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The Basel III Net Stable Funding Ratio and bank net interest margins

Michael R. King*

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Abstract

The Net Stable Funding Ratio (NSFR) is a new Basel III liquidity requirement designed to limit funding risk arising from maturity mismatches between bank assets and liabilities. This study explains the NSFR and estimates this ratio for banks in 15 countries. Banks below the ratio need to increase stable sources of funding and to reduce assets requiring funding. The most cost-effective strategies to meet the NSFR are to increase holdings of higher-rated securities and to extend the maturity of wholesale funding. These changes reduce net interest margins by 70 to 88 basis points on average, or around 40% of their year-end 2009 values. Universal banks with diversified funding sources and high trading assets are penalized most by the NSFR.

JEL Classification: G21; G28; E51

Keywords: banks, funding risk, liquidity, regulation, Basel III, net interest margins.

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“The proposals on bank capital and liquidity by the Basel Committee on Banking Supervision... are very significant. If the final form of the proposals, known as Basel III, is reasonably similar to the consultative version, we believe that the reforms are likely to .. trigger fundamental changes in business models and product pricing.”

Standard & Poor’s (2010)

1. Introduction

This paper presents the first comprehensive assessment of the Net Stable Funding Ratio (NSFR), a new Basel III liquidity requirement that addresses maturity mismatches between bank assets and liabilities (BCBS 2010a). The paper outlines how the NSFR is calculated and estimates the ratio for the representative bank in 15 countries. For banks that are below the minimum threshold, I examine different strategies to meet the NSFR and estimate the impact of these changes on bank net interest margins (NIMs).¹

The representative bank in the United States, Japan, and three emerging markets appear to exceed the target NSFR. In the remaining 10 countries, the representative bank appears to have a ratio below the required threshold. The most cost-effective strategies to increase the NSFR appear to be to increase holdings of higher-rated, liquid assets and to extend the maturity of wholesale funding. These changes are estimated to reduce bank NIMs in these 10 countries by 79 basis points on average, or around 40% of their year-end 2009 values. Banks in France, Germany, Switzerland and the UK should see the greatest fall in NIMs. They are estimated to have the lowest starting NSFRs due to their more diversified funding model that relies less on deposits and more on shorter-maturity funding, combined with larger holdings of trading assets

¹ Studies looking at bank profitability and net interest margins include Angbazo (1997), Lepetit et al. (2008), Maudos and Solis (2009), Memmel (2010), Rosen (2007), and Saunders and Schumacher (2000).

that must be fully funded. In these four countries, a more radical restructuring of bank balance sheets will be required to meet the NSFR, leading to a greater decline in NIMs.

During the 2007-2009 financial crisis banks in many countries suffered liquidity shortages due to the dislocation of wholesale bank funding markets. The most vulnerable banks funded long-term assets with short-term debt and were unable to rollover their borrowing (Acharya and Merrouche 2010; Afonso et al. 2011; Brunnermeier 2009; Diamond and Rajan 2009; Gorton 2009; Huang and Ratnovski 2011). These banks and other financial intermediaries became illiquid or insolvent following major losses on their US sub-prime investments and required public sector support. The most high profile case was the UK's Northern Rock, which was nationalized in February 2008 (Goldsmith-Pinkham and Yorulmazer 2010; Shin 2009).

In December 2010 the Basel Committee on Banking Supervision (BCBS) announced a package of reforms known as Basel III to address the vulnerabilities exposed by the crisis (BCBS 2010b). Two of the most controversial elements are the new liquidity requirements, namely the Liquidity Coverage Ratio (LCR) and the NSFR. The LCR addresses liquidity risk and is designed to ensure banks have adequate liquidity to survive one month of stressed funding conditions.² The NSFR addresses funding risk and is designed to promote structural changes in the risk profiles of banks away from short-term funding mismatches and toward more stable, longer-term funding of assets. Banks that do not meet the NSFR need to reduce assets requiring stable funding and to increase stable sources of funding.

² This study does not estimate the LCR as the data required to calculate this ratio is not available. Banks must calculate the LCR based on what their cash outflows might be during a period of market stress. These outflows will be bank-specific and not easily estimated.

This study highlights the tradeoffs between liquidity regulation, bank risk and profitability. The NSFR is designed to encourage banks to hold more high-quality, unencumbered, liquid assets and to increase funding from stable sources such as deposits, longer maturity debt, and equity.³ These changes should increase the resilience of banks during stressful periods. De-risking the bank in this way should bring some benefits, such as increasing capital ratios, lowering the cost of capital and increasing charter value. The tradeoff, however, is lower profitability during normal times. Holding fewer illiquid assets and more high-quality assets that cannot be pledged as collateral will lower interest income. Funding assets with longer maturity liabilities will increase interest expense. The resulting decline in net interest income combined with the increase in interest earning assets will cause NIMs to decline. Bank submissions to the BCBS suggest the liquidity requirements may dramatically and adversely impact bank business models and profitability. Concerned about potential unintended consequences, regulators have delayed implementation of the LCR until 2015 and the NSFR until 2018.

The tradeoff between liquidity and profitability is recognized in models of banking. Diamond and Rajan (2001) model how the fragility of bank deposits mitigates the ability of banks to extract rents from entrepreneurs. If bank funding via deposits was not fragile, banks would charge more for intermediation services, reducing liquidity creation. Liquidity regulations may also lead banks to take on more risk in other areas. Modeling and estimating the cost-benefit trade-off between liquidity regulation and welfare is an important area of future research.

Ideally researchers would use micro-data to study how banks may respond to the Basel III liquidity requirements. Unfortunately the data does not yet exist, even for national

³ Encumbered assets on the balance sheet must be funded at 100%, unless there is less than a year remaining in the encumbrance period. In that case, the assets are treated as “unencumbered”.

supervisors. The BCBS's 2009 quantitative impact study (QIS) found that only two-thirds of the 263 banks surveyed could calculate the NSFR, with the remaining third unable to calculate the ratio (BCBS 2010c).⁴ In the absence of better data, this study uses Bankscope data to estimate the NSFR and then outlines what balance sheet changes would be necessary to meet the target ratio. The estimates in this study are indicative of the potential costs but are only preliminary; this review highlights potential behavioral responses and possible unintended consequences. Analysis of this type should be useful for suggesting revisions to the NSFR before it is implemented in 2018.

The paper proceeds as follows. The second section reviews three concepts of liquidity to explain what the NSFR is targeting. The NSFR is designed to reduce funding liquidity, with implications for liquidity creation and potentially market liquidity. The third section describes the NSFR and how it is calculated. The fourth section describes the data, and provides stylized facts on the composition of bank balance sheets and NIMs. The fifth section outlines strategies to meet the NSFR, estimates the impact on NIMs in countries where the ratio is too low, and takes a closer look at the European banks that exhibit the greatest decline in NIMs. The final section concludes.

2. Funding risk, liquidity risk and regulation

This section outlines three concepts of liquidity – market liquidity, funding liquidity, and liquidity creation – in order to highlight which type is targeted by the NSFR. Briefly, the NSFR is designed to reduce *funding risk* arising from the mismatch between assets and liabilities, while

⁴ Two and a half years later, the BCBS update of this QIS exercise in June 2012 found that 209 could calculate the NSFR, although no details were provided (BCBS 2013a).

the LCR addresses *liquidity risk* by increasing bank holdings of high-quality, liquid assets. While not targeted directly, banks' role in *liquidity creation* and *market liquidity* may be adversely affected as an unintended consequence. These italicized terms are defined below. While liquidity is a major feature of banking models, to my knowledge there are no theoretical or empirical studies of liquidity regulation and no existing studies of the NSFR.

Brunnermeier and Pedersen (2009) distinguish market liquidity and funding liquidity and model how they are related. *Market liquidity* describes the cost of selling assets (Strahan 2010). Market liquidity is high when an agent can sell an asset with immediacy near its fundamental price while paying low transaction costs. The Basel III liquidity requirements do not target market liquidity, although they may affect it by increasing the cost of intermediation and changing the demand for assets with specific characteristics (i.e. high credit quality, longer maturity).

Funding liquidity is the ease with which an institution can obtain funding (Brunnermeier and Pedersen 2009) or the ability to raise cash on short notice (Strahan 2010). *Funding risk* refers to a bank's ability to raise funds in the desired amounts on an ongoing basis (CGFS 2010). It is closely related *liquidity risk*, which is ability to finance cash outflows at any given point in time. If liquidity risk refers to the asset side of the balance sheet, then funding risk refers to the liability side.

