281
R^2	0.8658	0.2755	0.8048	0.7266
F -statistic	20.71*	0.72	13.51*	8.45*

The p -values are in parentheses and * indicates significance at 5%.

Table A 4 – OLS regression results with no regulatory and macroeconomic variables with country fixed effects using ROE as dependent variable, 2003-2007

Variable	All banks	Canada	United States	Europe
Intercept	4.21280 (0.5905)	88.32684 (0.2465)	-12.54651 (0.1521)	-13.53957 (0.1697)
Tier 1 Capital Ratio	1.67054* ($<.0001$)	0.40519 (0.6051)	1.23484* (0.0048)	3.46199* ($<.0001$)
Leverage	0.16879 (0.1532)	0.40170 (0.7055)	1.45111* ($<.0001$)	0.24634 (0.1168)
Liquidity Ratio	-0.04550 (0.638)	0.35577 (0.765)	-0.09768 (0.639)	-0.18533 (0.1364)
Deposit Ratio	-0.07420 (0.2162)	-1.08634 (0.355)	0.00488 (0.8747)	-0.11618 (0.2533)
Credit Risk	-0.00836 (0.9115)	-0.24850 (0.7482)	0.01566 (0.8423)	0.14579 (0.1818)
Num observations	620	30	125	281
R^2	0.8439	0.1823	0.7904	0.6592
F -statistic	17.20*	0.42	12.35*	6.15*

The p -values are in parentheses and * indicates significance at 5%.

Table A 5 – Correlation Coefficient

	ROA	ROE	Tier 1 Capital Ratio	Leverage Ratio	Liquidity Ratio	Deposit Ratio	Credit Risk	Official	Capital	Restrict	Concen- tration	GDP growth
ROA	1.0000											
ROE	0.65635 (<.0001)	1.0000										
Tier_1_Capital_Ratio	0.38022 (<.0001)	0.14942 (0.0002)	1.0000									
Leverage_Ratio	-0.55366 (<.0001)	-0.19851 (<.0001)	-0.21742 (<.0001)	1.0000								
Liquidity_Ratio	0.0573 (0.111)	0.05935 (0.1025)	0.14589 (0.0002)	0.08244 (0.0206)	1.0000							
Deposit_Ratio	-0.02885 (0.4226)	-0.17247 (<.0001)	0.05984 (0.1332)	-0.05652 (0.1129)	-0.15194 (<.0001)	1.0000						
Credit_Risk	0.01069 (0.7663)	-0.07015 (0.0535)	-0.38228 (<.0001)	-0.22685 (<.0001)	-0.34615 (<.0001)	0.31175 (<.0001)	1.0000					
Official	0.26867 (<.0001)	0.00893 (0.8079)	0.18398 (<.0001)	-0.23124 (<.0001)	-0.03532 (0.3268)	0.26619 (<.0001)	0.08342 (0.0204)	1.0000				
Capital	-0.00734 (0.8399)	-0.03935 (0.2841)	0.00533 (0.8942)	-0.03291 (0.3608)	-0.0497 (0.1675)	-0.10595 (0.0032)	-0.0354 (0.3256)	0.22005 (<.0001)	1.0000			
Restrict	-0.02241 (0.5373)	-0.13022 (0.0004)	-0.16648 (<.0001)	-0.08211 (0.0224)	-0.09886 (0.0059)	0.32356 (<.0001)	0.21406 (<.0001)	0.27193 (<.0001)	-0.02398 (0.5056)	1.0000		
Concentration	-0.05411 (0.1323)	0.15803 (<.0001)	0.07988 (0.0449)	0.15684 (<.0001)	0.33235 (<.0001)	-0.31666 (<.0001)	-0.22158 (<.0001)	-0.22577 (<.0001)	0.06729 (0.0615)	-0.31197 (<.0001)	1.0000	
GDP_growth	0.24742 (<.0001)	0.18903 (<.0001)	0.13719 (0.0005)	-0.00965 (0.7868)	0.26174 (<.0001)	0.25572 (<.0001)	-0.02432 (0.4955)	0.05511 (0.1258)	-0.16061 (<.0001)	0.10386 (0.0038)	0.20283 (<.0001)	1.0000

Values in parentheses denote the p -value. If this p -value is less than or equal to the significance level chosen (i.e. $p \leq \alpha$), then this is a good sign that the correlation coefficient is significant.

