

The Impact of Basel III Bank Regulation on Lending Spreads: Comparisons across Countries and Business Models^{*}

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We estimate required increase in banks' lending spreads assuming that banks would raise lending spreads among the measures they could take to prevent ROE from falling when the capital regulation is tightened following the estimation methodology employed by King (2010) and Elliott (2009). We find that the required lending spreads vary from 0.1bp for real estate & mortgage banks to 9.1bp for commercial banks over the sample periods of 2005-2010. Countries such as Brazil, China, India, and Mexico require the banks to have large lending spreads ranging from 13.2bp to 29.7bp. On the other hand, countries such as Australia, Switzerland, Germany, Italy, and Netherland require them to increase smaller lending spreads for the increase in the regulatory capital. We find that liquidity regulation (NSFR) increases lending rates by 20.0bp for the commercial banks of the sample countries.

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1. INTRODUCTION

Since the excessive financial liberalization and the failures in financial regulation and supervision have been cited as the root causes of the global financial crisis triggered by the U.S. subprime mortgage crisis in 2007-2008, both scholars and practitioners have discussed consistently on the necessity of financial regulatory reform. Against the backdrop, the Basel Committee on Banking Supervision (herein after referred to as BCBS) finally unveiled “Basel III: A global regulatory framework for more resilient banks and banking systems” and “Basel III: International framework for liquidity risk measurement, standards and monitoring” (herein after referred to as Basel III) in December 2010 in response to the requests of the G20.

Basel III broadly consists of two parts; a micro-prudential and a macro-prudential regulatory framework. The micro-prudential regulatory framework includes following measures; raising the quality and quantity of the regulatory capital base, enhancing the risk coverage of the regulatory capital base, introducing global liquidity standards and a leverage ratio regulation, and strengthening supervision, risk management and disclosure. On the other hand, the macro-prudential regulatory framework includes introducing countercyclical buffers and a leverage ratio regulation and strengthening the regulation on systemically important banks.

They expect Basel III would enhance the stability of the global banking system in the medium to long term by providing banks incentives to buildup of capital and liquidity base. At the same time Basel III would curb banks’ practices of taking excessive risk in various ways. Firstly, it gives incentive for banks to move from a business model of high risk and high return to a new one of low risk and low return. Secondly, investors and shareholders should bear a heavy burden of responsibility before the injection of public funds by dint of the arrangements such as the write-off of regulatory capital and the conversion into common stock.

The liquidity regulation would force banks to change the business behavior of borrowing low-cost short-term funds and investing in long-term risky

assets with high returns. The leverage ratio regulation and countercyclical buffers would rein in banks' excessive expansion and following reduction in the asset size, and thereby moderate the fluctuation in the credit supply cycle.

The BCBS's Quantitative Impact Study (BCBS, 2010c) and macro-economic assessment results suggest that various measures proposed by Basel III could make both negative and positive effects on the banking industry and macro economy. When banks would fulfill the Basel III requirements, they have to secure a huge stock of capital and liquidity in order to meet new requirements. It could threaten the profitability of the banking industry by increasing the funding costs in the short term. It may also hamper the financial intermediation function by raising lending rates and reducing lending volumes, which could ultimately lead to slower economic growth. However, over the medium to long term it could promote economic growth by lowering the costs of funding capital and liquidity by reducing the chances of financial crises and enhancing the stability of banking industry overall.

Strengthened capital requirements are usually expected to reduce the bank's ROE. To prevent ROE from falling, banks can respond by taking various measures. Those measures include (i) increase lending spreads, (ii) reduce operating expenses, (iii) increase non-interest profit sources, (iv) shift to highly profitable business sector and (v) cut the costs or (vi) combination of multiple measures simultaneously. Which method is favorable depends on the competitive environment surrounding banks. If they recoup losses by increasing efficiency and cutting operating expenses, the negative impacts from the strengthened capital requirements would be eased. On the other hand, banks might have incentive to increase the riskiness of assets or to increase the risk exposures by expanding the maturity mismatches.

In this paper we focus on the impact on the lending spreads when capital regulation is tightened. We use the data of bank's balance sheet and income statement and follow the estimation methodology employed by King (2010) and Elliott (2009). We conduct the analyses over different business models and different countries separately, taking into account the fact that banks'

response may differ by business models and countries.

We assume that when capital regulation is strengthened by 1 percentage point (pp), the increase in equity is offset by reduction in the long term liabilities since they are regarded as the most expensive form of funding after equity. Even though the reduction in the long term debt leads to reduce the interest expenses and thereby to increase net income, ROE in general would fall. It is because the relative increase in the quantity of equity in the denominator is greater than the rise in net income in the numerator. The required lending spreads to keep ROE from falling vary from by 0.1 basis points (bp) for real estate & mortgage banks to 9.1bp for commercial banks over the entire sample periods.

As capital regulation is strengthened by 1pp incrementally, the lending spreads increases linearly. If the reduction in the ROE is tolerated, the required increase of lending spread falls. In general, it is found that required lending spreads decreases after the financial crisis. The magnitude of required increase in lending spreads is comparable to those in King (2010), Elliott (2009) and Kashyap *et al.* (2010) even though estimation methodology employed by Kashyap *et al.* (2010) is quite different from those of King (2010), Elliott (2009) or this study.

The increase in lending spreads is sensitive to the ratio of risk-weighted assets and loans to total assets. The ratio of risk-weighted assets to the total assets determines the amount of equity to be raised in order to satisfy the capital regulation, thereby determining the amount of long term debt reduced which affects the net income of the banks. If the loans to total assets ratio is bigger, the required lending spreads would be smaller since the slight increase in the lending spreads would compensate the decline in the net income. Since reduction in the interest expenses resulting from increased capital depends on the funding costs, long term rate of the debt also affects the magnitude of the lending spreads. Countries and banks engaged in the different business models exhibit quite different ratio of these variables and this contributes to the different effect of capital regulation on the lending rates. The impact of liquidity requirements on lending spreads reveals to be

around 20.03bp when the analysis is conducted on the aggregate data of commercial banks in the sample countries.

The paper is organized as follows. After this introduction, section 2 describes the details of Basel III. Section 3 reviews the literature on the impact of Basel III on lending spreads. Section 4 presents the results of empirical analysis, and section 5 concludes.

2. BASEL III

2.1. Tightening of Capital Regulation

BCBS released “Basel III: A global regulatory framework for more resilient banks and banking systems” and “Basel III: International framework for liquidity risk measurement, standards and monitoring” in December 2010 (BCBS 2010a, 2010b). The major objective of the Basel III capital framework is to raise the quantity and quality of the regulatory capital. To improve market discipline it requires heightening the transparency of the capital base by disclosing all elements of capital along with a detailed reconciliation to the reported accounts.

It requires simplifying the capital structure by changing the capital classification from the current six levels to three levels and by eliminating Tier 3 capital. Total regulatory capital is divided into Tier 1 capital showing loss absorbency on a going concern basis, and Tier 2 capital showing loss absorbency on a gone concern basis. In order to improve the quality of capital, bank’s own capital (Tier 1+Tier 2) has to exceed 8.0% of its risk-weighted assets, while its Tier 1 capital must exceed 6% of its risk-weighted assets. In addition, it requires banks have to hold at least 4.5% of Common Equity Tier 1 to their risk-weighted assets.¹⁾

¹⁾ The current minimum capital ratios are that Common Equity Tier 1 ratio is 2%, Tier1 ratio is 4%, and total capital ratio is 8%. Although the total capital ratio remains unchanged, it is actually a tighter standard taking into account the tightened Basel III capital requirements.

Table 1 BCBS Capital Requirements

(current) 6 Notches		(revised) 3 Notches		
Tier 1	Common equity capital non-innovative hybrid bonds ¹⁾ innovative hybrid bonds	Tier 1	Common equity capital (core Tier 1 capital)	4.5%
			Additional going concern capital	6.0%
Tier 2	Non-innovative subordinate bonds ²⁾ innovative subordinate bonds ²⁾	Tier 2		8.0%
Tier 3	Short-term subordinate debt			

Notes: 1) Hybrid bonds: no step-up clauses for non-innovative bonds; step-up clauses for innovative bonds. 2) Innovative subordinate bonds: 10-year maturity or longer for non-innovative bonds; 5-year maturity or longer for innovative bonds

Source: BCBS (2010a, 2010b).

2.2. Reducing Procyclicality of Regulatory Capital Requirements

The recent global financial crisis highlighted the issue of procyclicality inherent in the financial system. Banks are caught in a vicious cycle where, with risk weights adjusted in accordance with borrowers' credit ratings under Basel II, banks' asset size accelerates to grow driven by banks' improved asset soundness in upturn of the business cycle, while banks sell their assets competitively to deleverage in downturn. Capital buffer and dynamic provisioning have been proposed to resolve the procyclicality problems. The measures propose to build up capital buffers and to prepare dynamic provisions in boom times, and to use them in times of recession.

Capital buffers consist of capital conservation buffer and countercyclical buffer. For capital conservation buffer, 2.5% of risk-weighted assets is reserved in Common Equity Tier 1 in normal times and drawn down in the periods of stress when losses occur. If the reserved capital fails to reach the target level (2.5%), constraints on distribution get triggered. Apart from capital conservation buffer, countercyclical buffer is introduced to protect the banking sector from future potential losses in periods when excessively

Table 2 Regulatory Capital Requirement Ratios

	Common Equity Tier 1	Tier 1	Total Capital
Minimum Requirements (A)	4.5%	6.0%	8.0%
Capital Conservation Buffer (B)	2.5%		
A+B	7.0%	8.5%	10.5%
Countercyclical Buffer	0.0-2.5%		
Total	7.0-9.5%	8.5-11%	10.5-13.0%

Source: BCBS (2010a, 2010b).

expanded credit is measured likely to cause systemic risk.²⁾ The amount to be accumulated for countercyclical capital buffer is determined within the range of 0-2.5%.³⁾ As a result, the capital requirement ratios are accordingly strengthened; banks' common equity Tier 1 ratio is set at 7-9.5%, their Tier 1 ratio at 8.5-11%, and their total equity capital ratio at 10.5-13%.

2.3. Introduction of Leverage Ratio and Liquidity Standard

The BCBS has introduced leverage ratio, which limits the volume of bank's total exposure to regulatory capital. The leverage ratio is adopted in an effort to complement the existing risk-based capital regulations and to prevent excessive leverage accumulation. The ratio is set at 3% or higher of Tier 1 capital. Unlike the regulatory capital ratio, which applies different

²⁾ Since counter-cyclical buffers are accumulated in times of excessive credit expansion, such times are expected to occur less often. Meanwhile, banks with credit exposures to various countries are highly likely to have to save capital buffers more often, although in less sizeable amounts, since international credit cycles do not always have strong correlations.

³⁾ Banks are given 12 months to accumulate their counter-cyclical buffers, and during this period constraints on distribution are not triggered. If the regulatory authorities ease regulations within these 12 months, however, the constraints are immediately triggered. This is to prevent the risk of restriction of credit supply through the capital subject to regulation.

risk weights depending upon borrower's credit rating, the leverage ratio is the ratio of capital to total nominal assets including off-balance sheet exposure.