Citing a large literature on the topic, Berger and Bouwman (2009) argue that banks exist because they create liquidity and transform risk.⁵ *Liquidity creation* refers to the provision of

⁵ Allen and Carletti (2010), Berger et al. (2010) and Strahan (2010) summarize the extensive literature on the role of banks in liquidity creation. Allen and Saunders (2010) provide a summary of studies of bank risk management.

financing to the real economy. Banks create liquidity on-balance sheet by financing relatively illiquid assets with relatively liquid liabilities. Banks also provide access to alternative sources of finance through off-balance sheet operations, such as loan commitments. Risk transformation is part of this process, as banks issue riskless deposits to finance risky loans, taking on maturity and currency mismatches as well as other risks.

The liquidity creation and risk transformation roles of banks renders them intrinsically vulnerable to both funding risk and liquidity risk. Summarizing the extensive literature on these topics, Strahan (2010) argues that banks have a special advantage in managing these risks because of the structure of bank balance sheets as well as their access to deposit insurance, government guarantees and central bank liquidity. The 2007-2009 financial crisis, however, exposed the weakness of banks' risk management; Basel III is part of the regulatory response to the failure of bank risk management.

While the Basel III rules may represent the first attempt by international regulators to introduce harmonized minimum standards for liquidity (Standard & Poor's 2010), liquidity risk has long been central in models of bank runs (Diamond and Dybvig 1983), capital regulation and narrow banking (Diamond and Rajan 2001) and financial contagion (Allen and Gale 2000). While deposit insurance is widely seen as the solution to prevent depositor runs, the runs that occurred during the recent crisis occurred in wholesale funding markets, whether in federal funds (Afonso et al. 2011), interbank markets (Acharya and Merrouche 2013), repo markets (Gorton 2009) or securitized markets (Brunnermeier 2009).⁶

⁶ Huang and Ratnovski (2011) model how the reliance on short-term wholesale funding increases the vulnerability of banks.

Several banking models have implications for the regulation of liquidity. Diamond and Rajan (2001) argue that regulations on capital requirements and narrow banking may reduce liquidity creation. By reducing the financial fragility of banks, liquidity regulation would have the same effect as capital requirements or deposit insurance – they would strengthen banks’ ability to extract rents from entrepreneurs and increase the cost of borrowing, leading to lower credit demand. Repullo (2005) shows that the existence of a lender-of-last resort (LOLR) results in banks holding a lower level of liquid assets as they rely on the LOLR for liquidity, increasing the probability that the bank will require emergency liquidity assistance. By forcing banks to hold more liquid assets, liquidity regulation may reverse this effect and reduce the need for LOLR assistance. Finally, Acharya et al. (2011) model the implications for bank liquidity choices from different crisis resolution policies. While interventions to resolve banking crises may be desirable ex post, liquidity support to failed banks or unconditional support to surviving banks reduces incentives to hold liquidity. Again liquidity regulations may mitigate the moral hazard problem but with potential unintended consequences for the economy.

An open question is whether liquidity regulation will increase bank risk taking. The capital regulation literature is mixed on whether higher regulatory requirements lead banks to increase risk taking.⁷ Theoretical models by Hellmann et al. (2000), Jeitschko and Jeung (2007), Milne (2002), and Repullo (2004), among others, argue the implications are not straight-forward as they depend on the level of competition, the incentives facing managers, and the interaction with other regulatory instruments. The empirical literature is also mixed. González (2005), for example, finds that regulatory restrictions increase banks’ risk-taking incentives by reducing their

⁷ Santos (2001) and VanHoose (2007) are recent summaries of the literature on bank capital regulation.

charter value, while Laeven and Levine (2009) argue the relation depends critically on each bank's ownership structure. One conclusion is that the same regulation can have different effects depending on bank, industry and country characteristics. We leave the question of how liquidity regulation may affect bank behavior and liquidity creation to future research.

3. The Net Stable Funding Ratio

Between July 2009 and December 2010, the BCBS announced a series of reforms known as Basel III to increase the resilience of the banking sector (BCBS 2010b). To address the funding vulnerabilities typified by Northern Rock, the BCBS proposed two new liquidity requirements, the NSFR and the LCR (BCBS 2010a). The initial proposals published for comment in November 2009 were modified when released in December 2010. The LCR formula and timetable was revised again in January 2013, but plans for the NSFR were unchanged.

The LCR identifies the amount of unencumbered, high-quality, liquid assets that banks need to survive one month without access to wholesale funding while still being able to offset cash outflows. The focus is reducing liquidity risk by increasing the quantity of assets that banks can convert to cash during a stressful period. The January 2013 revision expanded the definition of high-quality liquid assets and modified the assumptions about cash inflows and outflows (BCBS 2013b). The LCR requirement will still become effective on 1 January 2015, but initial minimum threshold has been reduced to 60%, rising by 10 percentage points each year to reach 100% on 1 January 2019. Given that data on inflows and outflows are not available, this study does not attempt to estimate the LCR.

The NSFR is a longer-term structural ratio that addresses funding risk, namely the inability of banks to raise funding when needed. It covers on- and off-balance sheet items and

pushes banks to fund long-term illiquid assets with long-term capital. Currency mismatches and cross-border funding risk are only addressed indirectly by limiting the assets given credit in the ratio. As of this writing, the NSFR has not been modified and the timetable for initial implementation remains 1 January 2018.

3.1 Calculating the NSFR

Equation (1) presents a simplified version of the NSFR (BCBS 2010a). Appendix A provides more details on the components and factor weights.

$$\begin{aligned}
 NSFR &= \frac{\text{Available stable funding}}{\text{Required stable funding}} \\
 &= \frac{\text{Equity} + \text{Liabs}_{>1\text{yr}} + (\text{StableDeposits}_{<1\text{yr}} \cdot 90\%) + (\text{OtherDeposits} \cdot 80\%) + (\text{StDebt} \cdot 50\%)}{(\text{GovtDebt} \cdot 5\%) + (\text{CorpLoans}_{<1\text{yr}} \cdot 50\%) + (\text{Mtgs} \cdot 65\%) + (\text{RetLoans}_{<1\text{yr}} \cdot 85\%) + (\text{Other} \cdot 100\%)} \quad (1)
 \end{aligned}$$

The NSFR numerator measures the sources of Available Stable Funding (ASF), with greater weight given to sources that are least likely to disappear under stressed market conditions. Equity, longer-term wholesale funding and longer-term liabilities are the most stable forms of funding, followed by deposits and short-term wholesale funding maturing in less than one year. Interbank funding is not viewed as a stable funding source and is given a 0% weight.

The NSFR denominator shows a bank's Required Stable Funding (RSF), with a factor (or haircut) based on an asset's expected liquidation value under stressed circumstances. Cash, securities with less than 1 year to maturity, and interbank claims do not have to be funded and have a factor of 0%. Qualifying government debt with a 0% risk-weight is considered highly liquid and must only be funded at 5% of face value. Corporate loans and retail loans that mature within one year must be funded 50% and 85%, respectively. Residential mortgages of any maturity as well as corporate loans greater than one-year in maturity must be funded at 65%. All remaining assets must be funded at 100%.

3.2 Strategies to increase Available Stable Funding

To meet the target NSFR, banks must have ASF greater than their RSF. Banks that need to increase their NSFR can pursue a number of strategies that are shown in Figure 1. A bank's preferred strategy depends on a cost-benefit analysis, which will vary based on each bank's specific situation. The discussion below outlines a number of options.

A first strategy is to increase the share of funding from deposits (Box 1.1). Deposits represent around half of bank funding on average, rising to as much as 80% in some jurisdictions. The NSFR views commercial and retail deposits as sticky and less likely to flee during stressed conditions, particularly more stable deposits covered by deposit insurance or a government guarantee (Box 1.1a). Stable deposits are given a factor of 90%, recognizing that some are expected to run off during stressed conditions. Less stable deposits have a factor of 80% and include high-value deposits, deposits from high net worth individuals, deposits that can be withdrawn quickly (e.g. internet deposits) and foreign currency deposits. While banks may wish to increase deposits, competition should increase their cost at the margin. The ability to increase the NSFR by raising deposits is likely limited and depends on local conditions.

A second strategy is to extend the maturity of wholesale funding beyond one year (Box 1.2). Liabilities with an effective maturity of greater than one year receive a factor of 100% versus 50% for wholesale funding below one year. Note that interbank borrowing is assigned a 0% factor, as this source is not expected to be stable during stressed conditions.

While debt maturity extension increases the numerator of the NSFR, it also raises interest expense as the cost of longer-term wholesale funding is higher than shorter-term funding in most yield-curve environments. Higher interest expense, all else equal, leads to a fall in NIMs. To

measure the cost of this strategy, wholesale funding must be allocated between a portion of debt maturing within one year (ρ_t) and a remainder of longer-term debt (equation 2).

$$\text{WholesaleFunding}_t = \text{Debt}_t \cdot \rho_t + \text{Debt}_t \cdot (1 - \rho_t) \quad (2)$$

Third, banks can increase their ASF by increasing the share of Tier 1 capital (Figure 1, Box 1.3). Under Basel III, the predominant form of Tier 1 capital must be tangible common equity or instruments that are subordinated, have fully discretionary non-cumulative dividends and have neither a maturity date nor an incentive to redeem (i.e. non-cumulative, perpetual preferred shares). Innovative hybrid capital instruments are being phased out. Given this new definition, any Tier 1 capital increase will increase shareholder's equity and reduce return on equity. Theoretically, a bank's equity is the most expensive form of capital due to its higher risk and residual claim. Empirically, banks' Tier 1 capital as a share of total assets is small, implying that a significant increase in equity would be required to raise ASF. Increasing equity is therefore likely the most expensive and least desirable strategy to improve the NSFR.

