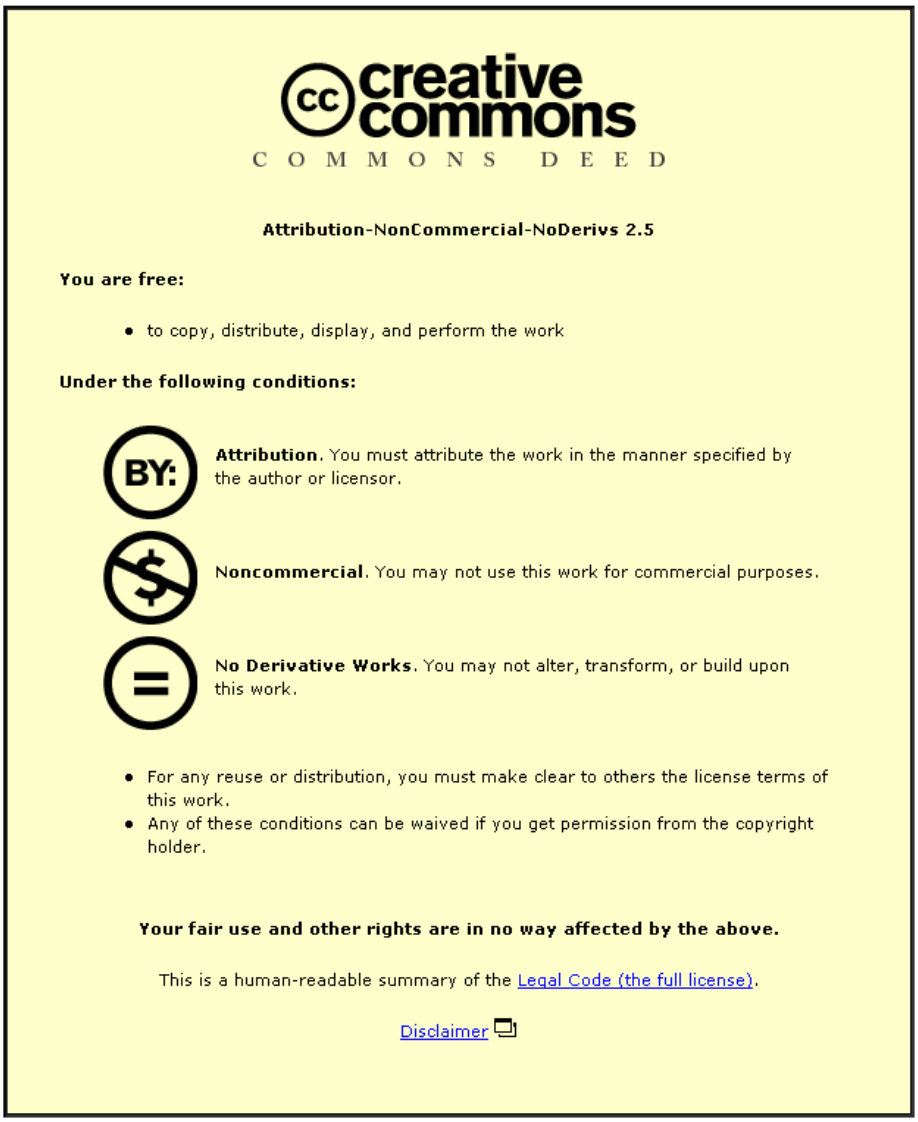

An Assessment of UK Banking Liquidity Regulation And Supervision

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Doctoral Thesis

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Abstract

This thesis assesses UK banking liquidity regulation and supervision and the Basel liquidity requirements, and models banks' liquidity risk. The study reveals that the FSA's risk-assessment framework before 2008 was too general without specifically considering banks' liquidity risk (as well as its failures on Northern Rock). The study also lists the limitations of the FSA's banking liquidity regimes before 2008. The thesis reviews whether the FSA's new liquidity regimes after 2008 would have coped with UK banks' liquidity risks if they have been applied properly. The fundamental changes in the FSA's liquidity supervision reflect three considerations. First, it introduces a systemic control requirement by measuring individual firm's liquidity risk with a market-wide stress or combination of idiosyncratic and market-wide stresses. Second, it emphasizes the monitoring of business model risks and the capability of senior managers. Third, it allows both internal and external managers to access more information by increasing the liquidity reporting frequencies.

The thesis also comments on the Basel Liquidity Principles of 2008 and the two Liquidity Standards. The Principles of 2008 represents a substantial revision of the Principles of 2000 and reflect the lessons of the financial market turmoil since 2007. The study argues that the implementation of the sound principles by banks and supervisors should be flexible, but also need to be consistent to make sure they understand banks' liquidity positions quite well. The study also explains the composition of the Basel liquidity ratios as well as the side effects of Basel liquidity standards; for example, it will reshape interbank deposit markets and bond markets as a result of the increase in demand for 'liquid assets' and 'stable funding'.

This thesis uses quantitative balance sheet liquidity analysis, based upon modified versions of the BCBS (2010*b*) and Moody's (2001) models, to estimate eight UK banks' short and long-term liquidity positions from 2005 to 2010 respectively. The study shows that only Barclays Bank remained liquid on a short-term basis throughout the sample period (2005-2010); while the HSBC Bank also proved liquid on a short-term basis, although not in 2008

and 2010. On a long-term basis, RBS has remained liquid since 2008 after receiving government support; while Santander UK also proved liquid, except in 2009. The other banks, especially Natwest, are shown to have faced challenging conditions, on both a short-term and long-term basis, over the sample period.

This thesis also uses the Exposure-Based Cash-Flow-at-Risk (CFaR) model to forecast UK banks' liquidity risk. Based on annual data over the period 1997 to 2010, the study predicts that by the end of 2011, the (102) UK banks' average CFaR at the 95% confidence level will be -£5.76 billion, Barclays Bank's (Barclays') CFaR will be -£0.34 billion, the Royal Bank of Scotland's (RBS's) CFaR will be -£40.29 billion, HSBC Bank's (HSBC's) CFaR will be £0.67 billion, Lloyds TSB Bank's (Lloyds TSB's) CFaR will be -£4.90 billion, National Westminister Bank's (Natwest's) CFaR will be -£10.38 billion, and Nationwide Building Society's (Nationwide's) CFaR will be -£0.72 billion. Moreover, it is clear that Lloyds TSB and Natwest are associated with the largest risk, according to the biggest percentage difference between downside cash flow and expected cash flow (3600% and 816% respectively). Since I summarize a bank's liquidity risk exposure in a single number (CFaR), which is the maximum shortfall given the targeted probability level, it can be directly compared to the bank's risk tolerance and used to guide corporate risk management decisions.

Finally, this thesis estimates the long-term United Kingdom economic impact of the Basel III capital and liquidity requirements. Using quarterly data over the period 1997:q1 to 2010:q2, the study employs a non-linear-in-factor probit model to show increases in bank capital and liquidity would reduce the probability of a bank crisis significantly. The study estimates the long-run cost of the Basel III requirements with a Vector Error Correction Model (VECM), which shows holding higher capital and liquidity would reduce output by a small amount but increase bank profitability in the long run. The maximum temporary net benefit and permanent net benefit is shown to be 1.284% and 35.484% of pre-crisis GDP respectively when the tangible common equity ratio stays at 10%. Assuming all UK banks also meet the Basel III long-term liquidity requirements, the temporary net benefit and permanent net benefit will be 0.347% and 14.318% of pre-crisis GDP respectively. Therefore, the results suggest that, in terms of the impact on output, there is considerable room to further tighten capital and liquidity requirements, while still providing positive effects for the United Kingdom economy.

JEL Classifications: C15; C22; C32; C53; C81; G01; G21; G28; G32; G38

Thesis Supervisors: Maximilian J.B. Hall and Paul M Turner.

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Abbreviations

- ALM: Asset and Liability Management
- ABS: Asset-Backed Securities
- ASF: Available Amount of Stable Funding
- Basel I: Basel Capital Accord of 1998
- Basel II: New Basel Capital Accord of 2004
- BCBS: Basel Committee on Banking Supervision
- BIPRU: Banks, Building Societies and Investment firms
- BOE: Bank of England
- CAD: Capital Adequacy Directive
- C&C: Close and Continuous
- CDO: Collateralised Debt Obligation
- CFaR: Cash Flow at Risk
- CFF: Financing Cash Flow
- CFI: Investment Cash Flow
- CFO: Operational Cash Flow
- CFP: Contingency Funding Plan
- CP: Consultative Paper

- CRD: Capital Requirement Directive
- CRIM: Contact, Revenue and Information Management Department
- CRMG: Counterparty Risk Management Group
- CSFI: Center for the Study of Financial Innovation
- DLG: Defined Liquidity Group
- DTD: Deposit Takers Division
- DSGE: Dynamic Stochastic General Equilibrium Model
- ECB: European Central Bank
- EEA: European Economic Area
- EU: European Union
- FHLB: Federal Home Loan Banks
- FSCS: Financial Services Compensation Scheme
- FSA: Financial Service Authority
- FMC: Firms and Markets Committee
- GAAP: General Accepted Accounting Principles
- GDP: Gross Domestic Product
- GLC: Global Liquidity Concessions
- HoDs: Heads of Departments
- ICAS: Individual Capital Adequacy Standards
- IFRS: International Financial Reporting Standards
- IFS: International Financial Statistics
- ILAA: Individual Liquidity Adequacy Assessment

- ILAS: Individual Liquidity Adequacy Standards
- ILG: Issuance of Individual Liquidity Guidance
- ILSA: Individual Liquidity Systems Assessment
- IRM: Interim Risk Manager
- IMF: International Monetary Fund
- LCR: Liquidity Coverage Ratio
- LIBOR-OIS: London interbank offered rate and the overnight index swap rate
- MBS: Mortgage-Backed Securities
- MRGD: Major Retail Groups Division Department
- NASDAQ: National Association of Securities Dealers Automated Quotations
- NCC: Net Cash Capital
- NR: Northern Rock
- NSFR: Net Stable Funding Ratio
- ONS: Office for National Statistics
- RSF: Required Amount of Stable Funding
- RWA: Risk-weighted Assets
- SEC: Securities and Exchange Commission
- SLRP: Supervisory Liquidity Review Process
- SRR: Special Resolution Regime
- TCE: Tangible Common Equity Capital
- TED: Treasury Eurodollar Spread
- VaR: Value at Risk

- VECM: Vector Error Correction Model
- WACC: Weighted Average Cost of Capital

Chapter 1

Introduction

1.1 The motivation of the research

The global financial crisis starting from the summer of 2007 is considered by many economists to be the worst financial crisis since the Great Depression of the 1930s. It resulted in the threat of total collapse of large financial institutions, the bailout of banks by national governments, and downturns in stock markets around the world. The crisis played a significant role in the failure of key businesses, declines in consumer wealth estimated in trillions of US dollars, and a downturn in economic activity leading to the 2008-2012 global recession and contributing to the European sovereign-debt crisis. The International Monetary Fund estimated that large U.S. and European banks lost more than $1 trillion on toxic assets and from bad loans from January 2007 to September 2009. These losses are expected to top $2.8 trillion from 2007-10.U.S. banks' losses were forecast to hit $1 trillion and European bank losses will reach $1.6 trillion. The IMF estimated that U.S.banks are about 60% through their losses, but British and eurozone banks only 40%.

The active phase of the crisis, which manifested as a liquidity crisis, can be dated from August 7, 2007 when BNP Paribas terminated withdrawals from three hedge funds citing 'a complete evaporation of liquidity'. The financial crisis was triggered by a complex interplay of government policies that encouraged home ownership, providing easier access to loans for subprime borrowers, and by an over-valuation of bundled sub-prime mortgages based on the theory that housing prices would continue to escalate. Questions regarding bank solvency, declines in credit availability and damaged investor confidence had an impact on global stock markets, where securities suffered large losses during 2008 and early 2009. Economies

worldwide slowed during this period, as credit tightened and international trade declined.

Given this experience, many economists have offered theories about how financial crises develop and how they could be prevented. Since this global financial crisis was largely about a drying-up liquidity, this research would like to focus on measuring the real liquidity risk positions of banks and how to monitor and prevent such problem occurring again. According to the study of the FSA(2008*a*), it is clear to see liquidity crises are not as rare as people may imagine. As the FSA (2009*d*) mentioned, firms do not have large enough incentives to build sufficient resilience into their liquidity stresses and hold appropriate levels of liquidity. It is thus justified for regulators to force banks to adopt higher liquidity management standards and advanced liquidity risk measurements.

1.2 The objectives and contributions of the study

Although liquidity stresses are usually considered as low probability events, liquidity crises are not as rare as people imagine since a bank's liquidity position is sensitive to the market failures. However, liquidity regulation has not received adequate attention since the end of the 1990s, either in the UK or internationally. Many scholars and officials have now realized that measuring and managing bank liquidity risk are as important as capital or solvency risk management. With respect to liquidity management, the BIS published a consultative paper in June 2008 entitled 'Sound Liquidity Risk Management and Supervision' (BCBS, 2008). The FSA also introduced a new liquidity regime in October 2009 (FSA, 2009*d*). With respect to the liquidity risk measurement, the IMF reviewed its stress test experience in 2008 (Stoiz et al., 2008). The Bank of England has focused on the management of funding liquidity risk in global markets since the end of 2008 (Aikman et al., 2009). And the European Central Bank provided a new measurement of funding liquidity risk in 2009 (Nikolaou and Drehmann, 2009).

This thesis studies liquidity regulation and supervision of the UK banking industry. My objectives in this thesis are as follows:

First, I study the theory on the economic rationale of financial regulation by answering the following questions. What is the development history of financial regulation? What can we learn from the global financial crisis of 2007-2009? Is it necessary to have financial regulation? What are the main purposes of financial regulation? How can supervisors improve modern financial regulation frameworks to prevent serious financial crisis and boost the real economy?

Second, I emphasize the economic rationale of liquidity regulation by replying the following questions. What is the definition of liquidity risk? Is central banks' liquidity support enough to address systemic liquidity problems? What is the relationship between liquidity regulation and central bank liquidity provision?

Third, I examine the Basel Committee's liquidity regulation and supervision. Are there any areas missed in the Committee's focus on liquidity risk in its Liquidity Principles of 2008? What are the academic and industry views on Basel's liquidity regulation and supervision? What are the compositions of the Basel Liquidity Ratios? And what are the peoples' views on the Basel Liquidity Ratios?

Fourth, I assess the UK banks' liquidity regulation and supervision by its single regulator, the Financial Services Authority. Specially, I answer the following questions. Did UK banks take more risky businesses and become 'casino banks' in the last decade? Is the FSA's previous risk assessment framework sufficient in terms of monitoring and controlling risks? How did the FSA fail to supervise high impact banks, such as the Northern Rock? What were the limitations of the FSA's banking liquidity regimes before 2008? How can the new regimes after 2008 cope with UK banks' liquidity risks?

Fifth, I apply a quantitative balance sheet liquidity analysis to measure short-term and long-term liquidity risk positions for UK banks. Besides answering the question 'How liquid are UK banks?', I also explain why the Basel Liquidity Ratios cannot accurately present a bank's real liquidity risk position and why my analysis is superior to other ratio analyses. I also explain the limitations of the quantitative balance sheet liquidity analysis.

Sixth, I develop a dynamic model to forecast UK banks' liquidity positions. The model measures UK banks' individual and systemic liquidity risks by calculating downside risk, known as Cash-Flow-at-Risk. I try to answer the question 'What are the differences between the Cash-Flow-at-Risk (CFaR) model and the Value-at-Risk (VaR) model?' Other questions addressed include: 'Why cannot the classic VaR model measure a bank's liquidity risk?'; 'Does the UK banking industry suffer liquidity pressure?'; and 'Can my exposure-based CFaR model help senior managers to develop a proper strategy to manage liquidity risk?'

Seventh, I provide a cost-benefit analysis of Basel III's tighter capital and liquidity requirements on the UK economy. Specially, I calculate the average capital and liquidity revel of the UK banking industry. The questions addressed include: 'What is the relationship between capital or liquidity ratio and changes in the probability of a banking crisis occurring?'; 'What are the temporary expected benefits or permanent expected benefits of the new requirements?'; 'What are the long-term economic costs of the new requirements?'; and

'Do the new requirements have net positive or negative effects on the UK economy?'

The contributions of this research are listed below:

1. I set out the necessity for financial regulation by briefly reviewing the huge impact of the global financial crisis of 2007-2009.

2. I explain liquidity provision operation of central banks would not be enough to address liquidity crises, but increase moral hazard problems in the banking sector.

3. I examine the Basel Liquidity Principles and Liquidity Ratios of 2008 in great detail.

4. I provide a good and concise introduction to the FSA's risk-assessment framework and liquidity regime adopted since 1998.

5. I analyze the political economy of liquidity regulation.

6. I give a special focus on developing advanced models to measure liquidity risk for the banking industry.

7. I apply a quantitative balance sheet liquidity analysis to measure the short-term and long-term liquidity risk positions for UK banks. The first contribution of this analysis is to take a comprehensive look at the banks' consolidated balance sheet information. The second contribution of this framework is to measure a bank's short-term or long-term liquidity position using a single number ('liquidity coverage' or 'net cash capital', respectively). The third contribution of this approach is to explain why the previous intra-day or one week liquidity focus no longer ensures a bank can survive an unexpected, serious systemic bank crisis.

8. I measure banks' liquidity risk by calculating downside risk, known as Cash-Flow-at-Risk (or CFaR), which can be directly compared to the banks' risk tolerance and used to guide corporate risk management decisions. Furthermore, I estimate exposure-based CFaRs for UK banks, which involves the estimation of the set of exposure coefficients that provide information about how various macroeconomic and market variables are expected to affect the banks' cash flow, and that also attempt to take account of inter-dependencies and correlations among such effects. For these reasons, they can also be used to predict how a hedging contract or change in financial structure will affect a bank's risk profile.

9. I provide Cost-Benefit analysis of the Basel III requirements. I quantify the long-term economic impact of the new requirements for the UK economy in one of the first stand-alone country analyses of the combined impact of the recently-agreed changes to the international standards for banks' capital and liquidity. I also calculate the capital and liquidity ratios based on the Basel III definitions, rather than the more commonly used Tier 1 capital ratio and the Loans-to-Deposits liquidity ratio. Third, I use the non-linear probit model to estimate the relationship between the probability of a banking crisis and banking capital and liquidity by considering the imperfect substitutability between UK banks' capital and liquidity. And fourth, I estimate the long-run cost of the requirements with a Vector Error Correction Model (VECM), which shows holding higher capital and liquidity would reduce output by a small amount but increase bank profitability in the long run.

10. Finally, I use a comprehensive and recent dataset to provide updated evidence.

1.3 The structure of the thesis

The thesis is organized in eight chapters, as follows:

Chapter 2: The Economic Rational of Financial Regulation

This chapter outlines the economic rationale of financial regulation by summarising the lessons of the global financial crisis of 2007-2009. The economic rationale for financial regulations is in part to deal with the existence of negative externalities, which suggest the collapse of illiquid banks might contaminate other solvent banks and generate economic distress. As Hall (1991) points out, informational asymmetries are very common in the banking sector. The rationale of regulation in this area does not only need to protect consumers from intermediaries with information advantages, but also to make sure that regulators can prevent banks' hazardous behaviour by requiring enough relevant information disclosure. The third economic rationale for financial regulation relates to the need for continuous monitoring of the fiduciary role of financial institutions. It is sub-optimal or even impossible for individual consumers to monitor such complex financial products, for example Collateralized Debt Obligations (CDOs) backed by subprime mortgages. The fourth economic rationale for regulation relates to consumer confidence. The main purpose of governments' largest liquidity injections in the last four years is to restore market confidence and limit taxpayers' risk. The last economic rationale for regulation relates to potential 'Grid Lock' problems,

which describe a phenomenon where a huge systemic paralysis is caused by herd behaviour which may even result from rational firms pursuing maximum personal benefits. After 2003, both commercial and investment banks increased leverage to pursue high-profit scuritization businesses. An important lesson we learn from the recent crisis is that financial deregulation or 'non-regulation' would not help to build up a healthy financial system and boost the real economy in the long term. Without restraining risky actions and protecting consumers, the unsafe and unsound practices adopted by 'casino banks' would eventually destroy the financial markets as a whole and shrink social welfare. The chapter also liquidity regulation is essential to prevent systemic liquidity crisis by requiring banks maintain enough liquidity all the time and improve internal liquidity risk management frameworks.

Chapter 3:An Assessment of the changes of Liquidity Regulations in the Basel Committee on Banking Supervision and UK Financial Services Authority

This chapter firstly compare the Basel Liquidity Principles of 2008 and the Principles of 2000. The Principles of 2008 represents a substantial revision of the Principles of 2000 and reflect the lessons of the financial market turmoil since 2007. It adds that the work is drawn from recent and ongoing work on liquidity risk by the public and private sectors and is intended to strengthen banks' liquidity risk framework to withstand a range of stress events, including those that affect secured and unsecured funding. I also examine the comments on the Principles of 2008 by 30 interested parties. All commentators welcomed the updated Liquidity Principles. I argue that it would be better for financial institutions to measure their own liquidity risk tolerance with an explicit example given by the Basel Committee. Since banks can deal with their own liquidity costs in a variety of ways, there is a chance that banks mislead customers by increasing prices of commercial loans and decrease the prices of other investment products. The assumptions of the stress tests should accommodate the nature of the bank's business and complexity of the bank's activities. The stress test analysis should be reviewed by senior management on a regular basis to make sure that the bank can fully operate even in the worst scenarios. In order to avoid excessively-detailed regulation and to effectively protect customers' interests, banks should provide material quantitative information as well as qualitative information on time. I explain the compositions of the Basel Committee's short-term Liquidity Coverage Ratio (LCR) and long-term Net Stable Funding Ratio (NSFR). I argue that a one-size-fits-all assumption for the LCR and the NSFR cannot be adapted to different economic structures. It will reshape interbank deposit markets and bond markets as a result of the increase in demand for 'liquid assets' and 'stable funding'. However, this balance-sheet ratio analysis is still an advanced and very important

approach to measure banks' liquidity risk positions.

This chapter secondly retrospects the financial risk outlook for the UK banking industry in the last decade. I find out that banks began to take on more risky businesses after 2005. Then I review the FSA' general risk management framework and list the 'failures' in the FSA's role as banking supervisor for high impact banks, like Northern Rock. These failures included the frequently changing supervisory responsibility, inadequate ARROW panel meetings to review risk positions, non-availability of regular management information to identify emerging risks and re-assess business risks, and little emphasis on liquidity risk and the use of market intelligence. I also assess the FSA's previous liquidity regime which operated from 1998 to 2008. However, the liquidity regime is no longer appropriate to reflect banks' real liquidity risk positions after 2005. This chapter analyzes the FSA's new liquidity regime in great detail. The new standards fully implement the Basel Committee's 'Principles for Sound Liquidity Risk Management and Supervision' (BCBS, 2008). The fundamental changes in the FSA's liquidity supervision reflect three considerations. First, it introduces a systemic control requirement by measuring individual firms' liquidity risk with a market-wide stress or combination of idiosyncratic and market-wide stresses. Second, it emphasizes the monitoring of business model risks and the capability of senior managers. Third, it allows both internal and external managers to access more information by increasing the liquidity reporting frequencies.

Finally, this chapter discusses the reasonable framework of the two policy tools (i.e. liquidity regulation and central bank liquidity provision operation) to deal with liquidity based financial crises. The introduction of liquidity regulation should reduce dependence on the central bank as a lender of last resort. With the implements of liquidity regulation and central banking, central banks should support the regulatory effort to reduce reliance of banks on the central banks and ensure that banks price the liquidity risks of their activities.

Chapter 4: How Liquid Are UK Banks?

This chapter uses quantitative balance sheet liquidity analysis, based upon modified versions of the BCBS (2010*b*) and Moody's (2001) models, to estimate UK banks' short and long-term liquidity positions respectively. The study also presents fundamental financial information to facilitate analysis of banks' business models and funding strategies. Using data for the period 2005-2010, I provide evidence that there have been variable liquidity strains across the UK banks in our sample. The estimated results show that Barclays Bank was the only bank to maintain a healthy short-term liquidity position throughout the sample period; while HSBC remained liquid in the short term, in both normal and stress conditions,

except in 2008 and 2010. RBS, meanwhile, maintained healthy long-term liquidity positions from 2008 after receiving government injections of capital. And Santander UK was also able to post healthy long-term liquidity positions, except in 2009. However, the other four banks, the Bank of Scotland, Lloyds TSB, Natwest, and Standard Chartered, proved illiquid, on both a short-term and long-term basis, throughout the six-year period, with Natwest being by far the worst performer.

Chapter 5: Estimating Liquidity Risk Using the Exposure-Based Cash-Flow-at-Risk Approach: An Application to the UK Banking Sector

This chapter uses a relatively-new quantitative model for estimating UK banks' liquidity risk. The model is called the Exposure-Based Cash-Flow-at-Risk (CFaR) model, which not only measures a bank's liquidity risk tolerance, but also helps to improve liquidity risk management through the provision of additional risk exposure information. Using data for the period 1997-2010, I provide evidence that there is variable funding pressure across the UK banking industry, which was forecasted to be slightly illiquid with a small amount of expected cash outflow (i.e. £0.06 billion) in 2011. In my sample of the six biggest UK banks, only the HSBC maintains positive CFaR with 95% confidence, which means that there was only a 5% chance that HSBC's cash flow would drop below £0.67 billion by the end of 2011. RBS was expected to face the largest liquidity risk with a 5% chance that the bank would face a cash outflow that year in excess of £40.29 billion. My estimates also suggest Lloyds TSB's cash flow is the most volatile of the six biggest UK banks, because it has the biggest deviation between its downside cash flow (i.e. CFaR) and expected cash flow.

Chapter 6: Cost Benefit Analysis Of Basel III: Some Evidence from the UK

This chapter provides a long-term cost-benefit analysis for the United Kingdom of the Basel III capital and liquidity requirements proposed by the Basel Committee on Banking Supervision (BCBS, 2010*c*). I provide evidence that the Basel III reforms will have a significant net positive long-term effect on the United Kingdom economy. The estimated optimal tangible common equity capital ratio is 10% of risk-weighted assets, which is larger than the Basel III target of 7%. I also estimate the maximum net benefit when banks meet the Basel III long-term liquidity requirements. My estimated permanent net benefit is larger than the average estimates of the BCBS. This significant marginal benefit suggests that UK banks need to increase their reliance on common equity in their capital base beyond the level required by Basel III as well as boosting customer deposits as a funding source.

Chapter 7: Conclusions

Finally, Chapter 7 ends the thesis by setting out the main findings and contributions of

my study. Opportunities for further research are also discussed.

Chapter 2

The Economic Rationale of Financial Regulation

2.1 Introduction

Financial regulation is a legislative 'product' to establish standard rules of behavior for each participant (Llewellyn, 1999). Features of financial regulation before the 1930s can be described as spontaneity, initial imperfection, and monotony (Mitchener, 2004). The long time depression of the whole economy was a consequence of massive bank and stock market failures. It is evident from Hall (1999) that modern financial regulation and supervision was made after a serious crisis. The main purpose is to prevent a recurrence of crisis. The period 1930 to 1970 was an era of strict supervision with comprehensive restrictions involving, inter alia, the segregation of financial business services, the control of interest rates, and limitations on trading in international money markets. Between 1970 and 1990, financial deregulation was used to increase competition. For example, under the Glass-Steagall Act, American depository institutions lost market shares to securities firms that were not so strictly regulated (Hall, 1993). The Gramm-Leach-Bliley Act of 1999 was a significant moment for financial deregulation in the U.S which allowed the mixed operation of commercial and investment banking businesses. Through post-mortems on a series of banking crises in the 1990s, economists realized that outdated regulation is a major reason for bank runs. An advanced and global regulatory framework was urgently demanded after 2007 to prevent systemic risk which is brought about by complex and sometimes toxic financial innovations.