The BCBS has also introduced global liquidity standard for the purpose of enhancing the international consistency of liquidity risk management and raising the resilience of banks in times of liquidity crisis. The standard includes Liquidity Coverage Ratio (LCR),⁴⁾ a short-term indicator, and Net Stable Funding Ratio (NSFR),⁵⁾ a long-term one. The LCR requires banks to set aside substantial high-quality liquid assets that can be easily converted into cash to cover total net cash outflows over the next 30 calendar days, the minimum period during which banks and supervisory authorities can take appropriate measures or banks can be resolved in times of serious crisis. The NSFR copes with a situation in which an individual bank faces a crisis for a year and comes to have difficulty in raising funds. It requires banks to set aside ample amounts of stable funds to overcome such a situation.

3. LITERATURE REVIEW

3.1. QIS Results

The BCBS conducted a Quantitative Impact Study in 2010 to assess the impact of Basel III on banks (BCBS, 2010c). A total of 263 banks participated from 23 out of the 27 BCBS member countries. The study showed that the capital requirements under Basel III would have significant impacts on banks. When the strengthened capital requirements are implemented on a full scale, average Common Equity Tier 1 ratio of Group 1 Banks (banks holding 3 billion EUR or more in Tier 1 capital) decreases from the current 11.1% to 5.7% as of the end of 2009. It is mostly attributable to the increase in capital adjustments deductible from capital.

⁴⁾ The formula is "LCR = (stock of high-quality liquid assets/total net cash outflows over 30 calendar days) \geq 100%".

⁵⁾ The formula is "NSFR = (available amount of stable funding/required amount of stable funding) \geq 100%".

Table 3 Basel III QIS Results

(unit: As of End of Year 2009, %)

	CET 1 ¹⁾	Tier 1 ¹⁾	Total Capital ¹⁾	Leverage Ratio	LCR	NSFR	
Minimum Capital Requirements	7-9.5	8.5-11.0	10.5-13.0	3.0	100.0	100.0	
QIS	Group 1	11.1→5.7	10.5→6.3	14→8.4	2.8	83	93
	Group 2	10.7→7.8	9.8→8.1	12.8→10.3	3.8	98	103

Note: 1) Capital conservation buffer (2.5%) and countercyclical capital buffer (0-2.5%) included.

Source: BCBS (2010c).

After the deductions, the amount of Common Equity Tier 1 declines by 41.3% from its current level. To meet the 7% requirement, Group 1 Banks are estimated to need 577 billion EUR, which is 2.8 times the total after-tax net income of the banks participated in the QIS. Meanwhile, Group 2 Banks are relatively less affected by the higher capital requirements. Their Common Equity Tier 1 ratio is 7.8% under Basel III.

To look at the leverage ratios, Group 1 Banks show a ratio of 2.8% on average, with about 42% of the participating banks having leverage ratios lower than the requirement (3%). This low leverage ratio owes to the fact that Group 1 Banks have large exposure to securities, derivatives and securitized loans. In the case of Group 2 Banks, the leverage ratio is relatively high at 3.8%, and only about 20% of banks have ratios below the requirement.

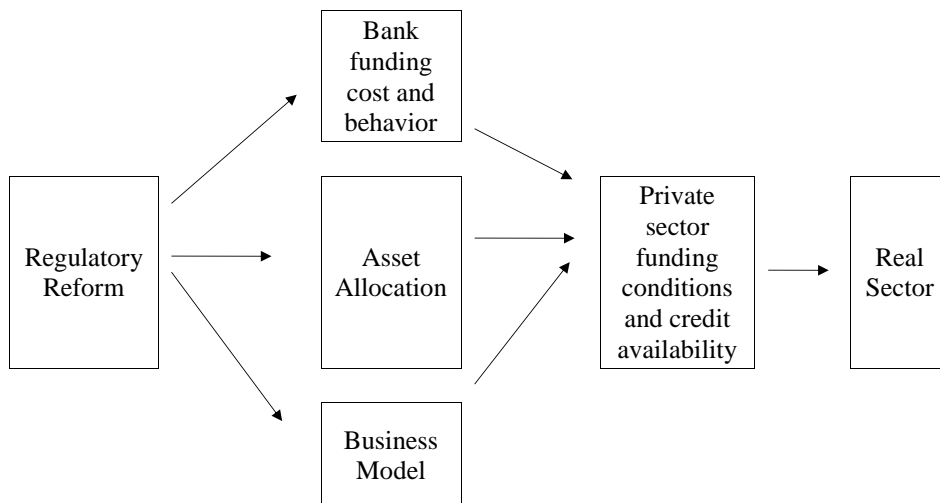
As for the liquidity ratios, Group 1 Banks fail to meet the minimum requirement (100%), with LCR of 83% and NSFR of 93% on average. Meanwhile, the LCR and NSFR of Group 2 banks are 98% and 103%, respectively. As of the end of 2009, banks need 1.7 trillion EUR in liquid assets to meet the required LCR and 2.9 trillion EUR to meet the required NSFR as a whole.

3.2. Literature Review

Strengthened regulation on banks may increase funding costs in the private sector, and reduces credit availability, affecting the real economy. If regulation is tightened, the profitability of banks decreases in response to the increasing cost of funding and the expansion of investment in low yielding assets. Banks would pass on these costs to the private sector through an increase in lending interest rate, worsening funding condition in the private sector. Figure 1 shows the channels through which regulatory reform may influence the real sector through the change of banks' behavior and strategies.

Studies on the effects of tightened regulation of the banking sector have focused on microeconomic aspects including banks' operational behaviors and changes in lending spreads. First of all, strengthening of regulation directly brings about changes in banks' operational behavior. Barrell *et al.* (2009) demonstrated in their study of 713 banks in OECD countries (from 1993

Figure 1 Channels through Which Regulatory Reform Influences the Real Sector



to 2007) that when the equity capital ratio is adjusted upward, banks' tendency to avoid risks increases not only before the change but also after it takes place. Cosimano and Dalia (2011) showed in their analysis of 100 international large banks using the GMM methodology that the impact of stricter capital regulation varies greatly across countries, depending upon the increase in capital cost and the resilience of credit demand to the change in lending rates.

Three recent papers have looked at the loan pricing implications of the proposed higher capital requirements under Basel III. Elliott (2009) provides an accounting-based analysis of how much the interest rate charged on loans will likely increase if US banks are required to hold more equity. Elliott calculates that if the ratio of common equity required for a given loan is raised by 2pp and no other adjustments are made, banks would need to raise lending spreads by 39bp to maintain a target ROE of 15%. Elliott (2009) claims that the effects of strengthened regulation differs depending upon asset size, region and business models, but that the impacts in terms of lending rate increase and credit supply capacity reduction are not great since banks progressively expand their capital and internal reserves to meet the requirements.

Kashyap *et al.* (2010) considers the question of the phasing-in of "substantially heightened" capital requirements. They also highlight the unintended consequences if the regulation is only applied to banks and not to the shadow-banking sector. Assuming the cost of long-term debt is 7% and the corporate tax rate is 35%, their baseline estimate is that an increase in capital-to-total assets by 1pp would raise the weighted average cost of capital by 2.5bp ($=75 \times 35\%$). King (2010) calculates that the higher cost associated with a one percentage point increase in the capital ratio can be recovered by increasing lending spreads by 15bp for a representative bank. This calculation assumes the return on equity (ROE) and the cost of debt are unchanged, with no change in other sources of income and no reduction in operating expenses. King (2010) also conducts calibration in order to conclude that bank would need to increase lending spreads by 24bp in order

Table 4 Assessment of Impacts of Basel III

	Amount of Required Recapitalization	Loan Spreads (bp)	Lending Amount (%)	GDP ⁴⁾ (%)
BIS ¹⁾	-	15	-1.4	-0.19
OECD ²⁾	-	15	-	-0.23
IIF ³⁾	\$1.3 trillion	376	-4.8	-3.1

Notes: 1) Estimates on the presumption of a four-year execution period (when there is a 1pp increase in the equity capital ratio). 2) Estimates for 2015 (when there is a 1.2pp rise, which is needed to meet the minimum equity capital ratio). 3) Capital and GDP are estimates for 2015. Other estimates are for 2011-2015. 4) The degree of decrease compared to the baseline.

to meet the target Net Stable Funding Ratio (NSFR).

Many studies on the effects of tightened regulation of the banking sector have also focused on macroeconomic aspects, such as the changes in the credit supply to the private sector and the subsequent impacts on the real sector. Various international organizations including the BIS have analyzed the impacts that Basel III would have on banks' lending spreads and on the real sector through a macroeconomic model. It is difficult to directly compare the assessment results due to differences in their samples and methodologies. The BCBS (2010d) estimated that a 1% increase in equity capital ratio over the course of four years results in a 15bp increase in lending spreads and a 1.4% decrease in lending volumes, and that as a result the GDP of the global economy falls as much as 0.19% (0.045pp decrease annually), supposing that the ROE remains the same. Furthermore, when the equity capital ratio increases by 1pp gradually over the course of eight years, the global GDP falls as much as 0.17% after 35th quarters out, implying that the effects are mitigated. The OECD (2011) analyzed the macroeconomic impacts of Basel III on banks in the US, the euro zone and Japan while the IIF (2011) analyzed the impacts on banks in the US, the euro zone, Japan, the UK and Switzerland. Their findings are presented below.⁶⁾

⁶⁾ Park *et al.* (2011) particularly investigates the post-crisis behavior of potential output in emerging East Asian economies, by employing the Markov-switching model after the 2008 financial crisis.

4. EMPIRICAL ESTIMATION RESULTS

4.1. Data and Descriptive Statistics

In order to analyze the impact of the tightened capital regulation on lending spreads, we select banks from 16 countries of developed and emerging economies and use their consolidated income statement and balance sheet data over the sample period of 2005-2010. Data are downloaded from Bankscope data base. When we choose the banks of asset size bigger than \$10 billion with no missing values in the period, total of 670 banks are selected.

Since the impact of capital regulation may vary by business models and countries, we group the banks into five different business models; Investment banks, Real estate & mortgage banks, Savings banks, Commercial banks, and Cooperative banks. The number of banks for each business model in each country is presented in table 5. Banks' behavior may have changed after the 2007-2008 global financial crisis, resulting in a different impact of capital regulation on lending spreads. Therefore we divide the sample period into two sub periods of 2005-2007 and 2008-2010, and conduct the analyses separately in order to find out the possible different impact of capital regulation.

Table 6 shows the descriptive statistics of the variables for each business model. Descriptive statistics for each country are presented in Appendix table A1. Table 6 shows that bank profitability, represented by the return on equity (ROE), was markedly affected by the 2007-2008 global financial crisis. For example, ROE of commercial banks dropped significantly to 6.6% from 13.6% after the crisis, while recording 9.6% over the whole period of 2005-2010. The drop in ROE after the crisis is most outstanding for investment banks, where ROE shifted to the negative after the crisis.