The costs of these strategies –increasing the share of deposits, extending the maturity of debt, increasing the share of Tier 1 capital – varies by funding sources. A bank's financial statements do not separately disclose the costs of interbank funding, deposits, and wholesale funding. Instead these costs are aggregated and reported as interest expense. A bank's interest expense can be approximated by equation 3.

$$\begin{aligned} \text{IntExp}_t = & R_{\text{deposits}} \times \text{Deposits} + R_{\text{Debt} \leq 1 \text{ year}} \cdot (\text{Interbank funding} + \text{Debt}_t \times \rho_t) \\ & + R_{\text{LtDebt}} \times \text{Debt}_t \times (1 - \rho_t) \end{aligned} \quad (3)$$

where R_{deposits} is the cost of deposits, $R_{\text{Debt} \leq 1 \text{ Year}}$ is the cost of wholesale funding maturing within one year and R_{LtDebt} is the cost of longer-term wholesale funding. These costs will depend on a bank's credit rating, business model, and market-specific factors.

In summary, this discussion leads to the following empirical predictions:

H1: Banks will prefer to raise deposits or to extend the maturity of debt than issue equity due to the higher cost of equity.

H2: Banks will increase the share of funding from deposits, but at a higher average cost.

H3: Banks with wholesale funding below one year in maturity will increase the maturity beyond one year.

3.3 Strategies to reduce Required Stable Funding

The complement (or alternative) to reducing ASF is to increase RSF by reducing or modifying a bank's assets.

First, banks can reduce RSF shrinking their balance sheets (Figure 1, Box 2.1). When deciding whether to shrink their balance sheets, banks should rationally conduct a cost-benefit analysis that compares the rate earned on an asset against the bank's cost of capital. Given that regulation will increase the costs of some assets, businesses that were NPV positive may become uneconomic. While asset sales may be optimal for an individual bank, this strategy across the banking sector could have adverse consequences for banks' profitability and the macroeconomy.

Banks can shrink their balance sheets by reducing the size of their loan portfolio (Box 2.1a) or by selling other assets (Box 2.1b). The cost of reducing the loan portfolio may be high. Loans and mortgages are higher yielding assets where banks have a comparative advantage over other financial intermediaries (Strahan 2010). By substituting loans for more liquid securities, banks would forego the loan spread and possibly incur a negative cost of carry relative to its cost of capital. This strategy is likely to be more costly and less attractive than other options.

Another option to shrink the balance sheet is to sell assets that must be funded at 100%, such as trading assets and fixed assets (Box 2.1b). Any reduction in trading assets would be associated with a fall in trading revenues, leading to lower non-interest income and profitability. Fixed assets may be required to support a bank's lending operations, so may not be feasible.

A second option to reduce RSF is to change the composition of investments (Box 2.2), either by selling illiquid investments and holding more cash (Box 2.2a) or by holding investments with less credit risk (Box 2.2b). For example, banks may hold fewer BBB-rated bonds and increase holdings of either cash or AAA-rated bonds. Cash and highly-rated securities have a 0% factor, implying that no additional funding must be held against them.⁸ This strategy is expensive, however, as these cash and AAA-rated securities would likely have a negative cost of carry vis-à-vis a bank's cost of capital. This substitution would reduce interest income, with the cost being a function of the difference in returns (or opportunity cost, θ_t). The ability to lower the RSF by shifting the composition of investments is limited by the quantity of investments relative to total assets. If the quantity of investments is small, banks may be required to change the composition of their assets more broadly.

A third strategy is to change the composition of the loan book (Box 2.3.). Under the NSFR, corporate loans and mortgages must be funded at 65% while retail loans require 85%. All else equal, this weighting should lead banks to favor commercial loans and mortgages over retail loans (Box 2.3a). The ability to switch between loan types will depend on a number of factors that are beyond the scope of this study, such as the elasticity of loan demand, the availability of substitutes and the competitive environment.

⁸ Recognizing the potential adverse consequences to bank funding markets, regulators have assigned a 0% factor to repos and non-renewable interbank claims with a maturity less than one year.

Another variation is to reduce the maturity of corporate loans to less than one year in maturity, which reduces their funding requirement to 50% (Box 2.3b). While this change would benefit banks, it would impose a cost on a bank's customers, as they will bear greater rollover risk on their borrowing. To make such a strategy more palatable, banks might try to offer contingent credit lines to their customers that effectively extend the maturity of the loan. The undrawn amount of committed credit and liquidity facilities must only be funded at 5%, bringing the factor weight of the combined short-maturity loan plus credit line to 55%. The weighting of other contingent funding obligations, however, is left to the discretion of national supervisors. By charging a higher haircut, supervisors could make this strategy unattractive.

A final option is to substitute assets that must be funded at 100% for assets with a lower factor weight (Box 2.4). Assuming banks have this ability without compromising their retail or trading operations, this study assumes the cost of this strategy is the same as substituting BBB-rated with AAA-rated bonds (equation 4):

$$OtherIntIncome_{t+1} = OtherIntIncome_t + [Investments_{t+1} \cdot \Delta(1 - \theta_{t+1}) \cdot xs_{inv}] + (\Delta OtherAssets \cdot xs_{inv}) \quad (4)$$

where xs_{inv} is the excess return earned on investments over the risk-free rate. xs_{inv} can be proxied by the credit spread between AAA-rated bonds and government bonds.

In summary, this discussion leads to the following empirical predictions:

H4: Banks may be expected to shrink their balance sheets on average.

H5: Banks will prefer to reduce investments and other assets rather than loans due to the higher return on loans and banks' comparative advantage in liquidity creation.

H6: Banks will change the composition of their loan books to hold a greater share of commercial loans and mortgages and a lower share of retail loans.

H7: Banks will increase the share of their loans that have a final maturity below one year, and increase contingent credit and liquidity facilities.

H8: Banks will substitute lower-rated securities for higher-rated securities and cash.

H9: Banks will reduce the share of assets that must be funded at 100% such as trading assets.

3.3 Empirical predictions for net interest margins

The balance sheet changes described above to increase the NSFR will have the following predicted impact on a bank's NIMs:

H10: Banks that need to meet the NSFR will experience a decline in net interest margins relative to banks that already meet the ratio.

a: The decline in NIMs will be greater when the yield curve is steeper due to the higher cost of extending wholesale funding.

b: The decline in NIMs will be greater when the credit spread between higher-rated and lower-rated securities is wider due to the rebalancing towards higher-rated securities.

c: The decline in NIMs will be greater when the excess return (or illiquidity premium) between less liquid and more liquid assets is greater due to the rebalancing towards more liquid assets.

4. Stylized facts on bank balance sheets and net interest margins

Having outlined the different strategies to raise the NSFR and their expected costs, this section provides stylized facts on bank balance sheets and NIMs in 15 countries. The data is as of

year-end 2009, although results over a longer time period present a similar picture.⁹ These data are used to create the representative bank in each country.

4.1 Data and descriptive statistics

I collect income statement and balance sheet data from Bankscope for all banks in the following countries: Australia (AU), Canada (CA), Chile (CL), France (FR), Germany (DE), Hong Kong (HK), Italy (IT), Japan (JP), Korea (KR), Mexico (MX), Netherlands (NL), Spain (ES), Switzerland (CH), United Kingdom (UK), and the USA (US). The sample consists of commercial banks, investment banks, savings and cooperative banks, and mortgage banks with total assets of \$100 million or greater. I use the consolidated entity where available, taking the last filing in a calendar year. Financial statements are based on IFRS where available, except for US banks where local GAAP is used. Deposit, loan and policy rates are from the IMF; 1-month interbank offer rates and risk-free rates are from Bloomberg.

Table 1 provides details of the final sample of 549 banks. The largest number are headquartered in the United States (106 banks) and Japan (122 banks). Given that the NSFR is a global standard, the sample includes banks from a number of emerging market economies: Chile, Hong Kong, Korea, and Mexico. The sample is heavily weighted towards commercial and bank holding companies (67%), followed by cooperative and savings banks (24%), mortgage banks (5%) and investment banks (4%).