In order to illustrate the necessity for financial regulation, Section 2.2 outlines the economic rationale of financial regulation by summarizing the lessons of the global financial crisis of 2007-2009. Section 2.3 explains the economic rationale of liquidity regulation. And Section 2.4 summarises and concludes.

2.2 The Economic Rationale of Financial Regulation

Over a decade of financial deregulation and outdated supervisory systems are two of the main causes of the recent financial crisis (United States Senate, 2011). Before judging the failures of regulators and supervisors and recommending to build up of advanced supervisory frameworks, it is essential to emphasize the necessity of financial regulation (Llewellyn, 1999) by reviewing the problems we have faced since 2007.

2.2.1 Existence of Negative Externalities

Banks are susceptible to the domino model of contagion[1] (Brunnermeier et al., 2009). Therefore, the economic rationale for financial regulation is in part to deal with the existence of negative externalities, which might:

1. Contaminate solvent banks.
   G7 finance minister forecast global sub-prime-related losses could reach $400 billion (David et al., 2008) All the financial institutions in the world which participate in subprime loan or subprime securities, have suffered huge losses. Table 2.1 lists the asset writedowns and credit losses for the major institutions. Citigroup, Merrill Lynch, and UBS took the biggest losses because of their worldwide subprime-related business. Because of losses on financial derivatives plus collapses in the housing and wholesale funding markets, highly-leveraged hedge funds faced serious liquidity problems. Bear Sterns' two hedge funds, High Grade Structured Credit Strategies Fund and High Grade Structured Credit Strategies Enhanced Leverage Fund were forced into bankrupt in July 2007. In August 2007, BNP announced a rescue of its two hedge funds. And, in March 2008, Carlyle Capital, belonging to the Carlyle Group, was forced to liquidate because it defaulted on about $16.6bn of debt.

[1] Suppose that bank A has borrowed from bank B, and bank B has borrowed from bank C. If A fails to pay back, then B will suffer a loss. If the loss is large enough to make B default, C then will take the loss.

Table 2.1: Writedowns & Losses from sub-prime-related business

Name	$bn
Citigroup	55.1
Merrill Lynch	51.8
UBS	44.2
HSBC	27.4
Wachovia	22.5
Bank of America	21.2
IKB Deutsche	15.3
Royal Bank of Scotland	14.9
Washington Mutual	14.8
Morgan Stanley	14.4
JP Morgan Chase	14.3
Deutsch Bank	10.8
Credit Suisse	10.5
Wells Fargo	10
Barclays	9.1
Lehman Brothers	8.2

Source: Onaran (2008).

The collapse of an illiquid bank might be eventually followed by a large number of other liquid banks because depositors or creditors are unable to discriminate between liquid and illiquid banks. It is obvious that a liquid bank cannot meet demand from depositors who withdraw all their money at the same time unless it sells assets or borrows the funds with high transaction costs. It became even harder in 2008 because of the drying up of the market for both securitized credit assets and wholesale funding. Liquidity crises at individual firms can lead to systemic instability. This, in fact proved to be the case during the recent financial crisis. Between 2007 and 2009, Lehman Brothers and Washington Mutual collapsed; Bear Stern, Merrill Lynch and HBOS were sold to JP Morgan, Bank of America, and Lloyds TSB respectively; and AIG, Fannie Mac, Freddie Mac, Citigroup, Northern Rock and Bradford & Bingley were nationalized. By the end of 2009, almost 100 banks also had gone bust in the United States since the beginning of the Sub-prime crisis(FDIC, 2009). The FDIC also revealed 171 bank failures in the third quarter of 2008.

2. Generate economic distress due to bank failures.

The difficulties in the financial system had already brought a marked global economic decline in the middle of 2008. US house prices year-on-year fell by 18.2% in November 2008 following an 18% fall a month earlier (according to the Case-Shiller index), presaging further sub-prime-related losses for investors (Hall, 2009). UK house prices also showd their biggest annual fall since the Nationwide began its housing survey in 1991, a decline of 8.1% in 2008. Average oil prices shrunk from 140 dollars to 40 dollars per barrel between July 2008 and March 2009, indicating a sharp decline in demand for goods and services. The WTO (2009) also made a gloomy forecast on 24th of March 2009 that global trade would decline in 2009 by 9%.

In April 2009, the International Monetary Fund (2009) reported that global GDP is estimated to contract by 6.25% in the fourth quarter of 2008, and global economic output to fall in 2009 by 0.5% to 1%, the worst performance since World War II. The Organization for Economic Cooperation and Development expected, in September 2009, the GDP growth rate of rich countries in 2009 to fall by 4.1%, and the output in the UK to contract by 4.3% , as opposed to the previous predictions of 3.7%. The (Elmeskov, 2009) . IMF expected global growth in 2009 to be 2.2%. The World Bank's Global Economic Prospects forcasted: global GDP of 3.3% in 2010 and 3.3% in 2011.

According to the Bureau of Economic Analysis, the US economy contracted by 5% at an annualisd rate in the third quarter of 2009, the worst performance since 1987. The Office for National Statistics reported that the UK economy contracted by 6.1% at an annualised rate in the second quarter of 2009, the worst performance recorded for 30 years. Its GDP growth rate quarter on quarter slowed to zero in the second quarter of 2008, ending a 16-year run of positive growth for the UK economy. The Janpanese Cabinet Office revealed that the Japanese economy contracted by 9.4% at an annualised rate in the second quarter of 2009. And the Germany Federal Statistical Office announced that its economy contracted by 6.8% at an annualised rate in the third quarter of 2009. Growth in China also slowed significantly in 2012 because of such a fragile external environment. As regards the labour market, Japan's unemployment rate rose to 5.6% in August 2009, the highest level recorded for five years. In November 2009, the US unemployment rate rose to 10%, the highest level since 1983. And, in Janurary 2012, the UK suffered its highest unemployment rate, of, 8.5% since 1992 [2].

3. Increase the cost of deposit insurance.

[2]Data are available on the Trading Economics website http://www.tradingeconomics.com.

Deposit insurance is a measure implemented by governments to protect bank depositors against losses caused by a bank's inability to pay its debts when due. The need for deposit insurance arises mainly from the fact that banks are in the business of lending money from depositors' accounts. The danger lies in the fact that if a bank's customers sense that their bank is having some kind of financial problems, perhaps due to borrowers defaulting on loans, their incentive is to get their money out while they still can. When a bank's depositors all do this at once, it is said that there is a run on the bank. Because a bank only holds a fraction of its customers' money on reserve as cash at any given time, not everyone will be able to get their money out immediately. Those who can get it, do so, and without any cash left on hand, the bank usually has no choice but to go out of business.

Deposit insurance systems are one of the financial system safety nets that are meant to promote financial stability; however, it always faces problems. On the one hand, deposit insurance agencies cannot efficiently control costs because it is difficult to calculate risk premiums for risk-loving bankers. On the other hand, since deposits are held by almost everyone in a country, it has become impossible for governments to refuse to bail out insolvent banks (Benston and Kaufman, 1996) . As from October 2008, many EU countries, starting with the United Kingdom, were in the process of increasing the amounts covered by their deposit insurance schemes. On October 7, 2008, the EU's ministers of finance agreed to increase the minimum amount to 50,000 euro, and, after one year, to 100,000 euro; and the UK raised coverage from 35,000 pounds to 50,000 pounds and ended 'co-insurance'. Two years later, the UK raised the amount of deposit insurance coverage to 85,000 pounds (on January 1, 2011).

2.2.2 Potential problems associated with Asymmetric Information

Hall (1991) points out that informational asymmetries are very common in the banking sector. The rationale of regulation in this area does not only need to protect consumers from intermediaries with informational advantages, but also to make sure that regulators can prevent banks' hazardous behaviour by requiring enough information disclosure.

1. The asymmetric information between the suppliers of financial services and consumers. Mortgage loan agents are incentivised to encourage customers to buy expensive houses to gain more Origination Fees from mortgage loans. Since agents' Origination Fees are only related to the volume of loans, some of them ignored borrowers' payment

abilities, and encouraged borrowers to refinance by pledging current mortgage loans. Some of these brokers also taught borrowers how to 'cheat' on loan application forms and enhance their credit records without any increase in income. By 2006, half of US subprime mortgage loans were made for unwaged borrowers. Investment banks then sold those packaged sub-prime mortgages based on rating agency reports. It is a common sense in the securities investment theory that high risk offers the prospect of high return, while low risk provides low returns. However, the US subprime securities were considered as low risk by credit rating agencies, even though its returns were higher than yields on government bonds or company debts. This misrepresenting of the risk attracted across of investors into sub-prime securities investment so many investors to purchase.

In early April 2009, Citigroup and the Bank of America reported accounting but not real profits, which came from a fall in debt prices (i.e. of some structured trading instruments) rather than from prudent investment. This game, which banks were playing to redeem their debts from investors, is a typical case of asymmetric information. The rapid discounting of the price of banks' debts is due to countless worried investors who sold securities unsure whether the banks would redeem them at par. But banks know that rather better, since the decision largely rests with these 'animals'.

2. The asymmetric information between the suppliers of financial services and the financial regulators.
   Regulated firms with information advantages can escape supervision even though they submit 'proper' information to regulators. Even worse, they could provide inadequate information and fictitious financial reports to mislead regulators. For example, there was no explanation of backed assets of 95% investment CDO, nor any risk warning anyalsis. Some AAA-rated of CDOs were even constructed using junk securities or sub-prime mortgage loans.

   Moreover, banking monopolies and cartels are a significant threat in developed countries. These influential companies, with high profits and good social connections, are able to cheat on regulators. Citigroup used an ' advantage accounting approach ' to help Greece to become an European Union member in 2001, by ' writing off ' over €1 billion debt to meet the requirement that each European Union country should hold its deficit below 3% of GDP. The huge Greek government debt created an even more serious and unavoidable European sovereign-debt crisis 10 years later.

3. Existence of fraud.

   Economic fraud not only destroys costumers' wealth, but could also disturb financial markets or cause a severe financial crisis. In recent years, financial regulators across the world worked hard to tackle economic crimes. One of the famous cases is the arresting of Bernard Madoff, a non-executive chairman of the NASDAQ stock exchange. He had been operating a classic Ponzi Scheme[3] to cheat thousands of clients out of around $65 billion since the early 1990s. In order to maintain the high investment return promised to his clients, he had committed numerous counts of fraud, including money laundering and perjury in the New York Federal court.

   In October 2007, a New York law firm mentioned that First American Corporation, a real estate raging agency, colluded with Washington Mutual Inc to increase real house prices.

   In April 2010, the Securities and Exchange Commission (SEC) filed charges against Goldman Sachs of securities fraud. And Goldman Sachs subsequently agreed to pay $550 million to the SEC to settle the charges of securities fraud linked to mortgage investments and acknowledging a 'mistake' in failing to reveal to clients certain information.

   On 27 June 2012, Barclays Bank was fined $200 million by the Commodity Futures Trading Commission, $160 million by the United States Department of Justice and £59.5 million by the Financial Services Authority for the attempted manipulation of the Libor and Euribor rates. Barclays manipulated rates for at least two reasons. Routinely, from at least as early as 2005, traders sought particular rate submissions to benefit their financial positions. And, later, during the 2007C2012 global financial crisis, they artificially lowered rate submissions to make their bank seem healthy.

2.2.3 A need for Continuous Monitoring of the fiduciary role of financial institutions

The third economic rationale for financial regulation relates to the need for continuous monitoring of the fiduciary role of financial institutions. According to Llewellyn (1999), there are several features of financial products which require a continuous check, for the sake of avoiding hazardous behaviour:

[3] A fraudulent investment operation that pays returns to investors from their own money or money paid by subsequent new investors rather than from any actual profit earned.

1. The nature of long-term contracts usually associated with principal-agent problems. Banks and insurers, eager to shift risk by extending sub-prime mortgage-related business, never looked into the eyes of borrowers to take account of their creditors' interests.

2. The difficult of testing the quality of financial products at the point of sale. In the stock market, some stock brokers make purchasing decisions which ultimately benefit their own interests.

3. The impossibility to value an investment product because of the uncertain behaviour of the suppliers after the point of purchase, especially when managers are motivated by a short-term bonus system. As a result, the future welfare of consumers would be very vulnerable.

For example, CDOs comprising financial derivatives of subprime mortgages, played a key role in triggering the 2007 sub-prime securities crisis which eventually impacted on equity and credit markets, and the global economy. CDOs are structured according to different default risks. The first and riskiest tranche is usually taken by issuers, and other investors choose different tranches based on their risk and return appetite. Therefore, CDO market participants involve both individual and institutional investors across the world. The purpose of a CDO is to diversify risk by allowing the investor to hold unrelated assets; however, because of the unprecedented prosperity of the US housing market, issuers packaged vast amount of similar mortgage assets into CDOs to pursue higher return but ignored their risk. In addition, imperfectly-understood valuation models force investors to depend on professional rating agencies to measure the value of CDOs [4]. Meanwhile, rating agencies elaborately enhanced the credibility of risky CDOs making those derivatives favorated investment products. For example, since rating agencies use a 'AAA' rating as the same standard to signify the lowest risk level for both government securities and CDOs, it is easy to mislead investors in treating these types of CDO as equal to government securities, but with a higher return. In the 1990s, the annual issuing of CDO was less than $250 billion but, in 2006, the total issuing volume arried at $2750 billion, with sub-prime mortgaged-backed CDOs amounting to $1000 billion.

It is sub-optimal or even impossible to individual consumers monitor such complex business. Firstly, unprofessional monitors without effective power may not prevent risky

[4]Between 2005 and 2007, Standard & Poor's rated 85% of mortgage-backed CDOs as 'AAA', but some of these CDOs were not worth anything by the end of 2007

actions being performed by influential financial institutions. Secondly, if all consumers spend time monitoring the issuing firms, the substantial costs of duplicated supervision may ultimately erode consumer benefits. Therefore, delegating to a specialist regulator with enforcement power would be a superior option.

2.2.4 The need to Maintain Confidence

The fifth economic rationale for regulation relates to consumer confidence. Under stressed circumstances, without regulation and government support, the reduction in demand for services and contracts may have damaging economic consequences. On 5th March 2009, Wen Jiabao, the Premier of the P.R. China, called for market confidence and said that 'confidence is much more valuable than gold'. The Financial Times editorial on 19th February 2009 put it this way: 'if everyone did the right thing by saving during a recession, the economy would slide further, possibly touching off a deflationary spiral'. The purpose of regulation is to clear the market 'lemons' [5] and to rebuild consumers' confidence (Llewellyn, 1999).

The main purpose of governments' largest liquidity injections in history is to restore market confidence and limit taxpayers' risk. The US,the UK, and Eurozone countries have used 'quantitative easing' to reduce market funding stress by increasing the money supply. Many other countries, including China, announced their stimulus packages to help boost the economy as well as consumer confidence[6].

2.2.5 The 'Grid Lock' problems

The fifth economic rationale for regulation relates to potential 'Grid Lock' problems. Economists apply the term 'grid lock' to describe a phenomenon where a huge systemic paralysis is caused by herd behaviour which may even result from rational firms pursuing maximum personal benefits. Llewellyn (1999) argues that the emergence of grid lock problems may induce herd-like behaviour of banks in line with other banks and lead to excessive system risk.

Under grid lock, associated with adverse selection and moral hazard, it is difficult to tell the difference between 'good' firms and 'bad' firms. The threat from adverse selection is that 'good' firms are unable to differentiate themselves from others. The problem of moral

[5]This is a clear cost as consumer welfare falls if mis-priced inappropriate products are purchased. Likewise, it is also costly to reject appropriate products.

[6]For more information see (Guillén, 2012).

hazard is that 'good' firms are inclined to adopt hazardous conduct because of the pressures from competition. Hardin (1968) used the 'Tragedy of the Commons' to vividly illustrate such disaster without efficient regulation.

Pursuing higher remuneration, managers of financial intermediaries have never done everything according to their financial capacities over the last twenty years. After 2003, both commercial and investment banks increased leverage to pursue high profit securitization businesses. Average investment banks' leverage reached more than 40 in 2006 compared with 25 years ago. Northern Rock, which used to be a star bank in the UK, only held £1.5 billion liquidity insurance against its 75% wholesale funding source.

The other rationale for regulations relates to imperfect competition. It is not covered in this chapter, because of limited relevenc to the current financial crisis.

2.3 The Economic Rationale of Liquidity Regulation

2.3.1 The Meaning of Liquidity Risk

The term 'liquidity' is anything but well defined. Back in the nineteenth century, Knies (1876) stressed the necessity for a cash buffer to bridge negative gaps between payment inflows and outflows in the cases where their timing cannot be completely regulated (requiring secured payments is the classical view especially concerning short-term liquidity). In the last century the issue was also taken up and intensely discussed, as for example initiated by Stützel (1959). The further discussions primarily centered on basic considerations such as the relationship between liquidity and level of solvency (Stützel, 1983) or the distinction between the level of liquidity reserves and its structure (Witte, 1964). Around the mid-1990s, a new wave started to focus on specific issues of liquidity management, but only touches policy issues related to liquidity. For example, requiring permanent trad-ability of capital market products without undue price concessions. The long intervals certainly have not helped to clarify the term. More importantly, however, getting funds has been of little concern in banks, because collecting points of money for the various groups within society is one of their basic functions.

As present, capacity to borrow sufficient long-term funds at appropriate spreads to support asset growth is very much the focus of many banks. Meanwhile, supervision and central banks act to main market liquidity to provide the base for borrowing in money and capital market. Under the fractional reserve system, a bank retains funds equal to only a

portion of the amount of its customers' deposits as readily available reserves (currency on hand at the bank plus deposit accounts for that bank at the central bank) from which to satisfy demands for payment. The remainder of customer-deposited funds is used to fund investments or loans so that the bank makes profit from creating credit, or bank money, through lending. If they lend too many loans, they may not have money to meet withdrawal demands. Because there is no telling how many customers would want to withdraw their money from their bank accounts on any given day, banks have to maintain their liquidity position in a strong way. In this sense, liquidity indeed represents a qualitative element of the financial strength of a bank.

This thesis takes the basic and most narrow definition of liquidity which represents the capacity to fulfill all payment obligations as and when they fall due. Liquidity thus is neither an amount nor a ratio. It rather expresses the degree to which a bank is capable of fulfilling its respective obligations. Since it is done in cash, liquidity relates to flows of cash only. Not being able to perform leads to a condition of illiquidity.

2.3.2 Lender of Last Resort is Not Enough

As the financial crisis made painfully clear, the business of liquidity provision inevitably exposes financial intermediaries to various forms of run risk. Their fragile funding structures, together with the binding liquidity commitments they have made, can result in rapid outflows, especially in adverse events. The absence of central bank intervention would also lead banks to fire-sell illiquid assets or even to fail altogether in a more severe case. And fire sales and bank failures–and the accompanying contractions in credit availability–can have spillover effects to other financial institutions and to the economy as a whole. Thus, while banks will naturally hold buffer stocks of liquid assets to handle unanticipated outflows, they may not hold enough because, although they bear all the costs of this buffer stocking, they do not capture all of the social benefits, in terms of enhanced financial stability and lower costs to taxpayers in the event of failure. For example, BNP Paribas was the first major bank to acknowledge the risk of exposure to sub-prime mortgage markets[7]. After the sub-prime turmoil hit the US financial system, doubts about the ability of individual banks to refinance their short term funding, and increasing concerns about bank solvency, meant that many banks could no longer borrow unsecured in the money markets, even overnight.

[7]BNP Paribas froze three of their funds on 9 August 2007, indicating that they had no way of valuing the complex assets inside them known as Collateralised Debt Obligations (CDOs), or packages of sub-prime loans.

As a result, these banks were forced to turn to central banks to replace their lost short term deposit funding. This was a systemic run of the entire global banking system. And it is this externality that creates a role for policy.

There are two broad types of policy tools available to deal with this sort of liquidity-based market failure. The first is after-the-fact intervention, either by a deposit insurer guaranteeing some of a bank's liabilities or by a central bank acting as an 'Lender of Last Resort' (LOLR); the second type is liquidity regulation, which requires banks to maintain adequate liquidity resources at all times. As an example of the former, when the economy is in a bad state, assuming that a particular bank is not insolvent, the central bank can lend against illiquid assets that would otherwise be fire-sold, thereby damping or eliminating the run dynamics and helping reduce the incidence of bank failure. Liquidity regulation, as an example of the latter, needs to have in place a charge per unit of short term wholesale funding set at a level that properly reflects the external liquidity costs of short term funding to avoid a similar crisis in future (Milne, 2009*a*).

The central bank certainly has a responsibility to provide market liquidity during a financial crisis. This was recognized in the doctrine of ' lender of last resort', as conceived by Thornton and Espoused by Bagehot (1873), who suggested that, faced with a liquidity crisis, central banks should stand prepared to lend, at will, to solvent banks, at a penalty rate of interest and against 'good' collateral, until the crisis subsides[8]. The actions taken by the US Federal Reserve (the 'Fed')and the European Central Bank (ECB) in the second week of August in 2007 satisfy these requirements apart from their failure to impose a penalty rate of interest on borrowers. [9]

However, these views can be contrasted with those of Mervyn King, the Governor of the Bank of England, who had been concerned that overgenerous provision of liquidity can create a problem of moral hazard and encourage banks to adopt an excessive exposure to liquidity risk. Despite the intensifying liquidity crisis in the summer of 2007, the Bank of England (the Bank) initially refused to offer additional liquidity to the market other than

[8]To be clear, this work assumes that the bank in question is fundamentally solvent, meaning that while its assets may not be liquid on short notice, the long-run value of these assets is known with certainty to exceed the value of the bank's liabilities. One way to interpret the message of this research is that capital regulation is important to ensure solvency, but once a reliable regime of capital regulation is in place, liquidity problems can be dealt with after the fact, via some combination of deposit insurance and use of the LOLR.

[9]The ECB injected €94.8 bn into the money markets on 9th August 2007 to shore up confidence in the financial system. About 49 banks availed themselves of the funding. The Fed announced a new emergency credit facility on 17 August 2007. Citigroup, JP Morgan, Chase, Bank of America and Wachovia each borrowed $500 million.

through the 'standing facility' under which banks can borrow (against eligible collateral), without limit, beyond their 'target reserve balance' at a penalty of 100 basis points above the official Bank Rate, under the modifications to official money market operations introduced in 2006 (Hall, 2009). On 12 September 2007, the Governor of the Bank explained, in a letter to the House of Commons' Treasury Select Committee, the reasons why the Bank, unlike its counterpart in the USA, the Fed, and the ECB was resisting pressure to provide liquidity against a wider range of collateral (i.e. other than government securities) and for longer periods of time (i.e. other than overnight) [10]. Whilst emphasizing the Bank's difficulty in balancing the needs of (short run) financial stability against the fear that a wider provision of liquidity would 'undermine the efficient pricing of risk' and hence long run stability, the Governor went on assert that proper management of 'the current turmoil, which has at its heart the earlier under-pricing of risk, should not threaten our long-run economic stability.' Hence the reason for the Bank's relatively sanguine approach. Additionally, the Governor argued that to go further would only increase moral hazard and raise the likelihood and intensity of a future financial crisis. As he put it:

'The provision of large liquidity facilities penalizes those financial institutions that sat out the dance, increases herd behaviour and increases the intensity of future crises.' And, *'The provision of greater short-term liquidity, would undermine the efficient pricing of risk by providing ex-post insurance for risky behaviour, encourages excessive risk-taking and sows the seeds of a future financial crisis.'*

Whilst in agreement with the action as 'Lender of Last Resort', I cannot agree that the LOLR is enough. From the experience of the past several years, it is clear that liquidity provision from central banks is uncertain and socially costly. Because of the worry of cash outflow into non-Euro markets, Euro-zone banks are hoarding reserves instead of providing them to the interbank market, even after taking a massive amount of cheap money from the ECB of €800bn. Eonia, the rate to measure European Interbank Liquidity, declined to 0.2% in April 2013 from 4.5% in July 2007. To my mind, liquidity regulation, that requires banks to maintain adequate liquidity resources at all times, is even more meaningful than

[10]But, unfortunately for the Bank, it retracted from this principles only two days after publication of the Governor's letter to the Treasury Select Committee. For, on the 14 September, following assurances given by the FSA that Northern Rock remained solvent, the Bank provided emergency funding to Northern Rock. Subsequent to this, on 19 September, the Bank announced that it would, after all, lend to banks for periods of up to three months and against a wider range of collateral than hitherto (to include, as in the Northern Rock case, mortgages for example) under a new emergency facility.

providing central banks' liquidity support in terms of financial stability[11]. And I favor the introduction of preventative liquidity regulation, such as the 'Liquidity Coverage Ratio' and 'Net Stable Funding Ration' on top of capital regulation. It is true that the central banks have shielded commercial banks from the consequence of the systemic liquidity problems. But the central banks could have made clear to individual banks that they would be allowed to fail in the event of a systemic run, such as the Northern Atlantic Liquidity Squeeze in Autumn 2007, and this would have given them much stronger incentives to hold more liquid assets and have more long term funding.

2.4 Summary and Conclusions

The main jobs of financial regulators across the world are to to sustain systemic stability, to maintain the safety of financial institutions, and to protect the consumer from market failures by dealing with the problems outlined above. An important lesson we learn from the recent crisis is that financial deregulation or 'non-regulation' would not help to build up a healthy financial system and boost the real economy in the long term. Without restraining risky actions and protecting consumers, the unsafe and unsound practices adopted by 'casino banks' would eventually destroy the financial markets as a whole and shrink social welfare.

The recent collapse of several giant financial institutions clearly demonstrated the critical nature of liquidity. As many economists concluded, the key cause of the global financial crisis was a drying up of liquidity. How to develop proper internal liquidity risk measurement and management for banks and build up sound liquidity regulation and supervision for regulators are very hot issues following these stressed years. The next chapter analyzes the changes of Liquidity Regulation by the Basel Committee on Banking Supervision and the UK Financial Services Authority.

[11]Baldan et al. (2012) also demonstrate that the action of modifying a bank's liquidity profile, in order to comply with the incoming constraints imposed by the Basel III framework, not only reduces liquidity risk but also lowers its interest rate risk, this enables banks to reduce the amount of capital absorbed by interest rate risk, giving rise to a globally positive effect.

Chapter 3

An Assessment of the changes in Liquidity Regulations used by the Basel Committee on Banking Supervision and the UK's Financial Services Authority

3.1 Introduction

In banking, liquidity is the ability to meet obligations when they fall due without incurring unacceptable losses. Managing liquidity is a daily process requiring bankers to monitor and project cash flows to ensure adequate liquidity is maintained. Maintaining a balance between assets and liabilities is critical since depositors may demand their funds when the bank is unable to generate adequate cash; in severe cases, this may result in a bank run.

In advance of the market turmoil that began in mid-2007, asset markets were buoyant and funding was readily available at low cost. The reversal in market conditions illustrated how quickly liquidity can evaporate and that illiquidity can last for an extended period of time. The turmoil, again, re-emphasized the importance of liquidity to the functioning of financial markets and the banking sectors. As a result, there was a need to update liquidity risk measurement and management for the financial system as a whole.