Further insight into the change in banks' profitability can be obtained from the equation to express ROE as the product of leverage multiplier (A/E) and return on asset (ROA), $ROE = A/E \times ROA$. While the leverage multiple

Table 5 Number of Banks for Various Business Model in Each Country

	Commercial Banks	Savings Banks	Cooperative Banks	Real Estate & Mortgage Banks	Investment Banks	Total
Australia (AU)	4	0	0	0	1	5
Brazil (BR)	10	0	0	0	1	11
Canada (CA)	13	1	3	1	4	22
China (CN)	29	0	3	0	1	33
France (FR)	23	13	41	3	2	82
Germany (DE)	15	22	6	19	2	64
India (IN)	27	0	0	1	0	28
Italy (IT)	24	6	9	0	4	43
Japan (JP)	90	0	35	0	7	132
Korea (KR)	6	0	1	0	2	9
Mexico (MX)	7	0	0	1	1	9
Netherlands (NL)	10	0	1	2	0	13
Spain (ES)	14	6	4	0	1	25
Switzerland (CH)	8	1	2	1	1	12
United Kingdom (GB)	31	1	0	7	13	52
United States (US)	93	13	4	14	6	130
Total	404	63	109	49	46	670

did not change much after the crisis for most business models except for investment banks, ROA has dropped significantly, almost being halved in some business models. The drop in ROA was contributed the most by the drop in non-interest income. Non-interest income comes mainly from trading income, which is generated by trading assets and trading liabilities, and fees and commissions. We infer from this finding that banks have reverted to more traditional business model after the crisis. Even though the interest income on loans remained at the similar level or slightly increased

Table 6 Descriptive Statistics

(unit: As percentage of total assets, %)

		2005-2010	2005-2007	2008-2010
All Banks	Interest income on loans	1.8	1.6	1.9
	Interest income on ex loans	1.6	2.1	1.2
	Interest expenses	2.0	2.4	1.7
	Net interest income	1.4	1.3	1.4
	Non interest income	0.6	1.0	0.4
	ROA	0.4	0.6	0.3
	ROE	8.5	12.3	5.7
	Leverage multiple	19.7	20.1	19.3
	Equity-asset ratio	5.1	5.0	5.2
	Total capital/RWA	12.0	10.7	13.3
	RWA/total assets	47.2	48.4	46.1
	Net loans, leases and mortgages	46.0	46.0	46.1
Commercial Banks	Interest income on loans	1.8	1.6	2.0
	Interest income on ex loans	1.5	2.0	1.2
	Interest expenses	1.9	2.2	1.7
	Net interest income	1.5	1.4	1.5
	Non interest income	0.6	1.0	0.3
	ROA	0.5	0.7	0.3
	ROE	9.6	13.6	6.6
	Leverage multiple	20.0	20.5	19.6
	Equity-asset ratio	5.0	4.9	5.1
	Total capital/RWA	12.1	10.8	13.4
	RWA/total assets	47.5	48.3	46.8
	Net loans, leases and mortgages	46.5	46.5	46.5
Savings Banks	Interest income on loans	2.7	2.4	2.9
	Interest income on ex loans	1.5	1.9	1.2
	Interest expenses	2.3	2.4	2.2
	Net interest income	1.9	1.9	1.9
	Non interest income	0.7	0.9	0.5
	ROA	0.5	0.7	0.4
	ROE	7.1	10.2	4.8
	Leverage multiple	13.5	13.7	13.4
	Equity-asset ratio	7.4	7.3	7.5
	Total capital/RWA	14.1	13.5	14.6
	RWA/total assets	62.6	68.4	56.8
	Net loans, leases and mortgages	60.9	61.0	60.8
Cooperative Banks	Interest income on loans	1.8	1.6	1.9
	Interest income on ex loans	1.4	1.9	1.0
	Interest expenses	2.1	2.5	1.7
	Net interest income	1.1	1.1	1.2
	Non interest income	0.4	0.6	0.2
	ROA	0.3	0.5	0.2
	ROE	6.8	9.4	4.7
	Leverage multiple	19.9	19.2	20.5
	Equity-asset ratio	5.0	5.2	4.9
	Total capital/RWA	11.7	10.6	12.9
	RWA/total assets	44.6	48.7	40.5
	Net loans, leases and mortgages	44.2	42.9	45.2

		2005-2010	2005-2007	2008-2010
Real Estate & Mortgage Banks	Interest income on loans	2.0	2.0	2.0
	Interest income on ex loans	2.2	2.9	1.5
	Interest expenses	3.6	4.3	3.0
	Net interest income	0.5	0.5	0.5
	Non interest income	0.1	0.1	0.0
	ROA	0.2	0.2	0.1
	ROE	4.8	6.5	3.1
	Leverage multiple	27.9	27.2	28.6
	Equity-asset ratio	3.6	3.7	3.5
	Total capital/RWA	8.1	7.4	8.7
	RWA/total assets	33.8	37.7	29.9
Net loans, leases and mortgages	65.5	68.8	62.3	
Investment Banks	Interest income on loans	0.3	0.3	0.3
	Interest income on ex loans	2.4	2.8	2.0
	Interest expenses	2.1	2.6	1.6
	Net interest income	0.6	0.6	0.7
	Non interest income	1.6	2.1	1.1
	ROA	0.2	0.5	-0.1
	ROE	2.9	8.1	-1.1
	Leverage multiple	13.9	15.5	12.7
	Equity-asset ratio	7.2	6.5	7.9
	Total capital/RWA	9.7	8.8	10.6
	RWA/total assets	46.4	49.8	42.9
Net loans, leases and mortgages	18.4	17.0	19.8	

Source: Bankscope, authors' calculations.

after the financial crisis, the interest income on ex-loans has reduced significantly. However, net interest income did not fall much since interest expenses at the same time fell when the interest income on ex-loans has fallen.

Despite the fact that ROE declined heavily after the crisis, the ratio of total capital to risk-weighted assets kept above 8% for commercial banks, savings banks, cooperative banks and investment banks. Equity to asset ratio sustained above 5% for the whole period except for real estate & mortgage banks. Equity to asset ratio before the crisis of 2005-2007 was around 5% for all banks on average.

When the capital levels fall below the new minimum capital requirements, banks usually increase their capital adequacy ratios. It can be done either by increasing regulatory capital in the numerator or by reducing risk-weighted assets (RWA) in the denominator. They can reduce RWA by

scaling down the size of assets. However, the most commonly used method is portfolio adjustment, such as the swapping of high risk-weighted assets (e.g., lending to SMEs) with low risk-weighted assets (e.g., government and public bonds). Table 6 shows that banks have reduced their RWAs (against total assets) in the wake of the global financial crisis, suggesting that they changed their business strategies and practices so as to enhance their capital adequacy.

4.2. Methodology

4.2.1. Mapping higher capital to lending spreads

We mapped the impact of higher capital and liquidity requirements on bank's lending spreads by following the methodology outlined by King (2010) and Elliott (2009).⁷⁾⁸⁾ Using the balance sheet and income statements for each business model and country, we tracked how changes in bank's capital structure and assets composition affect on each component of

⁷⁾ The debate and analysis surrounding bank capital increases has been heavily theoretical and qualitative. Research by Elliott (2009) and King (2010) supplements these shortfalls with numbers by focusing on the key variables and relationships as they exist today. They use actual balance sheet data to calibrate the regulatory impact. It enables us to take into account of composition of assets and liabilities, as well as the distinction between risk-weighted assets and total assets. It also provides estimates for different levels of capital. King (2010) additionally models the cost to meet the NSFR explicitly which makes it possible to explain the sensitivity of this calculation to the inputs.

⁸⁾ While the methodology used in this study is simple, it has limitation in that the estimates of the required increase in lending spreads when capital regulation is tightened are sensitive to differences in the size of loans to total assets, and differences in the size of RWA to total assets. We use the historical data of the ratios in order to replicate the real world data. Calculation of the cost to meet the NSFR is more complicated and sensitive to the assumptions made. The calculation of the outcome is sensitive to the definition of the ratio assumptions about the composition of bank's assets and liabilities, and estimates of the returns on different assets and the costs of different liabilities which are not disclosed in a bank's financial statements. Instead of using this kind of simple model, research by BIS (2011) uses macro models such as dynamic (stochastic) general equilibrium (DSGE) model. The idea is to "map" the tighter capital and liquidity requirements, countercyclical capital buffers into model inputs, parameters and features, and study the resulting steady state values and volatility of key macroeconomic variables. For the research of these macro economics simultaneous equations approach, please see Gerali (2011), Roger and Vlcek (2011), Roeger (2010) and Van den Heuvel (2008).

net income using accounting relationship. By measuring the change in net income and shareholder's equity associated with the regulatory changes, we could calculate the increase in lending spreads required to achieve a given ROE.

A typical bank's assets consist of a combination of cash and central bank balances, interbank claims, trading assets, loans, investments in securities, and other assets. Total liabilities generally consist of deposits, interbank funding, trading liabilities, wholesale funding (e.g., debt), and other liabilities. Table 7 shows an aggregate balance sheet of commercial banks for the sample

Table 7 Aggregated Balance Sheet of Commercial Banks

(unit: As percentage of total assets)

	2005-2010	2005-2007	2008-2010
Cash and Balance at CB	2.3	1.8	2.7
Interbank Claims	9.3	10.4	8.5
Trading-related Assets	11.4	13.8	9.6
Net loans, Leases and Mortgages	46.5	46.5	46.5
Investments and Securities	24.3	21.1	26.7
Other Assets	6.2	6.4	6.0
Total Assets	100.0	100.0	100.0
Deposits (Retail, Corporate)	47.4	46.5	48.0
Interbank Funding	17.1	17.9	16.4
Trading-related Liabilities	5.2	5.4	5.1
Wholesale Funding	10.7	12.2	9.6
Other Liabilities	14.7	13.1	15.9
Total Liabilities	95.0	95.1	94.9
Total Shareholders' Equity	5.0	4.9	5.1
Total Liab. & Stockholders' Equity	100.0	100.0	100.0
Leverage Multiple	20.0	20.5	19.6
RWA/Total Assets	47.5	48.3	46.8
Total Capital/RWA	12.1	10.8	13.4

Source: Bankscope, authors' calculations.

countries. All items are shown as percentages of total assets. Over the years of 2005-2010, loans (leases and mortgages) take about half of bank assets (46.5%), followed by investments and securities (24.3%), interbank claims (9.3%), and trading related assets (11.4%). The assets are funded by deposits (47.4%), interbank funding (17.1%), trading liabilities (5.2%), wholesale funding (10.7%), and other liabilities. Shareholder's equity takes the residual claim of shareholders, after the liabilities of creditors are deducted from total assets. RWA represent half of total assets, suggesting that an increase in the capital ratio of 1pp requires only a rise in shareholder's equity of half a percentage point.