[Enter Table 1 here]

Table 2 shows the income statement and balance sheet for a representative bank from each country, based on the average of a country's banks weighted by total assets. All items are

⁹ Averages taken over the 20-year period from 1990 to 2009 are available upon request.

shown as a percentage of total assets to allow comparability across countries. The first column shows the mean of the sample, revealing considerable heterogeneity in assets and funding across countries. These differences are important for explaining the variation in NSFR estimates and the impact on NIMs below.

Interest income was 3.7% of total assets on average, generated from interest earning assets (interbank claims, net loans and investments). Interest expense averaged 1.9% of total assets, payable on deposits, interbank funding and wholesale funding. Net interest income was 1.8%, with variation from a low of 0.8% in Germany to a high of 4.5% in Mexico. Non-interest income from fees, trading and commissions was an important source of revenues at 1.3% of total assets, with the US highest at 2.7%.

[Enter Table 2 here]

Total revenues averaged 3.1% of total assets, ranging from 1.2% (Japan) to 7.0% (Mexico). Total operating expenses amounted to 2.5% on average, with expenses the lowest in countries featuring a large number of banks such as Japan (1.3%) and Germany (1.2%). The average ratio of net income to total assets (or return on assets) was 0.5% across the sample, with the highest profitability in the emerging market economies and the lowest in Europe and the United States. In 2009 banks in Germany, Japan and the Netherlands suffered losses on average.

Table 2 also shows the consolidated balance sheet for a representative bank in each country. Loans net of provisions represented 51.0% of bank assets, followed by trading-related assets (16.4%), investments (15.0%) and interbank claims (7.7%). Cash holdings were 3.0% of total assets on average, with US banks at 5.2%. The average bank's assets were funded primarily by deposits (46.9%), trading-related liabilities (15.6%), wholesale funding (15.0%), and

interbank borrowing (8.2%). Shareholder's equity represented 6.4% of total assets. Risk-weighted assets represented 54.4% of total assets, with a Tier 1 capital ratio of 11.1%.

5. Estimates of NSFR and impact on net interest margins

This section estimates the NSFR for the representative banks in the sample countries. In cases where the weighted-average bank does not meet the NSFR, the balance sheet changes in Figure 1 are implemented and the impact on NIMs is estimated.

Table 3 provides a summary of the NSFR and NIM estimates by country. I work through the calculation of the NSFR and the NIM for each representative bank in greater detail below. The top half of the table shows the estimate of the NSFR and any gap relative to the target of 1.0 or greater. Based on the assumptions outlined below, the representative bank in 5 countries meets the NSF: Chile (1.05), Hong Kong (1.46), Japan (1.27), Korea (1.07) and the United States (1.11). Banks in the remaining countries must increase their NSFR ratios, with the biggest gaps estimated for banks in France, Switzerland, Germany, and the UK.

[Enter Table 3 here]

The bottom half of Table 3 shows the NIMs by country. The average NIM was 2.5% with considerable variation across countries. I estimate that meeting the NSFR will lead NIMs to fall by 79 basis points in the 10 countries with ratios below the threshold, or an average of 40% of their year-end 2009 values. It would be misleading to place too much importance on these point estimates given the imprecision of this exercise. What these estimates do suggest is that banks in a number of European countries will likely need to make significant changes to their balance sheets to meet the NSFR requirement.

5.1 Starting assumptions for calculating the NSFR

As described earlier, banks do not disclose or collect the detailed data required to calculate the NSFR. Given this shortcoming, this section illustrates the calculation of the NSFR based on the mean values reported for the 19 U.S. bank holding companies that participated in the US Treasury's May 2009 stress testing exercise (known as the Supervisory Capital Assessment Program):

- 70% of deposits are stable
- 50% of wholesale funding is less than 1 year in maturity
- 18% of investments are less than 1 year in maturity
- Government securities represent 20% of investments
- Loans are evenly split between corporate and retail
- 20% of corporate and retail loans are less than 1 year in maturity
- Committed but undrawn credit lines and other contingent liabilities together represent 6% of total assets

Table 4 illustrates the NSFR calculation for the representative bank for the five countries where the estimated values are above the minimum threshold. Column (1) shows the factors used to weight the different balance sheet items. Column (2) shows the product of each factor with the specific balance sheet item based on data in Table 2. For example, the average bank had shareholder's equity of 6.4% of total assets. Given a factor of 100%, shareholder's equity had a weight in the ASF of 0.064. Similarly, cash is not required to be funded and has a factor weight of 0%, leading to zeros in all columns.

[Enter Table 4 here]

These assumptions and the country-specific inputs generate an average NSFR for this sample of 0.99 – an estimate that is the close to the average reported in the BCBS’s QIS report (BCBS 2010c). The ASF is around 0.663 (numerator) and RSF is around 0.675 (denominator). To meet the NSFR, either stable funding sources must be increased or assets requiring stable funding must be decreased.

Column 3 of Table 4 shows that the representative US bank had an NSFR of 1.11, suggesting the weighted-average bank is above the threshold. Many US banks will still need to adjust, however, as all banks must be above the ratio. As seen in Table 2, US banks had higher than average levels of shareholder’s equity (9.6% of total assets), contributing to a higher ASF. The smaller loan portfolio (39.2% of total assets) relative to the overall sample (52.2%) contributed to a lower RSF. In Japan’s case, the high NSFR is explained by the high level of deposits (72.5% of total assets) and the low level of assets that require funding at 100%. Consistent with feedback provided to the BCBS, many emerging market economies appear to meet the minimum requirement as seen for Chile (1.05), Hong Kong (1.46) and Korea (1.07).

5.2 Changes required to meet NSFR

Given starting estimates for the representative bank in each country, the next step is to estimate what balance sheet changes may be required to either increase ASF and/or to reduce RSF. These strategies have different costs. To illustrate the costs, I make the following assumptions:

1. The yield curve is upward sloping and the cost of wholesale funding greater than 1 year in maturity is 100 basis points higher than funding less than 1 year. This value is used to calibrate a representative bank’s cost of wholesale funding using equations 2 and 3.

2. The opportunity cost (θ_i) between lower-rated, less liquid investments and high-quality liquid investments is 200 basis points.
3. The excess return ($x_{S_{inv}}$) earned on investments over government securities is 100 basis points. This spread is used to estimate the cost of increasing investments and reducing other assets using equation 4.

Table 5 provides examples of the changes required to meet the NSFR for the representative bank in Australia, Germany and the United Kingdom. To highlight the impact, only non-zero changes are shown.

[Enter Table 5 here]

For the representative Australian bank, one option is to extend the maturity of wholesale funding. Then investments are increased as a share of total assets, with other assets declining by an off-setting amount. Finally, the composition of investments is altered to increase holding of high-quality liquid bonds and to reduce lower-quality investments. These changes increase the ASF and reduce the RSF leading the NSFR to increase to the target ratio of 1.0.

Similarly the representative German bank could improve its NSFR by extending the maturity of wholesale funding and increasing the allocation to high quality securities. Unlike the case in Australia, however, these actions are not sufficient. The starting quantity of investments was already high at 16.7% of total assets (the fifth highest in the sample) and the quantity of other assets small at 4.0%. There is little room to substitute between these categories. In this example, more radical changes are required. Reducing the maturity of investments to below 1 year reduces RSF further but is not sufficient. Another option is to increase the share of corporate loans relative to retail loans, and to shorten their maturity. Finally, some investments

are sold with cash holdings increasing. This combination of changes reduces RSF sufficiently to meet the NSFR of 1.0.

Finally, Table 5 shows that the representative UK bank gains little from extending wholesale funding beyond one year. In the UK case, numerous changes are made to reduce RSF with only mortgages and contingent liabilities unaffected. These changes are indicative of the magnitude of changes required by UK banks to meet the NSFR.

Banks in each country will need to decide what is feasible and identify the most cost-effective strategies based on their own circumstances. The changes may go beyond simply changing the composition of existing balance sheets; banks may also need to exit some businesses or adopt new business models.

5.3 Impact on net interest margins across countries

Table 6 summarizes the illustrated changes employed for the 10 countries where the representative bank's NSFR is below the threshold. The first row indicates that the average country's bank needs to increase its ratio by 0.11.

[Enter Table 6 here]

Columns 2 to 9 summarize changes to bank assets to reduce RSF and the impact on interest income. As discussed earlier, banks can increase their NSFR by holding more government bonds (column 2) as a share of investments (column 3). Column 4 shows that in the case of four countries, cash holdings are increased. Columns 5 and 6 show the rebalancing between corporate and retail loans to take advantage of the lower RSF for corporate loans. All else equal, an increase in cash and investments must be offset by a fall in other assets (column 7). These changes increase interest earning assets (column 8) and reduce interest income (column 9).

Columns 10 and 11 illustrate possible changes to ASF and the impact on interest expense. Banks can increase ASF by extending the maturity of wholesale funding beyond one year (column 10), which increases interest expense (column 11). This strategy is likely less costly than issuing equity and more feasible than competing for more deposits.