In October 2008 Lord Turner, Chairman of the UK Financial Services Authority[1], was asked by the Chancellor Alistair Darling, to make a regulatory response to the global banking crisis. In the Turner review paper, he made it clear that the liquidity regulation was insufficient:

> 'Measuring and managing bank liquidity risk is as important as capital/solvency risk management, but in the years running up to the crisis did not receive adequate attention, either in the UK or internationally, where debates about bank regulation were dominated by the design of the Basel II capital adequacy standard. It is essential now to restore liquidity regulation and supervision to a position of central importance'.

Recognizing the limited attention paid to banks' liquidity risk management and supervision and aware of the global systemic banking losses after 2007, the Basel Committee on Banking Supervisory (BCBS, 2008) updated its Liquidity Principles and published Liquidity Ratios in record time following heavy political pressure. And the FSA also proposed a new liquidity regime right after the announcement of the Basel Liquidity Principle of 2008 and the Basel Liquidity Ratios.

This chapter firstly assesses the Basel Committee's Liquidity Principles and Liquidity Ratios in Section 3.2. Section 3.3 describes the FSA's Liquidity Regime after 1998. Section 3.4 comments on the revision to liquidity regulation by the BCBS and the FSA. Section 3.5 explains the interactions between liquidity regulation and central bank liquidity provision. And Section 3.6 summarises and concludes.

[1] At the end of 1998, the Financial Services Authority, as a single regulator for the whole of the UK financial services sector, was turned from 'a concept into a reality'. The FSA took the responsibility for Banking and Wholesale Markets supervision from the Bank of England, Building Society supervision from the Building Societies and Friendly Societies Commissions, and Insurance supervision from HM Treasury. On the first of April 2013, however, it was disbanded with micro-prudential supervision of most major financial firms returning to the Bank of England and conduct of business regulation being transferred to a new agency called the Financial Conduct Authority.

3.2 An Assessment of the Basel Committee on Banking Supervision's Liquidity Requirements

3.2.1 The Basel Committee's Liquidity Principles

Comparison of the Principles of 2008 with the Principles of 2000

In September 1992, the Basel Committee published its first requirements for liquidity risk management, within a document entitled 'A framework for managing and measuring liquidity risk'(BCBS, 1992). This work was updated in February 2000, in a paper entitled ' Sound Practices for Managing Liquidity in Banking Organizations'(BCBS, 2000). The Principles of 2000 focused on developing a greater understanding of the way in which international banks manage their liquidity on a global basis, on the premise that supervision of liquidity is particularly effective if based on a dialogue between bank and supervisor. In order to account for financial market developments as well as the lessons learned from the turmoil of 2007/09, the Basel Committee updated its guidance on liquidity risk supervision and management in September 2008, within a document entitled ' Sound Liquidity Risk Management and Supervision'(BCBS, 2008). This work has five areas of focus and seventeen principles in total which are presented in Table 3.1.

Table 3.1: Principles for Sound Liquidity Risk Management and Supervision

1	Fundamental principle for the management and supervision of liquidity risk: principle 1
2	Governance of liquidity risk management: principles 2,3, and 4
3	Measurement and management of liquidity risk: principles 5,6,7,8,9,10,11 and 12
4	Public disclosure: principle 13
5	The Role of Supervisors: principles 14, 15,16 and 17

Comparing with the Principles in 2000, the Principles of 2008 had been significantly expended into several key factors. Firstly, the Principle of 2008 start by asking a bank to maintain sufficient liquidity by holding enough cushions of unencumbered and high quality liquid assets (Principle 1). Moreover, they also require supervisors to take prompt action if a bank is in trouble in either area in order to protect depositors and to limit potential damage to the whole financial system (Principle 1). These requirements for a bank to maintain sufficient liquidity had not been considered in the previous Principles guidance.

Secondly, the Principles of 2008 significantly expanded in a new required area whereby

a bank should clearly articulate a liquidity risk tolerance that is appropriate for its business strategy and its role in the financial system. According to its own liquidity risk tolerance, a bank should ensure that it is able to withstand a prolonged period of stress (Principle 2). This was the first occasion on which the definition of liquidity risk tolerance had been introduced by the Basel Committee.

Thirdly, the Principles of 2008 highlight the necessity of allocating liquidity costs, benefits and risks to all significant on- and off- balance sheet business activities to limit the risk-taking incentive of individual business lines created by the bank as a whole (Principle 4). Moreover, liquidity risk costs, benefits and risks should be addressed explicitly in the new product approval process.

Fourthly, in order to set up a reliable process for identifying, measuring, monitoring and controlling liquidity risk, the Principles of 2008 firstly suggest a bank build a robust framework for comprehensively projecting cash flows arising from assets, liabilities and off-balance sheet items over an appropriate set of time horizons (Principle 5). The requirements of defining of liquidity risk and building up a robust framework to project cash flows on different time horizons are essential for a bank's internal measurement and management of liquidity risk. However, these requirements had only been paid attention to after the mid-2007 systemic financial crisis.

Fifthly, the Principles of 2008 require a bank to limit its liquidity risk exposures and manage its funding needs within and across legal entities, business lines and currencies, taking into account legal, regulatory and operational limitations to the transferability of liquidity (Principle 6).

Sixthly, the management of intraday liquidity risk and collateral is one of the significant new areas considered by the Principles of 2008. In terms of the management of intraday liquidity risk, it requires a bank to monitor its intraday liquidity positions and risks to meet payment and settlement obligations on a timely basis under both normal and stressed conditions and thus contribute to the smooth functioning of payment and settlement systems (Principle 8). As regards the management of collateral positions, it suggests a bank should monitor the legal entity and physical location where collateral is held and how it may be mobilized in a timely manner (Principle 9).

Seventhly, the design and use of severe stress test scenarios is a new area emphasized in the Principles of 2008. It requires a bank to conduct stress tests on a regular basis for a variety of institution-specific and market-wide stress scenarios (individually and in combination) to identify sources of potential liquidity strain and to ensure that current

exposures remain in accordance with a bank's established liquidity risk tolerance. A bank should use stress test outcomes to adjust its liquidity risk management strategies, policies, and position and to develop effective contingency plans (Principle 10). Moreover, a bank should hold high quality liquid assets as insurance against a range of liquidity stress scenarios (Principle 12).

Eightly, adopting the same requirements on public disclosure as the Principles of 2000, the Principles of 2008 require a bank to disclose information on a regular basis (Principle 13).

Finally, the Principles of 2008 suggest supervisors should not only carry out an independent and timely review of a bank's overall risk management framework (Principles 14 and 15), but also intervene to require a bank's effective and timely remedial action to address deficiencies in its liquidity risk management processes or liquidity position (Principle 16); as well as to communicate with other supervisors and public authorities, such as central banks, both within and across national borders, to facilitate effective cooperation regarding the supervision and oversight of liquidity risk management (Principle 17). This is the first time the committee had considered about the role of supervisors to communicate with other national supervisors to monitor banks' liquidity risk, which can create a systemic financial stress.

Examining the Comments on the Principles of 2008

Two days after publishing the consultative document on the Principles for Sound Liquidity Risk Management and Supervision, the Bank for International Settlement released 30 interested parties' written comments on the new Principles on its website. The objective of this section is to carry out an analysis of these comments.

The 30 commentators cover both industry and academic concerns. As shown in Table 3.2, sixteen belonged to the financial services industry associations' group, three commentators were from supervisors' group, five commentators were financial institutions, and the six remaining were placed into the Others' group. Table 3.3 displays the frequency of discussion of the Principles by outside commentators. And the detailed commentators' opinions on each Principle can be found in Appendix A.

The first principle's area of focus, the 'Fundamental Principle for the Management and Supervision of Liquidity Risk', was discussed by all commentators. 'Public Disclosure' was the second most discussed area of focus with twenty-five commentators. Eighteen commen-

tators on average discussed the 'Measurement and Management of Liquidity Risk' areas of focus. The 'Role of Supervisors' area of focus was discussed by fourteen commentators on average. While only twelve commentators on average discussed the principles involved with the 'Governance of Liquidity Risk Management'.

Table 3.2: Commentators (30)-Listed by Affinity Groups

Financial Service Industry Associations (16)
Canadian Bankers Association (CBA)
European Association of Co-operative Banks (EACB)
European Association of Public Banks (EAPB)
European Savings Banks Group-World Savings Banks Institute (ESBG-WSBI)
Febelfin
French Banking Federation (FBF)
International BK.Fed. (IBFed)
Institutional Money market Funds Association (IMMFA)
Institute of International Finance (IIF)
Associazione Bancaria Italiana (ABI)
Japanese Bankers Association (JBA)
Mortgage Insurance Companies of America (MICA)
Nederlandse Vereniging Banken (NVB)
UK Joint Trade Association (BBA,ISDA, and LIBA)
World Council of Credit Unions (WOCCU)
Zentraler Kreditausschuss
Supervisors (3)
Banco Central Do Brasil (BCDB)
International Organization of Securities Commission (IOSCO)
Reserve Bank of New Zealand (RBNZ)
Financial institutions (5)
Credit Suisse
Dexia
Royal Bank of Scotland (RBS)
UniCredit Group
US Bankcorp.
Others (6)
The Cleaning House
Fielder and Maltz
Independent Audit Limited
Institute of Chartered Accountants of England and Wales (ICAEW)
Thomson Reuters
Jean Desrochers and Jacques Préfontaine-University of Sherbrooke

Table 3.3: Identification of the Principles Discussed by Commentators-Listed by Affinity Group

Principle (Numbers)	Principle (Area of Focus)	Financial Services Industry Associations (16)	Supervisors (3)	Financial Institutions (5)	Others (6)	Total (30)
1	FP	16*	3*	5*	6*	30*
2	GLRM	4	1	2	3*	10
3		3	1	4*	5*	13
4		8*	0	2	4*	14
5	MMLR	11*	1	4*	2	18*
6		7	1	4*	2	14
7		7*	1	4*	1	13
8		11*	0	4*	2	17*
9		5	1	4*	1	11
10		10*	1	4*	5*	20*
11		8*	2*	3*	4*	17*
12		9*	1	3*	5*	18*
13	PD	12*	3*	5*	5*	25*
14	ROS	6	2*	2	4*	14
15		5	2*	1	2	10
16		6	1	1	3*	11
17		11*	2*	3*	5*	21*
FP		Fundamental Principle (30/30)				
GLRM:		Governance of Liquidity Risk Management (12.3/30)				
MMLR:		Measurement and Management of Liquidity Risk (18/30)				
PD:		Public Disclosure (25/30)				
ROS:		Role of Supervisors (14/30)				

Note: * Discussed by at least 50% of the subsample, or of the total sample (30)(Préfontaine et al., 2010).

Divergent Opinions on Areas of Focus and Principles

All commentators agreed that a principles-based approach was well adapted to the management and supervision of liquidity risk. However, they expressed a strong preference for more flexibility in the application of the 17 principles. Their arguments reflected a strong bias in favor of proportionality and materiality arguments (Préfontaine et al., 2010).

In the 'Fundamental Principle' area of focus, financial services industry associations suggest the integration of liquidity risk management should not be excessively deep (Zentraler Kreditausschuss, 2008), while supervisors believe the implementation of the liquidity management framework should be consistent with the supervisory objectives. Financial institutions focus their discussion on the definition of liquid assets (RBS, 2008), while others consider increase in the power of supervisors (Préfontaine et al., 2010).

In the 'Governance of Liquidity Risk Management' area of focus, all commentators agreed with principle 2 that a bank should articulate a liquidity risk tolerance; however, it need not necessarily be disclosed publicly. Financial services industry associations suggest in principle 3 that the operational functions of Boards of Directors and senior management should select the size and structure of the banking group (Febelfin, 2008). As for principle 4, financial services industry associations do not think it rational to present only quantitative approaches as guidance in product pricing for the regulatory authorities (JBA, 2008). Financial institutions suggest to educate customers regarding product pricing according to liquidity risk (RBS, 2008). Others focus on the consequences of increased liquidity cost for products and transaction levels (Carrel, 2008).

In the focus area of 'Measurement and Management of Liquidity Risk', each group of commentators suggest how to measure liquidity risk and monitor cash flow for principle 5. As for principles 6 and 7, all commentators argued that a bank should centrally manage liquidity risk exposure and funding needs at the group level, but should not be over-reliant on a single funding plan. In principles 8 and 9, they all think that intraday cash and collateral management goes beyond liquidity risk management. Furthermore, they point out that monitoring the physical location where collateral is held is not always possible. As for principle 10, they agree that a bank should carry out stress tests, but that the results should not be publicly disclosed. Financial institutions and other groups agreed to principle 11 on the formulation of a contingency funding plan that did not lead to the building-up of an excessive liquidity cushion. This cushion, described in principle 12, would be formed of unencumbered and high quality assets. Again, these commentators believed that the size

and exact composition of this liquidity cushion should not be publicly disclosed.

In the 'Public Disclosure' area of focus (principle 13), most individual financial institutions and other groups agreed with the BCBS's view that a bank should publicly disclose information on a regular basis to enable market participants to make informed judgments about the soundness of its liquidity risk management framework and liquidity positions. However, some of them believed that the present level and extent of qualitative and quantitative publicly disclosed information was satisfactory (USbank, 2008). Nevertheless, more complete and perhaps staggered information could be disclosed to supervisors and credit rating agencies.

Finally, in the focus area covering the 'Role of Supervisors', commentators again presented very diverging views. In principle 14, financial institutions and their trade associations requested that supervisors more clearly define their role in firm-only extreme liquidity events and also in market-wide extreme liquidity events (IBFed, 2008). The supervisors group suggested that supervisors should perform a comprehensive assessment on an ongoing basis (not just be periodic) of a bank's overall liquidity risk management framework and liquidity position to determine whether they deliver an adequate level of resilience to liquidity stress and, if found to be inadequate, advise the bank to, among other tings, consider seeking longer term financing and/ or reduce its illiquid positions (IOSCO, 2008). In principle 15, following the comply-or-explain doctrine, financial institutions and their trade associations expressed the view that supervisors make more intense use of banks' internal liquidity risk management reports as opposed to one format-only prudential reports (Zentraler Kreditausschuss, 2008). In principle 16, the BCBS argued that supervisors should intervene to require effective and timely remedial action (usually in the form of higher capital adequacy requirements). While financial institutions and their trade associations argued that capital is a poor substitute for inadequate liquidity; however, they did not suggest any satisfactory alternative (EAPB, 2008). In closing, all commentators agreed with the essence of Principle 17 saying that supervisors, both home and host country, should more closely communicate and cooperate within and across national borders. In addition, they favor designating a lead supervisor, the mutual recognition of home-host country supervisors and other measures designed to facilitate the role of a college of supervisors.

I argue that it will harm the development of financial institutions as well as the real economy if we set up financial regulation in great detail. Implementation of the sound principles by banks and supervisors should be flexible, but also needs to be consistent to make sure they understand banks' liquidity positions quite well. I welcome the definition

of liquidity risk tolerance, but it would be better for financial institutions to measure their own liquidity risk tolerance with an explicit example given by the Basel Committee. Since banks can deal with their own liquidity costs in a variety of ways, there is a chance that banks mislead customers by increasing prices of commercial loans and decrease the prices of other investment products. Furthermore, I think the assumptions of the stress test should reflect the nature of the bank's business and complexity of the bank's activities. Meanwhile, the stress test analysis should be reviewed by senior management on a regular basis to make sure that the bank can fully operate even in the worst scenarios. Finally, I do not believe the current disclosure of quantitative information is enough. It is essential to help investors understand banks' liquidity risk positions by providing relevant information. To avoid excessively-detailed regulation and effectively protect customers' interests, banks should provide material quantitative information as well as qualitative information on time. Meanwhile, supervisors should be empowered to obtain more quantitative information from individual firms by operating a 'traffic light system' when risks rise, say for example from green to orange and from orange to red (Milne, 2009*b*).

3.2.2 The Basel Committee's Liquidity Ratios

The Committee has developed two standards (BCBS, 2009) for supervisors to use in liquidity risk supervision. The first objective is to promote the short-term resilience of the liquidity risk profile of banks by ensuring that they have sufficient high-quality liquid assets to survive a significant stress scenario lasting 30 calendar days. The Committee developed the Liquidity Coverage Ratio (LCR) to achieve this objective. The second objective is to promote resilience over a longer time horizon by creating additional incentives for banks to fund their activities with more stable sources of funding on an ongoing basis. The Net Stable Funding Ratio (NSFR) has a time horizon of one year and has been developed to capture structural issues to provide a sustainable maturity structure of assets and liabilities.

BCBS (2010*b*) states that the LCR will be introduced as a binding constraint on January 1, 2015, and the NSFR will become a minimum standard by January 1, 2018. However, the Committee has since- on 7 January 2013- issued the full text of a revised Liquidity Coverage Ratio on 7 January 2013(BCBS, 2013)[2]. The revisions to the NSFR will be made by mid-2016, and the NSFR will be introduced as a requirement on January 1, 2018(BCBS,

[2]The Liquidity Coverage Ratio was first published in December 2009 (BCBS, 2009). But it faced pressure from the banking industry and politicians to 'water-down' its original plans.

2010*d*).

The section below explains and assesses the two standards.

The Liquidity Coverage Ratio

This standard aims to ensure that a bank maintains an adequate level of unencumbered, high-quality liquid assets that can be converted into cash to meet its liquidity needs for a 30 calendar day time horizon under a significantly severe liquidity stress scenario specified by supervisors. At a minimum, the stock of liquid assets should enable the bank to survive until Day 30 of the stress scenario, by which time it is assumed that appropriate corrective actions can be taken by management and/or supervisors, and/or the bank can be resolved in an orderly way.

The Basel 'Liquidity Coverage Ratio' (LCR) builds on traditional 'liquidity coverage ratio' methodologies used internally by banks to assess exposure to contingent liquidity events. As defined,

$$\text{LCR} = \frac{\text{Stock of high-quality liquid assets}}{\text{Total net cash outflows over the next 30 calendar days}} \geq 100\%.$$

According to BCBS (2010*b*), there are two categories of assets comprising the stock of high-quality liquidity assets (i.e. 'Level 1' assets and 'Level 2' assets). Level 1 assets include: marketable securities guaranteed by sovereigns, central banks,the BIS,or the IFS and assigned a 0% risk-weight under the Basel II standardized approach for credit risk, and traded in large, deep and active repo markets; 0% risk-weighted sovereign or central bank debt securities issued in domestic currencies; and 0% risk-weighted sovereign or central bank debt securities issued in foreign currencies. And Level 2 assets include: marketable securities guaranteed by sovereigns and central banks and assigned a 20% risk-weight under the Basel II standardized approach for credit risk; corporate bonds and covered bonds issued by a financial institution or any of its affiliated entities; corporate bonds and covered bonds not issued by a bank itself or any of its affiliated entities rated at least AA-.

Assets to be included in each category are those that the bank is holding for a month. Level 1 assets can comprise an unlimited share of the pool and are not subject to any discount under the LCR. Level 2 assets can be included in the stock of liquid assets, subject to the requirement that they comprise no more than 40% of the overall stock after an assumed weight (85%) has been applied.

Cash outflows come from retail deposits, unsecured wholesale funding provided by small business customers, unsecured wholesale funding with operational relationships, unsecured wholesale funding provided by non-financial corporates, sovereigns, central banks and public sector entities, unsecured wholesale funding provided by other legal entity customers, and secured funding.

In the revisions to the LCR (BCBS, 2013), the BCBS has been mindful not only of the potential impact of the standard on the financial markets, the extension of credit and economic growth, but also of the timing of its introduction as significant financial strains persist in some banking systems. There are four major areas of change:

1. Expansion of the range of assets eligible for inclusion in the stock of high-quality liquid assets (HQLA), through the addition of a new category of 'Level 2B assets' which national supervisors may choose to recognise as HQLA in their local LCR regulations. Supervisors exercising such discretion are expected to ensure that the Level 2B assets included as HQLA meet all relevant qualifying criteria and that the banks holding these assets have appropriate systems to monitor and control the associated risks;

2. Recalibration of the stress assumptions for some cash-flow items (including in respect of retail and non-financial corporate deposits and undrawn committed facilities), taking into account industry feedback and actual experience in times of stress. Such assumptions will affect the calculation of the Total net cash outflows denominator of the LCR;

3. Affirmation of the usability of the stock of HQLA by banks in times of stress, notwithstanding that this may cause the LCR to fall below the minimum requirement. Supervisors are expected to establish guidance to specify the circumstances for usage of the HQLA, and to ensure appropriate supervisory action in response to such circumstances; and

4. Adoption of a phase-in arrangement that introduces the LCR as planned on 1 January 2015, but with the minimum requirement set at 60%. This will then rise by 10 percentage points per annum to reach 100% on 1 January 2019. This graduated approach is to ensure that the standard can be implemented without material disruption to the ongoing strengthening of banking systems and financing of economic activity.

The Net Stable Funding Ratio

To promote more medium and long-term funding of the assets and activities of banking organizations, the Committee has developed the Net Stable Funding Ratio (NSFR). The NSFR builds on traditional 'net liquid asset' and 'cash capital' methodologies used widely by internationally-active banking organizations, bank analysts and rating agencies. As defined,

$$\text{NSFR} = \frac{\text{Available amount of stable funding}}{\text{Required amount of stable funding}} \geq 100\%.$$

This metric establishes a minimum acceptable amount of stable funding based on the liquidity characteristics of an institution's assets and activities over a one year horizon. Therefore, it can measure the amount of available longer-term stable sources of funding over the required amount under a 1 year stress scenario (includes off-balance-sheet exposures). This standard is designed to act as a minimum enforcement mechanism to complement the LCR and reinforce other supervisory efforts by promoting structural changes in the liquidity risk profiles of institutions away from short-term funding mismatches and toward more stable, longer-term funding of assets and business activities. In particular, the NSFR standard is structured to ensure that long term assets are funded with at least a minimum amount of stable liabilities in relation to their liquidity risk profiles. The NSFR aims to limit over-reliance on short-term wholesale funding during times of buoyant market liquidity and encourage better assessment of liquidity risk across all on- and off-balance sheet items. In addition, the NSFR approach offsets incentives for institutions to fund their stock of liquid assets with short-term funds that mature just outside the 30-day horizon for that standard.

The available amount of stable funding includes Tier 1 and Tier 2 capital, preferred stock due in 1 year, debt securities due in more than 1 year, liabilities due in more than 1 year, stable deposits due in 1 year, less stable deposits due in 1 year, and unsecured wholesale funding or terms deposits due in 1 year. The required amount of stable funding comes from Government debt securities, unencumbered corporate bonds rated over AA-, unencumbered corporate bonds due in 1 year, unencumbered residential mortgages, retail loans due in 1 year, and 'other assets' due in more than 1 year[3].

These ratios need to be reported to supervisors starting January 2012. The LCR will be calculated and reported at least monthly, with the operational capacity to increase the frequency to weekly or even daily in stressed situations at the discretion of the supervisor.

[3]Preferred stock excludes Tier 2 capital, and 'other assets' exclude cash and interbank loans.

The NSFR will be calculated and reported at least quarterly. The BCBS sets a two-week limit for the time between the end of the reporting period and when the data should be available.

Comments on the Basel Committee's Liquidity Ratios

Both the LCR and NSFR measures clearly address the fragility identified by the crisis and strive to increase the resilience of banks to liquidity shocks by establishing minimum levels of buffers and by structurally matching more closely the term structure of both sides of the balance sheet. The ratios look at liquidity gaps in defined time horizons; no information is provided about liquidity exposures in other periods. Moreover, the observation period is not flexible but standardized. For a bank involved in correspondent banking and clearing and settlement activities, 30 days could be a long term horizon.

Besides, even though BCBS (2010*b*) imposes weights for each category of assets as well as liabilities, it failed to consider and clarify the real contractual maturities. This shortcoming has been explained in great detail in chapter 4, in which I build up proper frameworks to measure a bank's short-term liquidity risk and long-term liquidity risk, respectively.

The ratios are calculated with pre-defined standard aggregations and stress assumptions (a one-size-fits-all approach) yet, assumptions can differ across banks with different sized and business models and operating in different countries. One-size-fits-all assumption sets for the LCR and the NSFR cannot convey the differences in funding processes of different economies. Moreover, one-size-fits-all assumption sets for the LCR and the NSFR cannot be adapted to different economic structures, because:

1. banks are intermediaries in the credit process of the economy;

2. the funding requirements may not be consistent with what funding providers (ie: households at the end of the day) can deliver in balances or terms, or with the required rates to attract those funds compared to the acceptable rates for funding needs (ie: households, corporates, governments), the impacts may be detrimental to the economy as a whole;

3. within the Euro zone, households' savings are different in amounts and structures, notably due to tax incentives. For example, the Netherlands and France allow relatively unrestricted tax deductions for mortgage interest, but Italy allows mortgage interest deductions for first-time homeowners only. The Netherlands allows tax deductions

for consumer borrowings, while France and Italy taxpayers are not allowed (Poterba, 2001).;

4. as the European economy is more bank-intermediated than the US economy, the effects on the European economy would be more significant[4];

Both the NSFR and LCR requirements assume that no maturing interbank liabilities will be rolled over and no new interbank funding will be available. This means banks can rely on outstanding interbank funding only to the extent that they have contractually formalized rights to avoid repayment for more than 30 days (LCR) or for more than 1 year (NSFR). It will reshape interbank deposit markets in the long-run.

In order to meet the LCR, banks will shift demand towards assets eligible for inclusion in the liquid buffer. This will distort bond markets, especially the price of government bonds. In the LCR, capital is taken account of only to the extent it is invested into eligible liquid assets. In the NSFR, capital is eligible as a stable funding source. The idea of the committee is that banks first raise new capital, and then invest it to build up the liquid asset buffer. This may have an adverse impact on the real economy.

Trading securitization-transforming illiquid assets to liquid instruments will be discouraged. And banks might need to raise medium funding to comply with the NSFR, since:

1. from the perspective of a bank willing to invest in asset-backed securities, ABS are not eligible as liquid assets to any extent. All holdings of ABS with a maturity exceeding one year are 100% accounted for in the determination of required stable funding and must be matched with medium/long-term funding. And

2. from the perspective of a bank willing to grant medium/long-term credit to its customers in the form of mortgages, credit card loans, personal loans etc, the NSFR states that loans with maturity exceeding one year must be funded with medium/long-term finance up to percentages that depend on the loan credit quality and are completely independent of the possibility of being securitized. As a result, lending banks cannot draw any benefits in terms of liquidity from securitizations.

[4]This is notably due to the operation of the US agencies (Fannie Mae, Freddy Mac)and the Federal Home Loan Banks (FHLB), all of which are de-facto state guaranteed. The US agencies supply huge amounts of mortgages, this saves US banks from a lot of funding needs, leverage and credit risk. While the Federal Home Loan Banks provide secured funding to US banks. The FHLB replied to the BCBS's Consultative Paper to affirm its role of funding provider in case of a crisis.