Table A 6 – Collinearity Diagnostics using ROA

Number	Eigenvalue	Condition Index	Proportion of Variation										
			Intercept	Tier 1 Capital Ratio	Leverage Ratio	Liquidity Ratio	Deposit Ratio	Credit Risk	Official	Capital	Restrict	Concentration	GDP growth
1	9.75741	1	6.38E-05	0.000301	0.0012	0.00203	0.000617	0.000329	0.000395	0.000637	0.000483	0.000743	0.00195
2	0.35907	5.2129	0.000283	0.000466	0.0092	0.37282	0.00891	0.00781	0.00551	0.00513	0.00507	0.00514	0.12039
3	0.29624	5.73911	0.000132	9.67E-05	0.11343	0.03502	0.01382	0.000716	0.000352	0.00742	0.00105	0.01138	0.47488
4	0.20056	6.97508	4.37E-06	2.24E-03	0.35832	0.37991	0.00133	0.00154	0.00415	0.00311	0.00087	0.0034	0.16446
5	0.12407	8.86802	8.80E-05	9.34E-03	0.13988	0.14867	0.07976	4.46E-05	0.000113	0.03522	0.03258	0.28309	0.03308
6	0.0759	11.33829	2.64E-04	7.41E-02	0.00464	0.01157	0.000273	0.17542	4.67E-02	0.13446	0.02105	0.13274	0.02362
7	0.06687	12.07916	0.000434	0.13727	4.86E-05	0.01295	0.12864	0.01752	4.51E-03	0.40531	0.01001	0.07088	0.09879
8	0.04815	14.23594	5.78E-05	0.00601	0.00529	0.01418	0.37012	0.03955	0.05159	0.11676	0.5116	0.00217	0.000953
9	0.03745	16.14097	0.00467	0.06765	0.04526	0.01459	0.34737	0.21003	0.09011	0.11434	0.20804	0.26219	0.03856
10	0.02926	18.26047	0.00752	0.17992	0.00653	0.00248	0.04915	0.01671	0.79534	0.09832	0.08901	0.17916	0.025
11	0.00501	44.12359	0.98648	0.52261	0.31619	0.0058	1.86E-05	0.53032	0.00126	0.0793	0.12023	0.04911	0.01831

Table A 7 – Collinearity Diagnostics using ROE

Number	Eigenvalue	Condition Index	Proportion of Variation										
			Intercept	Tier 1 Capital Ratio	Leverage Ratio	Liquidity Ratio	Deposit Ratio	Credit Risk	Official	Capital	Restrict	Concentration	GDP growth
1	9.75648	1	6.41E-05	0.000299	0.00121	0.00203	0.000621	0.000329	0.000397	0.000641	0.000485	0.000745	0.00196
2	3.60E-01	5.20712	2.74E-04	4.57E-04	0.01057	0.3779	0.00952	0.00786	0.00551	0.00482	0.00524	0.00541	0.11054
3	0.29586	5.74248	1.41E-04	9.75E-05	0.11854	0.02686	0.01323	0.000643	0.000338	0.00749	0.000895	0.01116	0.48167
4	0.20024	6.98017	4.77E-06	0.00211	0.35001	0.38827	0.00139	0.00143	0.00415	0.00318	0.00105	0.00361	0.17848
5	0.12391	8.87339	8.8E-05	0.00896	0.14673	0.14218	0.08162	5.57E-05	6.24E-05	0.03731	0.03198	0.28278	0.03044
6	0.07628	11.30947	0.000264	0.07322	0.00488	0.01145	0.000333	0.17432	0.04659	0.13427	0.02124	0.13343	0.02281
7	0.06703	12.06418	0.000433	0.13532	0.000171	0.01341	0.12805	0.01788	0.00423	0.40619	0.01039	0.0751	0.09539
8	0.04848	14.18675	6.45E-05	0.00641	0.00444	0.01416	0.37574	0.03792	0.05151	0.11808	0.50727	0.0014	0.00137
9	0.0375	16.12903	0.00468	0.06654	0.04354	0.01551	0.34034	0.21138	0.09178	0.11309	0.2182	0.25791	0.03413
10	0.02934	18.23396	0.00775	0.18188	0.00707	0.00245	4.91E-02	0.01719	0.79446	0.09576	0.08435	0.17893	0.0257
11	0.00503	44.06218	0.98624	0.52471	0.31283	0.00578	2.23E-05	0.53099	0.000971	0.07917	0.1189	0.04953	0.01751