Table 8 is the bank's consolidated income statement of commercial banks, which displays various components to generate net income. Bank's revenues consist of net interest income and non-interest income, where net interest income refers to interest income less interest expense. Total revenue less operating expenses and taxes equals to net income, as in equation (1).

$$\begin{aligned} \text{Net Interest Income} = & [(\text{Income on Loans} + \text{Other Interest Income} \\ & - \text{Interest Expenses}) + \text{Non Interest Income} \quad (1) \\ & - \text{Operating Expenses}] \times (1 - \text{tax}). \end{aligned}$$

We assume that the quantity of shareholder's equity increases relative to RWAs to meet a target capital adequacy ratio. The size and composition of balance sheet is held constant, but the relative share financed by shareholder's equity and total liabilities changes. A 1pp increase of capital ratio generates a smaller rise in shareholder's equity, since RWAs are typically smaller than total assets as in equation (2). The increase in the quantity of shareholder's equity matches an equal and offsetting decrease in the quantity of liabilities. We assume that long-term wholesale funding should be the first liabilities to be replaced with equity, since it is the most expensive form of liabilities as in equation (3).

Table 8 Aggregated Income Statement of Commercial Banks

(unit: As percentage of total assets)

	2005-2010	2005-2007	2008-2010
Interest Income on Loans	1.8	1.6	2.0
Interest Income ex Loans	1.6	2.0	1.2
Interest Income	3.4	3.6	3.2
Interest Expense	1.9	2.2	1.7
A. Net Interest Income	1.5	1.4	1.6
Trading Income	0.1	0.2	0.1
Non-interest Income ex trad.	0.5	0.8	0.3
B. Non-interest Income	0.6	1.0	0.4
C. Total Revenues	2.1	2.4	1.9
Personnel Expenses	0.7	0.7	0.7
Other adm. Expenses	0.8	0.8	0.8
D. Total Operating Expenses	1.5	1.5	1.5
E. Operating Profit	0.6	0.9	0.4
F. Income Tax Provision	0.2	0.3	0.1
G. Net Income (Return on Assets)	0.5	0.7	0.3
Return on Equity (ROE, %)	9.6	13.6	6.6
Average Effective Tax Rate (%)	29.9	30.4	29.0

Source: Bankscope, authors' calculations.

$$\Delta \text{Equity} = \Delta \text{Total Capital Ratio} \times RWA_{t+1}, \quad (2)$$

$$\Delta \text{Debt} = \Delta \text{Equity}. \quad (3)$$

The change in capital structure leads to a rise in bank's capital cost, since debt is substituted with more expensive equity. Since the decline in the quantity of debt outstanding reduces interest expenses while raising net income, all else being equal, net income should rise. The magnitude of fall

in interest expenses, or that of increase of net income, should depend on interest rates on the long term bonds. Since a bank's financial statement doesn't disclose the costs of wholesale funding separately by components, the costs of long term liabilities are assumed to be equal to deposit rates plus 200 basis points, where deposit rates are derived by dividing interest expenses on deposit by the amount of deposits.

When net income increases, ROE, the ratio of net income to shareholder's equity, typically falls, since the relative increase in the quantity of equity in the denominator is greater than the increase in net income in the numerator. As a base case, we assume that bank's ROE and cost of long-term debt are not changed despite the reduction in leverage, rather than fall. When bank's ROE and cost of debt are allowed to decline, the impact on lending spreads should be reduced.

In response to the fall in ROE, banks take various measures to block the fall. For example, banks could (i) reduce operating expenses, (ii) increase non-interest sources of income, (iii) redirect activities towards more profitable lines of business, or (iv) absorb the higher costs and reduce ROE. To the extent that banks absorb some of the costs either by increasing efficiency or by reducing operating expenses, the costs of new regulatory reforms would be lowered. However, in this study, we assume that banks respond to the fall in ROE by raising the lending spreads (α) charged on loans.⁹⁾

The magnitude of increase in lending spreads α is determined such that the increase in net income exactly offsets the increase in capital cost, allowing ROE to be unchanged at its previous value. Equation (4) provides a measure of the rise in lending spreads needed to offset the fall in ROE associated with 1pp increase in capital ratio. As long as long-term debt is replaced by equity and the costs of debt and equity are unchanged, the

⁹⁾ Banks are likely to increase lending spreads reflecting the increased cost burdens from the higher capital requirements by raising lending rates rather than lowering deposit rates. It is because the increase in lending rates, which will in turn reduce lending, is more favorable to banks for meeting both their capital and liquidity requirements rather than lowering their deposit rates which would lead to a reduction in deposits.

increase in lending spreads rises linearly with the increase in capital ratio. If cheaper forms of liabilities are replaced with more expensive equity, the rise in lending spreads should be higher.

$$\alpha = (\text{IncomeLoans}_{t+1} - \text{IncomeLoans}_t) / \text{Loans}_{t+1}, \quad (4)$$

where, $\text{IncomeLoans}_{t+1} = (\text{ROE}_{t+1} \times E_{t+1}) / (1 - \text{tax}) - (\text{OtherIntIncome}_{t+1} - \text{IntExp}_{t+1} + \text{NonIntIncome}_{t+1} - \text{OpExp}_{t+1})$.

4.2.2. Mapping NSFR to lending spreads

Estimating the cost for meeting the NSFR is more challenging than estimating the cost for meeting higher capital requirements, since the inputs to the NSFR are not disclosed in banks' financial statements. The December 2010 BCBS document finalized the definition and calibration of the NSFR. A simplified version is shown in equation (5). The numerator measures the source of available stable funding (ASF), with greater weight given to funding sources that are more stable and least likely to disappear under stressed market conditions. The denominator shows assets that require funding, with a factor applied on the base of their expected liquidation value under stressed circumstances.

$$\text{NSFR} = \frac{\text{available amount of stable funding}}{\text{required amount of stable funding}}. \quad (5)$$

Table 9 provides details on the calculation of NSFR based on the balance sheet data of commercial banks. Column A in table 9 shows the NSFR factors applied to different balance sheet items. Column B shows the relative weights of various items on the representative bank's balance sheet as percentage of total assets.

The calculation of the cost for meeting the NSFR is sensitive to the definition of the ratio, assumptions about the composition of bank's assets and liabilities, and estimates of the returns on various assets and of the costs

Table 9 Calculation of the NSFR

	NSFR Factor (A)	% of Total Assets (B)	NSFR (A×B)/100
Available Stable Funding (ASF)			
Tier 1 and Tier 2 capital instruments	1.0	5.3	0.05
Wholesale funding and liabilities > 1yr	1.0	23.5	0.24
Stable deposits < 1yr	0.9	32.6	0.29
Less stable deposits	0.8	10.9	0.09
All other liabilities not included above	0.0	27.7	0.00
Total ASF (numerator)		100.0	0.67
Required Stable Funding (RSF)			
Cash and short-term, unsecured, liquid instruments	0.0	2.3	0.00
Securities < 1yr	0.0	4.0	0.00
Loans to financials < 1yr (e.g., interbank)	0.0	6.3	0.00
Debt issued by sovereign and quasi-sovereigns	0.05	4.0	0.00
Loans to corporate clients < 1yr	0.5	12.9	0.06
Loans to retail clients < 1yr	0.85	12.9	0.11
All other assets not included above	1.0	57.6	0.58
Undrawn amount of committed credit and liquidity facilities	0.05	3.0	0.00
Other contingent obligations	0.1	3.0	0.00
Total RSF (denominator)		106.0	0.76
NSFR Ratio (ASF/RSF)			0.88

Source: Authors' calculations over commercial banks.

of various liabilities. In our calculation of NSFR we assumed as follows.

- 75% of deposits are stable
- Government debt initially takes 25% of investments
- 25% of investments are less than 1 year in maturity
- Committed but undrawn credit lines and other contingent liabilities are each assumed to be 3% of total assets.

As far as the ASF goes, funding sources viewed as stable are given higher weights. They are shareholders equity of 5.3%, longer-term debt and liabilities of 23.5%, and deposits of 43.5% (divided between stable and less stable deposits). After deducting the stable sources of funding, all remaining liabilities are given a 0% weight in the ASF, implying that they are not viewed as stable. It takes 27.7% of the representative bank's balance sheet. They include debt and liabilities due within one year, since they are expected to roll off during stressed market conditions.

Concerning the RSF, assets viewed as less liquid bear a higher factor, implying a greater need for stable funding. Cash, short-term securities, and interbank loans maturing within one year do not require funding. Investment in government bonds with maturity longer than one year represents 4.0% of total assets, of which 5% of the par value should be funded. Loans to corporate and retail clients with maturity longer than one year should be funded at 50% and 85%, respectively. When the assets indicated above are deduced, the remaining on-balance sheet assets that should be fully funded takes 57.6% of the representative bank's balance sheet. Off-balance and contingent liabilities should be funded at 10% of their value. Column C, which is a product of columns A and B, shows the contribution of each category to the NSFR. To achieve a target NSFR, banks should have an ASF greater than their RSF, leading to a NSFR of 1 or greater.

4.3. Empirical Estimation Results

4.3.1. Impact of raising the capital ratio on lending spreads

Table 10 shows the calculation of lending spreads when the capital regulation is tightened by following the changes in the components of balance sheet and income statement over the aggregate data of commercial banks of the sample countries. The ratio of risk-weighted assets to total asset is 47.53 and shareholder's equity ratio is 4.9966. When equity to risk-weighted asset is increased by 1pp, equity should increase by 0.4753 (= 47.53×0.01). We assume that the same amount of long-term whole sale

Table 10 Calculation of Rise in Lending Spreads for 1pp Increase in Capital Ratio

	Before	No Change in Lending Spreads		Increase in Lending Spreads	
		After	Change	After	Change
Total capital/RWA	12.0600	13.0600	1.0000	13.060	1.0000
RWA/Total assets	47.5300	47.5300	0.0000	47.5300	0.0000
Shareholder's equity	4.9966	5.4719	0.4753	5.4719	0.4753
Wholesale funding	10.7009	10.2256	-0.4753	10.2256	-0.4753
Increase in lending spreads		0bp		9.08bp	
Interest income on loans	1.8420	1.8420	0.0000	1.8842	0.0422
+ Interest income on ex loans	1.5451	1.5451	0.0000	1.5451	0.0000
= Interest income	3.3871	3.3871	0.0000	3.4293	0.0422
- Interest expense	1.9077	1.8909	-0.0168	1.8909	-0.0168
= Net interest income	1.4794	1.4961	0.0168	1.5383	0.0590
+ Non interest income	0.6270	0.6270	0.0000	0.6270	0.0000
= Revenue	2.1064	2.1232	0.0168	2.1654	0.0590
- Operating expenses	1.4864	1.4864	0.0000	1.4864	0.0000
= Pretax income	0.6200	0.6368	0.0168	0.6790	0.0590
Net Income	0.4349	0.4467	0.0118	0.4763	0.0414
ROE	0.0870	0.0816	-0.0054	0.0870	0.0000

Source: Authors' calculations.

funding is reduced and the resulting reduction in the interest expenses can be calculated by multiplying the amount of whole sale funding by long term rate on debt. Long-term rate on debt is assumed to be bigger than deposit rate by 200bp, where deposit rate is derived by dividing interest expenses on deposit by the amount of deposits.

Reduction on long-term debt reduces the interest expenses by 0.0168pp to 1.8909% from the 1.9077% of total assets. It raises the pretax income by 0.0168pp and net income by 0.0118pp. Since change in income is usually smaller than change in equity, ROE decline by 54bp. If banks intend to keep the ROE at the pre-regulation level, they should increase lending spreads by 9.08bp.