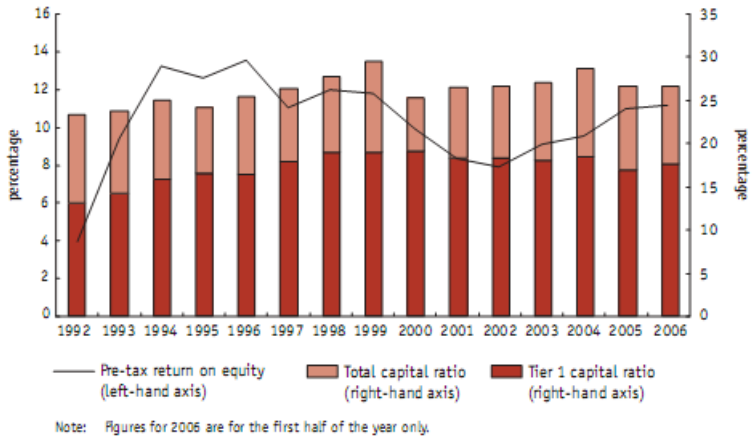
3.3 An Assessment of the UK Financial Services Authority's Liquidity Regulation and Supervision

3.3.1 The financial risk outlook for the UK banking sector since 1998

Apart from Japan, the major developed economies experienced positive growth without significant inflationary pressures from 1998 to 2007. The major UK banks' [5] growth rate of assets was close to the growth of nominal GDP in 1999. Some banks improved their competitive advantage by purchasing other financial parties in 2000 (e.g. Barclays acquired the Woolwich; HSBC acquired the Credit Commercial de France).

Although the financial system was fragile and uncertain throughout 2001, especially against the background of the 11th September terrorist attack, the collapse of Enron and Argentina's default, UK banks' capitalization and profitability was supported by the relative-healthy domestic economy (see Figure 3.1).

Figure 3.1: Major UK banks' profitability and capitalization



Source: FSA (2007*a*, pg.36) , Bank of England and Company accounts.

But, after 2004, the slight rise in interest rates and the decline in lending margins caused a rise in credit risks from mortgages for banks and building societies, especially for those which had expanded lending activities by relying heavily on self-certificated 'Buy-to-Let'

[5]Major UK banks at that time refers to Abbey National, Alliance and Leicester, Barclays, Bradford and Bingley, HBOS, HSBC, Lloyds TSB, Northern Rock and the Royal Bank of Scotland.

investors[6]. UK retail banks and building societies were likely to face a more challenging operating environment after 2005[7]. However, the decline in interest margins (caused by competitive pressures and a flattening yield curve) had been offset by a growth in non-interest income. For the larger banks, slower growth in retail lending was offset by stronger growth in leveraged lending[8] and other financial market activities. Building societies moved towards higher-risk lending and attempted to earn non-interest income. The structure of funds had also changed. Banks preferred international financial markets to fill the funding gap between sluggish deposits and fast-growing loans as a result of the steady decline in UK households' saving rates. However, increasing reliance on short-term external funding proved to be a key vulnerability for the banking sector in the Sub-Prime crisis of 2007.

Before 2000, securitised credit had played a small role in the UK mortgage market but, by 2007, 18% of UK mortgage credit was funded through securitization (see Figure 3.2). But the UK also saw the rapid growth of on-balance-sheet mortgage lending, with UK banks expanding their loan books more rapidly than deposit bases, placing increasing reliance on wholesale funding (see Figure 3.3). At the aggregate level, this implied a significant increase in overseas bank financing of the UK current account deficit.

Because of high credit default rates on mortgage-related products, banks and other financial participants, in order to maintain their own liquidity, would refuse to lend to each other. Between August 2007 and April 2008, the indicator of lending markets' overall risk, the Treasury Eurodollar Spread (TED)[9], rose sharply from 50 basis points to 200 basis points. Besides, funding for short-term loans were costly, especially in 2008 through 3-month LIBOR-OIS spreads[10]. (see Figure 3.4).

[6]Those investors buy properties (e.g. through mortgage) to let for profits.

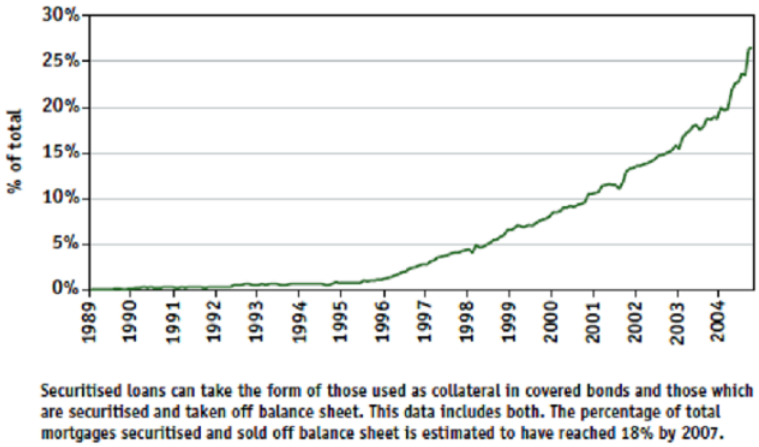
[7]Net interest income of UK building societies fell to 1.06% in the first half of 2006, down from 1.45% in 2000.

[8]Leveraged lending is a type of corporate finance used for mergers and acquisitions, business recapitalization and refinancing, equity buyouts, and business or product line build-outs and expansions. It is used to increase shareholder returns and to monetize perceived 'enterprise value' or other intangibles. In this type of transaction, debt is commonly used as an alternative to equity when financing business expansions and acquisitions.

[9]The TED spread is the difference between the three-month Treasury Bill interest rate and the three-month Eurodollar interest rate (or LIBOR interest rate). The TED spread measures the degree of riskiness of the bank lending market. Increases or decreases in this spread are viewed by market participants as indicating the degree of problems in the banking system. (`http://understandingthemarket.com/?p=51`)

[10]The LIBOR-OIS spread is the difference between the London Interbank Offered Rate (LIBOR) and the overnight index swap (OIS) rate, and is commensurate with the amount of perceived credit risk in the interbank lending market. The LIBOR is a daily reference rate based on the interest rates at which banks borrow unsecured funds from other banks in the London wholesale money market (or interbank market). The OIS rate relates to interest rate swaps based on a specific currency that exchanges fixed rate interest

Figure 3.2: Estimated share of securitised loans in UK mortgage lending (includes covered bonds)



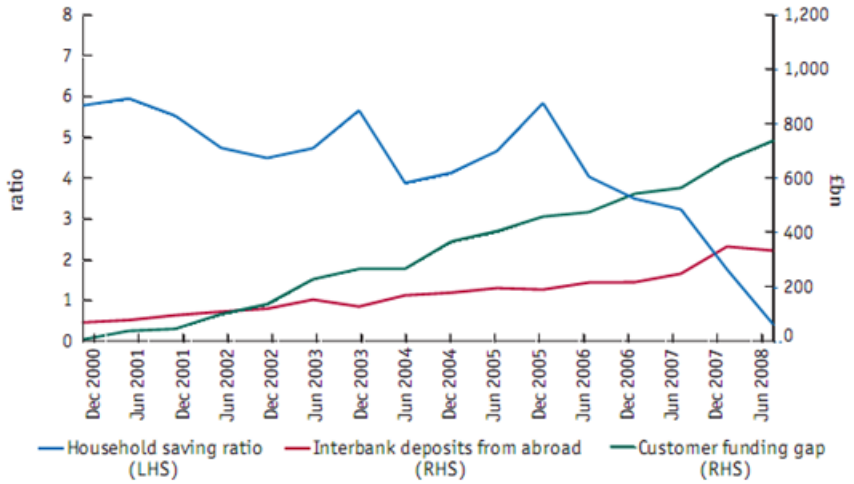
Source: Bank of England, ONS, FSA (2009*e*, pg.34)

A crucial feature of the UK system in the run-up to the crisis was, therefore, the rapid growth of a number of specific banks-Northern Rock, Bradford &Bingley, Alliance and Leicester and HBOS-which were increasingly reliant on the permanent availability of a large-scale interbank funding and/or on their continuous ability to securitise and sell down rapidly accumulating credit assets, particularly in the mortgage market. Banks have been considerably weakened by adverse economic and financial market conditions since Northern Rock was nationalized on 22rd February 2008; Bradford & Bingley was partly nationalized on 29th September 2008, and its deposits and branches were sold to Santander; Alliance and Leicester was acquired by the Spanish firm Banco Santander in October 2008; HBOS was merged into Lloyds Banking Group on 19th January 2009; Dunfermline's deposits, residential mortgages and branches were taken over by Nationwide on 30th March 2009; and the Royal Bank of Scotland, announcing the largest losses in UK corporate history at £24bn, was part nationalized by the UK Government-with on equity share of almost 84.4% early in November 2009.

Turner summarises some specific factors in the UK crisis:

payments for floating rate payments dependent on a notional swap principal at regular intervals over the life of the swap contract.

Figure 3.3: Major UK banks' customer funding gap, household saving ratio and foreign interbank deposits



Source: Bank of England; Dealogic; ONS; FSA (2009*e*, pg.34).

1. The failure of Northern Rock[11] was not caused by immediately evident solvency/credit quality problems, but by the drying up of the market for both securitised credit assets and wholesale funding availability (i.e. low probability but high impact events [12]). Such funding issues were also critical to the problems at Bradford & Bingley and HBOS in September/ October 2008.

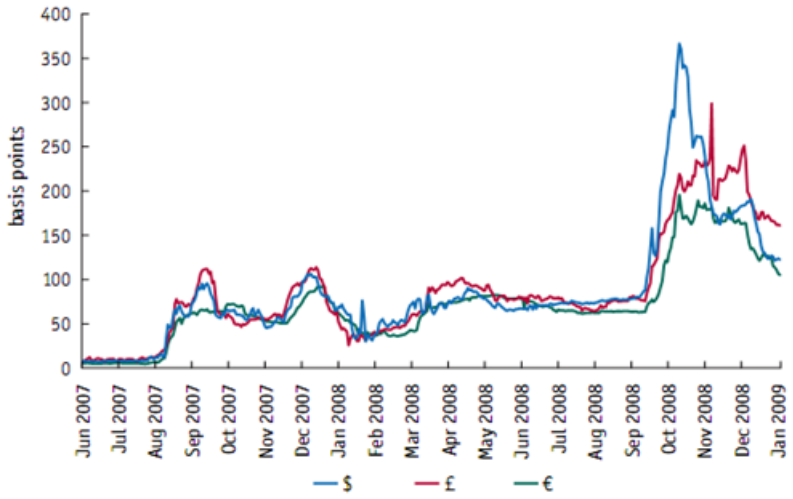
2. The emergence of major trading book losses on the balance sheets of those UK banks which had been extensively involved in the ' acquire and arbitrage ' model of securitised credit intermediation.

3. The subsequent emergence of a wider set of credit problems-in mortgages and in corporate lending and, in particular, in commercial real estate-as the financial crisis itself generated credit capacity constraints and economic slowdown. This slowdown

[11]For more information about FSA responses on Northern Rock's failures, please see Appendix B

[12]Appendix C explains the FSA's risk assessment on firm-specific risks is on probability of the problem occurring and impact of the problem if it occurs. Despite admitting that low probability but high impact episodes are very harmful, the FSA has claimed that such circumstances would not be prioritized because they are very difficult to measure. However, both Pearson and Clair (1998) and Mitroff (2005) emphasize the meanings of crisis management is the active prevention and mitigation of low probability but high impact events.

Figure 3.4: 3-month LIBOR-OIS spreads in sterling, US dollar and Euro



Source: Bloomberg; FSA (2009*a*).

in turn exposed the risky nature of some credit extension in the boom years and is now generating credit quality deterioration, even among previously creditworthy customers.

Learning from recent events, investors have realized that banks' values should be based on long-term survival prospects-dependent on quality and quantity of capital and liquidity-rather than on short-term leveraged profit potential. In order to survive and keep a strong relationship with investors, therefore, banking regulators need to adjust supervision frameworks for requiring banks to improve their quantitative risk management as well as build a sustainable business model supported by ample liquidity and robust capitalization. Above all else, both banking regulators and banks need to restore trust with their customers.

3.3.2 The FSA's liquidity regulation 1998-2008

Regulatory agencies can be viewed as supplying regulatory rules, monitoring (overseeing whether the rules are obeyed) and providing guidance services (general conduct of the financial firms) to stake-holders (Llewellyn, 1999).

Before 2008, the three liquidity regimes (see Appendix D) in the UK had not been changed since the end of the 1990s. The Sterling Stock regime-see Equation (D.1)- applied

to large UK retail banks and required banks to hold 'eligible assets', such as cash, UK Treasury bills and gilts (Hall, 1999) to cover their five-day wholesale net outflow and 5% of retail deposits withdrawable over the same period. However, this regime had a number of limitations:

1. even though the Sterling Stock requirement can deal with a 'short-duration' liquidity stress, it has less relevance for longer duration liquidity stresses, as were apparent during the recent crisis;

2. this calculation, first introduced in 1996, was no longer appropriate, since several liabilities are excluded, such as non-sterling liabilities and off-balance sheet contingent liabilities;

3. in a stressed scenario, there may be few certificates of deposits available because of a lack of confidence in the banking system; and

4. in the case of Northern Rock, a loss of 5% of sterling retail deposits cannot reflect the possible retail behaviour over five working days[13] .

The Maturity Mismatch regime -see Appendix D, Table (D.1) applied to all other banks to assess whether they had enough marketable assets-including, inter alia, regularly-traded assets with regularly quoted prices-to meet their liabilities through limiting the ' cumulative net mismatch position' between a bank's inflows (assets) and outflows (liabilities) in different time-bands within a maturity ladder (e.g. next day, one week, one month, three months, etc). The marketable assets are subject to varying discounts. The regime also required a firm to analyze the changes in cash flows which may not match their contractual maturity based on relevant factors, such as economic conditions. However, recent events have shown that some regularly-traded assets may no longer be as marketable as previously thought.

The Building Society regime was derived from policy work by the predecessor regulator, the Building Societies Commission, in 1997. The regime reflects a simpler business model-residential mortgage lending primarily funded out of retail savings. However, recent events have shown that societies have adopted more complex business models and concentrated on wholesale funding. Under this regime, building societies must hold appropriate amounts of both total and short-term liquidity. The range for total liquidity is between 15% and

[13]Between 14th September and 16th September 2007, worried customers had taken out an estimated £1.5 bn in deposits against £30.1 bn of total customer deposits- believed to be the biggest unplanned withdrawal from a British bank operation in history.

25% of banking liabilities, while the minimum for short-term liquidity is 3.5% of banking liabilities (FSA, 2007*b*). However, there is no methodology linking the liquidity calibration to an individual society's risk features- such as its wholesale funding gaps, or the volatility of its retail deposit base.

3.3.3 The FSA's liquidity regulation after 2008

In order to avoid these drawbacks of existing regimes, the FSA proposed a new liquidity regime between 2008 and 2009 (see CP 08/22, 09/13, 09/14, and PS09/16). All Banks, Building Societies and Investment (BIPRU) firms and EEA banks should follow two high-level principles. Firstly, they must maintain adequate liquidity resources at all times. Secondly, they must not depend on other parts of their group to satisfy the overall liquidity adequacy rule[14]. To make sure all BIPRU firms and EEA banks can smoothly comply with the new requirements, the FSA also arranged a training conference for them in November 2009. This new regime set out four main components, as follows:

1. Systems and Controls Requirements;
2. Individual Liquidity Adequacy Standards (ILAS);
3. Group-wide management of liquidity; and
4. The composition of liquid assets buffers and liquidity reporting.

The main requirements proposed under each heading will now be addressed in turn.

Systems & controls requirements

A systemic approach to liquidity management can capture the contagious feature of liquidity risk. In 2009, Turner stated that 'liquidity risk has inherently systemic characteristics, with the reaction of one bank to liquidity strains capable of creating major liquidity strains for others'. The systems and control requirements consist of liquidity risk management, stress testing, and contingency funding plans (CFPs), as set out in the FSA Handbook (chapter on Prudential Sourcebooks for Banks, Building Societies, and Investment Firms,or BIPRU 12.3,12.4).

[14]The FSA clarified that a self-sufficient branch would only be allowed to count liquidity resources that are under the day-to-day control of the branch's senior management, held in account with one or more custodians in the sole name of the UK branch,unencumbered,or attributed to the balance sheet of the branch.

Firms will take one of three options to comply with the new provisions. For standard ILAS firms, their Individual Liquidity Adequacy Assessment (ILAA) should include an assessment of their compliance with BIPRU 12.3 and 12.4. Simplified ILAS firms need to carry out an Individual Liquidity Systems Assessment (ILSA) assessing their compliance with BIPRU 12.3 and 12.4. And Non-ILAS firms must undertake annual completion of systems and controls questionnaires to demonstrate their compliance with BIPRU 12.3 and 12.4 (PD 09/16, pp. 24-25).

1. Liquidity risk management
   Under the new regime, liquidity risk management should cover: the overarching systems and control requirements (e.g. through sound, effective and complete processes, strategies and systems that enable a firm to identify, measure, monitor and control liquidity risk, including early warning indicators to identify immediately the emergence of increased liquidity risk or vulnerabilities); pricing liquidity cost (e.g.by considering significant business activities both in normal financial conditions and stressed circumstances); intra-day management of liquidity (such as monitoring a firm's intra-day liquidity position, identifying gross liquidity inflows and outflows, acquiring sufficient intra-day funding); the management of collateral risk (e.g. calculating all collateral positions of a firm, and monitoring changes in the collateral usage); managing liquidity across legal entities, business lines and currencies (e.g. by measuring net funding positions); and funding diversification and market access.

2. Stress testing (for full details, see CP 08/22, pp.26-27)
   Stress testing is a means to identify sources of potential liquidity strain. ILAS firms need to report their stress testing results to the FSA in their ILAA. The stress-test results should be reviewed by senior management and reported to the governing body. They should also be used to develop the firm's CFPs.

   In conducting stress testing, a firm should consider the impact of its chosen stresses on the appropriateness of its assumptions relating to: correlations between funding markets; the effectiveness of diversification across its chosen sources of funding; additional margin calls and collateral requirements; contingent claims; liquidity absorbed by off-balance-sheet vehicles and activities; the transferability of liquidity resources; the ability to access central bank facilities; the future balance sheet growth; the continued availability of market liquidity in several currencies; the ability to access secured

and unsecured funding; and the currency convertibility and access to payment or settlement systems on which the firm relies.

3. Contingency funding plans
   The aim of contingency funding plans for a firm should ensure that, in each stress, it should still have sufficient liquidity resources. However, the CFPs of many firms failed to rescue them by ensuring sufficient liquidity resources during the recent crisis.

   In order to design a useful CFP, a firm should consider the amount of funding, the impact of market disruptions on the funding sources, the impact of business and reputation consequences on its ability to raise funding and the terms and conditions of any central bank facilities.

Individual Liquidity Adequacy Standards (ILAS)

The Individual Liquidity Adequacy Standards framework, based on three stress tests, comprises an Individual Liquidity Adequacy Assessment (ILAA), a Supervisory Liquidity Review Process (SLRP) and the Issuance of Individual Liquidity Guidance (ILG). The FSA sets out its final risk appetite for firms in terms of the liquidity stresses in 2009 with an expectation that firms are able to survive without reliance on support from the public authorities (e.g. central bank Emergency Liquidity Assistance). The reason why its risk appetite for liquidity cannot be expressed statistically, using a probabilistic method as in the minimum risk asset ratio for capital adequacy requirement, is because liquidity stresses are typically low-frequency, high-impact events. Therefore, any statistical model applying historical data to estimate future liquidity needs at a given level of confidence is unreliable. These three separate stresses are an idiosyncratic liquidity stress, a market-wide liquidity stress and a combination of the two. The appropriate events under those stress scenarios are outlined in Appendix D, Table D.2.

1. Individual Liquidity Adequacy Assessment (ILAA)
   A firm should conduct ILAA according to its own business model to identify the following sources of liquidity risk which could cause a stress event:

   (a) Wholesale secured and unsecured funding risk;

   (b) Retail funding risk;

   (c) Intra-day liquidity risk;

(d) Intra-group liquidity risk;

(e) Cross-currency liquidity risk;

(f) Off-balance-sheet liquidity risk;

(g) Franchise viability risk;

(h) Marketable assets risk;

(i) Non-marketable assets risk; and

(j) Funding concentration risk.

A firm is required to carry out its ILAA at least annually or more frequently if changes in the business, strategy, nature or scale of its activities or the operational environment suggest that its level of liquidity resources or stress assumptions may no longer be adequate.

2. Supervisory Liquidity Review Process (SLRP) A SLRP is conducted by the FSA at a frequency depending on the risk profile of a firm. The aim of a SLRP is to provide an Individual Liquidity Guidance (ILG) to the firm. In addition to a firm's ARROW assessment and other issues arising from day-to-day supervision, including its capital adequacy and market perception of the firm, the FSA will review the firm's:

   (a) Most recent ILAA (see BIPRU 12.5);

   (b) Systems and controls for liquidity risk (see BIPRU 12.3); and

   (c) Internal stress testing and contingency funding plan (CFP) (see BIPRU 12.4).

3. Individual Liquidity Guidance (ILG) The ILG contains guidance about:

   (a) the quantity of a firm's liquid assets buffer; and

   (b) the firm's funding profile.

   A firm must monitor its conformity with its ILG on a daily basis, while the FSA would regularly monitor its liquidity risk profile.

4. Quantitative standards for simpler firms: There are several regulatory challenges with ILAS for simpler firms. Firstly, due to their smaller management teams relative to large firms', it is an expensive process for simpler firms. Secondly, the resources required by the FSA to implement ILAS is significant for simpler firms relative to their risk-profiles and to the risk to the statutory objectives of the FSA.

Comparing with large and more complex firms, the FSA has removed the requirement for simpler firms to conduct ILAAs and have designed the following standardized buffer ratio for simpler firms. Appendix D, Tables D.3 and D.4 also contain the definition of simpler firms as well as their standardized buffer ratios.

Group-wide management of liquidity

A whole-firm liquidity modification will replace the current Global Liquidity Concessions (GLC) to the requirement for European Economic Area (EEA) and non-EEA branches to be self-sufficient.

Under the GLC regime, day-to-day liquidity supervision is transferred to the home state regulator from the host regulator. Under the whole-firm liquidity modification, a branch can rely on other parts of its group to satisfy the FSA's systems and controls liquidity requirement, and it will no longer be subject to the ILAS regime. However, the branch will be required to provide liquidity reports with more clarity on the frequency on a monthly or quarterly basis depending on the level of market impact of the branch.

An intra-group liquidity modification is the other process for granting and maintaining modifications of the self-sufficiency requirement for UK solo entities. Firms that have been granted an intra-group liquidity modification will also have the option of relying on other parts of its group to satisfy the liquidity requirement. Only after determining how much liquidity such firms should hold and how much liquidity support they should receive from the intra-group would the FSA likely grant a firm an intra-group liquidity modification. In addition, the ILAS group will still be subject to normal reporting requirements.

The composition of the liquid assets buffers and liquidity reporting

In relation to the liquidity assets buffer, the FSA requires all ILAS BIPRU firms to maintain sufficient liquid assets, such as a stock of high quality government bonds, central bank reserves and bonds issued by multi-lateral development banks. However, assets used as collateral should not be used as liquid assets. A firm may only include in its liquid assets buffer the following items (see BIPRU 12.7):

1. High quality government debt securities:

    - issued by the central government of an EEA State; or

- issued by the central governments of the United States of America, Canada, Japan, Switzerland and Australia.

2. Securities issued by those international institutions listed in Appendix VI to the Bank of England's 'Operations under the Sterling Monetary Framework: Operating Procedures', as periodically updated; and

3. Sight deposits and tradeable securities issued by a central bank of:

   - an EEA State; or
   - the United States of America, Canada, Japan and Switzerland.

4. For simpler firms' liquid assets, investments in qualifying money market funds will also be included, subject to meeting the following criteria:

   - the funds must offer same-day liquidity to any notification given before 3pm; and
   - the investment of the fund should be restricted so that it is only permitted to invest in assets themselves eligible for the liquidity buffer and sight deposits with credit institutions that are fully secured at all times by assets themselves eligible for the liquidity buffer.

With respect to the composition of liquidity reporting, the FSA proposed reforms in terms of frequency of liquidity data collection and a standardized reporting format providing a view on liquidity risk from firm-specific, sector-and market-wide events. The main requirements will now be addressed in turn.

1. Data items and frequency
   Appendix D Tables D.5 and D.6 summarizes the data items, reporting frequency and submission deadlines. The FSA's strengthening of liquidity standards policy in BIPRU 12 was applied on 1st December 2009. However, there was a transitional period after then; firms were required to continue to submit current liquidity regulatory reports until the transition was completed.

2. Consolidation levels of reporting
   There are three consolidation levels of reporting for each individual ILAS firms:

   (a) Solo basis;

(b) Defined Liquidity Group (DLG) by modification: the DLG includes each entity which can receive liquidity support from other parts to meet the overall liquidity adequacy rules;

   i. -UK DLG: A DLG whose members are all ILAS firms

   ii. -Non- UK DLG: any other type of DLG as it relates to the firm or the UK DLG created by the modification; and

(c) DLG by default: the DLG includes each entity which is a member of the firm's group and provides or is committed to providing material support to the firm against liquidity risk; the firm provides or is committed to provide material support to that entity against liquidity risk; or that entity has reasonable grounds to believe that the firm would supply such support, and vice versa.

Firms or DLGs that are below the £50m threshold for total assets minus called up share capital, minority interests and reserves are excluded from the new quantitative reporting requirements and only have to complete a systems and controls questionnaire (FSA 055).

Two factors demonstrate which consolidation levels a firm should apply:

(a) Whether it has been granted a modification;

(b) Whether the FSA is the lead regulator.

A firm which is under UK-lead regulation and does not have a UK DLG modification will report on a Solo and DLG by default basis. A firm which is under UK-lead regulation and has a UK DLG modification will report on a Solo, UK DLG and DLG by default basis. A firm which neither follows the UK-lead regulation nor has a UK DLG modification will only report at the Solo level. Finally, a firm which is not under UK-lead regulation but has a UK DLG modification will report on a Solo and DLG levels (see Figures D.1 and D.2 in Appendix D).

3.4 Comments on the Revision to Liquidity Regulations by the BCBS and the FSA

After years of lobbying by banks, politicians and even some financial regulators[15], the revisions to the LCR are largely good news for bank profits because institutions will be allowed to count more, higher-yielding assets in their liquidity buffers. In addition, the Basel group made clear that national regulators would be able to relax the rules in a crisis so institutions will not be expected to hold 'buffers on top of buffers'.

Fitch (2013) discusses that the latest Basel III changes are good for banks, giving them more time and scope to adapt to banking regulations targeted to prevent a repeat of the global financial crisis of 2007-09. Sir Mervyn King, speaking in his capacity as head of the Global Heads of Supervision college within BCBS, has said the agreement is 'a very significant achievement [and] a clear commitment to ensure that banks hold sufficient liquid assets to prevent central banks from becoming lenders of first resort' (Masters, 2013). And Stefan Ingves, the Swedish central banker who chairs the Basel Committee itself, said the changes would effectively increase the average LCR for the world's 200 largest banks from 105 to 125 per cent. But he noted that liquidity stocks are not evenly spread, and some institutions remain well below the required levels. That is why the banks will only have to meet 60 per cent of the requirement in 2015, and fully by 2019 (Masters, 2013).

In order to head off a severe double-dip recession and benefit banks and their customers by not choking off the flow of credit to the real economy, the Financial Services Authority, on 9 June 2012, informed banks that they will not be required to hold any extra capital against new UK loans. And they also relaxed liquidity rules to include a broader variety of assets in the buffers that banks must hold in case of a run by depositors or other market crises. This move, again, put Britain at the forefront of a global experiment to use bank regulation to moderate the economic cycle (Masters, 2012).