References

- Acharya, Viral V., 2009, "A theory of systemic risk and design of prudential bank regulation," *Journal of Financial Stability* 5, 224-255
- Acharya, Viral V., Thomas F. Cooley, Matthew P. Richardson, Indo Walter, 2011, *Regulating Wall Street, The Dodd-Frank Act and the New Architecture of Global Finance*, John Wiley & Sons, Inc., Hoboken, New Jersey
- Admati, Anat R., Franklin Allen, Richard Brealey, Michael Brennan, Markus K. Brunnermeier, Arnoud Boot, John H. Cochrane, Peter M. DeMarzo, Eugene F. Fama, Michael Fishman, Charles Goodhart, Martin F. Hellwig, Hayne Leland, Stewart C. Myers, Paul Pfleiderer, Jean Charles Rochet, Stephen A. Ross, William F. Sharpe, Chester S. Spatt, Pamela R. Dunn, Kenneth B. Dunn, Anjan Thakor, "Healthy Banking System is the Goal, not Profitable Banks," *Financial Times*, November 9, 2010, <http://www.gsb.stanford.edu/news/research/admatiopen.html>
- Admati, Anat, Martin Hellwig, 2013, *The Bankers' New Clothes, What's Wrong with Banking and What to Do About It*, Princeton University Press, Princeton, New Jersey
- Admati, Anat R., Peter M. DeMarzo, Martin F. Hellwig, Paul Pfleiderer, 2010, "Fallacies, Irrelevant Facts, and Myths in the Discussion of Capital Regulation: Why Bank Equity is *Not* Expensive," The Rock Center for Corporate Governance at Stanford University Working Paper Series No. 86, Stanford GSB Research Paper No. 2063
- Agur, Itai, 2013, "Multiple banks regulators and risk taking," *Journal of Financial Stability* 9, 259-268
- Albertazzi, Ugo, Leonardo Gambacorta, 2009, "Bank profitability and the business cycle," *Journal of Financial Stability* 5, 393-409
- Athanasoglou, Panayiotis P., Sophocles N. Brissimis, Matthaios D. Delis (2006), "Bank-specific, industry-specific and macroeconomic determinants of bank profitability," *Int. Fin. Markets, Inst. and Money* 18, 121-136
- Bank of Canada, 2012, "Canadian Bank Balance-Sheet Management: Breakdown by Types of Canadian Financial Institutions," Discussion Paper 2012-7
- Barth, James R., Chen Lin, Yue Mac, Jesús Seade, Frank M. Song, 2013, "Do bank regulation, supervision and monitoring enhance or impede bank efficiency?" *Journal of Banking and Finance* 37, 2879-2892
- Barth, James R., Gerard Carpio, Jr., and Ross Levine, 2012, *Guardians of Finance, Making Regulators Work for Us*, The MIT Press, Cambridge, Massachusetts
- Barth, James R., Tong Li, Wenling Lu, 2010, "Bank Regulation in the United States," *CESifo Economic Studies* 56, 112-140
- Barth, James R., Gerard Carpio, Jr., and Ross Levine, 2006, *Rethinking Bank Regulation, Till Angels Govern*, Cambridge University Press, New York

Basel Committee on Banking Supervision (BCBS), 2011, "Basel III: A Global Regulatory Framework for More Resilient Banks and Banking Systems," Bank for International Settlements, Basel

Bean, Donald J.S., Lawrence Kryzanowski, Gordon S. Roberts, 2011, "Canada and the United States: Different roots, different routes to financial sector regulation," *Business History* 53, 249-269

Beltratti, Andrea, Rene M. Stulz, 2012, "The credit crisis around the globe: Why did some banks perform better?" *Journal of Financial Economics* 105, 1-17

Blinder, Alan S., 2013, *After the Music Stopped, The Financial Crisis, The Response, and the Work Ahead*, The Penguin Press, New York, New York

Brooks, Chris, 2008, *Introductory Econometrics for Finance*, Cambridge University Press, Cambridge, UK