Above estimation is applied to the banks of different business models allowing the fall in ROE to the different degree and increasing the magnitude of capital regulation incrementally. The results are presented in table 11. Over the entire sample period, lending spreads required to keep ROE constant is greatest for commercial banks recording 9.1bp, followed by savings banks and cooperative banks. When the two periods of before and after the crisis are compared, required lending spreads became smaller after the crisis. One of the reasons for this is due to the significant decrease in the ratio of RWA to total asset after the crisis. Required lending spreads decreases from 14.4bp to 5.3bp for commercial banks after the crisis. It decreases from 10.3bp to 3.5bp, and 8.4bp to 2.2bp for savings banks and cooperative banks respectively.

When the ROE is allowed to fall, the required lending spreads also fall. If required capital ratio is increased incrementally by 1pp, the required lending spreads increases linearly. The required lending spreads become 45.4bp for commercial banks when the capital regulation requires banks to increase equity by 5pp and if banks want to keep ROE at the original level. Lending spreads increases up to 31.4bp and 23.6bp for savings banks and cooperative banks respectively when the capital regulation requires 5pp increase in the capital ratio with no change in ROE.

In the case of investment banks and real estate and mortgage banks, required lending spreads become negative over the whole sample periods of 2005-2010. Negative lending spreads means that lending spreads should decrease rather than increase when capital regulation is tightened. Splitting the sample periods into before and after the crisis era provides the answer to the seemingly unintuitive results. ROE after the financial crisis recorded

Table 11 Impact of Higher Capital Requirements on Lending Spreads for Various Business Models (bp)

	Increase in Capital Ratio	2005-2010				2005-2007				2008-2010			
		No Change in ROE	Fall in ROE per 1pp			No Change in ROE	Fall in ROE per 1pp			No Change in ROE	Fall in ROE per 1pp		
			10bp	15bp	20bp		10bp	15bp	20bp		10bp	15bp	20bp
Investment Banks	1pp	-0.5	-6.0	-8.8	-11.5	18.1	13.0	10.4	7.8	-11.1	-15.6	-17.8	-20.1
	2pp	-1.0	-6.8	-9.8	-12.7	36.2	30.7	28.0	25.2	-22.2	-26.9	-29.3	-31.6
	3pp	-1.4	-7.6	-10.7	-13.8	54.3	48.4	45.5	42.6	-33.3	-38.2	-40.7	-43.2
	4pp	-1.9	-8.5	-11.7	-15.0	72.4	66.2	63.0	59.9	-44.4	-49.5	-52.1	-54.7
	5pp	-2.4	-9.3	-12.7	-16.2	90.5	83.9	80.6	77.3	-55.4	-60.9	-63.6	-66.3
Real Estate & Mortgage Banks	1pp	0.1	-0.6	-1.0	-1.4	1.3	0.6	0.2	-0.1	-0.9	-1.7	-2.1	-2.5
	2pp	0.2	-0.6	-1.0	-1.4	2.6	1.8	1.4	1.0	-1.9	-2.7	-3.2	-3.6
	3pp	0.3	-0.5	-1.0	-1.4	3.9	3.0	2.6	2.2	-2.8	-3.7	-4.2	-4.7
	4pp	0.5	-0.5	-0.9	-1.4	5.2	4.3	3.8	3.4	-3.8	-4.7	-5.2	-5.7
	5pp	0.6	-0.4	-0.9	-1.4	6.5	5.5	5.0	4.5	-4.7	-5.8	-6.3	-6.8
Savings Banks	1pp	6.3	4.5	3.7	2.8	10.3	8.5	7.6	6.7	3.5	1.9	1.0	0.2
	2pp	12.5	10.7	9.8	8.8	20.7	18.7	17.7	16.8	7.0	5.2	4.4	3.5
	3pp	18.8	16.8	15.8	14.8	31.0	28.9	27.8	26.8	10.5	8.6	7.7	6.8
	4pp	25.1	23.0	21.9	20.8	41.3	39.1	37.9	36.8	14.0	12.0	11.0	10.0
	5pp	31.4	29.1	28.0	26.8	51.7	49.3	48.0	46.8	17.5	15.4	14.3	13.3
Commercial Banks	1pp	9.1	7.4	6.6	5.7	14.4	12.7	11.9	11.1	5.3	3.6	2.7	1.9
	2pp	18.2	16.3	15.4	14.5	28.8	27.0	26.1	25.2	10.6	8.7	7.8	6.9
	3pp	27.2	25.3	24.3	23.3	43.2	41.2	40.3	39.3	15.8	13.9	12.9	11.9
	4pp	36.3	34.2	33.1	32.1	57.6	55.5	54.4	53.4	21.1	19.0	17.9	16.9
	5pp	45.4	43.1	42.0	40.9	72.0	69.8	68.6	67.5	26.4	24.1	23.0	21.9
Cooperative Banks	1pp	4.7	3.0	2.1	1.2	8.4	6.5	5.5	4.6	2.2	0.5	-0.3	-1.2
	2pp	9.4	7.5	6.6	5.6	16.7	14.7	13.6	12.6	4.4	2.6	1.7	0.8
	3pp	14.2	12.1	11.1	10.1	25.1	22.9	21.8	20.7	6.6	4.7	3.7	2.7
	4pp	18.9	16.7	15.6	14.5	33.4	31.1	29.9	28.7	8.8	6.7	5.7	4.7
	5pp	23.6	21.3	20.1	18.9	41.8	39.3	38.0	36.7	11.0	8.8	7.7	6.6

negative value for these banks because operating expenses were greater than revenue. When interest expenses are reduced after the capital regulation, ROE increases rather than decreases. Banks' effort to prevent ROE from rising lenders lending spreads to decline rather than to increase.

Major factors affecting lending spreads are the ratio of RWA to total assets, the relative size of loan to total assets or the long term interest rate on debt, *ceteris paribus*. When capital regulation is tightened, the higher ratio of RWA to total assets requires bigger amount of equity to be raised thereby requiring bigger reduction in the whole sale funding. This usually has the effect of increasing lending spreads since the increase in the capital become bigger than increase in the net income. Level of interest rates will affect the magnitude of reduction in the interest expense and net profit. We can expect the reduction in the interest expense bigger leading to bigger increase in net income, higher the level of interest rates, which would result in the smaller increase in the required lending spreads to maintain ROE at the given level.

The relative size of loans to total assets is another factor which affects required lending spreads. In response to an increase in capital requirements, a given quantity of net income should be recovered by raising pre-tax income on the existing loan portfolio. When the loan portfolio has a larger share of total assets, a smaller increase in lending rates per loan can increase interest income on loans enough to keep ROE at a pre-level.

Table 6 shows that the ratios of RWA and loans to total assets vary across business models, which makes it hard to identify the factors which affects the magnitude of lending spreads. Savings banks recorded the highest ratio of RWA to the assets and second highest ratio of loans to asset after real estate and mortgage banks. This works in the opposite direction for the required lending spreads. Commercial banks and cooperative banks have relatively high ratios of RWA and loans to the assets. For mortgage banks the ratio of RWA is lowest being 33.8 while loans ratio records the biggest being 65.5% of total asset and this contribute to lowering the required increase in the lending spreads.

Table 12 shows the estimation results of the effects of capital regulation on

Table 12 Impact of Higher Capital Requirements on Lending Spreads for Countries (bp)

		2005-2010				2005-2007				2008-2010			
	Increase in Capital Ratio	No Change in ROE	Fall in ROE per 1pp			No Change in ROE	Fall in ROE per 1pp			No Change in ROE	Fall in ROE per 1pp		
			10bp	15bp	20bp		10bp	15bp	20bp		10bp	15bp	20bp
AU	1pp	3.2	1.1	0.0	-1.0	7.9	5.9	5.0	4.0	0.7	-1.4	-2.5	-3.5
	2pp	6.3	4.1	3.1	2.0	15.8	13.7	12.7	11.7	1.4	-0.8	-1.9	-3.0
	3pp	9.5	7.2	6.1	5.0	23.7	21.5	20.5	19.4	2.1	-0.2	-1.3	-2.5
	4pp	12.7	10.3	9.1	8.0	31.6	29.3	28.2	27.1	2.8	0.4	-0.8	-1.9
	5pp	15.8	13.4	12.2	10.9	39.5	37.2	36.0	34.9	3.5	1.0	-0.2	-1.4
BR	1pp	23.1	20.1	18.7	17.2	29.7	26.6	25.1	23.5	19.0	16.2	14.7	13.3
	2pp	46.2	43.0	41.4	39.8	59.4	56.0	54.4	52.7	38.1	35.0	33.4	31.9
	3pp	69.2	65.8	64.1	62.4	89.0	85.5	83.7	81.9	57.1	53.8	52.1	50.4
	4pp	92.3	88.7	86.8	85.0	118.7	114.9	113.0	111.0	76.2	72.6	70.8	69.0
	5pp	115.4	111.5	109.6	107.6	148.4	144.3	142.3	140.2	95.2	91.4	89.5	87.6
CA	1pp	8.3	5.7	4.4	3.1	15.2	12.7	11.5	10.3	3.6	0.8	-0.5	-1.9
	2pp	16.6	13.9	12.5	11.2	30.5	27.8	26.5	25.2	7.1	4.3	2.9	1.4
	3pp	24.9	22.1	20.7	19.3	45.7	43.0	41.6	40.2	10.7	7.7	6.3	4.8
	4pp	33.2	30.3	28.8	27.3	60.9	58.1	56.6	55.2	14.3	11.2	9.7	8.1
	5pp	41.5	38.5	36.9	35.4	76.2	73.2	71.7	70.2	17.9	14.7	13.1	11.5
CH	1pp	1.1	-0.3	-1.0	-1.7	7.5	5.8	5.0	4.1	-4.0	-9.6	-12.5	-15.3
	2pp	2.2	0.7	0.0	-0.7	15.1	13.3	12.4	11.5	-8.0	-13.9	-16.8	-19.8
	3pp	3.2	1.7	1.0	0.2	22.6	20.7	19.8	18.8	-12.0	-18.1	-21.2	-24.3
	4pp	4.3	2.7	1.9	1.1	30.1	28.1	27.1	26.2	-16.0	-22.4	-25.6	-28.8
	5pp	5.4	3.7	2.9	2.1	37.7	35.6	34.5	33.5	-20.2	-26.6	-30.0	-33.3