Finally, columns 12 to 14 highlight the change in net interest income and NIMs. The strategies illustrated here reduce net interest income by -0.4 percentage points on average (column 12). The fall in net interest income combined with the rise in interest earning assets leads to a fall in NIMs (column 13). NIMs are shown to fall by 79 basis points or around 40% of the year-end 2009 value. This decline is large and significant, with considerable variation across countries.

5.4 Sensitivity of changes in net interest margins to assumptions

The estimates for the change in NIMs in this study are sensitive to the assumptions, as outlined in hypothesis 10 in Section 4. Table 7 shows how key assumptions affects the cost to meet the NSFR. Overall these sensitivity analyses highlight that the impact on NIMs can vary, with the average impact ranging from 70 to 88 basis points. Individual countries show greater variation based on the composition of their balance sheets and other country-specific factors.

[Enter Table 7 here]

First, the exercise is based on estimates of the cost to extend the maturity of wholesale funding, holding shareholders equity and deposits unchanged. The cost of maturity extension depends on the shape of the yield curve. If the yield curve is either steeper (or flatter), the cost of this maturity extension will rise (or decrease). In this study, the base case assumption is that longer-maturity debt costs 100 basis points more than short-term debt. Table 7 shows that the

average change in NIMs rises to 86 basis points if the yield curve is assumed to be 200 basis points, but declines to 71 basis points if the yield curve is flat. This change is in line with hypothesis 10a. There is still an additional cost with a flat yield curve as changes in the maturity of wholesale debt are only one of several steps required to meet the NSFR target.

Second, the estimates rely on the assumption of how much interest income is lost by switching investments from lower quality assets into higher-quality assets. Riskier investments are assumed to generate a higher return. In this analysis, the opportunity cost of holding higher-quality liquid bonds relative to other investments is assumed to be 200 basis points. Table 7 shows that increasing this opportunity cost to 300 basis points raises the average cost to meet NSFR to 88 basis points, while decreasing it to 100 basis points lowers the impact to 70 basis points. This change is in line with hypothesis 10b.

Third, the estimates depend on the excess return that is lost when substituting other assets that must be funded at 100% with more liquid assets that require lower RSF. I assume the excess return declines by 100 basis points in the base case. If the lost excess return is 200 basis points, the average impact on NIMs is greater at 88 basis points. When the excess return is lowered to 0 basis points, the impact on NIMs is lower at 70 basis points. These results are in line with hypothesis 10c.

5.5 Discussion of results for European banks

The analysis suggests that banks in France, Germany, Switzerland and the UK may experience the greatest declines in NIMs as they seek to meet the NSFR. The average decline in NIMs for these four countries is -156 basis points vs. -27 basis points for the other six countries with estimated NSFRs below the target ratio (Table 3). What explains the much worse

performance for these 4 European countries? The answer appears to be their universal banking model, with highly diversified funding and a high concentration in trading assets.

Table 8 provides a summary of NSFRs and its components. The representative banks in these four European countries have the lowest NSFRs in the sample, with ratios from 0.78 to 0.83, and have the greatest gaps to close. The difference in NSFRs lies in the structure of their balance sheets. Decomposing the NSFR into ASF and RSF, it becomes clear the problem lies in low ASF values for all four countries, complicated by high RSF ratios in three out of four cases.

[Enter Table 8 here]

What explains the low ASF values in these countries? Table 8 shows that banks in these four countries have the most diversified funding sources, illustrated using a Herfindahl index of capital sources. Germany and France have the lowest share of deposits in the sample, with Swiss and UK banks also below the average; these countries rely more on wholesale debt, particularly Germany. Swiss banks rely heavily on interbank loans, which are three times greater than their interbank claims, with banks in Germany, French and UK banks also above the average. Finally, German, French and UK banks have high trading liabilities, offset by large trading assets. The average Herfindahl index for funding is 18.2%, with the lowest values in France (4.3%), Germany (6.0%) and Switzerland (8.1%) with the UK (10.3%) in sixth position. The NSFR penalizes their diversification of funding, rewarding equity and deposits the most and giving no weight to interbank borrowing or other short-term sources.

On the asset side of the balance sheet, Swiss banks have the highest RSF, driven by their high share of trading assets (39.2% of total assets) that must be funded 100%. Table 2 shows the next three highest ratios of trading assets are French (29.6%), German (24.3%) and UK (24.2%)

banks. Based on the Herfindahl index of assets, French and German banks are again the most diversified after US banks, with Switzerland and the UK above the average.

In summary, the NSFR penalizes banks that diversify funding away from stable sources and hold trading assets that must be funded at 100%. This combination is found in universal banks, which dominate the samples for France, Germany, Switzerland and the US.

5.6 Synergies between NSFR and other Basel III requirements

The discussion of the costs to meet the NSFR has focused on the interest income lost and the higher interest expense of different strategies. A number of synergies exist, however, between the NSFR and the other Basel III requirements. I discuss two synergies, namely how meeting the NSFR will contribute to: (i) meeting the LCR and (ii) raising a bank's Tier 1 capital.

A first synergy concerns the relationship between the NSFR and the LCR. As described earlier, the LCR requires banks to hold enough liquid assets to survive a one-month stressed period without access to wholesale funding by liquidating investments. The bottom of Table 3 shows that meeting the NSFR raises liquid assets from 8.2% to 11.8% of total assets, an increase of 3.6 percentage points. When focusing on the 10 countries that appear to be below the threshold, the increase is greater at 5.4%. Meeting the NSFR will therefore contribute towards meeting the LCR by encouraging banks to hold more liquid assets.

A second synergy concerns the relationship between the NSFR and regulatory capital requirements. Under Basel III, banks are required to reach a common equity Tier 1 (CET1) capital ratio of 7.0% by 2018 (BCBS 2010b). To address the build-up of systematic risk, supervisory authorities will also have discretion to add a counter-cyclical capital buffer of 0% to 2.5%, bringing the minimum capital requirement to 9.5%. Basel III raises the risk-weights for

certain categories of assets -- the trading book, complex securitization exposures and off-balance sheet exposures – increasing a banks' risk weighted assets (RWAs). The new definition of capital and the increase in RWAs lead to a significantly higher capital requirement under Basel III than Basel II.

A principal strategy for reducing RSF is to substitute assets requiring 100% funding with high-quality, liquid investments. This change in a bank's investment portfolio reduces a bank's RWAs, leading to a modest increase in a bank's regulatory capital ratio.

6. Conclusion and future research

The Net Stable Funding Ratio (NSFR) is a new structural liquidity requirement introduced under Basel III designed to address funding risk. Banks that do not meet the minimum requirement need to modify the composition of their balance sheets to increase stable sources of funding and to reduce assets requiring stable funding. This study estimates the NSFR for banks in 15 countries. I find that the representative bank in 10 countries appears to have an NSFR below the minimum threshold at year-end 2009. Strategies to increase the NSFR are estimated to reduce bank NIMs by 70 to 88 basis points on average, or around one third of their year-end 2009 values. The biggest absolute declines are estimated for banks in France, Germany, Switzerland and the UK that rely more on less-stable funding sources and hold more trading assets that must be fully funded. The NSFR estimates in this study are illustrative of the potential magnitude of the impact, but a more accurate estimate would require more detailed data and a knowledge of each bank's competitive setting.

The analysis points to different possible behavioral responses to this liquidity regulation. Banks may choose to shrink their balance sheets, to change the composition or maturity of their

loans, or to change the composition of their investments. These strategies would have costs for the broader economy. The study highlights that there is a tradeoff between liquidity regulation, bank risk and profitability. Given the lack of experience with liquidity regulation, there is also the potential for unintended consequences. Banks may engage in riskier activities or may reduce traditional activities such as liquidity creation or market making. The NSFR will undergo an extended observation period, so more research is warranted to inform possible revisions before the NSFR is implemented in 2018.