Caprio, Gerard, Luc Laeven, Ross Levine, 2007, "Governance and bank valuation, Journal of Financial Intermediation," *Journal of Financial Intermediation* 16, 584-617

Dietrich, Andreas, Gabrielle Wanzenried, 2011, "Determinants of bank profitability before and during the crisis: Evidence from Switzerland," *Journal of International Markets, Institutions & Money* 21, 307-327

Gertler, Mark, Nobuhiro Kiyotaki, Albert Queralto, 2012, "Financial crises, bank risk exposure and government financial policy," *Journal of Monetary Economics* 59, S17-S34

Grossman, Emiliano, Patrick Leblond, 2012, "Financial Regulation in Europe: From the Battle of the Systems to a Jacobinist EU," in Jeremy Richardson, ed., *Constructing a policy-making state? Policy dynamics in the European Union*, Oxford University Press, Oxford, 189-208

Grossman, Emiliano, Patrick Leblond, 2011, "European Financial Integration: Finally the Great Leap Forward?" *Journal of Common Market Studies* 49(2), 413-435

Hill, Carter R., William E. Griffiths, George G. Judge, *Undergraduate Econometrics*, Second Edition 2001, John Wiley & Sons, Inc.

Jenkins, Paul, Gordon Thiessen, 2012, "Reducing the Potential for Future Financial Crises: A Framework for Macro-Prudential Policy in Canada," C.D. Howe Institute, Commentary No. 351

Klomp, Jeroen, Jakob de Haan, 2012, "Banking risk and regulation: Does one size fit all?" *Journal of Banking and Finance* 36, 3197-3212

Lall, Ranjit, 2012a, "From failure to failure: The politics of international banking regulation," *Review of International Political Economy* 19(4), 609-638

Lall, Ranjit, 2009b, "Why Basel II Failed and Why Any Basel III is Doomed," Global Economic Governance Program, Working Paper 2009/52

- Leblond, Patrick, 2013a, "Cool Canada: A Case of Low Market-Based Banking in the Anglo-Saxon World", in Iain Hardie and David Howarth, eds, *Market-Based Banking and the International Financial Crisis*, Oxford University Press, New York, 201-217
- Leblond, Patrick, 2013b, "The logic of a banking union for Europe," Unpublished manuscript, University of Ottawa.
- Leblond, Patrick, 2011, "A Canadian Perspective on the EU's Financial Architecture and the Crisis", in Kurt Hübner, ed., *Europe, Canada and the Comprehensive Economic Partnership*, Routledge, New York, 165-179
- Lee, Tung-Hao, Shu-Hwa Chih, 2013, "Does financial regulation affect the profit efficiency and risk of banks? Evidence from China's commercial banks," *North American Journal of Economics and Finance*, Forthcoming
- Longworth, David, 2013, "Strengths and Weaknesses of Canadian Financial Regulation Before and After the Global Financial Crisis," Paper prepared for *Who Wants Big Banks?* symposium
- Mankiw, N. Gregory, William M. Scarth, 2004, *Macroeconomics, Second Canadian Edition*, Worth Publishers, New York
- Martin, Antoine, Bruno M. Parigi, 2012, "Bank Capital Regulation and Structured Finance," *Journal of Money, Credit and Banking* 45, 87-119
- Miles, David, Jing Yang, Gilberto Marcheggiano, 2012, "Optimal Bank Capital," *The Economic Journal* 123, 1-37
- Naceur, Sami Ben, Mohammed Omran, 2011, "The effects of bank regulations, competition, and financial reforms on banks' performance," *Emerging Markets Review* 12, 1-20
- OECD Statistics Portal*, retrieved November 22, 2013 from <http://stats.oecd.org/glossary/detail.asp?ID=7022>
- Ongena, Steven, Alexander Popov, Gregory F. Udell, 2013, "When the cat's away the mice will play": Does regulation at home affect bank risk-taking abroad?" *Journal of Financial Economics* 108, 727-750
- Quaglia, Lucia, 2013, "Financial regulation and supervision in the European Union after the crisis," *Journal of Economic Policy Reform* 16, 17-30
- Sufian, Fadzlan, Muzafar Shah Habibullah, 2009, "Bank specific and macroeconomic determinants of bank profitability: Empirical evidence from the China banking sector," *Font. Econ. China* 4, 274-291