CN	1pp	20.9	19.0	18.0	17.0	20.1	18.0	17.0	15.9	21.4	19.5	18.6	17.6
	2pp	41.9	39.8	38.7	37.6	40.3	38.0	36.8	35.7	42.8	40.8	39.8	38.7
	3pp	62.8	60.5	59.4	58.3	60.4	57.9	56.7	55.5	64.2	62.0	60.9	59.8
	4pp	83.8	81.3	80.1	78.9	80.5	77.9	76.6	75.2	85.6	83.3	82.1	80.9
	5pp	104.7	102.1	100.8	99.5	100.7	97.9	96.4	95.0	107.1	104.5	103.3	102.0
DE	1pp	1.4	0.3	-0.2	-0.8	5.1	4.1	3.6	3.1	-1.7	-8.4	-11.7	-15.0
	2pp	2.7	1.5	1.0	0.4	10.2	9.0	8.5	7.9	-3.4	-10.7	-14.4	-18.1
	3pp	4.1	2.8	2.2	1.5	15.2	14.0	13.4	12.8	-5.1	-13.1	-17.1	-21.1
	4pp	5.4	4.0	3.3	2.7	20.3	19.0	18.3	17.7	-6.8	-15.5	-19.8	-24.1
	5pp	6.8	5.3	4.5	3.8	25.4	24.0	23.2	22.5	-8.5	-17.8	-22.5	-27.1
ES	1pp	11.0	9.7	9.1	8.4	13.2	11.9	11.2	10.5	9.3	8.0	7.4	6.8
	2pp	22.1	20.6	19.9	19.2	26.5	24.9	24.2	23.4	18.6	17.2	16.6	15.9
	3pp	33.1	31.6	30.8	30.0	39.7	38.0	37.2	36.4	27.9	26.4	25.7	25.0
	4pp	44.1	42.5	41.7	40.8	52.9	51.1	50.3	49.4	37.2	35.6	34.8	34.1
	5pp	55.2	53.4	52.5	51.6	66.1	64.2	63.3	62.3	46.5	44.8	44.0	43.2
FR	1pp	4.9	3.3	2.5	1.7	8.9	7.2	6.3	5.5	2.1	0.6	-0.1	-0.8
	2pp	9.7	8.1	7.2	6.4	17.8	16.0	15.0	14.1	4.2	2.7	1.9	1.1
	3pp	14.6	12.8	11.9	11.0	26.7	24.7	23.8	22.8	6.4	4.7	3.8	3.0
	4pp	19.5	17.5	16.6	15.6	35.6	33.5	32.5	31.4	8.5	6.7	5.8	4.9
	5pp	24.3	22.3	21.3	20.2	44.5	42.3	41.2	40.0	10.6	8.7	7.7	6.8
GB	1pp	3.4	1.9	1.2	0.5	12.3	11.1	10.5	9.9	-3.7	-4.3	-4.6	-4.9
	2pp	6.8	5.2	4.4	3.6	24.7	23.4	22.7	22.0	-7.4	-8.1	-8.4	-8.7
	3pp	10.2	8.5	7.6	6.8	37.0	35.6	34.9	34.2	-11.1	-11.8	-12.2	-12.5
	4pp	13.7	11.8	10.9	9.9	49.4	47.8	47.1	46.3	-14.8	-15.6	-16.0	-16.3
	5pp	17.1	15.1	14.1	13.1	61.7	60.1	59.2	58.4	-18.5	-19.3	-19.7	-20.1
IN	1pp	13.2	11.4	10.6	9.7	15.7	14.0	13.1	12.3	11.6	9.8	8.9	8.0
	2pp	26.4	24.5	23.5	22.6	31.3	29.5	28.6	27.7	23.2	21.3	20.3	19.3
	3pp	39.6	37.5	36.5	35.5	47.0	45.0	44.0	43.0	34.8	32.7	31.7	30.7
	4pp	52.8	50.6	49.5	48.4	62.6	60.5	59.4	58.4	46.3	44.2	43.1	42.0
	5pp	66.0	63.7	62.5	61.4	78.3	76.0	74.9	73.7	57.9	55.6	54.5	53.3

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IT	1pp	4.1	2.2	1.2	0.3	8.8	6.7	5.7	4.7	1.0	-0.7	-1.6	-2.5
	2pp	8.1	6.1	5.1	4.1	17.5	15.3	14.2	13.1	2.0	0.1	-0.8	-1.7
	3pp	12.2	10.0	9.0	7.9	26.3	23.9	22.7	21.6	2.9	1.0	0.0	-1.0
	4pp	16.3	14.0	12.8	11.7	35.0	32.5	31.2	30.0	3.9	1.9	0.8	-0.2
	5pp	20.3	17.9	16.7	15.4	43.8	41.1	39.8	38.4	4.9	2.7	1.6	0.5
JP	1pp	7.5	6.0	5.3	4.5	12.5	11.0	10.2	9.4	3.8	2.3	1.6	0.8
	2pp	15.1	13.4	12.5	11.7	25.1	23.3	22.4	21.6	7.7	6.0	5.1	4.3
	3pp	22.6	20.7	19.8	18.8	37.6	35.7	34.7	33.7	11.5	9.6	8.7	7.8
	4pp	30.2	28.1	27.0	26.0	50.2	48.0	46.9	45.8	15.3	13.3	12.3	11.3
	5pp	37.7	35.4	34.3	33.2	62.7	60.4	59.2	58.0	19.2	17.0	15.9	14.8
KR	1pp	9.2	7.8	7.1	6.4	17.5	16.1	15.3	14.6	2.5	1.1	0.5	-0.2
	2pp	18.4	16.9	16.1	15.4	35.0	33.4	32.6	31.8	4.9	3.5	2.8	2.0
	3pp	27.6	26.0	25.1	24.3	52.5	50.8	49.9	49.1	7.4	5.8	5.0	4.3
	4pp	36.8	35.0	34.2	33.3	70.0	68.1	67.2	66.3	9.8	8.1	7.3	6.5
	5pp	46.0	44.1	43.2	42.2	87.5	85.5	84.5	83.5	12.3	10.5	9.6	8.7
MX	1pp	29.7	25.9	24.0	22.1	36.4	32.6	30.6	28.7	22.5	18.9	17.0	0.0
	2pp	59.5	55.4	53.4	51.4	72.9	68.8	66.7	64.6	45.1	41.2	39.2	0.0
	3pp	89.2	84.9	82.8	80.6	109.3	104.9	102.7	100.6	67.6	63.5	61.4	0.8
	4pp	119.0	114.4	112.2	109.9	145.7	141.1	138.8	136.5	90.2	85.8	83.7	4.3
	5pp	148.7	143.9	141.5	139.2	182.2	177.3	174.9	172.4	112.7	108.2	105.9	7.8
NL	1pp	-0.6	-1.6	-2.1	-2.6	3.4	2.4	1.9	1.5	-4.0	-4.8	-5.2	-5.6
	2pp	-1.1	-2.2	-2.8	-3.4	6.8	5.7	5.2	4.7	-7.9	-8.8	-9.2	-9.7
	3pp	-1.7	-2.9	-3.5	-4.1	10.2	9.1	8.5	7.9	-11.9	-12.8	-13.3	-13.8
	4pp	-2.3	-3.6	-4.2	-4.9	13.6	12.4	11.7	11.1	-15.8	-16.9	-17.4	-17.9
	5pp	-2.8	-4.2	-4.9	-5.6	17.0	15.7	15.0	14.3	-19.8	-20.9	-21.4	-22.0
US	1pp	8.3	5.9	4.7	3.5	17.2	14.9	13.8	12.7	1.9	-0.5	-1.6	-2.8
	2pp	16.5	13.9	12.6	11.3	34.4	31.9	30.7	29.5	3.8	1.3	0.0	-1.3
	3pp	24.8	22.0	20.6	19.2	51.6	48.9	47.6	46.2	5.7	3.0	1.6	0.3
	4pp	33.0	30.0	28.6	27.1	68.8	65.9	64.5	63.0	7.5	4.7	3.2	1.8
	5pp	41.3	38.1	36.5	34.9	86.0	82.9	81.4	79.8	9.4	6.4	4.9	3.4

lending spreads for sample countries. Various types of banks are included in the country analysis. The results show that required lending spreads vary greatly country by country. Countries such as Brazil, China, India, and Mexico require the banks to have large lending spreads ranging from 13.2bp to 29.7bp. On the other hand, countries such as Australia, Switzerland, Germany, Italy and Netherland require them to increase smaller lending spreads for the 1pp increase in regulatory capital ratio during the period of 2005-2007.

Since the effects of capital regulation may vary by a composition of business models in each country, we only include the commercial banks in each country. They are presented in Appendix table A2, which doesn't seem to make any qualitative difference with the calibration results when all the business models are included in the analysis.

4.3.2. Impact of meeting NSFR on lending spreads

For estimating the impact of meeting NSFR on lending spreads, we build a set of assumptions on balance sheet data and analyze the aggregate data of commercial banks in the sample countries. The starting NSFR in table 13 is 0.88 below the target of 1.0. Available stable funding is 0.67 and required stable funding is 0.76. To meet the target NSFR of 1.0 or greater, either stable funding sources should be increased or illiquid assets should be decreased. Table 13 shows the steps taken to achieve the target NSFR and their impact on bank's net income. The steps include the changes in bank's capital structure and the composition of its assets.

The first step to meeting the NSFR is to extend the maturity of wholesale debt. All debt maturing within one year is extended beyond one year such that the longer-term debt and other liabilities increase from 23.50% to 26% of total assets. The change increases the ASF, leading to a rise in the NSFR to 0.92. Long-term debt bears higher cost than the debt maturing within one year in the analysis so that the strategy increases interest expenses, lowering net income and reducing ROE. The increase in lending spreads required to offset the fall in ROE is calculated to be 5.4 basis points.

Table 13 Meeting the Target of NSFR

(unit: As percentage of total assets)

	NSFR Factor (A)	% of Total Assets(B)	NSFR (A×B)/100	Step 1		Step 2	
				After	Change	After	Change
Panel A: Calculation of NSFR							
Available Stable Funding (ASF)							
Tier 1 and Tier 2 capital instruments	1.0	5.3	0.05	5.30	0.00	5.30	0.00
Wholesale funding and liabilities > 1yr	1.0	23.5	0.24	26.00	2.50	26.00	2.50
Stable deposits < 1yr	0.9	32.6	0.29	32.63	0.00	32.63	0.00
Less stable deposits	0.8	10.9	0.09	10.88	0.00	10.88	0.00
All other liabilities not included above	0.0	27.7	0.00	25.20	-2.50	25.2	-2.50
Total ASF (numerator)		100.0	0.67	100.0		100.0	
Required Stable Funding (RSF)							
Cash and short-term, unsecured, liquid instruments	0.0	2.3	0.00	2.30	0.00	2.30	0.00
Securities < 1yr	0.0	4.0	0.00	4.03	0.00	4.03	0.00
Loans to financials < 1yr (e.g., interbank)	0.0	6.3	0.00	6.30	0.00	6.30	0.00
Debt issued by sovereign and quasi-sovereigns	0.05	4.0	0.00	4.03	0.00	10.03	0.00
Loans to corporate clients < 1yr	0.5	12.9	0.06	12.90	0.00	12.90	6.80
Loans to retail clients < 1yr	0.85	12.9	0.11	12.90	0.00	12.90	0.00
All other assets not included above	1.0	57.6	0.58	57.55	0.00	51.55	0.00
Undrawn amount of committed credit and liquidity facilities	0.05	3.0	0.00	3.00	0.00	3.00	-6.80
Other contingent obligations	0.1	3.0	0.00	3.00	0.00	3.00	0.00
Total RSF (denominator)		106.0	0.76				
NSFR (ASF/RSF)			0.88		0.92		1.00

Panel B							
Change in lending spreads				5.4		20.03	
Interest income on loans	1.8			1.87	0.025	1.94	0.093
+ Income on investments	1.6			1.55	0	1.48	-0.068
= Interest income	3.4			3.41	0.025	3.41	0.025
- Interest expense	1.9			1.93	0.025	1.93	0.025
= Net interest income	1.5			1.48	0	1.48	0

Source: Authors' calculations.