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Figure 1: Strategies to increase the Net Stable Funding Ratio

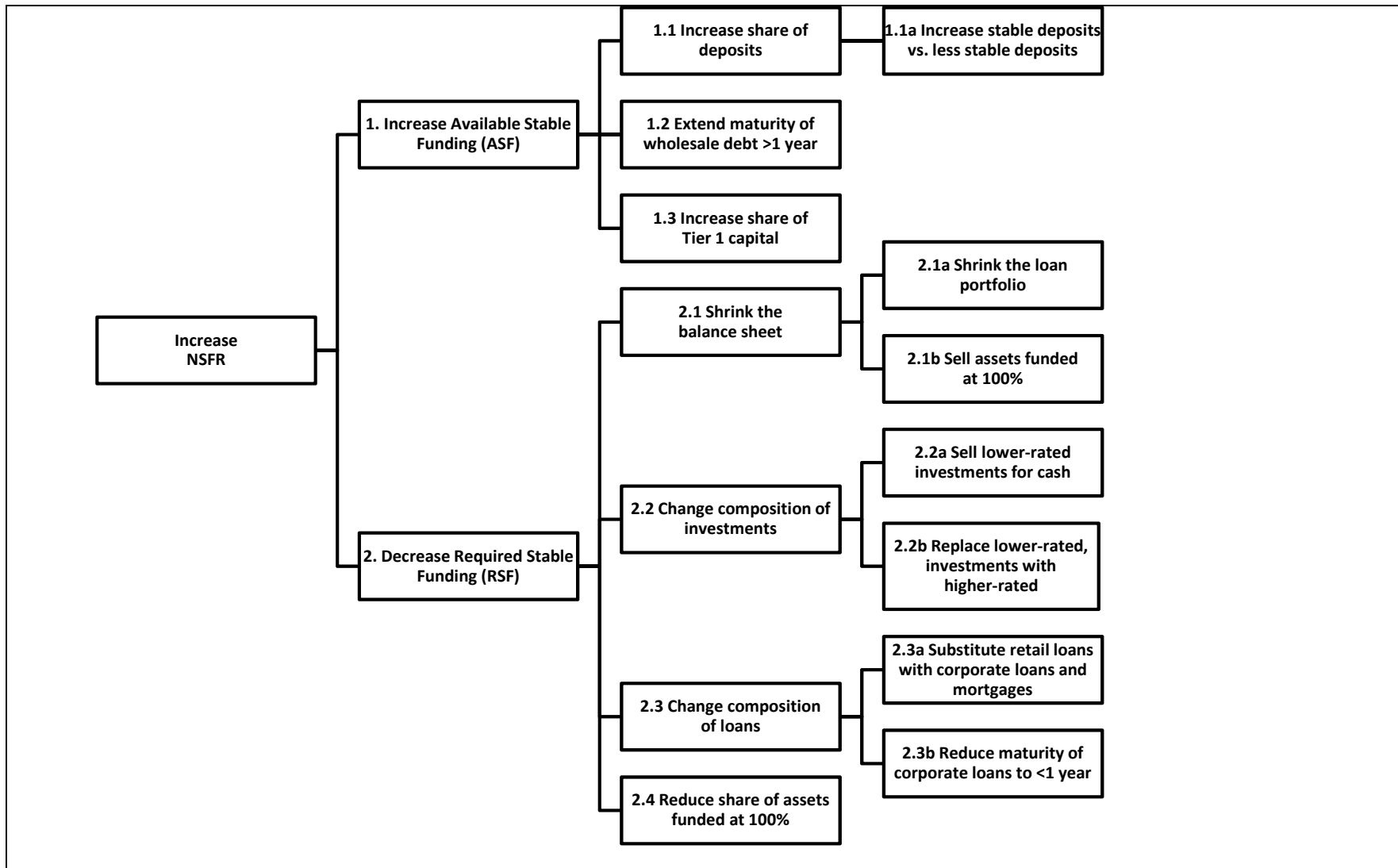


Table 1: Composition of sample by country and bank type

This table provides details on the sample of 549 banks from 15 countries. Data is based on Bankscope as of year-end 2009, using the consolidated entity where available (i.e. bank holding company) and taking the last filing in a calendar year. Financial statements based on IFRS are used where available, except for US banks where local GAAP is used. The sample is restricted to banks with total assets greater than \$100 million.

Country	Number of banks	Commercial & bank holding company	Investment banks	Cooperative & savings banks ¹	Mortgage banks
Number of banks	549	367	22	131	29
Per cent of sample	100%	67%	4%	24%	5%
Of which:		% of banks by category:			
Australia (AU)	9	89%	11%		
Canada (CA)	15	87%	7%	7%	
Chile (CL)	8	88%			13%
France (FR)	18	61%		28%	11%
Germany (DE)	47	40%	2%	34%	23%
Hong Kong (HK)	16	100%			
Italy (IT)	43	51%	12%	37%	
Japan (JP)	122	80%	1%	20%	
Korea (KR)	14	93%	7%		
Mexico (MX)	35	94%			6%
Netherlands (NL)	12	83%		8%	8%
Spain (ES)	49	27%		73%	
Switzerland (CH)	26	31%	4%	62%	4%
UK (UK)	29	52%	14%		34%
USA (US)	106	77%	7%	15%	1%

1. Includes German Landesbanks and Swiss cantonal banks.

Source: Bankscope, author's calculations.

Table 2: Representative income statement and balance sheet for 15 countries, year-end 2009

This table shows the average income statement and balance sheet for a representative bank from each country as of year-end 2009. All items are shown as a percentage of total assets. The representative bank for each country is the average of the banks in the sample, weighted by total assets. The first column reports the mean across the following 15 countries: Australia (AU), Canada (CA), Chile (CL), France (FR), Germany (DE), Hong Kong (HK), Italy (IT), Japan (JP), Korea (KR), Mexico (MX), Netherlands (NL), Spain (ES), Switzerland (CH), United Kingdom (UK), and the USA (US).

Country	Avg	AU	CA	CH	CL	DE	ES	FR	HK	IT	JP	KR	MX	NL	UK	US
Income Statement																
Interest income	3.7	5.2	3.2	2.3	4.7	3.5	4.2	2.9	2.0	3.5	1.6	5.2	8.3	3.3	2.4	3.5
- Interest expense	1.9	3.4	1.5	1.5	1.6	2.7	2.1	1.9	0.5	1.6	0.6	3.0	3.7	2.3	1.3	1.2
Net interest income	1.8	1.8	1.8	0.8	3.1	0.8	2.0	1.0	1.5	1.9	1.0	2.2	4.5	1.0	1.1	2.3
+ Non-int. income	1.3	0.9	1.5	2.8	1.8	0.4	0.9	0.7	1.0	0.9	0.2	1.2	2.4	0.6	1.1	2.7
= Revenue	3.1	2.7	3.2	3.7	4.9	1.2	3.0	1.7	2.5	2.9	1.2	3.4	7.0	1.6	2.2	5.0
- Operating expenses	2.5	1.9	2.5	2.7	3.5	1.2	2.3	1.5	1.4	2.6	1.3	2.8	5.5	1.6	2.3	4.9
- Taxes	0.1	0.3	0.2	0.1	0.3	0.0	0.1	0.0	0.2	0.1	0.1	0.1	0.4	0.0	-0.1	0.0
= Net income	0.5	0.6	0.6	0.9	1.2	-0.1	0.6	0.2	1.1	0.3	-0.2	0.4	1.4	-0.1	0.0	0.2
Assets																
Cash	3.0	2.6	0.9	4.2	5.9	0.7	2.4	1.9	3.6	1.0	1.5	3.8	5.9	2.9	3.0	5.2
Interbank claims	7.7	2.7	3.0	4.7	5.8	16.0	6.4	11.7	14.6	11.0	3.6	2.5	9.1	7.4	10.5	7.2
Trading assets	16.4	11.2	23.3	39.2	7.5	24.3	8.8	29.6	9.3	13.9	4.1	4.6	22.0	10.9	24.2	12.8
Net loans	51.0	72.7	48.2	35.2	66.6	38.2	64.3	36.5	40.2	61.7	45.9	69.4	41.4	57.1	48.0	39.2
Investments	15.0	3.5	12.2	7.4	11.9	16.7	12.3	13.4	26.2	5.7	38.8	14.6	18.6	13.7	9.1	21.0
Other assets	6.9	7.2	12.3	9.4	2.4	4.0	5.9	6.8	6.1	6.8	6.1	5.2	3.0	8.0	5.3	14.6
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Liabilities + Equity																
Deposits	46.9	43.4	62.5	39.0	57.1	25.3	42.8	27.4	72.3	36.9	72.5	52.0	48.4	39.2	40.1	44.4
Interbank loans	8.2	3.2	3.5	17.2	13.3	17.6	5.4	13.5	4.4	13.1	1.3	6.7	2.3	7.9	13.5	1.0
Trading liabilities	15.6	21.3	13.1	11.4	8.4	23.3	16.4	23.0	4.8	9.6	12.0	8.3	27.7	17.7	20.1	17.6
Wholesale funding	15.0	20.1	1.6	15.1	10.2	25.3	23.7	19.9	2.7	28.1	5.2	19.5	4.6	17.1	16.9	15.8
Other liabilities	7.7	5.9	13.5	11.7	2.6	5.5	5.4	12.5	7.2	4.9	4.6	6.3	5.3	13.9	5.0	11.5
Total liabilities	93.6	93.8	94.2	94.4	91.6	96.9	93.6	96.2	91.4	92.6	95.6	92.8	88.3	95.8	95.7	90.4
Equity	6.4	6.2	5.8	5.6	8.4	3.1	6.4	3.8	8.6	7.4	4.4	7.2	11.7	4.2	4.3	9.6
TOTAL	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Capital Ratios																
RWA / total assets	54.4	46.5	42.2	44.1	89.8	38.8	63.9	39.6	57.6	63.0	52.7	64.5	59.3	39.9	44.4	70.4
Tier 1 capital ratio	11.1	9.2	13.1	15.8	7.3	9.7	9.6	9.2	12.4	9.8	8.8	10.3	13.8	14.4	11.4	11.7
Total capital ratio	14.1	11.9	15.9	16.9	14.3	13.2	12.7	10.7	16.7	12.5	11.0	14.0	16.1	16.4	15.2	13.9

Table 3: Estimates of Net Stable Funding Ratio and change in net interest margins for 15 countries, year-end 2009

This table reports estimates of the Net Stable Funding Ratio (NSFR) and net interest margins (NIMs) by country based on year-end 2009 data. NIMs are net interest income divided by interest earning assets. For countries below the NSFR, the estimated fall in NIMs from meeting the NSFR is shown in basis points and as a percentage of the 2009 year-end NIM. Liquid assets are cash, investments in government bonds, and holdings of short-term investments as a percentage of total assets.