However, Valladares (2013) criticizes regulators who pretend to supervise while banks pretend to be liquid. The bankers had argued that the stricter requirements of the originally proposed LCR would have constrained credit availability. But there is no guarantee that a weaker LCR will embolden banks to lend more. Given the amount of liquidity that monetary authorities in the U.K., Europe, and the U.S., have injected, banks have had plenty of opportunity to lend to the real economy.

[15]The detailed discussion of banking industry objections to Basel III can be found in several newspaper articles: e.g. Jenkins (2010), Watt (2011), Insight (2013), and Masters (2013)

The calculation methods have also been changed in ways that will significantly increase the stock of high quality liquid assets and reduce the total size of the net cash outflow. The main winners under this new rule are those, mainly European, banks struggling to meet the original requirements by the deadline of 2015 as well as universal banks with big retail deposit bases and large corporate lending relationships. 'This is quite a lot more favorable to the industry than I and the market were expecting. The changes to the asset definitions and the outflow calculations in particular look like a fairly massive softening of approach,' said Daniel Davies, banking analyst for Exane BNP (Masters, 2013).

Even before the LCR was softened, a problem with the LCR was that even if a sovereign security was not in the upper echelon of ratings, it could still be considered a Level I asset as long as it was denominated in the sovereign's own currency. Given the current fiscal condition of a number of European countries, it was already questionable how liquid these securities really are. Level 2 assets comprising sovereign, corporate, and covered bonds that were rated AA-minus could also be part of the numerator with a 15% haircut. Under the revised LCR announced on 7 January 2013, the numerator can also now include: corporate bonds rated BBB-minus to A-plus; unencumbered equities; and residential mortgage-backed securities. At least these assets have what some would consider a significant haircut (25% for the mortgage bonds, 50% for the others). But it is important to remember how volatile and illiquid even highly-rated sovereign securities can become, not to mention the above assets. Also, yet again, the market will be relying on public ratings that are paid for by the issuer, a conflict of interest that led to dicey securities receiving high grades during the boom years. The Basel Committee also eased its recommended stress scenarios in many instances. For instance, it reduced the outflow stress levels on certain fully-insured retail deposits, non-financial corporate deposits, and committed liquidity facilities to non-financials.

Instead of needing a 100% LCR by 2015, banks now are expected to have just a 60% ratio by then. The remainder would increase incrementally until 2019, when banks would have to be fully compliant. It is important to remember, however, that the Basel Committee has no legislative or enforcement powers anywhere. Hence, it is quite likely that any jurisdiction could water down the LCR or delay it further depending on its views and needs, as follows:

1. Fears that the introduction of the original agreement would serve to depress bank lending amid clear evidence of a continuing 'credit crunch', thereby aborting the nascent global economic recovery;

2. Doubts about the size of the pool of ' high quality liquid assets' available to the global

banking industry under the original agreement;

3. Recognition that sovereign debt need not necessarily represent the most liquid of assets;

4. A desire to loosen the ties between banks and sovereigns; and

5. A desire to 'kick start' the securitization markets.

3.5 The Interaction Between The Liquidity Regulation and the Liquidity Provision Operations of Central Banks

The key assumption underlying the new liquidity regulation is that the firm should rely on its own capacity to raise funding in the financial markets in the first instance and not rely on central bank funding. On the basis of this assumption the regulation seeks to require banks to internalize or price their liquidity risk and build-up liquidity buffers independently of central banks. And this assumption necessitates a clear qualification-the dependence of banks on the central bank is exogenous to the decisions of banks. Under the proposition of non-provision of central bank liquidity, Schmieder et al. (2012) build up liquidity stress tests to simulate how liquidity support provided by parent banks and central banks would alter the worse scenario outcomes. Any estimated liquidity shortfall of a subsidiary should indicate the possible needed amount of additional parent funding support. Meanwhile, central banks could use this tool to assess whether its regular and emergency liquidity support is sufficient and to determine how much additional liquidity might be needed to be earmarked for worst case situations.

Central banks' liquidity provision is not enough, not only because it is socially costly (Stein, 2013), but also because it distorts banks' liquidity choices, given they may have incentives to undertake more risky activities due to the explicit or implicit commitment of the lender of last resort. However, there are those central banks who continue to argue (e.g. the Fed and the Bank of Japan, although they both have vested interests!) that continuing central bank involvement in banking supervision is essential, not least because it provides direct access to important market information that can prove invaluable in crisis situations. Hall (2009) suggests that the involvement of the central banks in banking supervision, especially in the event of a financial crisis, may be necessary because of their continuing lender of last resort function and their responsibility for 'maintaining overall

financial stability', whilst the main regulatory authorities are responsible for the first port of call for any financial firm which gets into difficulties. But, as the Northern Rock episode demonstrated, this would open the Bank up to a further possible loss of credibility additional to that deriving from the operation of its residual role of lender of last resort.

It may be easier, therefore, if the respective frameworks of the regulation and the central bank have to remain separate so as to recognize their respective purposes and not reduce the effectiveness of their functions. Bindseil and Lamoot (2011) propose that central banks should support the regulatory effort to reduce the reliance of banks on the central banks and ensure that banks price the liquidity risks of their activities. And central banks must ensure that the less liquid collateral they accept is thoroughly valued and assessed. Otherwise, an excessive reliance of banks on central bank funding with the least liquid collateral will be the result. Rochet (2008) suggests that a simple and uniform liquidity ratio required by the Banking Supervisors could be considered as a microprudential regulatory tool. As for macro-prudential purposes, it is probably necessary to go further, and either to require additional liquidity, or secure a credit line by the Central Bank. But Banking Supervisors should always firstly identify macro shocks (possibly using stress tests and worst case scenarios) and carefully apply some form of cost-benefit analysis of liquidity provision by the Central Bank.

3.6 Summary and Conclusions

The Bank for International Settlements (BIS) is one of the first regulatory bodies to adopt this new and more comprehensive liquidity risk regime to strengthen banks and restore public confidence. The Basel Liquidity Principles of 2008 represent a substantial revision of the Principles of 2000 and reflect the lessons learnt from the financial market turmoil since 2007. I argue that it will harm the development of financial institutions as well as the real economy if we set up financial regulation in great detail. Implementation of the sound principles by banks and supervisors should be flexible, but also needs to be consistent to make sure they understand banks' liquidity positions quite well. I welcome the definition of liquidity risk tolerance, but it would be better for financial institutions to measure their own liquidity risk tolerance with an explicit example given by the Basel Committee.

I suspect that the one-size-fits-all assumptions of the LCR and the NSFR cannot be adapted to different economic structures. It will reshape interbank deposit markets and bond markets as a result of the increased demand for 'liquid assets' and 'stable funding'.

However, this balance-sheet-ratio analysis is still an advanced and very important approach to measuring banks' liquidity risk positions.

This chapter examines the FSA' previous liquidity regime which cannot reflect banks' risk exposures and then explains the FSA's new liquidity regime in great detail. The new standards fully implement the Basel Committee's 'Principles for Sound Liquidity Risk Management and Supervision' (BCBS, 2008). The fundamental changes in the FSA's liquidity supervision reflect three considerations. First, it introduces a systemic control requirement by measuring individual firms' liquidity risk with a market-wide stress or combination of idiosyncratic and market-wide stresses. Second, it emphasizes the monitoring of business model risks and the capability of senior managers. Third, it allows both internal and external managers to access more information by increasing the liquidity reporting frequencies.

Further, this chapter refers to some contrasted views on the revisions to Basel III's LCR and the FSA's liquidity buffer. Some universal banks or even financial regulators welcome the eased requirement as giving them more time to adapt the new liquidity regulation. While others criticized these changes for having a 'watering-down' effect on Basel III by powerful lobbies.

Finally, this chapter discusses that the liquidity regulation is desirable as an important safeguard against moral hazard. The introduction of liquidity regulation after the crisis can be thought of as reflecting a desire to reduce dependence on the central bank as a lender of last resort, based on the lessons learned over the previous several years. With the implementation of liquidity regulation, central banks should support the regulatory effort to reduce the reliance of banks on the central banks and ensure that banks price the liquidity risks of their activities. Meanwhile, banking supervisors should evaluate the benefit and cost of an external credit line before requiring additional liquidity provision by the central banks.

Chapter 4

How Liquid Are UK Banks?

4.1 Introduction

As I discussed in chapter 2.3.1, the definition of liquidity in this thesis represents the capacity to fulfill all payment obligations as and when they fall due. Therefore, liquidity risk can arise on both sides of the balance sheet, if either the liquidity generated from selling assets or the liquidity available from various funding sources is insufficient to meet obligations as they fall due. In most cases, a trigger event exposes the existing vulnerability in a bank's balance sheet and causes an adverse liquidity outcome. The most common sources of bank vulnerability lie in maturity mismatches between assets and liabilities, with assets typically being less liquid than liabilities, and significant short options of the bank with respect to counterparties and customers, such as the right of holders of sight deposits to withdraw them at any time, or the right of providers of short-term money market financing not to roll over that funding at the end of the contract.

Even though Basel II (BCBS, 2003) required regulators and banks to adopt an improved framework for dealing with liquidity risk, the measurement and management of bank liquidity risk did not receive adequate attention. Before the latest banking crisis, the liquidity regimes in the UK had not been fundamentally changed since the early 1980s. According to the Sterling Stock regime applied to large UK retail banks[1], these banks were encouraged to just focus on controlling intra-day or weekly liquidity, ignoring wider liquidity issues which became apparent during the recent crisis-notably, the growing dependence on volatile

[1]The Sterling Stock regime basically required UK banks to be able to cover their five-day wholesale net outflow and 5% of withdrawable retail deposits over the same period (Hall, 1999, Chapter 18, pages 304-26).

wholesale funding. While the limits applied to the 'cumulative net mismatched position' of the remaining banks likewise failed to address key liquidity concerns. Accordingly, as recognized in Basel III (BCBS, 2010*b*), there was a need for a thorough overhaul of liquidity risk management and assessment.

Regulators now argued that liquidity regulation and supervision should be recognized as being of equal importance to capital regulation. The new international framework for liquidity risk regulation requires individual banks to retain enough liquidity, rather than over rely on central bank funding, which might increase the problem of moral hazard as emphasized by Mernyn King[2]. Indeed, the UK Financial Services Authority (FSA) was one of the first national banking regulators to propose the adoption of a new liquidity regime (see FSA (2008*a*), FSA (2009*b*), FSA (2009*c*) and FSA (2009*d*)), just after the Basel Committee on Banking Supervision (2008) announced new principles for sound liquidity risk management and supervision in September 2008 .

The first contribution of this chapter is to enhance individual banks' liquidity risk measurement and management by applying quantitative balance sheet liquidity analysis, based upon modified versions of the BCBS (2010*b*) and Moody's (2001) models. The fundamental aim of this chapter is to remind banks should understand their own business model and funding strategies in order to match liquidity needs on different time horizons more efficiently.

The second contribution of this chapter is to take a comprehensive look at the UK banks' consolidated balance sheet information. This analytical framework provides valuable operational information, such as a bank's funding strategy and business model, for external agencies and regulators to analyze.

The third contribution of this chapter is to measure a bank's short-term or long-term liquidity position using a single number ('liquidity coverage' or 'net cash capital', respectively). As they are calculated using balance sheet information according to different time scales, these numbers are more accurate than more commonly used 'liquidity ratios', such as the deposits-to-assets ratio (Barrell, Davis, Liadze and Karim, 2010) or the loans-to-deposits

[2]Mernyn King's letter to Treasury and Civil Service Select Committee on 12th September 2007: ' ... there is a case for the provision of additional central bank liquidity against a wider range of collateral and over longer periods in order to reduce market interest rates at longer maturities? This is the most difficult issue facing central banks at present and requires a balancing act between two different considerations. On the one hand, the provision of greater short-term liquidity against illiquid collateral might ease the process of taking the assets of vehicles back onto bank balance sheets and so reduce term market interest rates. But, on the other hand, the provision of such liquidity support undermines the efficient pricing of risk by providing ex post insurance for risk behaviour'

ratio (Gambacorta, 2011), as measures of a bank's liquidity position. Different from BCBS's short-term Liquidity Coverage Ratio and long-term Net Stable Funding Ratio, my short-term liquidity framework is built to measure whether a bank's liquid assets can cover its cash outflow for up to one year or not. And my long-term liquidity framework is built to measure whether a bank's long-term funding due to mature in more than a year can cover its illiquid assets and securities or not.

The fourth contribution of this chapter is to explain why the previous intra-day or one week liquidity focus no longer ensures a bank can survive an unexpected, serious systemic bank crisis, such as that which caused the demise of Lehman Brothers in September 2008[3].

I analyze eight UK banks' liquidity positions from 2005 to 2010 using consistent financial reporting information. Most primary accounting data is taken from the Bankscope database, with secondary data being collected from each bank's financial reports.

I show that, in these six years, only Barclays Bank kept adequate short-term liquidity positions throughout, although the HSBC Bank also remained liquid on a short-term basis, except in 2008 and 2010. Meanwhile, Santander UK was able to cover illiquid assets and securities using long-term funding except in 2009; and, after receiving a huge equity injection from the UK government, RBS also managed to maintain adequate long-term liquidity positions after 2008. In contrast, the rest of the sampled banks (BOS, Lloyds TSB, Natwest, and Standard Chartered) failed to manage their internal liquidity risks properly, exposing themselves to both short-term and long-term illiquidity over the six year period.

The structure of the chapter is as follows. Section 4.2 is the literature review. Section 4.3 describes the data. Section 4.4 outlines the methodologies adopted. Section 4.5 presents the results. And section 4.6 summarises and concludes.

[3]Lehman Brothers collapsed in September 2008, a year after the start of the US sub-prime crisis.

4.2 Literature Review

As Allen and Gale (2001), Diamond and Rajan (2001), and Freixas and Rochet (1997) mentioned, banks are inherently fragile. This fragility arises because banks provide liquidity by financing themselves with external funding. Song and Thakor (2007) argued that various funding sources create risk for the bank owing to unanticipated withdrawals that may be precipitated by adverse expectations of creditors about the bank's payoffs (Chari and Jagannathan, 1988) due to economic shocks (Gorton and Rosen, 1992) or perceived potential bank portfolio risk (Calomiris and Kahn, 1991). Hence, a bank's liquidity stress might be diminished by both reducing its risk-taking on the asset side and extending stable funding on the liability side. In order to assess a bank's liquidity position accurately, it is essential to take a comprehensive look at the bank's consolidated balance sheet information to examine where banks invest and how they fund themselves rather than to evaluate simple liquidity ratios, such as the ratio of cash and balances with the central bank plus securities over total assets (Barrell, Davis, Liadze and Karim, 2010) and the loans-to-deposits ratio (Gambacorta, 2011).

The balance sheet liquidity analysis differentiates between different balance sheet items on both the assets side and the liabilities side, depending on whether the assets are liquid or illiquid, and whether their funding is stable or volatile respectively (Neu, 2007). Under this approach, a bank liquid in the short term would have enough liquid assets to cover volatile short-term liabilities, while a bank liquid in the long term would have enough stable long-term funding to cover sticky illiquid assets (see Table 4.1).

Table 4.1: Balance sheet liquidity analysis

Assets	**Liabilities**
Cash and deposits with central bank	Short term unsecured bank deposits
Trading assets	Trading liabilities
Liquid securities	Current portion of long term debt
Repos (and security borrowing)	Repos (and security lending)
Illiquid assets	Non-bank deposits
Illiquid securities	Certified liabilities
	Equity

Source: Neu (2007, pg. 19).

4.2.1 Short-term Liquidity Framework

Fitch (2010), like other credit rating agencies, uses a short-standing liquidity framework to analyze whether an institution is in the potentially vulnerable position of having insufficient liquid assets or contingency funding to cover short-term debt. Fitch (2010) assumes that a bank will not be able to use long-term funding to maintain short-term solvency, and it focuses on short-term 'liquidity coverage', which is the difference between the liquidity pool (a pool of liquid assets) and stress scenario cash outflows, as follows:

$$\text{Liquidity coverage} = \text{Liquidity pool} - \text{Cash outflows}.$$

A positive figure indicates that the bank would be able to maintain liquidity even with a temporary idiosyncratic or market-wide shock. However, a negative figure means that a bank may be seriously weakened by a disruption of funding capacity, and will need to access other funding facilities to maintain its core business franchise.

Fitch (2010) defines the liquidity pool to include cash, unencumbered assets, government securities, liquid financial assets at fair value, and committed un-drawn lines of credit. The cash outflows come from short-term unsecured debt, brokered deposits, retail deposits, wholesale deposits, collateralized financing, payables and other liabilities, trading liabilities, and commitments to extend credit. To ensure prudence, Fitch (2010) applies different 'shrinkage margins' on the possible sources of cash outflow, as shown in Table 4.2 below.

Table 4.2: Shrinkage margins for short-term funding imposed by Fitch

Assumed Shrinkage Margins	**Cash Outflows**
100%	Short-term unsecured debt
25%	Brokered/internet deposits
10%	Retail deposits
50%	Wholesale deposits
25%	Payables and other liabilities
25%	Trading liabilities
10%	Collateralized financing
25%	Commitments to extend credit

Source: Fitch (2010).

Fitch (2010) characterizes balance sheet positions only as 'liquid' or 'illiquid'. There are no statements about in which time frame positions can be liquidated or liabilities become due. In particular, management cannot know from this analysis whether cash outflows

becoming due within, say, the next eight days can be met. If the time to maturity of a retail deposit is eight days, it cannot truly be considered as a retail deposit attracting a 10% shrinkage margin.

Learning from the serious financial crisis of 2007-2009, the FSA began overhauling the supervision of bank liquidity risk after August 2008[4]. FSA (2009*d*) sets out a new liquidity reporting regime, a part of the overhaul of UK liquidity regulation, which took effect after June 2010, which requires individual banks to collect daily flows out to three months (i.e. 90 days) to analyze survival periods and spot potential liquidity squeezes early [5]. BCBS (2010*b*) develops the liquidity coverage standard for supervisors to use to measure whether a bank makes realistic assumptions about its future liquidity needs for the short-term that reflect the complexities of its underlying business, products and markets. This standard aims to ensure that a bank maintains an adequate level of unencumbered, high-quality liquid assets that can be converted into cash to meet its liquidity needs for a 30 calendar day time horizon under a significantly severe liquidity stress scenario specified by supervisors. At a minimum, the stock of liquid assets should enable the bank to survive until Day 30 of the stress scenario.

The Basel liquidity coverage ratio (LCR) builds on traditional 'liquidity coverage ratio' methodologies used internally by banks to assess exposure to contingent liquidity events. As defined,

$$\text{LCR} = \frac{\text{Stock of high-quality liquid assets}}{\text{Total net cash outflows over the next 30 calendar days}} \geq 100\%.$$

There are two categories of assets comprising the stock of high-quality liquidity assets, namely 'Level 1' assets and 'Level 2' assets[6]. Assets to be included in each category are those that the bank is holding for a month. Level 1 assets can comprise an unlimited share

[4]The FSA requires all UK banks to maintain adequate liquidity resources at all times and not to depend on other parts of their group to satisfy the overall liquidity adequacy rule.

[5]Even though banks are required to report daily cash flow from both on-balance-sheet and off-balance-sheet accounts, there is no requirement that all the information is made available to external analysts.

[6]Level 1 assets include: marketable securities guaranteed by sovereigns, central banks,the BIS, and the IFS, assigned a 0% risk-weight under the Basel II standardised approach for credit risk, and traded in large, deep and active repo markets; 0% risk-weighted sovereign or central bank debt securities issued in domestic currencies; and 0% risk-weighted sovereign or central bank debt securities issued in foreign currencies. And Level 2 assets include: marketable securities guaranteed by sovereigns and central banks, and assigned a 20% risk-weight under the Basel II standardised approach for credit risk; corporate bonds and covered bonds issued by a financial institution or any of its affiliated entites; corporate bonds and covered bonds not issued by a bank itself or any of its affiliated entities rated at least AA-.

of the pool and are not subject to any discount under the LCR. Level 2 assets can be inluded in the stock of liquid assets subject to the requirement that they comprise no more than 40% of the overall stock after an assumed weight (85%) has been applied.

Cash outflows come from retail deposits, unsecured wholesale funding provided by small business customers, unsecured wholesale funding with operational relationships, unsecured wholesale funding provided by non-financial corporates, sovereigns, central banks and public sector entities, unsecured wholesale funding provided by other legal entity customers, and secured funding. Table 4.3 sets out the weights imposed by the Basel Committee for each type of liability, based on the assumptions about the likely speed of cash outflow over the next 30 calendar stressed days. These stress scenarios include bank-specific scenarios, such as an unexpected rating downgrade and operational problems, and external scenarios, such as Emerging Market crises, payment system disruption and macroeconomic shocks.

However, BCBS (2010*b*) faces the same problem as Fitch (2010) because of having a uniform weight for a group of liabilities without considering the real contractual maturities. If the time to maturity of a type of secured funding is less than one week, for example, it should not really attract a weight of only 25%.

Table 4.3: Weights imposed under the Basel Committee's Liquidity Coverage Ratio

Stock of high-quality liquid assets	**Assumed Weight**
Cash and central bank reserves	100%
Level 1 assets at 1 month	100%
Level 2 assets at 1 month	85%
Total stock of high-quality liquid assets	
Cash outflows over the next 30 calendar days	**Assumed Weight**
Stable deposits	5%
Less stable deposits	10%
Unsecured wholesale funding provided by small business customers	5-10%
Unsecured wholesale funding with operational relationships	25%
Unsecured wholesale funding provided by non-financial corporates, sovereigns, central banks and public sector entities	75%
Unsecured wholesale funding provided by other legal entity customers	100%
Secured funding	25%
Total cash outflows	
Surplus/deficit	

Source: BCBS (2010*b*).

4.2.2 Long-term Liquidity Framework

Moody's (2001) has developed a long-standing liquidity framework to determine whether a bank's long-term funding is greater than its illiquid assets. Moody's assume that the bank will not be able to roll over its short-term funding or to sell its liquid assets to maintain long-term solvency. Besides assuming no new short-term funding for a bank, the liquidation of business by a bank cannot be viewed as a prudent alternative liquidity plan. Raffis (2007) points out that the virtue of the tool is that it provides a bank with a consistent and externally-accepted framework to quantify, analyze, and then report its liquidity position to rating agencies and regulatory analysts.

Moody's (2001) identifies that 'net cash capital' is the balance after deducting illiquid assets and illiquid securities from long-term funding, as follows:

$$\text{Net cash capital} = \text{Long-term funding} - \text{Illiquid assets} - \text{Illiquid securities}.$$

A positive figure indicates that the bank would be able to continue operating from its currently available resources, even with a temporary disruption in the unsecured wholesale funding markets. However, a negative figure means the bank is in a challenging position, requiring it to unwind its liquid assets or secure access to the central bank's liquidity facility in order to maintain its core business franchise.

Moody's (2001) defines long-term funding to include hybrid capital securities, long term debt, and insured deposits that are not brokered; while the illiquid assets include fixed assets, intangibles, loans excluding residential mortgages (because of their marketability, only 20% of the value of the latter is deemed illiquid), and other assets. Moody's (2001) gives no credit to a bank which can generate cash from credit cards or other securitizations except residential mortgages. But it excludes loans and advances to banks from illiquid assets in that these funds can be replaced quickly by funding elsewhere within the banking system. However, following the sub-prime crisis of 2007, which created uncertainty about the scale and location of associated losses, and, more recently, the eurozone sovereign debt crisis, which created similar uncertainty, banks refused to lend to each other as they hoarded liquidity. Therefore, in the light of recent crises, interbank loans should not be considered as liquid assets under stress scenarios.

Because of the potential default risk, a part of available-for-sale financial investments should also be considered as illiquid securities. Table 4.4 lists the weights, allowing for haircuts, imposed on such securities by Moody's (2001). These weights are based on feedback

from market participants. In the future, it may be necessary to change the weights in response to any change in market appetite.

Table 4.4: Investment securities' weights imposed by Moody's

Available-for-sale financial investments	**Liquid Weights**	**Illiquid Weights**
MBS or ABS without government sponsorship, credit card receivables, home equity loans, automobile loans, other customer loans, commercial and industrial loans	0%	100%
MBS with government sponsorship	90%	10%
Other debt securities including foreign debt	67%	33%
Equity Securities	85%	15%
Treasury securities,government and central bank-sponsored securities	98%	2%

Source: Moody's (2001)

However, there is still no statement from Moody's (2001) about the time scale in which the long-term funding can be liquidated or become due. Even senior debt is generally considered as long-term debt, although it cannot be considered long-term funding if the time to maturity of it is eight days.

BCBS (2010*b*) also develops the 'net stable funding' standard for supervisors to use to measure whether a bank makes realistic assumptions about its future liquidity needs for the long-term that reflect the complexities of its underlying business, products and markets. The Basel liquidity requirements are also designed to reinforce other supervisory efforts by promoting structural changes in the liquidity risk profiles of institutions away from short-term funding and toward more stable, longer-term funding of assets and business activities.

To promote more medium and long-term funding of the assets and activities of banking organizations, the Committee has developed the concept of a net stable funding ratio (NSFR). The NSFR builds on traditional 'net liquid asset' and 'cash capital' methodologies used widely by internationally-active banking organizations, bank analysts and rating agencies. As defined,

$$\text{NSFR} = \frac{\text{Available amount of stable funding}}{\text{Required amount of stable funding}} \geq 100\%.$$

This metric establishes a minimum acceptable amount of stable funding based on the liquidity characteristics of an institution's assets and activities over a one year horizon. In

particular, the NSFR standard is structured to ensure that long term assets are funded with at least a minimum amount of stable liabilities in relation to their liquidity risk profiles. The NSFR aims to limit over-reliance on short-term wholesale funding during times of buoyant market liquidity and encourage better assessment of liquidity risk across all on- and off-balance sheet items. In addition, the NSFR approach offsets incentives for institutions to fund their stock of liquid assets with short-term funds that mature just outside the 30-day horizon for that standard.

Table 4.5 sets out the NSFR's composition according to BCBS (2010*b*). Even though BCBS (2010*b*) imposes weights for each funding category according to the remaining period to maturity, it failed to clarify the contractual maturity of long-term funding. Therefore, even a part of on-demand deposits can also be considered as available stable funding. Besides, it gives too much weight for funding within less than one year to maturity. For instance, the Basel Committee does not explain why it assumes 90% of 1 year stable deposits as availalbe funding.

Table 4.5: Weights imposed under the Basel Committee's Net Stable Funding Ratio

Available amount of stable funding	**Weight**
Tier 1 and Tier 2 capital	100%
Preferred stock due in 1 year[1]	100%
Debt securities due in more than 1 year	100%
Liabilities due in more than 1 year	100%
Stable deposits due in 1 year	90%
Less stable deposits due in 1 year	80%
Unsecured wholesale funding or term deposits due in 1 year	50%
Required amount of stable funding	**Weight**
Government debt securities	5%
Unencumbered corporate bonds rated over AA-	20%
Unencumbered corporate bonds/loans due in 1 year	50%
Unencumbered residential mortgages	65%
Retail loans due in 1 year	85%
Other assets due in more than 1 year[2]	100%

Note: 1: Preferred stock excludes Tier 2 capital. 2: Other assets exclude cash and interbank loans.

Source: BCBS (2010*b*).