To increase the NSFR further, in the second step, they lower the RSF by increasing the holdings of liquid unencumbered bonds such as qualifying government debt. Increasing the holdings of government bonds in the portfolio, all else being equal, requires reducing the holdings of other higher-yielding securities such as corporate bonds, equities and other securities. Consequently, interest income declines, as the higher-yielding but less liquid investments are replaced with lower-yielding but more liquid securities. The lost income critically depends on the assumption of how much interest income is lost by switching into government bonds relative to other higher-yielding investments. In this analysis, we assume the opportunity cost of holding government bonds relative to other investments to be 100 basis points per annum.

When banks switch 6.8% of their assets from higher-yielding securities to government bonds, the NSFR increases to 1. Interest income would be lost by 6.8pp. In total, lending spreads needs to increase by 20.03bp in order to keep bank's net interest income constant.¹⁰⁾

5. CONCLUSION

Strengthened capital requirement may reduce the bank's ROE as debt is

¹⁰⁾ Switching to safe government securities in the asset reduces the RWA which reduces the amount of equity to be raised. If this synergy effect is added, the required lending rate may further decrease as demonstrated in King (2010).

substituted with more expensive equity. To prevent ROE from falling, banks can respond by taking various measures such as reducing operating expenses or increasing non-interest profit sources besides increasing lending spreads. The most favorable methods would depend on the competitive environment surrounding banks. We assume that banks would raise lending spreads among the measures they could take to prevent ROE from falling. In order to estimate the required lending spreads when the capital regulation is tightened, we employ the accounting relationship by using bank's balance sheet data and income statement following spirit of King (2010) and Elliott (2009). Since bank's responses in increasing lending rates vary by banks' business models and countries, we conduct the analyses for various business models in various countries.

Major factors affecting lending spreads are the ratio of RWA to total assets, the relative size of loan to total assets or the long term interest rate on debt, *ceteris paribus*. The ratios of RWA and loans to total assets vary across business models and countries, which makes it hard to identify the factors which affect the magnitude of lending spreads consistently. We found that the required lending spreads to keep ROE from falling vary from 0.1bp for real estate and mortgage banks to 9.1bp for commercial banks over the sample periods of 2005-2010. Required lending rate decreases after the 2007-2008 global financial crisis and one of the main reasons for this is the significantly decreased ratio of RWA to total assets. The estimation results show that required lending spreads vary greatly country by country. Countries such as Brazil, China, India, and Mexico require the banks to have large lending spreads ranging from 13.2bp to 29.7bp during the period of 2005-2010. On the other hand, countries such as Australia, Switzerland, Germany, Italy, and Netherland require them to increase smaller lending spreads for the 1pp increase in capital ratio. Apart from the capital regulation, we found that liquidity regulation (NSFR) increases lending spreads by 20.0bp for the commercial banks of the sample countries if they want to keep ROE at the pre-regulation level.

APPENDIX

Table A1 Descriptive Statistics by Countries

(unit: As percentage of total assets, %)

	05-10	05-07	08-10	05-10	05-07	08-10	05-10	05-07	08-10
	<AU>			 			<CA>		
Interest income on loans	3.1	2.8	3.4	6.4	6.9	6.2	1.6	1.1	2.0
Interest income on ex loans	2.3	2.7	2.1	4.5	5.5	4.0	1.8	2.8	1.0
Interest expenses	3.9	3.9	4.0	5.7	6.3	5.5	1.9	2.4	1.5
Net interest income	1.5	1.7	1.5	5.2	6.1	4.7	1.5	1.4	1.5
Non interest income	1.7	2.4	1.4	1.1	1.3	1.0	1.6	2.3	1.1
ROA	0.8	1.2	0.6	1.7	2.0	1.5	0.9	1.2	0.5
ROE	8.3	13.3	5.7	22.6	25.3	21.1	10.3	15.2	6.6
Leverage multiple	10.4	11.4	9.8	13.7	12.5	14.3	12.1	12.2	12.0
Equity-asset ratio	9.7	8.8	10.2	7.3	8.0	7.0	8.3	8.2	8.3
Total capital/RWA	30.4	32.6	28.2	11.5	11.3	11.6	11.8	9.6	13.9
RWA/total assets	41.3	40.2	42.4	65.5	71.0	59.9	40.1	43.8	36.3
Net loans, leases & mortgages	66.8	67.5	66.4	37.5	36.6	37.9	40.6	40.7	40.6
	<CH>			<CN>			<DE>		
Interest income on loans	0.9	0.8	1.0	2.7	2.9	2.6	2.9	3.2	2.7
Interest income on ex loans	2.3	3.0	1.6	1.2	1.1	1.2	1.0	1.0	1.0
Interest expenses	2.7	3.4	2.0	1.6	1.6	1.6	2.9	3.2	2.7
Net interest income	0.5	0.5	0.6	2.3	2.4	2.2	1.0	0.9	1.0
Non interest income	1.3	1.5	1.0	0.2	0.1	0.2	0.2	0.4	0.0
ROA	0.2	0.5	-0.1	1.0	0.8	1.0	0.1	0.3	0.0
ROE	6.7	17.1	-2.8	15.6	13.8	16.4	4.8	10.3	-0.4
Leverage multiple	33.1	35.3	31.1	16.0	16.4	15.8	32.2	31.1	33.2
Equity-asset ratio	3.0	2.8	3.2	6.2	6.1	6.3	3.1	3.2	3.0

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Total capital/RWA	16.9	10.4	23.4	11.2	11.5	10.8	8.4	8.3	8.6
RWA/total assets	15.9	16.5	15.3	55.8	55.3	56.2	36.0	39.0	33.0
Net loans, leases & mortgages	24.3	23.4	25.2	53.0	52.1	53.4	47.4	48.1	46.7
	<ES>			<FR>			<GB>		
Interest income on loans	3.5	3.4	3.5	1.8	1.8	1.8	1.3	1.2	1.3
Interest income on ex loans	0.9	0.9	0.9	1.5	1.7	1.3	1.1	1.7	0.6
Interest expenses	2.5	2.6	2.4	2.4	2.9	2.1	1.5	2.1	1.1
Net interest income	1.8	1.6	2.0	0.8	0.7	0.9	0.8	0.9	0.8
Noninterest income	0.6	0.9	0.3	0.7	1.0	0.4	0.5	0.9	0.2
ROA	0.9	1.0	0.7	0.3	0.5	0.2	0.2	0.4	0.0
ROE	14.5	17.3	12.4	8.2	11.7	5.5	5.6	13.7	-0.8
Leverage multiple	16.7	16.8	16.6	26.5	25.6	27.3	30.7	30.7	30.7
Equity-asset ratio	6.0	5.9	6.0	3.8	3.9	3.7	3.3	3.3	3.3
Total capital/RWA	10.6	9.7	11.6	10.7	9.5	12.0	12.0	9.3	14.7
RWA/total assets	58.4	62.5	54.3	31.9	33.6	30.2	31.6	34.1	29.1
Net loans, leases & mortgages	63.2	63.4	63.1	35.6	33.5	37.2	38.3	42.0	35.4
	<IN>			<IT>			<JP>		
Interest income on loans	4.8	4.1	5.2	2.7	2.4	2.9	1.0	1.0	1.0
Interest income on ex loans	2.2	2.7	1.9	1.2	1.4	1.0	0.6	0.6	0.6
Interest expenses	4.5	3.9	4.8	2.0	2.1	1.9	0.6	0.5	0.6
Net interest income	2.5	2.8	2.4	1.9	1.8	1.9	1.0	1.1	1.0
Non interest income	1.2	0.9	1.4	0.5	0.9	0.2	0.3	0.4	0.2
ROA	1.0	1.0	1.0	0.5	0.8	0.3	0.2	0.4	0.1
ROE	14.8	15.4	14.5	7.3	10.6	4.7	6.3	10.2	2.8
Leverage multiple	15.2	16.2	14.7	13.9	14.0	13.8	25.1	23.9	26.2
Equity-asset ratio	6.6	6.2	6.8	7.2	7.2	7.2	4.0	4.2	3.8
Total capital/RWA	6.7	6.1	7.3	12.9	11.6	14.3	9.0	8.3	9.7
RWA/total assets	55.3	58.8	51.8	57.4	62.3	52.5	56.2	62.9	49.5
Net loans, leases & mortgages	56.9	54.8	58.1	62.0	59.6	64.0	50.9	50.7	51.0

	<KR>			<MX>			<NL>		
Interest income on loans	4.3	4.4	4.2	0.6	0.4	0.7	2.1	1.7	2.5
Interest income on ex loans	1.0	0.9	1.0	9.2	12.0	7.3	1.7	1.8	1.6
Interest expenses	2.9	2.8	3.1	4.6	6.5	3.3	2.8	2.6	3.0
Net interest income	2.3	2.6	2.1	5.2	5.9	4.7	1.0	0.9	1.1
Non interest income	0.3	0.8	-0.1	0.6	1.5	0.0	0.3	0.7	0.0
ROA	0.7	1.1	0.4	1.8	2.5	1.4	0.3	0.4	0.2
ROE	11.4	16.4	6.8	15.6	18.5	13.1	8.7	12.0	5.6
Leverage multiple	15.8	15.4	16.2	8.4	7.5	9.2	28.1	30.3	26.0
Equity-asset ratio	6.3	6.5	6.2	11.9	13.4	10.9	3.6	3.3	3.8
Total capital/RWA	9.5	8.5	10.5	15.7	14.8	16.6	10.4	9.6	11.3
RWA/total assets	65.4	70.7	60.0	81.8	95.2	68.5	36.5	35.7	37.3
Net loans, leases & mortgages	68.5	68.8	68.3	44.9	53.5	39.2	56.1	51.8	60.9
	<US>								
Interest income on loans	1.0	0.2	1.6						
Interest income on ex loans	3.2	4.6	2.0						
Interest expenses	2.2	3.0	1.4						
Net interest income	2.0	1.8	2.2						
Non interest income	1.0	1.6	0.6						
ROA	0.5	0.8	0.3						
ROE	6.0	9.8	3.2						
Leverage multiple	12.1	13.0	11.5						
Equity-asset ratio	8.3	7.7	8.7						
Total capital/RWA	14.6	12.7	16.5						
RWA/total assets	72.6	76.0	69.1						
Net loans, leases & mortgages	51.8	53.1	50.6						

Table A2 Impact of Higher Capital Requirements on Lending Spreads by Countries (Commercial Banks, bp)