Country	Mean	AU	CA	CH	CL	DE	ES	FR	HK	IT	JP	KR	MX	NL	UK	US
Net Stable Funding Ratio (NSFR):																
Before	0.99	0.90	0.99	0.81	1.05	0.78	0.96	0.79	1.46	0.91	1.27	1.07	0.99	0.96	0.83	1.11
Target	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Gap if below	0.11	0.10	0.01	0.19		0.22	0.04	0.21		0.09			0.01	0.04	0.17	
Net Interest Margins (NIMs):																
Before	2.5	2.3	2.9	1.8	3.7	1.4	2.6	2.0	2.1	2.7	1.2	2.5	6.9	1.4	1.8	1.8
After	1.9	1.9	2.9	0.2	3.7	0.1	2.2	-0.2	2.1	1.9	1.2	2.5	6.8	1.1	0.2	1.8
Change for 10 countries with NSFR below 1.0:																
NIM (bps)	-79	-35	-4	-154	n.a.	-135	-36	-216	n.a.	-83	n.a.	n.a.	-11	-31	-158	n.a.
% 2009 NIM	-42	-15	-1	-88	n.a.	-94	-14	-108	n.a.	-30	n.a.	n.a.	-2	-23	-88	n.a.
Change in liquid assets as % total assets:																
Before	8.2	3.8	5.1	6.7	10.0	6.5	6.7	6.5	12.6	2.9	14.9	8.8	12.3	7.6	6.1	12.5
After	11.8	8.4	5.1	18.6	10.0	18.4	6.7	20.3	12.6	6.5	14.9	8.8	13.0	7.6	13.9	12.5
Change	3.6	4.7	0.0	11.8		11.9	0.0	13.8		3.6			0.8	0.0	7.8	

n.a. = not applicable, bps = basis points.

Table 4: Calculation of Net Stable Funding Ratio as of year-end 2009

This table provides details of the calculation of the NSFR. Column 1 shows the factor weights for different balance sheet items. Column 2 shows the calculation for the representative bank in our sample. Columns 3 to 7 show the calculation for banks in the five countries where the estimated ratio is above the minimum threshold. The value shown in each column is the product of the NSFR factor and the specific item from each country's representative bank balance sheet in Table 2.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Average of 15 countries	USA	Japan	Chile	Hong Kong	Korea
Available stable funding (ASF):	Factor						
Shareholders' equity (Tier1+2)	100%	0.064	0.096	0.044	0.084	0.086	0.072
Wholesale funding <1 yr	50%	0.038	0.039	0.013	0.026	0.007	0.049
Wholesale funding + Liabs >1 yr	100%	0.152	0.194	0.072	0.078	0.085	0.161
Stable deposits	90%	0.295	0.280	0.457	0.359	0.456	0.328
Less stable deposits	80%	0.113	0.107	0.174	0.137	0.174	0.125
A. Total ASF (numerator)		0.663	0.716	0.760	0.684	0.807	0.734
Required stable funding (RSF):							
Cash	0%	0.000	0.000	0.000	0.000	0.000	0.000
Securities <1 yr	0%	0.000	0.000	0.000	0.000	0.000	0.000
Interbank Loans <1 yr	0%	0.000	0.000	0.000	0.000	0.000	0.000
Eligible govt debt > 1 yr	5%	0.001	0.002	0.003	0.001	0.002	0.001
Investments and securities >1 yr	50%	0.049	0.069	0.127	0.039	0.086	0.048
Loans to corporate clients < 1 yr	50%	0.020	0.016	0.023	0.027	0.015	0.029
Loans to corporate clients > 1 yr	65%	0.103	0.083	0.119	0.140	0.081	0.149
Loans to retail clients <1 yr	85%	0.034	0.027	0.039	0.046	0.026	0.049
Loans to retail clients >1 yr	100%	0.159	0.127	0.183	0.215	0.124	0.229
Residential mortgages	65%	0.073	0.048	0.000	0.083	0.060	0.079
All other assets	100%	0.233	0.273	0.102	0.099	0.154	0.098
Undrawn credit facilities	5%	0.002	0.002	0.002	0.002	0.002	0.002
Other contingent obligations	5%	0.002	0.002	0.002	0.002	0.002	0.002
B. Total RSF (denominator)		0.675	0.648	0.600	0.652	0.551	0.684
NSFR ratio (A/B)		0.99	1.11	1.27	1.05	1.46	1.07

Table 5: Changes to meet NSFR in Australia, Germany and United Kingdom as of year-end 2009

This table illustrates possible balance sheet changes to meet the NSFR for three countries. The table shows the different components of the numerator and denominator of the NSFR. Categories with a zero factor weight (e.g. cash) are not shown. The first two columns for each country display the product of the NSFR factor and the balance sheet item for each country. A final column highlights non-zero changes.

	Australia			Germany			United Kingdom		
	Before	After	Change if non-zero	Before	After	Change if non-zero	Before	After	Change if non-zero
Available stable funding (ASF):									
Shareholders' equity (Tier1+2)	0.062	0.062		0.031	0.031		0.043	0.043	
Wholesale funding <1 yr	0.050	0.020	-0.030	0.063	0.025	-0.038	0.042	0.017	-0.025
Wholesale funding + Liabs >1 yr	0.159	0.219	0.060	0.181	0.257	0.076	0.135	0.185	0.051
Stable deposits	0.274	0.274		0.160	0.160		0.252	0.252	
Less stable deposits	0.104	0.104		0.061	0.061		0.096	0.096	
A. Total ASF (numerator)	0.649	0.680	0.030	0.495	0.535	0.038	0.569	0.598	0.025
Required stable funding (RSF):									
Eligible govt debt > 1 yr	0.000	0.002	0.002	0.001	0.001		0.001	0.002	0.001
Investments and securities >1 yr	0.011	0.006	-0.006	0.055	0.003	-0.052	0.030	0.006	-0.024
Loans to corporate clients < 1 yr	0.016	0.016		0.015	0.050	0.035	0.016	0.051	0.036
Loans to corporate clients > 1 yr	0.086	0.086		0.080	0.065	-0.015	0.082	0.067	-0.015
Loans to retail clients <1 yr	0.028	0.028		0.026	0.046	0.020	0.027	0.047	0.020
Loans to retail clients >1 yr	0.132	0.132		0.123	0.054	-0.069	0.127	0.055	-0.071
Residential mortgages	0.259	0.259		0.048	0.048		0.106	0.106	
All other assets	0.184	0.149	-0.035	0.284	0.268	-0.016	0.295	0.266	-0.030
Undrawn credit facilities	0.002	0.002		0.002	0.002		0.002	0.002	
Other contingent obligations	0.002	0.002		0.002	0.002		0.002	0.002	
B. Total RSF (denominator)	0.720	0.680	-0.039	0.636	0.535	-0.098	0.687	0.598	-0.083
NSFR ratio (A/B)	0.90	1.00	0.10	0.78	1.00	0.22	0.83	1.00	0.17

Table 6: Changes to meet NSFR in 10 countries and impact on net interest margins

This table summarizes the changes used in this study to illustrate the impact of meeting the NSFR on net interest margins. Results are shown for the 10 countries in the sample where the representative bank's ratio is estimated to be below the required threshold. The first row presents the simple average across these 10 countries. Column 1 shows the NSFR gap that must be closed. Columns 2 and 3 show the increase in government bonds and offsetting decline in other investments as a share of total assets. Column 4 shows the increase in cash holdings. Columns 5 and 6 show the rebalancing of corporate and retail loans. Column 7 shows the decline in other assets. Column 8 shows the net effect on interest earning assets, with the impact on interest income in column 9. Column 10 shows the maturity extension of wholesale debt with the increased interest expense in column 11. Column 12 shows the change in net interest income, with column 13 reporting the decline in net interest margins. Column 14 shows the NIM decline as a percentage of the year-end 2009 value.