4.3 Data Description

Since all listed EU companies have been required to use International Financial Reporting Standards (IFRS) rather than local Generally Accepted Accounting Principles (GAAP) since 2005, it does not any make sense to use pre-2005 bank data. In order to compare consistent accounting information, I therefore estimate UK banks' liquidity positions from 2005 to 2010 under IFRS. Most of the primary accounting data was obtained from the Bankscope database, but some secondary data and contractual maturities information was collected from the banks' annual financial reports.

Because of the limited availability of bank data, I finally chose to focus on 8 banks out of 121 banks incorporated in the UK and authorized by the FSA (2011*a*), namely Barclays Bank plc (Barclays), Bank of Scotland (BOS), HSBC Bank plc (HSBC), Lloyds TSB Bank plc (Lloyds TSB), National Westminster Bank plc (Natwest), The Royal Bank of Scotland plc (RBS), Santander UK plc (Santander UK) and Standard Chartered plc (Standard Chartered). These banks accounted for 88% of the total assets of the UK banking sector in 2010.

Since much of the current literature focuses on measuring US banks' liquidity risk, using accounts based on GAAP, I need to make appropriate adjustments to reflect UK banks' use of IFRS accounting principles. There are two significant differences relating to recognizing and calculating the assets and liabilities under GAAP and IFRS accounting policies which might change the calculation of a bank's short long-term liquidity position (Barclays, 2005).

The first difference relates to the treatment of derivatives and hedging accounting. Under GAAP, derivatives are treated like other assets or other liabilities, as 'balances arising from off-balance-sheet financial instruments'. Furthermore, before 2004, derivatives were classified as trading or non-trading. Trading derivatives were reported at market value in the balance sheet, with movements in market value recognized immediately in the income statement. Non-trading derivatives, which were transacted for hedging and risk management purposes, were accounted for on an accruals basis in the balance sheet. However, under IFRS, all derivatives are recognized at 'fair value' in the balance sheet as assets or liabilities.

The second difference concerns the classification and measurement of financial instruments. Under GAAP, financial instruments are classified into three items, namely Treasury bills, debt securities, and equity shares. Each item is measured according to the different purpose for which it is held. Trading instruments are allocated to a trading book, and are carried at fair value; while non-trading instruments are allocated to a banking book, and

are carried at cost. Under IFRS, all the financial assets are treated as being held for trading purposes and are measured at 'fair value'. Table 4.6 is our stylized contractual maturity balance sheet under IFRS accounting standards[7].

[7]The contractual maturity balance sheet under GAAP standards is in Appendix E

Table 4.6: UK Banks' Balance Sheets Under IFRS

	On demand	< 3 months	3-6 months	6 mon- 1 year	1-5 years	5-10 years	> 10 years	Total
Assets								
Cash and balances at central banks								
Items in the course of collection from other banks								
Trading portfolio assets								
Financial assets designated at fair value								
Derivative financial instruments								
Net loans								
Reverse repurchase agreements and secured lending								
Available-for-sale financial investments								
Other financial assets								
Equity investments								
Intangible assets								
Fixed assets								
Other assets								
Liabilities								
Deposits from banks								
Items in the course of collection from other banks								
Customer accounts								
Trading portfolio liabilities								
Financial liabilities designated at fair value								
Derivative financial instruments								
Senior debt securities in issue								
Subordinated liabilities								
Reverse repurchase agreements and secured borrowing								
Other financial liabilities								
Equity reconciliation								
Equity								
Hybrid capital securities accounted for as equity								
Other adjustments								
Published equity								

4.4 Methodology

A severe liquidity event affecting a bank usually lasts between two weeks and three months (FSA, 2008*a*). In a severe crisis that is resolved, one way or an other, within days, liquidity risk managers generally only have access to stand-by liquidity held on the balance sheet at the start of the problem. However, a liquidity crisis with both an idiosyncratic impact and market-wide impact might endure for several years. The latest global banking liquidity crisis started in the summer of 2007 because of the United States' sub-prime mortgage problem, and lasted until the end of 2009. In these types of environment, liquidity needs are not related to instantaneous shocks; instead, they develop in stages. Moreover, the stages can drag on for a year or more. Therefore, holding enough liquidity to buy sufficient time to access contingent sources is critical.

My short-term liquidity framework is built to measure whether a bank's liquid assets can cover its cash outflow for up to one year or not. A short-term illiquid position suggests that the bank might face a potential liquidity event during the year and that it should try to maximize the value of its assets portfolio and make necessary adjustment to its short-term liability portfolio, such as rolling over deposits of less than one year to maturity. My long-term liquidity framework is built to measure whether a bank's long-term funding due to mature in more than a year can cover its illiquid assets and securities or not. A long-term illiquid position suggests that the bank's funding capacity might be insufficient if the liquidity crisis lasts for longer than one year. In such a scenario, the bank should adjust its business model by, for example, switching dependence on wholesale short-term funding to secured long-term funding, and considering its own funding capacity before making new loans.

In this chapter, I establish a quantitative balance sheet liquidity framework to measure a UK bank's liquidity risk by considering the real contractual maturities of its assets and liabilities, which has not been undertaken in previous studies.

4.4.1 Liquidity Coverage

As I am seeking to estimate one year short-term liquidity coverage, only the values of assets and liabilities maturing within one year are considered. Unlike Fitch (2010) and BCBS (2010*b*), therefore, I argue that government securities and trading assets with residual maturities in excess of one year cannot be considered as high-quality liquid assets. The one year liquidity coverage ratio we focus on is thus defined as follows:

$$\text{LCR} = \frac{\text{Stock of high-quality liquid assets within one year to maturity}}{\text{Total net cash outflows over the next year}}.$$

If the ratio is over 100%, then the bank is deemed liquid in the short-term.

The stock of high-quality liquid assets within one year to maturity is taken to include cash and deposits with central banks, items in the course of collection from other banks, trading portfolio assets at fair value, financial assets designated at fair value, derivative cash flow and repos. Since an available-for-sale security is a debt or equity security that is purchased with the intent of selling before its maturity date, the major part of these securities is liquid in capital markets. Therefore, I impose the assumed weights by Moody's (2001) to calculate the value of liquid available-for-sale securities. The short-term cash outflows are assumed to arise from interbank deposits, stable retail deposits, other deposits, trading portfolio liabilities, financial liabilities designated at fair value, derivative cash flow, senior debt, subordinated debt, other financial liabilities and repos.

For valuation purposes, I firstly assume that no other asset sales or early-maturing assets can be used to cover short-term cash outflows and that all of the assets and liabilities are in the same maturity ladders. Secondly, I assume that the value of the stock of high-quality liquid assets under normal circumstance would not be discounted, although the value would be compromised under stress scenarios. Table 4.7 sets out both the normal and stress weights imposed on high-quality liquid assets. According to the disclosure requirements of IFRS (Deloitte, 2011), an entity has to classify its financial instruments held at fair value according to a hierarchy that reflects the significance of observable market inputs. The fair value hierarchy introduces three levels of inputs. The level 1 assets are considered as very liquid assets, while the level 3 assets are considered as illiquid assets. The level 1 liabilities are considered as very stable liabilities, while the level 3 liabilities are considered as the most unstable liabilities. Therefore, under stress scenarios, the value of the stock of high-quality liquid assets would be compromised and level 3 assets would no longer be considered as high-quality liquid assets. As mentioned earlier, BCBS (2010*b*) uses a 85% weight for less liquid assets; we also use the same weight to measure the stress value of less liquid financial instruments held at fair value. The stress weight of the available-for-sale portfolio is 85% of its normal weight[8] .

[8]The available-for-sale portfolio includes Treasury and other bills, debt securities, and equity securities. We also assume unexpected rating downgrades or other market volatility might reduce the market value of fianncial assets by 15%.

I apply the same weights as the BCBS (2010*b*) for each liability with a remaining maturity from 3 months up to 1 year to measure cash outflows during a liquidity stress year[9]. But we assume it is difficult to roll over on-demand deposits and the most unstable financial liabilities in a short time period; here, the weight should be 100%.

4.4.2 Net Cash Capital

Long-term debt with short maturity dates cannot be considered as long-term stable funding to cover sticky assets with more than one year to maturity. As Raffis (2007) mentions, some of the stable deposits at least should have a contractual maturity in excess of one year. Therefore, long-term funding in my analysis only includes liabilities with contractual maturity in excess of one year. The long-term net cash capital ratio I use is therefore defined as follows:

$$\text{NCCR} = \frac{\text{Long-term Funding}}{\text{Total Illiquid Assets} + \text{Total Illiquid Securities}}.$$

If the ratio is over 100%, then the bank is deemed liquid in the long-term.

The long-term funding due in more than a year is taken to include deposits by banks, customer deposits, financial liabilities designated at fair value, derivative cash flow, senior debt securities, subordinated debt, other funding, equity and hybrid capital securities accounted for as equity.

Some financial instruments that are held neither for trading nor sale should also be considered as illiquid assets, since they might be unable to generate cash inflow until the end of their maturity. Therefore, different from Moody's (2001), I include held-to-hedge derivatives and other held-to-maturity financial investments as illiquid assets as well. The illiquid assets include net loans[10], equity investments, non-trading derivative financial instruments, other real estate-owned, intangible assets, fixed assets, other assets and held-to-maturity financial investments.

The illiquid securities from available-for-sale accounts are taken to include Treasury and other bills, debt securities, and equity securities. Moody's (2001) argues that the weights on mortgage-backed securities (MBS) and other asset-backed securities (ABS) without government sponsorship should be higher (i.e. subject to higher haircuts) than those of other

[9]The stress scenarios include bank-specific scenarios and systemic funding strains.

[10]As loans and advances to banks were not replaced quickly by funding elsewhere within the banking system between 2007 and 2009, different from Moody's (2001), I therefore, include them as illiquid assets.

Table 4.7: Weights imposed under the short-term liquidity framework

	Normal Weights	**Stress Weights**
Stock of high-quality liquid assets		
Cash and deposits with central banks	100%	100%
Items in course of collection from other banks	100%	100%
Trading portfolio assets at fair value due in 1 year	100%	
Trading portfolio assets at fair value due in 1 year (level 1)		100%
Trading portfolio assets at fair value due in 1 year (level 2)		85%
Financial assets designated at fair value due in 1 year	100%	
Financial assets designated at fair value due in 1 year(level 1)		100%
Financial assets designated at fair value due in 1 year(level 2)		85%
Derivative cash flow due in 1 year	100%	
Derivative cash flow due in 1 year (level 1)		100%
Derivative cash flow due in 1 year (level 2)		85%
Treasury and other Bills	98%	83%
Debt securities without government sponsorship	0%	0%
Debt securities with government sponsorship	90%	77%
Other Debt securities, including foreign debt	67%	57%
Equity securities	85%	72%
Repos (and security borrowing)	100%	100%
Cash outflow over next 1 year	**Weights**	
Interbank deposits (on demand)	100%	
Interbank deposits due in 1 year	50%	
Stable retail deposits (on demand)	100%	
Stable retail deposits due in 1 year	5%	
Other less stable deposits (on demand)	100%	
Other less stable deposits due in 1 year	10%	
Trading portfolio liabilities (level 1)	10%	
Trading portfolio liabilities (level 2)	75%	
Trading portfolio liabilities (level 3)	100%	
Financial liabilities designated at fair value due in 1 year (level1)	10%	
Financial liabilities designated at fair value due in 1 year (level 2)	75%	
Financial liabilities designated at fair value due in 1 year (level 3)	100%	
Derivative cash flow due in 1 year (level 1)	10%	
Derivative cash flow due in 1 year (level 2)	75%	
Derivative cash flow due in 1 year (level 3)	100%	
Senior debt due in 1 year	10%	
Subordinated debt due in 1 year	25%	
Other financial liabilities designated at fair value due in 1 year	25%	
Repos (and security lending)	10%	

debt securities because of the higher default risk of such MBS and ABS. So the weight for MBS or ABS without government sponsorship is set by them at 100%, compared with the weight of MBS with government sponsorship of 10%, and the weight of other debt securities of 33%. However, it is difficult to obtain accurate imformation on the composition of each bank's MBS or ABS from current information. I therefore assume the normal weight of all debt securities without government sponsorship is 100%, the normal weight of debt securities with government sponshorship is 10%, and the normal weight of other debt securities is 33%. Therefore, my estimated value of illiquid securities would be higher than Moody's (2001). The stress weights of illiquid securities are 1 minus the stress weights of liquid securities listed in Table 4.7. The normal and stress weights imposed under this long-term liqudiity framework are presented in Table 4.8.

Table 4.8: Weights imposed under the long-term liquidity framework

	Normal Weights	**Stress Weights**
Long-term Funding		
Deposits by banks due in more than 1 year	100%	
Customer deposits due in more than 1 year	100%	
Financial liabilities designated at fair value due after 1 year	100%	
Derivative cash flow due in more than 1 year	100%	
Senior debt due in more than 1 year	100%	
Other funding due in more than 1 year	100%	
Subordinated debt due in more than 1 year	100%	
Equity	100%	
Hybrid capital securities accounted for as equity	100%	
Total Illiquid Assets		
Net loans	100%	
(Residential mortgages)[1]	-80%	
Equity investments	100%	
Held-to-hedge financial instruments	100%	
Held-to-maturity financial instruments	100%	
Investment in property	100%	
Intangible assets	100%	
Fixed assets	100%	
Other assets	100%	
Total Illiquid Securities		
Treasury and other Bills	2%	17%
Debt securities without government sponsorship	100%	100%
Debt securities with government sponsorship	10%	23%
Other debt securities, including foreign debt	33%	43%
Equity securities	15%	28%

Note: 1: The net loans should exclude 80% of residential mortgages because of their marketability.

4.5 Results[11]

4.5.1 Liquidity Coverage

Barclays Bank was the only bank posting healthy short-term liquidity positions throughout the six-year period. HSBC Bank also remained liquid, in both normal conditions and stress scenarios, but not in 2008 and 2010. However, the other six banks, Bank of Scotland, Lloyds TSB, Natwest, RBS, Santander UK and Standard Chartered, failed to maintain adequate short-term liquidity positions under either normal or stress conditions in hardly any of the years (see Tables 4.9 and 4.10)!

Barclays Bank's 'success' was due to holding billions in cash with central banks and in loans from other banks and engaging in repos. Since these assets are highly liquid, the value of them would not be compromised even under stress circumstances. The bank also continuously held stable liquid financial assets in its trading portfolio, as well as in the form of financial assets designated at fair value, and derivatives. Meanwhile, the bank's cash outflows were well diversified, with the biggest exposures being due to on-demand stable retail deposits which typically amounted to 30% or so of total cash outflows, and to level 2 derivative cash outflow.

Because of only a tiny dependence on those liabilities with 100% cash outflow weight, HSBC's total cash outflows were very limited, helping it to remain liquid in normal conditions, except in 2008, the year the UK economy faced a steep recession. The positive stress liquidity coverage in 2009 resulted from large cash holdings with central banks[12]. However, under stress scenarios, HSBC turned out to be illiquid in both 2008 and 2010. This was mainly because HSBC significantly increased its dependence on short-term trading portfolio liabilities and derivatives in those two years, which generated significant cash outflow.

The Bank of Scotland, meanwhile, failed to hold enough high-quality liquid financial assets to cover the total cash outflows, resulting in illiquidity in all years under both normal and stress conditions. Moreover, the bank was over-dependent on deposit funding, which, on average, accounted for around 74% of total cash outflows. After 2007, the average liquidity coverage ratio was only 67% of that recorded between 2005 and 2006, largely because of the large increase in the bank's retail deposit holdings.

[11]The balance sheet data is available in Appendix F.

[12]The average level of cash and deposits held with central banks between 2009 and 2010 was 5 times as high as it was between 2005 and 2007, reflecting the 'hoarding' of liquidity by banks during the global financial crisis.

As for Lloyds TSB, the bank's total liquid assets rarely exceeded half of its total cash outflow. As a result, it too remained illiquid throughout the period, in both normal and stress years. Moreover, the bank over-concentrated its liabilities on on-demand deposits which contributed, on average, around 73% of total cash outflows.

The average value of Natwest's high-quality liquid assets in the six-year period was limited to just under £6 billion, which represented around 10% of its average cash outflows in the same period. As a result, the bank also remained illuiqid throughout the sample period, under both normal and stress conditions, posting by far the lowest LCRs. The bank's failure to hold any items in the course of collection from other banks, trading portfolio assets, or financial assets designated at fair value contributed to its poor performance.

RBS also experienced severe short-term liquidity problems throughout the sampled period. In 2010, for instance, its total cash outflows were £548 billion but the total normal value of liquid assets was just £150 billion. Moreover, total deposits were 3 times as much as the bank's total high quality liquid assets. And its total deposits contributed around 83% of its total cash outflow.

Santander UK Plc has not held significant amounts of investment securities for a long time, resulting in its total liquid assets being, on average, only half of its total cash outflows. Moreover, the bank has been over-dependent on the most unstable liabilities. Its on-demand retail deposits contributed some 51% of total cash outflows, on average. As a result , the bank proved illiquid throughout the sample period, under both normal and stress condition.

Finally, Standard Chartered had roughly the size of cash outflows as HSBC Bank, but its size of high-quality liquid assets was, on average, less than 31% of the size of HSBC's. Thus, its liquid assets could not even cover cash outflow from on-demand retail deposits in any of the sample years, causing the bank to remain illiquid, in both normal and stess conditions, throughout the sample period.

Table 4.9: UK banks' normal LCRs

	2005 (%)	2006 (%)	2007 (%)	2008 (%)	2009 (%)	2010 (%)
Barclays Bank Plc	108.75	132.50	128.45	131.17	139.52	161.12
Bank of Scotland	36.33	41.71	31.51	29.37	22.02	22.12
HSBC Bank Plc	161.43	147.96	122.79	98.50	129.57	103.82
Lloyds TSB	43.56	43.01	34.53	85.26	35.94	60.71
Natwest	2.45	2.30	2.58	3.36	2.08	17.94
RBS Bank Plc	13.14	11.39	9.75	25.60	20.40	27.30
Santander UK Plc	91.27	31.79	64.10	53.07	48.55	63.56
Standard Chartered	30.09	30.32	32.71	45.62	33.94	37.73

Table 4.10: UK banks' stress LCRs

	2005 (%)	2006 (%)	2007 (%)	2008 (%)	2009 (%)	2010 (%)
Barclays Bank Plc	100.18	119.37	114.43	111.22	123.37	143.34
Bank of Scotland	31.02	35.63	26.94	24.40	18.70	18.76
HSBC Bank Plc	138.66	126.86	105.23	88.69	119.62	96.43
Lloyds TSB	37.25	36.81	29.71	76.24	33.54	56.05
Natwest	2.20	1.99	2.26	2.61	1.85	12.15
RBS Bank Plc	11.35	9.87	8.35	21.78	17.88	24.48
Santander UK Plc	77.71	27.07	54.61	45.52	42.34	58.33
Standard Chartered	26.42	26.41	28.44	39.88	29.99	33.84

4.5.2 Net Cash Capital

RBS's long-term liquidity position dramatically improved from 2008. Between 2005 and 2007, however, its average net cash capital was -£173bn and -£176bn in normal and stress conditions respectively, resulting in average NCCRs of 58.74% and 58.27% respectively (see Tables 4.11 and 4.12). The post 2008 improvement reflected increased funding from derivative trading, senior debt issuance, and equity issuance. For example, the bank's 2009 equity increased by £9bn (20%) to £55.2bn.[13] As a result, its total long-term funding could cover both illiquid assets and securities, even under stressed conditions.

Santander UK Plc also posted healthy long-term liquidity positions, but not in 2009. Although the bank's illiquid assets and securities rose by only 4% between 2008 and 2009, the size of its long-term funding shrank by 32%, causing the illiquidty. A 28% growth in long-term funding in 2010 restored the bank's healthy net cash capital position that year.

The other six banks, Barclays Bank, Bank of Scotland, HSBC, Lloyds TSB, Natwest and Standard Chartered, all unfortunately failed to post any healthy long-term liquidity positions in the sample period (see Tables 4.11 and 4.12), with Natwest again being by far the worst performer (reporting a NCCR of only 29% in 2010, under both normal and stressed conditions). Those banks' long-term funding could not cover illiquid assets, let alone illiquid securities. For instance, HSBC's average illiquid assets were 3.58 times its average long-term funding, and Natwest's average illiquid assets were 3.26 times its average long-term funding. And, during 2007 and 2008, Lloyds TSB's long-term funding shrank sharply (by nearly 50%) compared with its 2006 position while illiquid assets and securities continued to grow, causing the record low NCCR figures for 2008.

[13]Between 2007 and 2011, the UK government spent £456.33bn in aggregate on bailing out the banks. The figure breaks down into £123.93bn in loans or share purchases, which required cash injections from the government to the banks, and £332.4bn in shoring up the failing banking system. Of the £123.93bn., the RBS Group received £45.8bn. As a result, the UK government raised its stake in the RBS Group from 57% to 84%.

Table 4.11: UK banks' normal NCCRs

	2005 (%)	2006 (%)	2007 (%)	2008 (%)	2009 (%)	2010 (%)
Barclays Bank Plc	90.27	84.18	80.72	61.14	62.77	68.71
Bank of Scotland	78.49	70.35	80.18	73.05	75.11	82.90
HSBC Bank Plc	23.11	28.09	25.43	21.08	26.28	31.48
Lloyds TSB	94.80	97.61	38.96	38.44	66.97	91.38
Natwest	26.45	28.51	26.53	29.66	43.05	29.37
RBS Bank Plc	53.54	57.05	65.63	153.59	109.40	121.64
Santander UK Plc	209.82	212.56	374.12	150.09	98.52	122.14
Standard Chartered	49.53	47.84	53.03	55.69	47.98	48.64

Table 4.12: UK banks' stress NCCRs

	2005 (%)	2006 (%)	2007 (%)	2008 (%)	2009 (%)	2010 (%)
Barclays Bank Plc	88.07	82.29	79.26	59.92	61.39	66.92
Bank of Scotland	76.85	68.84	78.82	72.41	74.47	82.35
HSBC Bank Plc	22.63	27.48	24.84	20.41	25.58	30.45
Lloyds TSB	94.36	90.17	38.68	37.17	66.32	90.43
Natwest	26.39	28.55	26.46	29.57	42.95	29.31
RBS Bank Plc	52.94	56.59	65.29	152.78	108.31	120.29
Santander UK Plc	209.70	212.54	374.05	149.40	98.40	122.11
Standard Chartered	47.51	49.05	51.04	53.49	46.11	47.10

4.6 Summary and conclusions

My balance sheet analysis, based on the work of BCBS (2010*b*) and Moody's (2001), but modified to account for recent market experience and to give greater recognition to the actual maturity profiles of banks' assets and liabilities, has demonstrated that the largest eight UK banks have all suffered some liquidity strains since 2005. My results show that only Barclays Bank remained liquid on a short-term basis throughout the sample period (2005-2010); while the HSBC Bank also proved liquid on a short-term basis, although not in 2008 and 2010. On a long-term basis, RBS has remained liquid since 2008 after receiving government support; while Santander UK also proved liquid, except in 2009. The other banks, especially Natwest, are shown to have faced challenging conditions, on both a short-term and long-term basis, over the sample period.

The balance sheet liquidity framework adopted not only provides straightforward liquidity risk measurement, but also presents fundamental financial information to facilitate analysis of banks' business models and funding strategies. Risk managers, for example, could adjust their liquidity risk management operations to secure more high-quality funding in accordance with the limitations exposed by the quantitative analysis. Regulators, meanwhile, can see from the analysis whether or not banks are adopting appropriate business models, and react accordingly.

While my approach, using updated weights to reflect recent market experience, is somewhat superior to that recommended by Moody's and the BCBS, the results are still highly sensitive to the key assumed weights adopted within the analysis. Moreover, no single snapshot measure can ever fully capture all the mitigating activities that can be undertaken by bank management to enhance liquidity in a crisis. By focusing on the gap between assets and liabilities under different maturity ladders, the analysis fails to capture dynamic changes in banks' liquidity positions. Accordingly, I develop a dynamic model to forecast UK banks' liquidity positions in the next chapter.

Chapter 5

Estimating Liquidity Risk Using the Exposure-Based Cash-Flow-at-Risk Approach: An Application to the UK Banking Sector

5.1 Introduction

Even though liquidity management is a core activity of banks, it has not received much attention in recent decades, as liquidity has not been perceived as scarce[1]. However, this perception has completely changed since the global financial crisis of 20008/09. Both financial regulators and academic researchers realized that the most serious crisis in the last hundred years was due to liquidity events. However, up to the present, only very simple reports are used for disclosing banks' liquidity management. For instance, statistically calculating the funding gap between assets and liabilities under different maturity ladders, or

[1]As noted by the FSA (2008*a*), however, the failure of Barings Bank, due to the fraudulent activities of one of its traders, threatened the liquidity position of UK banks due to a general loss of confidence in the robustness of the UK banking system. Moreover, the collapse of Long Term Capital Management(LTCM), due to panic selling and divergence in the prices of US and Japanese/European bonds which led to LTCM incurring massive losses, triggered investor panic and a general flight to liquidity in the market.

listing both secured and unsecured funding channels, which banks can specify without testing the quality of these resources in crisis situations, tend to be the height of sophistication.

The development of modeling bank liquidity has thus been rather slow, despite bankers ranking liquidity risk as one of the top five risks to consider (CSFI, 2010). Contrasting with the advanced techniques applied for other risks, such as credit and market risk, Fiedler (2007) argues that there is no sophisticated method to capture a bank's liquidity position by testing whether there will be sufficient cash to pay future bills.

As I explained in chapter 2.3.1, liquidity relates to flows of cash only since it expresses the degree to which a bank is capable of fulfilling its respective obligations. This chapter, therefore, uses a relatively-new quantitative model, which is called the Exposure-Based Cash-Flow-at-Risk (CFaR) model, for estimating UK banks' liquidity risk. The model does not only measure a bank's liquidity risk tolerance, but also help to improve liquidity risk management through the provision of additional risk exposure information.

The first contribution of this chapter is to improve individual banks' liquidity risk measurement and management by developing downside risk measurements. The main purpose of this chapter is to remind banks should effectively control their intragroup cash flow and rely on their own capacity to raise funding instead of ask central bank funding. Especially like Milne and Wood (2009) argue that central banks would reject to lending as the last resort because of the afraid of the undermining the efficient pricing of risk by providing ex post insurance for risky behaviour[2].

The second contribution of this chapter is to clarify the difference between VaR and CFaR. Researchers typically choose VaR as the basis for risk management systems within financial institutions, and CFaR when assessing risk management among non-financial firms, because there is an argument that a financial institutions's VaR is also their CFaR, since portfolio holdings by financial firms are marked-to-market (Shimko, 1998). But, VaR, unlike CFaR, will capture only a small part of the firm's overall exposure since it ignores the risk of its underlying commercial cash flow. Moreover, this chapter will demonstrate that reducing the maximum shortfall of value cannot fully reflect the volatility of cash flow. Therefore, VaR is not an efficient tool to manage liquidity risk. Banks should develop more advanced cash flow models to control liquidity risk.

The third contribution of this chapter is to summarize a bank's liquidity risk exposure in a single number (CFaR), which is the maximum shortfall given the targeted probability

[2]Mervyn King, the Governor of the Bank of England, argued that central banks needed to be concerned about the incentive implications of the providing liquidity to markets(Milne and Wood, 2009)

level; it can be directly compared to the bank's risk tolerance and used to guide corporate risk management decisions.