		2005-2010				2005-2007				2008-2010			
	Increase in Capital Ratio	No Change in ROE	Fall in ROE per 1pp			No Change in ROE	Fall in ROE per 1pp			No Change in ROE	Fall in ROE per 1pp		
			10bp	15bp	20bp		10bp	15bp	20bp		10bp	15bp	20bp
AU	1pp	-2.7	-4.9	-6.0	-7.1	1.8	-0.3	-1.3	-2.4	-5.1	-7.3	-8.4	-9.4
	2pp	-5.4	-7.7	-8.8	-10.0	3.6	1.4	0.3	-0.7	-10.2	-12.5	-13.6	-14.7
	3pp	-8.1	-10.5	-11.7	-12.8	5.4	3.1	2.0	0.9	-15.3	-17.6	-18.8	-20.0
	4pp	-10.8	-13.3	-14.5	-15.7	7.2	4.8	3.7	2.5	-20.4	-22.8	-24.0	-25.3
	5pp	-13.5	-16.1	-17.3	-18.6	8.9	6.5	5.3	4.1	-25.5	-28.0	-29.3	-30.5
BR	1pp	19.3	16.4	15.0	13.6	23.6	20.6	19.1	17.6	16.4	13.6	12.2	10.8
	2pp	38.6	35.5	33.9	32.4	47.2	44.0	42.3	40.7	32.8	29.8	28.3	26.8
	3pp	57.9	54.6	52.9	51.2	70.8	67.3	65.6	63.8	49.3	46.0	44.4	42.7
	4pp	77.2	73.6	71.8	70.0	94.4	90.7	88.8	86.9	65.7	62.2	60.5	58.7
	5pp	96.5	92.7	90.8	88.9	118.0	114.0	112.0	110.0	82.1	78.4	76.5	74.7
CA	1pp	12.2	10.8	10.1	9.5	17.0	15.7	15.1	14.4	8.8	7.4	6.7	6.1
	2pp	24.3	22.9	22.1	21.4	34.1	32.6	31.9	31.2	17.6	16.2	15.4	14.7
	3pp	36.5	34.9	34.1	33.4	51.1	49.6	48.8	48.0	26.5	24.9	24.1	23.3
	4pp	48.7	47.0	46.2	45.3	68.2	66.5	65.6	64.8	35.3	33.6	32.8	31.9
	5pp	60.9	59.1	58.2	57.3	85.2	83.4	82.5	81.6	44.1	42.3	41.5	40.6
CH	1pp	-4.8	-6.3	-7.1	-7.8	2.1	0.2	-0.8	-1.7	-10.6	-14.7	-16.8	-18.8
	2pp	-9.6	-11.2	-12.0	-12.8	4.1	2.1	1.1	0.1	-21.3	-25.6	-27.7	-29.9
	3pp	-14.4	-16.1	-16.9	-17.7	6.2	4.1	3.0	2.0	-31.9	-36.4	-38.6	-40.9
	4pp	-19.2	-21.0	-21.8	-22.7	8.3	6.1	4.9	3.8	-42.6	-47.2	-49.6	-51.9
	5pp	-24.0	-25.8	-26.8	-27.7	10.3	8.0	6.9	5.7	-53.2	-58.1	-60.5	-63.0

CN	1pp	20.5	18.5	17.6	16.6	19.6	17.5	16.5	15.4	20.9	19.1	18.2	17.3
	2pp	40.9	38.8	37.8	36.8	39.3	37.0	35.8	34.7	41.9	39.9	38.9	37.9
	3pp	61.4	59.1	58.0	56.9	58.9	56.4	55.2	54.0	62.8	60.7	59.6	58.5
	4pp	81.8	79.4	78.2	77.0	78.5	75.9	74.6	73.3	83.7	81.4	80.3	79.1
	5pp	102.3	99.7	98.4	97.2	98.1	95.3	93.9	92.5	104.7	102.2	101.0	99.8
DE	1pp	-1.8	-2.8	-3.3	-3.8	0.5	-0.6	-1.2	-1.7	-3.8	-4.7	-5.1	-5.5
	2pp	-3.6	-4.7	-5.3	-5.8	0.9	-0.3	-0.9	-1.5	-7.7	-8.6	-9.1	-9.5
	3pp	-5.5	-6.7	-7.3	-7.9	1.4	0.0	-0.6	-1.3	-11.5	-12.5	-13.0	-13.5
	4pp	-7.3	-8.6	-9.2	-9.9	1.8	0.4	-0.3	-1.1	-15.4	-16.5	-17.0	-17.5
	5pp	-9.1	-10.5	-11.2	-11.9	2.3	0.7	-0.1	-0.8	-19.2	-20.4	-21.0	-21.6
ES	1pp	10.1	8.8	8.2	7.5	11.8	10.5	9.9	9.2	8.6	7.4	6.8	6.2
	2pp	20.1	18.8	18.1	17.4	23.6	22.2	21.5	20.8	17.2	15.9	15.2	14.6
	3pp	30.2	28.7	27.9	27.2	35.5	33.9	33.1	32.3	25.8	24.4	23.7	23.0
	4pp	40.3	38.6	37.8	37.0	47.3	45.6	44.7	43.9	34.5	32.9	32.1	31.4
	5pp	50.3	48.6	47.7	46.8	59.1	57.3	56.3	55.4	43.1	41.4	40.6	39.8
FR	1pp	-1.6	-3.0	-3.7	-4.4	2.2	0.7	-0.1	-0.9	-4.0	-5.3	-6.0	-6.6
	2pp	-3.1	-4.7	-5.4	-6.2	4.5	2.8	1.9	1.1	-8.1	-9.5	-10.2	-10.9
	3pp	-4.7	-6.4	-7.2	-8.0	6.7	4.9	4.0	3.0	-12.1	-13.7	-14.4	-15.2
	4pp	-6.3	-8.1	-9.0	-9.9	9.0	7.0	6.0	5.0	-16.2	-17.8	-18.7	-19.5
	5pp	-7.9	-9.8	-10.7	-11.7	11.2	9.1	8.0	6.9	-20.2	-22.0	-22.9	-23.8
GB	1pp	2.3	1.0	0.3	-0.4	10.5	9.3	8.7	8.1	-4.2	-4.0	-3.9	-3.8
	2pp	4.6	3.1	2.4	1.7	20.9	19.6	19.0	18.3	-8.4	-8.2	-8.1	-7.9
	3pp	6.9	5.3	4.5	3.7	31.4	30.0	29.3	28.6	-12.6	-12.3	-12.2	-12.1
	4pp	9.1	7.5	6.6	5.8	41.9	40.3	39.6	38.8	-16.7	-16.5	-16.4	-16.3
	5pp	11.4	9.6	8.7	7.8	52.3	50.7	49.9	49.1	-20.9	-20.7	-20.5	-20.4

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IN	1pp	12.5	10.7	9.9	9.0	14.8	13.1	12.3	11.4	10.9	9.2	8.3	7.4
	2pp	24.9	23.1	22.1	21.2	29.6	27.7	26.8	25.9	21.9	20.0	19.1	18.1
	3pp	37.4	35.4	34.4	33.4	44.3	42.3	41.4	40.4	32.8	30.8	29.8	28.8
	4pp	49.9	47.7	46.7	45.6	59.1	57.0	55.9	54.9	43.8	41.6	40.6	39.5
	5pp	62.4	60.1	58.9	57.8	73.9	71.6	70.5	69.3	54.7	52.5	51.3	50.2
IT	1pp	1.2	-0.7	-1.6	-2.5	5.9	3.9	2.9	1.9	-1.8	-3.5	-4.3	-5.1
	2pp	2.3	0.4	-0.6	-1.6	11.7	9.6	8.5	7.4	-3.6	-5.4	-6.3	-7.1
	3pp	3.5	1.4	0.4	-0.7	17.6	15.3	14.1	13.0	-5.5	-7.3	-8.2	-9.2
	4pp	4.7	2.4	1.3	0.2	23.4	21.0	19.7	18.5	-7.3	-9.2	-10.2	-11.2
	5pp	5.9	3.5	2.3	1.1	29.3	26.7	25.4	24.0	-9.1	-11.2	-12.2	-13.3
JP	1pp	8.4	7.1	6.4	5.8	12.6	11.2	10.5	9.8	5.2	4.0	3.4	2.8
	2pp	16.7	15.3	14.6	13.8	25.2	23.6	22.8	22.0	10.5	9.1	8.4	7.8
	3pp	25.1	23.5	22.7	21.9	37.7	36.0	35.1	34.2	15.7	14.2	13.4	12.7
	4pp	33.5	31.7	30.8	29.9	50.3	48.4	47.4	46.4	20.9	19.3	18.5	17.6
	5pp	41.9	39.9	38.9	38.0	62.9	60.8	59.7	58.6	26.1	24.4	23.5	22.6
KR	1pp	7.0	5.7	5.0	4.3	15.1	13.7	13.0	12.3	0.5	-0.8	-1.4	-2.1
	2pp	14.1	12.6	11.8	11.1	30.3	28.7	28.1	27.2	1.0	-0.4	-1.1	-1.8
	3pp	21.1	19.5	18.7	17.9	45.4	43.7	42.9	42.1	1.5	0.0	-0.7	-1.5
	4pp	28.1	26.4	25.5	24.7	60.6	58.7	57.8	56.9	2.0	0.4	-0.4	-1.2
	5pp	35.1	33.3	32.4	31.4	75.7	73.7	72.8	71.8	2.6	0.8	0.0	-0.9
MX	1pp	16.8	13.0	11.1	9.2	22.3	18.4	16.5	14.6	11.6	8.0	6.2	4.4
	2pp	33.5	29.5	27.5	25.5	44.6	40.5	38.4	36.4	23.2	19.3	17.4	15.5
	3pp	50.3	46.1	43.9	41.8	66.9	62.5	60.3	58.2	34.8	30.7	28.7	26.7
	4pp	67.1	62.6	60.3	58.1	89.2	84.5	82.2	79.9	46.3	42.1	39.9	37.8
	5pp	83.9	79.1	76.7	74.4	111.5	106.6	104.1	101.7	57.9	53.4	51.2	48.9

NL	1pp	-5.4	-4.8	-4.5	-4.2	1.2	0.2	-0.3	-0.8	-11.6	-12.3	-12.7	-13.1
	2pp	-10.8	-10.1	-9.8	-9.4	2.3	1.2	0.7	0.1	-23.2	-24.0	-24.4	-24.8
	3pp	-16.1	-15.4	-15.0	-14.7	3.5	2.3	1.7	1.1	-34.8	-35.7	-36.1	-36.6
	4pp	-21.5	-20.7	-20.3	-19.9	4.7	3.3	2.7	2.0	-46.4	-47.3	-47.8	-48.3
	5pp	-26.9	-26.0	-25.6	-25.2	5.8	4.4	3.7	3.0	-58.0	-59.0	-59.5	-60.0
US	1pp	6.2	3.4	1.9	0.5	13.1	10.4	9.0	7.7	1.5	-1.4	-2.9	-4.3
	2pp	12.5	9.4	7.9	6.3	26.2	23.3	21.8	20.4	3.0	-0.1	-1.6	-3.2
	3pp	18.5	15.5	13.8	12.2	39.3	36.2	34.7	33.1	4.5	1.3	-0.4	-2.0
	4pp	25.0	21.5	19.8	18.1	52.4	49.1	47.5	45.8	6.1	2.6	-0.9	-0.9
	5pp	31.2	27.6	25.7	23.9	65.5	62.0	60.3	58.5	7.6	3.9	2.1	0.3

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