Country	(1) NSFR	(2) Govt bonds	(3) Other Invest- ments	(4) Cash	(5) Loans to corpo- rates	(6) Loans to retail	(7) Other assets	(8) Interest earning assets	(9) Interest Income	(10) Whole- sale funding >1 yr	(11) Interest expense	(12) Net interest income	(13) Net interest margin (NIM)	(14) As % of 2009 value
Mean	0.10	4.7	-3.1	0.6	1.4	-1.4	-2.3	1.6	-0.3	5.1	0.2	-0.4	-0.79	-42
AU	0.10	4.9	-1.4	0.0	0.0	0.0	-3.5	3.5	-0.2	6.0	0.0	-0.1	-0.28	-12
CA	0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	-0.03	-1
CH	0.21	10.9	-7.3	2.1	1.6	-1.6	-5.7	3.6	-0.9	6.0	0.2	-1.1	-2.06	-103
DE	0.21	8.7	-10.4	3.3	4.6	-4.6	-1.6	-1.7	-0.4	7.6	0.2	-0.7	-1.22	-85
ES	0.09	4.1	-2.8	0.0	0.0	0.0	-1.3	1.3	-0.1	8.4	0.3	-0.5	-0.71	-26
FR	0.02	0.9	-0.9	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	-0.1	-0.11	-2
IT	0.04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.1	0.2	-0.2	-0.24	-18
MX	0.04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.9	0.2	-0.2	-0.28	-11
NL	0.18	10.5	-2.9	0.0	3.2	-3.2	-7.6	7.6	-0.5	4.5	0.1	-0.7	-1.46	-83
UK	0.16	7.0	-5.0	1.0	4.8	-4.8	-3.0	1.9	-0.7	5.1	0.2	-0.9	-1.50	-84

Table 7: Sensitivity of decline in net interest margins to different assumptions

This table shows the sensitivity of the estimated fall in net interest margins in 10 countries to three key assumptions. Changes in net interest margins are shown in percentage points. The first assumption is the cost of extending the maturity of wholesale funding from below one year to greater than one year in maturity. The base assumption is 100 basis points. The second assumption is the opportunity cost (θt) of switching between lower-rated, less liquid investments (e.g. BBB-rated) and high-quality liquid investments (e.g. AAA-rated). The base case is a loss of interest income of 200 basis points per annum. The third assumption is the loss of excess return ($x_{S_{inv}}$) from increasing holdings of investments and reducing other assets. The base case is a loss of interest income of 100 basis points per annum.

	1. If yield curve is:			2. If opportunity cost is:			3. If excess return is:		
	200 bps	100 bps (base)	0 bps	300 bps	200 bps (base)	100 bps	200 bps	100 bps (base)	0 bps
Mean	-0.86	-0.79	-0.71	-0.88	-0.79	-0.70	-0.88	-0.79	-0.70
AU	-0.35	-0.28	-0.20	-0.33	-0.28	-0.22	-0.33	-0.28	-0.22
CA	-0.04	-0.03	-0.02	-0.03	-0.03	-0.03	-0.03	-0.03	-0.03
CH	-1.54	-1.46	-1.37	-1.67	-1.46	-1.24	-1.67	-1.46	-1.24
DE	-1.35	-1.22	-1.09	-1.43	-1.22	-1.01	-1.43	-1.22	-1.01
ES	-0.36	-0.28	-0.21	-0.28	-0.28	-0.28	-0.28	-0.28	-0.28
FR	-2.16	-2.06	-1.95	-2.29	-2.06	-1.82	-2.29	-2.06	-1.82
IT	-0.83	-0.71	-0.59	-0.76	-0.71	-0.66	-0.76	-0.71	-0.66
MX	-0.13	-0.11	-0.09	-0.12	-0.11	-0.10	-0.12	-0.11	-0.10
NL	-0.31	-0.24	-0.17	-0.24	-0.24	-0.24	-0.24	-0.24	-0.24
UK	-1.58	-1.50	-1.42	-1.63	-1.50	-1.38	-1.63	-1.50	-1.38

Table 8: Explaining low NSFR ratios of German, French, Swiss and UK banks

This table ranks the estimated Net Stable Funding Ratio (NSFR) for the 15 countries at year-end 2009, from highest to lowest. It also shows the numerator, Available Stable Funding (ASF), and the denominator, Required Stable Funding (RSF). Higher NSFRs are generated by higher values of ASF and lower values of RSF. The Herfindahl index of funding is calculated based on six sources (from Table 2): deposits, interbank loans, trading liabilities, wholesale funding, other liabilities and equity. The Herfindahl index of assets is created based on six categories: cash, interbank claims, trading assets, net loans, investments and other assets. A lower Herfindahl value represents greater diversification.

Country	NSFR end-2009	Gap if below	ASF	RSF	Herfindahl of funding	Herfindahl of assets	NSFR rank (High=1)	ASF rank (High=1)	RSF rank (Low=1)	Herf. funding rank	Herf. assets rank
HK	1.46		0.81	0.55	0.45	0.12	1	1	1	14	4
JP	1.27		0.76	0.60	0.46	0.24	2	2	2	15	9
US	1.11		0.72	0.65	0.13	0.09	3	5	5	8	1
KR	1.07		0.73	0.68	0.20	0.41	4	4	8	10	14
CL	1.05		0.68	0.65	0.24	0.36	5	6	6	12	13
CA	0.99	0.01	0.75	0.75	0.32	0.18	6	3	14	13	8
MX	0.99	0.01	0.63	0.63	0.20	0.12	7	12	3	11	5
NL	0.96	0.04	0.65	0.68	0.09	0.24	8	9	7	4	10
ES	0.96	0.04	0.67	0.70	0.13	0.33	9	7	11	7	12
IT	0.91	0.09	0.65	0.72	0.10	0.30	10	8	12	5	11
AU	0.90	0.10	0.65	0.72	0.14	0.46	11	10	13	9	15
GB	0.83	0.17	0.57	0.69	0.10	0.17	12	13	9	6	7
CH	0.81	0.19	0.63	0.77	0.08	0.15	13	11	15	3	6
FR	0.79	0.21	0.55	0.69	0.04	0.11	14	14	10	1	2
DE	0.78	0.22	0.50	0.64	0.06	0.11	15	15	4	2	3
Mean	0.99	0.11	0.66	0.67	0.18	0.23					

Appendix A: Summary of Net Stable Funding Ratio

Available stable funding		Required stable funding	
Item	Factor	Item	Factor
<ul style="list-style-type: none"> Tier 1 & 2 capital instruments Other preferred shares and capital instruments having an effective maturity of one year or greater Other liabilities with an effective maturity of one year or greater 	100%	<ul style="list-style-type: none"> Cash Short-term unsecured actively-traded instruments (< 1 yr.) Securities with exactly offsetting reverse repo Securities with maturity < 1 yr. Interbank claims with maturity < 1 yr. 	0%
<ul style="list-style-type: none"> Stable deposits of retail and small business customers (non-maturity or residual maturity < 1yr) 	90%	<ul style="list-style-type: none"> Government debt with a 0% risk weight under Basel II Debt issued or guaranteed by sovereigns, central banks, BIS, IMF, EC, non-central government, multilateral development banks with a 0% risk weight under Basel II standardized approach 	5%
<ul style="list-style-type: none"> Less stable deposits of retail and small business customers (non-maturity or residual maturity < 1yr) 	80%	<ul style="list-style-type: none"> Unencumbered non-financial senior unsecured corporate bonds and covered bonds rated at least AA-, and debt that is issued by sovereigns, central banks, and public sector entities with a risk-weighting of 20%; maturity ≥ 1 yr. 	20%
<ul style="list-style-type: none"> Wholesale funding provided by non-financial corporate customers, sovereign central banks, multilateral development banks and public sector entities (non-maturity or residual maturity < 1yr) 	50%	<ul style="list-style-type: none"> Unencumbered listed equity securities or non-financial senior unsecured corporate bonds (or covered bonds) rated from A+ to A-, maturity ≥ 1 yr. Gold Loans to non-financial corporate clients, sovereigns, central banks, and public sector entities with a maturity < 1 yr. 	50%
<ul style="list-style-type: none"> All other liabilities and equity not included above (including interbank lending) 	0%	<ul style="list-style-type: none"> Unencumbered residential mortgages of any maturity that would qualify for the 35% or lower risk weight under Basel II standardized approach. Other unencumbered loans (excluding loans to financial institutions) with a remaining maturity of one year or greater that would qualify for the 35% or lower risk weight under Basel II standardized approach. 	65%
		<ul style="list-style-type: none"> Other loans to retail clients and small businesses having a maturity < 1 yr. 	85%
		<ul style="list-style-type: none"> All other assets 	100%
		<ul style="list-style-type: none"> Undrawn amount of committed credit and liquidity facilities 	5%
		Other contingent funding obligations – factor at discretion of national supervisors	

Source: BCBC (2010b).