The fourth contribution of this chapter is to estimate exposure-based CFaRs for UK banks, which involves the estimation of the set of exposure coefficients that provide information about how various macroeconomic and market variables are expected to affect the banks' cash flow, and that also attempt to take account of inter-dependencies and correlations among such effects. For these reasons, they can also be used to predict how a hedging contract or change in financial structure will affect a bank's risk profile. Therefore, the cash flow approach can avoid over dependency of banks on emergency central bank liquidity.

I use annual data over the period 1997 to 2010. The bank-specific data was collected from Bankscope and banks' annual reports. The macroeconomic data was collected from the Datastream database, the Bank of England, the International Financial Statistics (IFS) database, and the IMF (2010).

I forecast that, by the end of 2011, the (102) UK banks' average CFaR at the 95% confidence level would be -£5.76 billion, Barclays Bank's (Barclays') CFaR -£0.34 billion, the Royal Bank of Scotland's (RBS's) CFaR -£40.29 billion, HSBC Bank's (HSBC's) CFaR £0.67 billion, Lloyds TSB Bank's (Lloyds TSB's) CFaR -£4.90 billion, National Westminister Bank's (Natwest's) CFaR -£10.38 billion, and Nationwide Buidling Society's (Nationwide's) CFaR -£0.72 billion. Moreover, it is clear that Lloyds TSB and Natwest are associated with the largest risk, according to the biggest percentage difference between downside cash flow and expected cash flow (3600% and 816% respectively).

The structure of the chapter is as follows. Section 5.2 is the literature review. Section 5.3 describes the data. Section 5.4 outlines the methodologies adopted. Section 5.5 presents the empirical results and risk analysis. And section 5.6 summarises and concludes.

5.2 Literature Review

5.2.1 Value-at-Risk VS Cash-Flow-at-Risk

Essentially, VaR measures how much market value might be lost over a defined period for a given confidence interval. For example, if the VaR on an asset is £100 million at a one-week, 95% confidence level, then there is only a 5% chance that the value of the asset will drop by more than £100 million over any given week. Therefore, it has the intuitive interpretation of the amount of economic or equity capital that must be held to support that level of risky business activity. Likewise, an annual CFaR of £100 million with 95% confidence can be explained as there being only a 5% probability that cash flows will drop by more than £100 million during the next year. It is clear that VaR specifies the maximum amount of the total value of an asset that a firm is expected to lose under a given level of statistical confidence, whereas CFaR determines the maximum short-fall of cash the firm is willing to tolerate with a given confidence level (Andrén et al., 2005).

In terms of the early history of VaR, Leavens (1945) offered a quantitative example to measure bonds' default risk, which may be the first VaR measure ever published. Markowitz (1952) and Roy (1952) then independently published surprisingly similar VaR measures, each of whom was working to develop a means of selecting portfolios that would optimize reward for a given level of risk. Lietaer (1970) later described a practical VaR measure for foreign exchange risk. His work may be the first instance of the Monte Carlo method being employed in a VaR measure. Garbade (1986) subsequently presented sophisticated measures of Value at Risk for a firm's fixed income portfolios, based upon the covariance in yields on bonds of different maturities.

By the early 1990s, many financial service firms had developed rudimentary measures of VaR, generally following Markowitz's (1952, 1959) approach to allocating capital or monitoring market risk limits. A portfolio's value would be modeled as a linear polynomial of certain risk factors. A covariance matrix would then be constructed for the risk factors and, from this, the standard deviation of portfolio value would be calculated. If portfolio value were assumed normal, a quantile of loss could be calculated. Wilson (1993) was the first to attempt to address leptokurtosis and heteroskedasticity in the practical VaR measures used on trading floors; while (Longerstaey and Spencer, 1996) pioneered the use of Value-at-Risk to measure downside risk. The key contribution of the latter study was that it made the variance and covariances across different asset classes freely compute the VaR for a portfolio.

Gupta and Liang (2005) argued that the definition of VaR is completely compatible with the role of equity capital[3], as perceived by financial institutions. A VaR-based capital adequacy measure is also being increasingly adopted by regulators and supervisors. The Securities and Exchange Commission (SEC) has required securities firms to estimate one-month, 95% VaR and hold enough capital to cover the potential losses since the 1980's. While the Basel Committee on Banking Supervision (BCBS) in 1995 allowed commercial banks, subject to certain safeguards, to use their own interanl VaR estimates to determine their capital requirements for market risk under an amendment to the Basel Capital Accord (Holton, 2002). And finnaly, the SEC in 1997 also issued a ruling that requires companies to disclose quantitative information about the risks associated with derivatives and other financial instruments in financial reports filed with the SEC (Jorion, 2007).

Banks face a serious liquidity risk if their net cash flows cannot meet their liabilities as they fall due. But taking market liquidity for granted, financial institutions are not particularly interested in cash flows over decades. Shimko (1998) argues that a bank's VaR is also its CFaR, because banks' marked-to-market portfolios are generally converted into cash at short notice; any gain or loss in value immediately affects reported earnings and cash flow. However, this argument would not hold in 'thin' markets and challenges fundamental accounting principles. In thin markets, assets would become less marketable and wouldn't be readily converted into cash as the markets provide little chance of matching (Lippman and McCall, 1986). A liquidity crisis, unlike other crises, can make the markets become even thinner, possibly for years. It is quite possible that a well-capitalized bank would be forced into bankruptcy, because very thin markets would not allow banks to transfer marketable securities into cash in time. Moreover, under accounting theory, for a bank that has to make contractual payments during a particular period, the drying up of cash flow income might put the bank at risk of default, even though its net worth remain relatively stable. And, Returns on a bank's assets and liabilities (or Net Incomes), as the key VaR matrix, cannot provide a more accurate picture of the bank's current cash holding without taking account of non-cash expense items. Changes in a bank's profit and loss might not always capture the changes in cash flow, especially during stressed periods. Therefore, in these studies, CFaR will be more useful than VaR in terms of measuring liquidity risk. Despite VaR being a method to determine capital requirements for absorbing investment loss, it has nothing to do with estimating sufficient cash holdings for financial institutions. Besides, the VaR

[3]The equity capital is held to provide a capital cushion against any potential unexpected losses.

computes over only days or weeks, whereas the CFaR is measured over quarters or years.

5.2.2 A Short History of Cash-Flow-at-Risk

CFaR is gaining in popularity among industrial companies for easily summing up all of their risk exposures in a single number that directly reflects the firm's risk tolerance. In particular, the lower end tail of the cash flow distribution could indicate very costly consequences for the firm, such as not having enough funds to carry out the company's investment program, or even bankruptcy. Recent research in corporate finance, for example Froot et al. (n.d.), Stulz (1996), and Froot and Stein (1998), has shown that risk management can indeed be an important tool for creating shareholder value. But theses work also stress that the value of risk management is greater when there is a higher probability that operating cashflows will fall to the point that important strategic investments are compromised. Miller and Leiblein (1996) also proves that downside risk measures are more consistent with how risk is actually perceived by managers and investors.

Thus, in order to quantify the benefits of risk management, one again needs to have an accurate picture of the probability distribution of cashflows. The calculation of the single risk statistic requires a forecast of the probability distribution of cash flow at some future point in time. There are two dominant methods to simulate such distributions. One is the bottom-up approach, the other is the top-down approach.

Hayt and Song (1995) and Lee (1999), using the bottom-up approach, begins with a pro forma cash flow in which production volumes, prices, and costs are the key factors. The conditional value of cash flow distribution can be calculated by random prices and rates generating their own variance-covariance matrix. The basic assumption of this approach is that there is a direct link between production prices and exchange rates on the one hand and cash flow on the other. But this assumption appears to be contradicted by one of the main conclusions coming out of more than 20 years of research into how and why firms are exposed to macroeconomic and market risks (Oxelheim and Wihlborg, 1997). It is dangerous to use a pro forma statement because total corporate risk exposures are so complex and multifaceted. How, for example, would one model the effect on corporate cash flow of an exchange rate change that influences both the firm's and its competitors' input and output prices and their future sales volumes due to consumers' responses to price changes, while at the same time affecting interest rates, which in turn affect the firm's interest expense and consumers' willingness to spend money on consumption goods? Andrén et al. (2005) believe

that the use of pro form cash flow statements to model risk exposures would yield biased results since it cannot deal with more than one exposure at a time. Even when bottom-up modeling attempts to reflect such competitive exposures by introducing more complex relationships between changes in rates and cash flow, such modeling has a tendency to ignore the simultaneous impact of exchange rates and the effects of other macroeconomic market variables such as interest rates, inflation, and asset prices. Because of these complex linkages and interactions, the exposures that can be meaningfully captured in a pro forma statement are generally only a small part of a firm's total exposure.

Stein et al. (2001) use, instead, a top-down approach based on the assumption that total cash flow volatility is the ultimate variable of interest. Such volatility can be estimated from a company's historical cash flows when such data exists. But because the data on any given company's cash flow might be insufficient to provide a statistically-significant estimate of volatility, they call for pooling of cash flow data for a large number of firms, and then identify four characteristics with significant explanatory power for predicting patterns in unexpected changes in cash flow in their sample: size, profitability, riskiness of industry cash flow, and stock price volatility. On the basis of these key characteristics, Stein et al. (2001) sort all the firms into pools of comparable companies. The pooled cash flows for the comparable companies are then used to calculate each firm's cash flow distribution. Thus, even though this approach aggregates data for a large number of companies, the results are applied to individual firms in a way to reflect these four key characteristics. Andrén et al. (2005) point out a limitation in that the firm in question could be very different from the 'average' company in the sample. Moreover, the top-down approach does not provide an estimation of CFaR conditional on market risks.

Given the limitations of both bottom-up and top-down methods, Andrén et al. (2005) use a third approach, called exposure-based CFaR. Different from Stein et al. (2001), Andrén et al. (2005) estimate a company's cash flow volatility by taking account of its own corporate macroeconomic exposure and the various channels through which such variables affect corporate cash flow. They begin with a fundamental analysis of the company's exposure to changes in the macro economy. Such analysis attempts to provide answers to important questions about the current composition of the company's operating activities, and the structure of its financial positions. The conditional CFaR, in turn, can tell managers how much cash flow is at risk, given the specified probabilities associated with fluctuations in macroeconomic and market factors such as interest rates, exchange rates, and other key (e.g.commodity) prices. Therefore, CFaR can also be used to evaluate how the expected

future distribution of cash flow would be affected if, for example, an option contract were used to reduce a specific exposure. The exposure-based cash flow model can also provide information about the relative contribution of macroeconomic and market risks to volatility compared with that of other sources of cash flow volatility.

The exposure-based cash flow at risk model, involving a process of mapping out the firm's exposure and the asking of difficult questions about how and through what channels the firm's cash flow is exposed to risk, is one of the key benefits of having a risk management program. With this in mind, we follow Andrén et al. (2005) and use a exposure-based CFaR model to measure UK banks' downside risk. It establishes a framework for banks to control their own liquidity risk by undertaking a more careful analysis of the drivers of corporate macroeconomic exposure.

5.3 Data description

5.3.1 Cash Flow

A bank's cash receipts and payments are classified on the cash flow statements as either operating, investing, or financing activities (See Table 5.1). Therefore, its total cash flows are the sum of the operational cash flow (or CFO), the investment cash flow (or CFI), and the financing cash flow (or CFF). However, our analysis can only use profit before tax as the target cash flow variable. There are three main reasons for this. Firstly, in order to analyze the liquidity risk of UK banks, I collect all the relevant bank information from Bankscope, the standard database for both private and public banks. However, since the database only contains balance sheets and income statements, the best cash flow data we can get from Bankscope is for profit before tax, starting from the end of 1997 and running through to the end of 2010. Secondly, even though some public banks release their own annual cash flow data on their official websites, the series of accurate cash flow is only available after 2002. The sample is too small to accurately estimate the relationships between banks' cash flow and macroeconomic risk variables. Thirdly, I also notice that despite some major banking groups[4] providing both annual and half-yearly cash flow data after 2005, even the future cash flow distribution estimated from this information cannot represent the 102 UK banks' average cash flow distribution[5].

Besides measuring, annually, cash flow volatility, I also need to estimate quarterly volatility or at least half-yearly volatility, since a liquidity crisis usually lasts between 3 months and 1 year. The significant data limitation problem does not only prove that both regulators and banks' managers have ignored liquidity risk for a long time, but also deters the development of bank liquidity modeling . Klumpes et al. (2009), by case studies of Northern Rock and HBOS, show that analysis of the cash flow statement can provide fresh insight into a bank's finanical health. However, they argue that the international accounting standard governing cash flow reporting, which requires more information about robust sovlency and strong returns, is poorly suited to the needs of banks. I also argue that it will jeopardize academic research if regulators still refuse to release banks' historical cash flow information, at least for the last decade.

[4]These are Barclays Plc, HSBC Group, and Lloyds Banking Group.

[5]We included 102 out of a total of 190 UK banks because of the unbalanced data limitation. There were 121 incorporated banks operating in the UK, according to the FSA, on 30 June 2011, and 69 building societies. Together, they accounted for 98.9% of UK banking sector assets in 2010. However, this sample does not include banks incorporated outside the UK but accepting deposits through a branch in the UK.

Table 5.1: Make-up of A Typical Consolidated Cash Flow Statement

Profit before tax
Adjustments for:
Change in operating assets
Change in operating liabilities
Non-cash and other items
Tax received
Net cash used in operating activities
Cash flows from investing activities
Purchase of available-for-sale financial assets
Proceeds from sale and maturity of available-for-sale financial assets
Purchase of held-to-maturity investments
Purchase of fixed assets
Proceeds from sale of fixed assets
Acquisition of businesses, net of cash acquired
Disposal of businesses, net of cash disposed
Net cash provided by investing activities
Cash flow from financing activities
Dividends paid to non-controlling interests
Interest paid on subordinated liabilities
Proceeds from issue of subordinated liabilities
Proceeds from issue of ordinary shares
Repayment of subordinated liabilities
Change in stake of non-controlling interests
Net cash provided by financing activities
Effects of exchange rate changes on cash and cash equivalents
Change in cash and cash equivalents
Cash and cash equivalents at beginning of year
Cash and cash equivalents at end of year

5.3.2 Risk Exposure Factors

It is obvious that the market and macroeconomic risks faced by banks are from their own operational activities. Based on the saving/lending business, banks' cash flows are sensitive to uncertainty of interest rates. 3-month or 90 day interbank lending rates (i.e. UK LIBOR) and 10-year government bond yields are widely used as leading short-term and long-term interest rates respectively. Banks use these interest rates to decide what they want to earn from loans and what they will pay for deposits. Some interest rates on special savings products, like Certificates of Deposit and Eurodollar Deposits, are highly correlated with those two interest rates in various maturities. Therefore, I chose 3-month short-term interbank lending rates (SI) and 10-year long-term government bond yields (LI) as the interest rate risk exposure factors.

Banks need to manage their exposure to debt securities, equities and derivatives traded in their investment business. Both RBS and Barclays Bank suffered huge losses during the 2008/09 banking crisis because of the collapse of derivative markets. At that time, RBS's net exposure to asset-backed-securities was £64,130 million, which represented 84.29% of its investment assets. And Barclays's net exposure to asset-backed-securities (£42,052 million) was 64.34% of its investment assets. I therefore chose the UK bond market index (UB)[6] and spreads of US asset-backed securities (ABS)[7] as the leading indices to represent the risk exposure factors for debt securities. For the equity and derivatives markets, I chose the price volatility index (PV)[8] and Euro area swap spreads (Swap) as the relevant exposure factors since banks were holding significant amounts of options and swaps in their asset portfolios over the sample period.

Taking market funding for granted, banks became much more reliant on the wholesale funding market in the run up to the recent global crisis. Merton (2005) explains that the large components of a commercial bank's financing are short-term, not least sticky deposits. By the summer of 2007, for example, 77% of Northern Rock's funding came from non-retail funding (Shin, 2009). However, it had to rely on government guarantees for funding when the private wholesale funding markets closed in the wake of the US sub-prime crisis. Between 2008 and 2009, even stronger banks across the world hardly obtained any funding

[6]The reason for not also choosing the global bond market index is that both indices are highly correlated (i.e. cor=0.79).

[7]Even though UK banks are heavily exposed to the UK ABS market and EU ABS market, the relevant indices are only available after 2004. Hence the choice of the US ABS index.

[8]The asset price volatility index uses implied volatility derived from options from stock market indices, interest and exchange rates. A higher value indicates more vulnerable asset markets.

in any major currency. I therefore chose market liquidity indices (LQ) [9] and repo spreads (Repo)[10] to measure the funding ability effect on cash flow.

Beyond their domestic trading business, the main overseas trading businesses of these major banks are in the Americas, Asia and Europe, more than 80% of which are traded in US dollars and Euros. In 2009, the sterling equivalents of total trading products priced in US dollars and Euros by HSBC, Barclays, and RBS were £14.66 bn, £23.45 bn, and £16.78 bn, repectively. Therefore, we selected two sources of exchange rate exposure for UK banks, namely the British pounds against US dollars exchange rate ($/£) and the British pounds against Euros exchange rate(€/£).

Banks' risk exposures also arise from the domestic macroeconomic environment. Banks will gain , for example, from exposure to relatively low inflation and high economic growth because of lower expenses and higher investment income. For example, without significant inflationary pressures, the major UK banks' growth rate of assets was close to the growth of nominal GDP in 1999. I thus chose the inflation rate (π) and real GDP growth rate (g) to capture the macroeconomic risk effect on banks' cash flow.

To summarize, I used eleven risk factors (Table 5.2 describes where the data was obtained from.) within the exposure-based cash-flow-at-risk model. These are the short-term interest rate (SI), the long-term interest rate (LI), the UK bond market index (UB), the price volatility index (PV), the Euro area swap spreads (Swap), the market liquidity index (LQ), Repo spreads (Repo), the British pounds-US dollars exchange rate($/£), the British pounds-Euros exchange rate (€/£), the inflation rate (π), and the real GDP growth rate (g). The reason for not also using spreads of US asset-backed-securities (ABS) is because they are highly correlated with LQ, PV, Repo, Swap, and π (see Table 5.3).

[9]The funding and market liquidity indices use the spreads between yields on government securities and interbank rates, the spreads between term and overnight interbank rates, currency bid-ask spreads, and daily return-to-volume ratios of equity markets. A higher value indicates tighter market liquidity conditions.

[10]Repo spreads are the difference between yields on three-month Gilt Repos and on three-month UK treasury bills.

Table 5.2: Description of Variables and Data Sources Used

Variable	Definitions	Source	Dataset Code
SI	3-month or 90 day UK LIBOR	OECD	
LI	10-year government bond yields	OECD	
UB	All bands of UK bond clean prices index edited by International City/ County Manager Association	DATASTREAM	ISMSTAL
ABS	US spreads of asset-backed-securities	IMF	GISR 04/2010
PV	Asset price volatility	IMF	GISR 04/2010
Swap	Euro area swaps spreads	IMF	GISR 04/2010
LQ	Market liquidity index	IMF	GISR 04/2010
Repo	Spreads between yield on a 3-month gilt repo and on a 3-month UK treasury bill	BOE	
\$/£	British pounds against US dollars exchange rate	IFS	AH.ZF
€/£	British pounds against Euros exchange rate	IFS	ED.ZF
π	Inflation rate	IFS	64 ..XZF
g	Real GDP growth rate	IFS	99BPXZF

Table 5.3: Correlation of Independent Variables after First Differencing

Δ	SI	LI	π	LQ	PV	\$/£	€/£	Repo	Swap	g	ABS	UB
SI	1.00	0.51	0.35	0.58	0.22	0.75	0.57	0.51	0.59	0.60	0.48	-0.28
LI		1.00	0.20	0.47	0.21	0.48	0.31	-0.07	0.33	0.34	0.18	-0.60
π			1.00	0.56	0.61	0.22	-0.13	0.49	0.44	0.44	0.75	0.17
LQ				1.00	0.71	0.59	0.07	0.54	0.66	0.29	0.79	-0.44
PV					1.00	0.02	-0.20	0.70	0.60	-0.03	0.85	-0.05
\$/£						1.00	0.28	0.23	0.17	0.48	0.29	-0.39
€/£							1.00	-0.17	0.25	0.55	-0.06	-0.06
Repo								1.00	0.59	-0.05	0.77	0.04
Swap									1.00	0.29	0.74	-0.46
g										1.00	0.19	-0.02
ABS											1.00	-0.16
UB												1.00

5.4 Methodology

5.4.1 Exposure-Based Model

From a managerial perspective, the total variability of cash flow can be attributed to a number of different factors. Therefore, in assessing exposures, total cash flow variability is decomposed into several fluctuations which are independent of the changes of cash flow. The exposure model is a multivariate regression of relevant macro and market variables on corporate cash flow that looks as follows:

$$CF_t - E(CF_t|I_{t-1}) = \beta_0 + \sum_{i=1}^{n} \beta_i (X_{it} - E(X_{it}|I_{t-1})) + \varepsilon_t \tag{5.1}$$

where CF_t is the cash flow in period t, and X_t=[SI, LI, UB, PV, Swap, LQ, Repo, \$/£, €/£, π, g]. $E_{t-1}[.]$ are included to capture forecasted or expected developments of the variables in each period. Because risk derives from random and unexpected deviations from the expected or forecasted values, the above regression implies that the risk of cash flow $[CF_t - E(CF_t|I_{t-1})]$ is dependent on the risks associated with the relevant macro and market variables $[X_{it} - E(X_{it}|I_{t-1})]$.

Then the reduced form of the exposure cash flow model can be interpreted by all past information as follows:

$$\Delta CF_t = \beta_0 + \sum_{i=1}^{n} \beta_i \Delta X_{it} + \varepsilon_t. \tag{5.2}$$

5.4.2 Simulation of CFaR

To derive a conditional distribution of cash flow, the regression model must be used together with the variance/covariance matrix of the significant macroeconomic and market variables identified in the exposure model. I run simulations in which the values for the various explanatory variables are picked randomly from the variance/covariance matrix. In each of these iterations, the randomly-picked values are inserted into the regression model to generate a simulated value of cash flow conditional on macroeconomic and market variables. 10,000 scenarios were simulated, so I got 10,000 simulated values of cash flow.

To estimate total cash flow, I must also complement the conditional cash flow distribution with a distribution of the error term. If the error term is well behaved it has, by definition, no correlation with any of the explanatory variables or its own past values, and I can simply

draw a value from a normal distribution ($\varepsilon \sim N(0, \sigma^2)$) and add that value to the conditional distribution. To summarize, the calculation of Exposure-Based CFaR is a six-step process. Firstly, choosing an annual data set (CF_t, X_{it}) from 1997 to 2010, estimating regressions to get relevant coefficients ($\hat{\beta}_i$). Secondly, calculating the mean and covariance matrix of the first differences (ΔX_{it}). Thirdly, generating 10,000 new ΔX_{i2011} based on the mean and covariance matrix:

$$\Delta X_{i2011} \sim N(\mu, \Omega) \tag{5.3}$$

where the mean vector:$\mu = E(\Delta X_{1,2011}, \Delta X_{2,2011} ... \Delta X_{n,2011})$ and the covariance vector: $\Omega = COV(\Delta X_{i2011}, \Delta X_{j2011})_{i,j=1,2...n}$.

And then generating 10,000 new error terms (ε_{2011}):

$$\varepsilon_{2011} \sim N(0, \sigma^2). \tag{5.4}$$

Fifthly, predicting a bank's cash flow volatility in 2011 as a sum of intercepts, the simulated variables multiplied by exposure coefficients, and error terms:

$$\Delta CF_{2011} = \beta_0 + \sum_{i=1}^{n} \beta_i \Delta X_{i,2011} + \varepsilon_{2011}. \tag{5.5}$$

Finally, deriving the distribution of cash flow in 2011 as follows:

$$\begin{array}{rcccl} CF_{2011} & = & E(CF_{2011}|I_{2010}) & + & \Delta CF_{2011} \\ & = & CF_{2010} & + & \Delta CF_{2011}. \end{array} \tag{5.6}$$

5.5 Results

5.5.1 Exposure-Based Model

Before analyzing the results of the exposure assessments, we need to check that the effects of different risk factors on banks' cash flow are in accordance with economic theory, since specifying an acceptable exposure model is a combination of art and science. First of all, we use the stepwise regression (Rawlings et al., 1998) to find a subset of independent risk factors (X_i) mentioned above that best predict cash flow. The general idea of stepwise regression is either to start with a simple model and add variables that have significant p-values (i.e. forward stepwise selection) or to start with a large model and keep variables whose p-values

are below a certain significance level (i.e. backward elimination). Neither forward selection nor backward elimination takes into account the effect that the addition or deletion of a variable can have on the contributions of other variables to the model. A variable added early to the model in forward selection can become unimportant after other variables are added, or variables previously dropped in backward elimination can become important after other variables are dropped from the model. Therefore, we combine the two selections to test at each step for variables to be included or excluded. We start with a froward selection process that rechecks at each step the importance of all previously included variables. If the partial sums of squares for any previously-included variables do not meet a minimum criterion to stay in the model, the selection procedure changes to backward elimination and variables are dropped one at a time until all remaining variables meet the minimum criterion. Then, forward selection resumes.

According to the results of stepwise regression on each UK bank's cash flow, we get various sizes for the subsets of risk factors. For instance, the cash flow of Barclays Bank, HSBC Bank, and Natwest can be predicted using 6 different risk factors. And the cash flow of Lloyds and Nationwide can be predicted using 5 different risk factors[11]. However, with such a small sample of data, we have to balance the numbers of degree of freedom against a high adjusted R^2. We finally choose 4 risk factors as independent variables and leave 8 degree of freedom for each regression.

Table 5.4 presents the exposure results for all the UK banks sampled plus individual results for the six biggest banks (which held over 80% of total UK bank assets in 2010). As argued by Andrén et al. (2005), the preferred exposure model should include variables with a strong basis in economic theory which are supported by empirical evidence. In other words, to gain acceptance from management, a risk estimation model must have not only statistical backing, including high significance levels[12], a high goodness of fit statistic (R^2), no serial correlation problems, and well-behaved error terms (ε), but also an emphatic logic as to how one would expect the main variables to affect the banks' cash flow.

[11]The market liquidity index (LQ) might not be a significant variable to predict UK banks' cash flow since it was deleted under each stepwise regression.

[12]The minimum significance in our model is at the 90% confidence level.

Table 5.4: Exposure Model Results

Bank Name	UK banks	Barclays	RBS	Lloyds	HSBC	NatWst	Nationwide
Intercept	0.14**	0.39***	1.16	0.11	0.25***	-0.21	0.017
	(0.056)	(0.110)	(0.71)	(0.148)	(0.062)	(0.195)	(0.026)
SI	0.26***		2.49***	0.38**	0.33***	1.5****	0.14****
	(0.054)		(0.656)	(0.151)	(0.083)	(0.288)	(0.022)
LI				-1.32***		-1.74***	-0.26***
				(0.284)		(0.429)	(0.059)
UB	2.59*						-1.31*
	(1.338)						
PV	-0.36***	-0.87***					
	(0.082)	(0.178)					
Swap		3.36**	-21.62***				
		(1.10)	(6.362)				
LQ							
Repo	-2.03*		-25.99**		-2.78**	-12.11***	
	(0.982)		(9.413)		(1.114)	(2.9)	
\$/£							
€/£		4.62**		4.3*			
		(1.426)		(1.91)			
π		0.88**	-3.78***		0.38**		0.15***
		(0.199)	(1.093)		(0.123)		(0.037)
g				0.84****	-0.15***	-0.6****	
				(0.072)	(0.044)	(0.107)	
R^2	0.911	0.891	0.896	0.976	0.73	0.833	0.909
Ad R^2	0.867	0.837	0.844	0.965	0.595	0.749	0.863
P(normal)	0.419	0.168	0.225	0.428	0.742	0.353	0.535
P(non-auto)	0.646	0.447	0.301	0.692	0.311	0.162	0.137
standard error	0.186	0.382	2.28	0.464	0.199	0.610	0.078

Note: Coefficients show average cash flow changes in billions of British pounds from one-unit increases in the independent variables. In order to keep enough degrees of freedom, we apply stepwise regressions to use the best estimation results with a maximum of 4 explanatory variables in each model. '$*$' indicates significance at the 90% confidence level, '$**$' at the 95% confidence level, '$***$' at the 99% confidence level, and '$****$' at the 99.9% confidence level.

Representing the basic price of loans, short-term interbank lending rates should positively affect a bank's cash flows. And the long-term government bond yields, representing a major part of a bank's interest expenses as they determine long-term deposit rates, should have a negative effect on its cash flow. As an indicator of equity market uncertainty, we expect the price volatility index to have a negative effect on a bank's cash flows. But I suggest the UK bond clear price index and swap spreads may have either positive or negative effects on cash flows, dependent on a bank's own investment strategy and portfolio management i.e. whether it is a seller or a holder of the specified financial instruments. The market liquidity index and UK Repo spreads, indicating funding pressures, are expected to have a negative effect on a bank's cash flows. A depreciation in foreign currency or appreciation in pounds sterling would increase banks' cash inflow by increasing trading income or reducing trading expense. Inflation effects on banks' cash flows are variable and can be simultaneously positive and negative. High inflation may increase banks' operational costs and lead to low revenues by discouraging aggregate investment and savings. However, positive effects include encouraging banks to offer more credit to industrial firms and households. Finally, GDP growth rates should positively affect a bank's assets and profitability. But a bank with expanding assets and high book profits can still face liquidity problems, as Northern Rock demonstrated.

My UK banks' exposure model indicates a one percentage point short-term interest rate increase, on average, increases the UK banking industry's cash flow by £0.26 billion. It confirms my expectation that banks' cash flow will increase with an increase in the short-term interbank lending rates. Their bond market exposure is £2.59 billion, indicating that banks have a long position in bonds and gain cash inflow from the bond market of around £2.59 billion based on a one percentage point increase in the bond index. However, a one percentage point increase in the price volatility index shrinks cash flow by £0.36 billion, showing that equity market volatility negatively impacts on UK banks' cash flow. Finally, the significant negative relationship (i.e. -2.03) between Repo spreads and banks' cash flow also proves that UK banks face funding pressures when the spreads become bigger.

Barclays' exposure model also confirms that its cash flow will decline with an increase in the price volatility index. A one percentage point increase in the price volatility index shrinks cash flow by £0.87 billion. The positive coefficient (i.e. 3.36) of swaps indicates that Barclays benefits from the use of swaps. Moreover, Barclays also gains cash inflow from its overseas trading activities of £4.62 billion for a one percent point euro deprecation against sterling. Finally, the significant positive coefficient of the inflation rate indicates Barclays

also secured cash inflow over the last fourteen years because of this factor.

RBS's cash flow in shown to increase by £2.49 billion with a one percentage point increase in short-term interest rates. A one percentage point increase in Repo spreads, however, shrinks cash flow by £25.99 billion. And there is a big loss on its derivatives portfolio, which were mostly held for hedging purposes, since a one percentage point increase in swap spreads is accompanied by a decrease in cash flow of £21.62 billion. Moreover, the domestic inflation rate has a negative effect on RBS's cash flow, with a one percentage point increase in the inflation rate causing a £3.78 billion cash outflow.

As expected, Lloyds TSB' cash flow is also affected positively by short-term interest rate increases, but negatively by increases in the long-term interest rate. The short-term interest rate exposure is £0.38 billion but the long-term interest rate exposure is -£1.32 billion. Overseas trading business also contributes £4.3 billion to Lloyds TSB's cash inflow for a one percent point euro depreciation against sterling. Finally, a one percent point increase in the growth rate will be accompanied by an increase in Lloyds TSB's cash flow of £0.84 billion.

HSBC's exposure model demonstrated that a one percentage point increase in short-term interest rates will increase its cash flow by £0.33 billion. While a one percentage point increase in Repo spreads will shrink its cash flow by £2.78 billion. Somewhat surprisingly, however, HSBC's cash flow will increase in response to rising inflation, but decline in response to a higher GDP growth rate. This means the bank will lose cash in high GDP growth years, but gain it in an inflationary environment.

Natwest's cash flow is also affected positively by short-term interest rate increases and negatively by increases in the long-term interest rate. The short-term interest rate exposure is £1.5 billion while the long-term interest rate exposure is -£1.74 billion. A one percentage point increase in Repo spreads will also shrink its cash flow by £12.11 billion. Moreover, Natwest faces liquidity problems in periods of rising GDP growth rates.

Finally, for Nationwide, cash flow is also affected positively by short-term interest rate increases and negatively by increases in the long-term interest rate. Its short-term interest rate exposure is £0.14 billion but its long-term interest rate exposure is -£0.26 billion. Like Barclays and HSBC, domestic inflation positively contributes to its cash inflow. However, it lost out in the bond market over the past fourteen years, with cash outflow amounting to £1.31 billion for each one percentage point increase in the bond index.

5.5.2 Risk Exposure Analysis

Since the exposure-based model decomposes the cash flow estimates into individual risk exposures, it provides insights into the cash flow dynamics of the company and the key drivers of risk. In particular, the model allows for a clearer view of the portfolio aspects of corporate risk.

First, it suggests banks should take liquidity risk seriously, since the significant negative coefficients of Repo spreads would indicate a significant source of funding pressure across the UK banking industry. Second, it can help to improve the offsetting of risk exposures by focusing on correlated risk factors. A high correlation between two risk factors will have a significant impact on estimated cash flow, and the sign of the exposure coefficients determines whether the overall net impact is positive or negative. For example, the short-term interest rate (SI) and real GDP growth rate (g) are positively correlated (see Table 5.3), but HSBC is positively exposed to one and negatively to the other; therefore the cash flow risk will be dampened in this case. Third, it may encourage some banks to review their investment strategies by comparing with peers. For instance, in light of the significant cash inflow secured by Barclays' trading in swaps , RBS should limit its exposure by changing its trading business strategies.

Another benefit of the exposure-based model is its ability to inform hedging decisions which can mitigate the impact on cash flow variability.[13] In Lloyds TSB's model, the indicated exposure to the euro/sterling exchange rate is £4.3 billion for each percentage point depreciation of the euro. This means that if management expects a 1% future appreciation in sterling and wishes to neutralize its exposure to this exchange rate for the next year, it should sell forward exactly this number of pounds.

5.5.3 Simulation of Cash-Flow-at-Risk

Using the variance/covariance matrix of significant variables identified in Table 5.4, I firstly programmed a simulation to run 10,000 scenarios of those variables in the forecasting system. Then, following the methodology outlined in the previous section, I apply the software to estimate these commercial banks' cash flow for each of the 10,000 simulations as a function of the simulated macroeconomic and market variables multiplied by the relevant exposure coefficients. By so doing, I end up with a distribution of expected cash flow that reflects

[13]However, not all the information necessary for deciding the size of the hedge positions is contained in the coefficients in the exposure model.

not just the cash flow sensitives to each of the individual risk factors, but also the expected variances and covariances of these risks. And the resulting distribution of cash flow in turn enables me to estimate the CFaR for 2011 for each of the banks.

As shown in Figures 5.1 to 5.7, there is a 5% possibility that the UK banking industry's average cash flow will fall below -£5.76 billion, that Barclays' cash flow will fall below -£0.34 billion, that RBS's cash flow will fall below -£40.29 billion, that HSBC's cash flow will fall below £0.67 billion, that Lloyds TSB's cash flow will fall below -£4.90 billion, that Natwest's cash flow will fall below -£10.38 billion, and that Nationwide's cash flow will fall below -£0.72 billion in 2011. Figures 5.8 and 5.9, comparing these banks' cash flow positions, shows only HSBC contributed positive cash flow to the UK banking industry at the 5% confidence level. The other banks (barring Barclays and Nationwide), with fatter-tailed distributions, face relatively greater downside risk. Table 5.5 also compares banks' downside cash flow at risk as a percent of expected cash flow. It is clear that Lloyds TSB and Natwest face the largest risks (with figures of 3600% and 816%, respectively).

Table 5.5: Exposure-Based CFaR Estimates for 2011 (£bn)

	Mean Cash Flow (A)	CFaR at 5% confidence level (B)	CFaR in percent $(\|A - B\|/A) \times 100$
Barclays	6.54	-0.34	109%
RBS	9.97	-40.29	504%
HSBC	5.40	0.67	88%
Lloyds TSB	0.14	-4.90	3600%
Natwest	1.45	-10.38	816%
Nationwide	0.93	-0.72	177%

Figure 5.1: UK Banks' Simulated Cash Flow Distributions

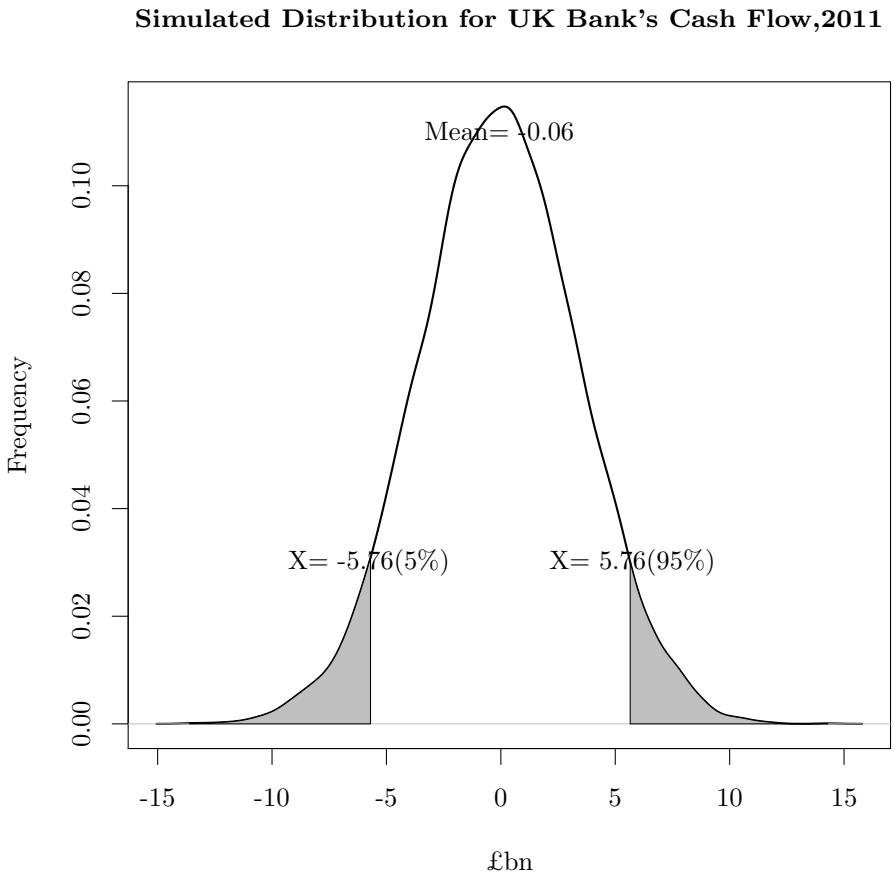


Figure 5.2: UK Banks' Simulated Cash Flow Distributions ($cont^d$)

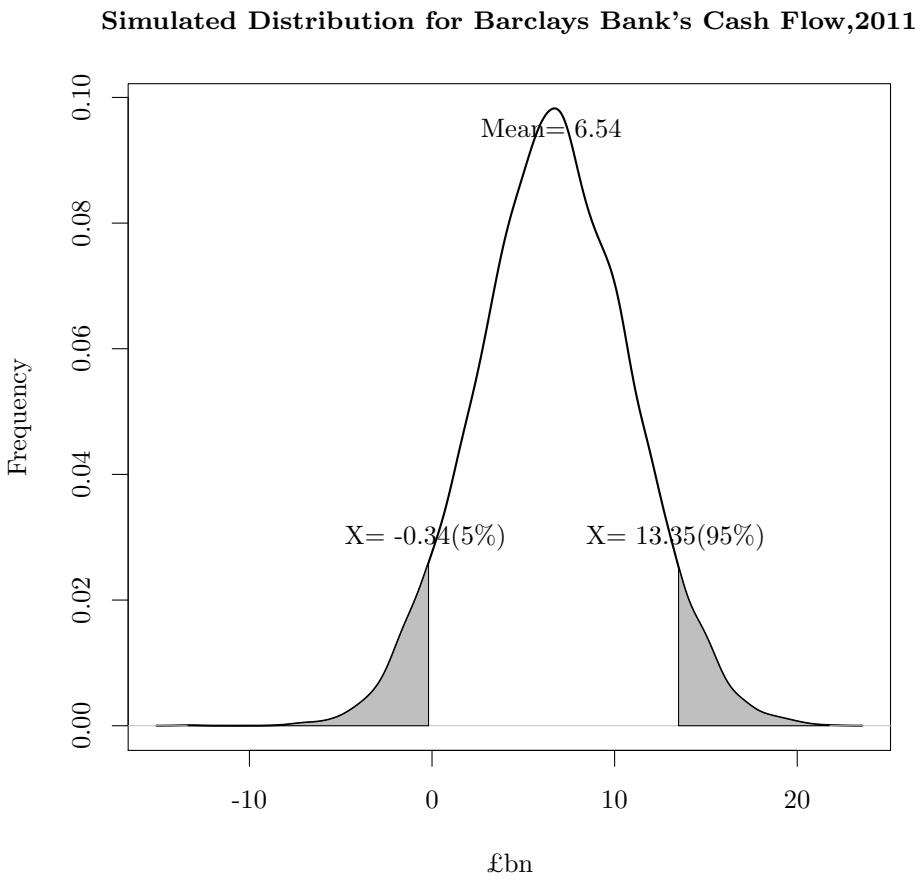


Figure 5.3: UK Banks' Simulated Cash Flow Distributions ($cont^d$)

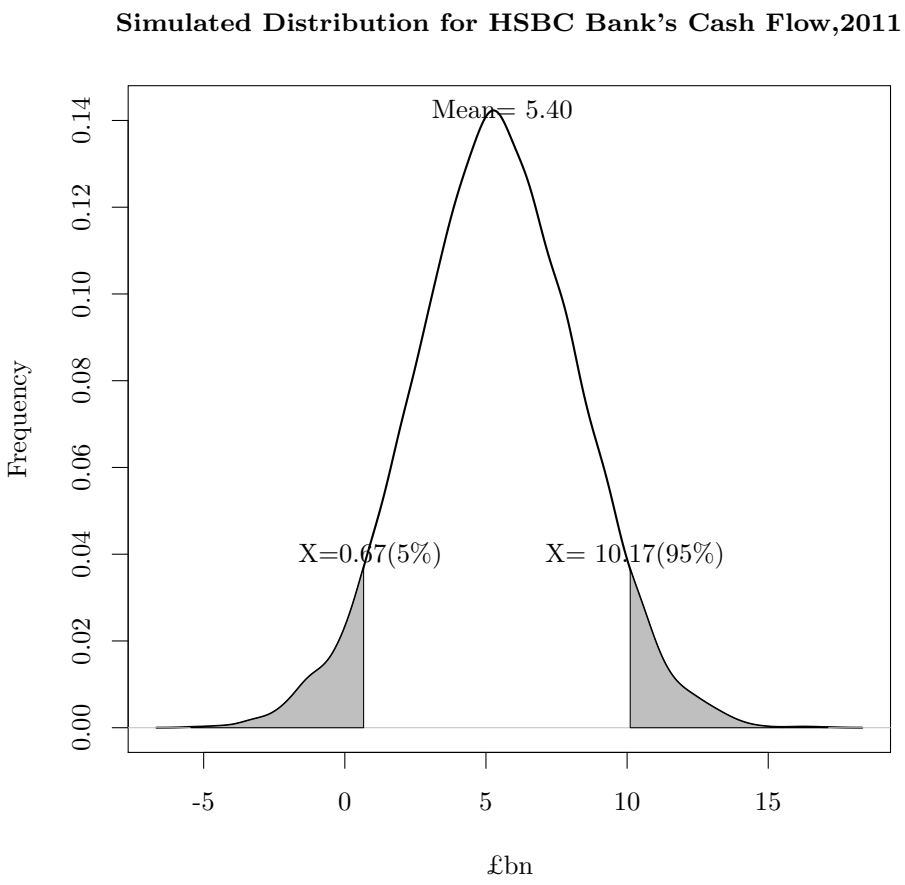


Figure 5.4: UK Banks' Simulated Cash Flow Distributions ($cont^d$)

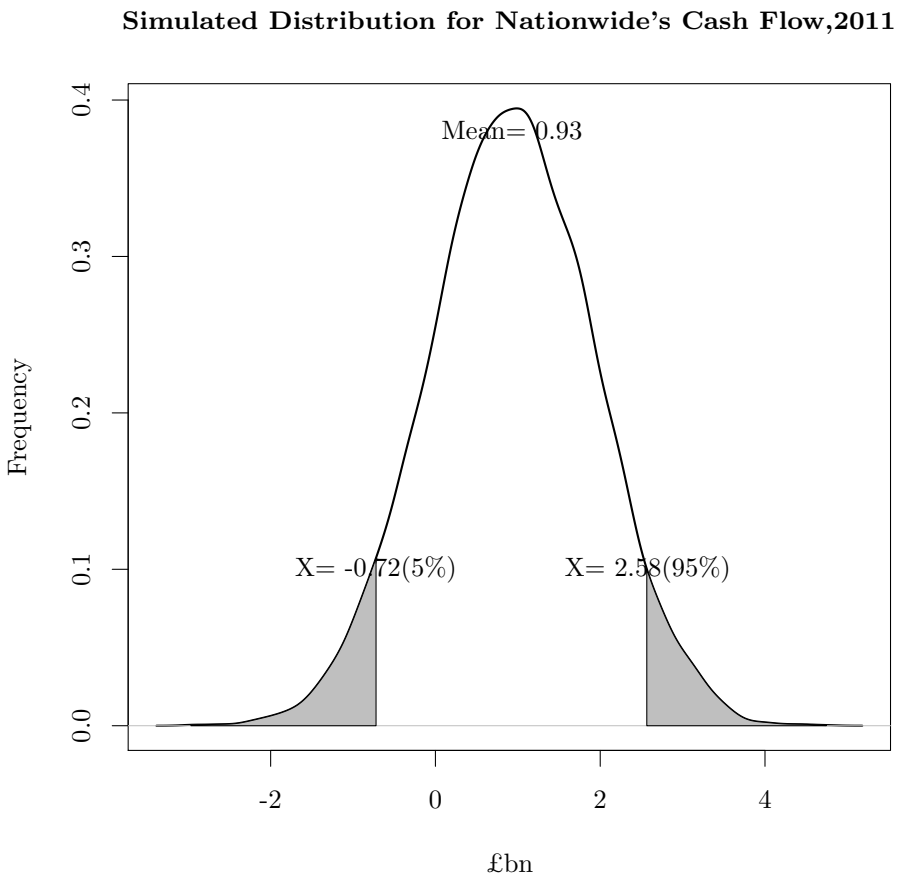


Figure 5.5: UK Banks' Simulated Cash Flow Distributions ($cont^d$)

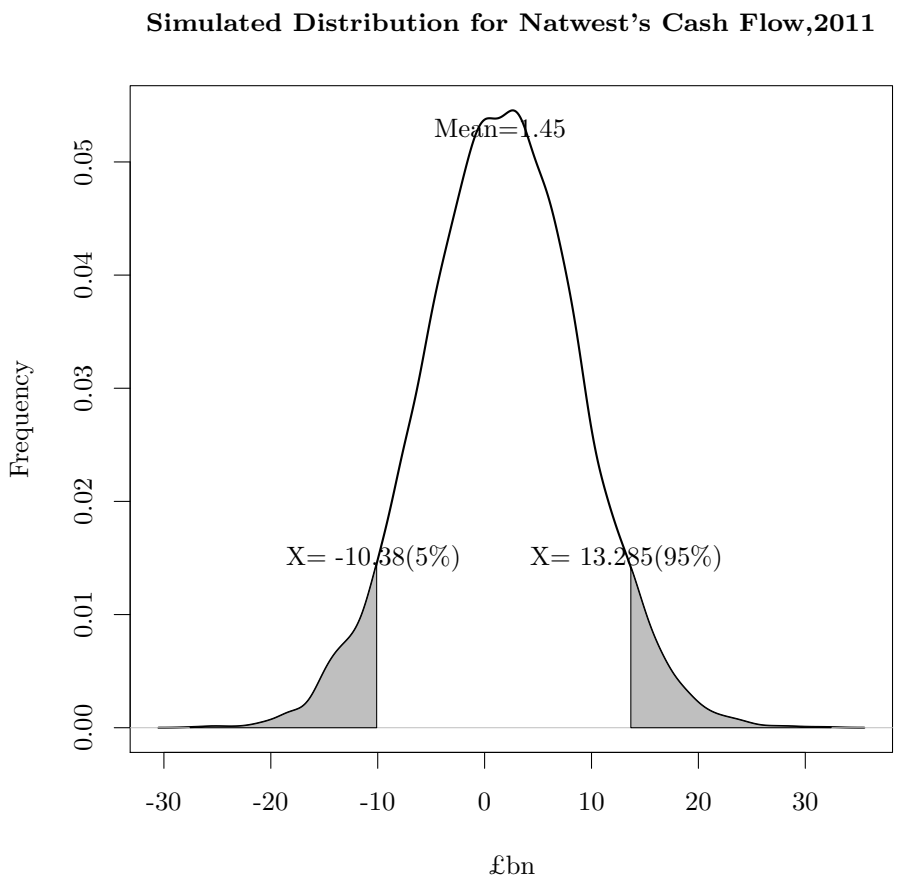


Figure 5.6: UK Banks' Simulated Cash Flow Distributions ($cont^d$)

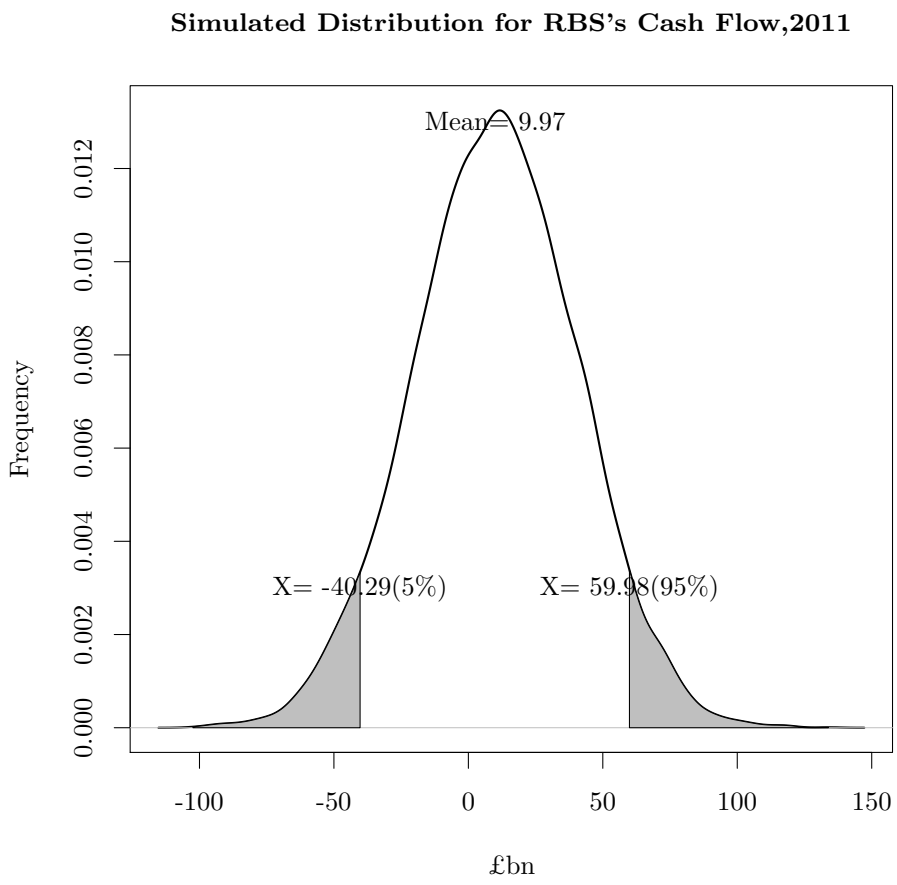


Figure 5.7: UK Banks' Simulated Cash Flow Distributions ($cont^d$)

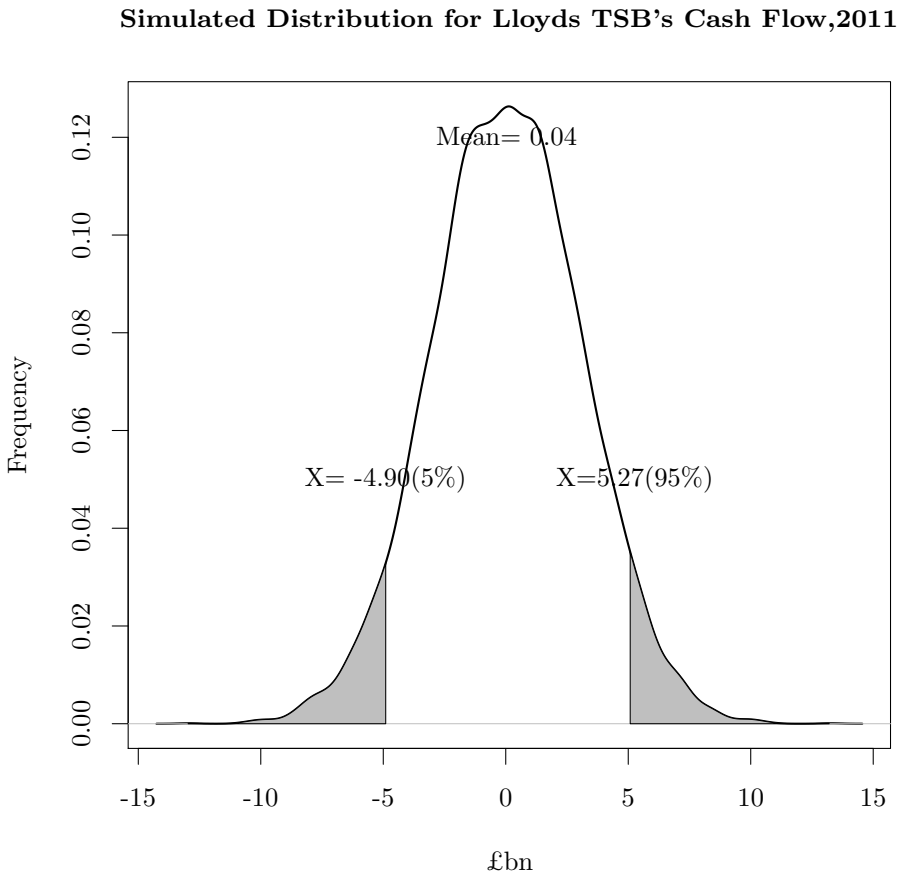


Figure 5.8: UK Banks' Simulated Cash Flow Distributions: A Comparison

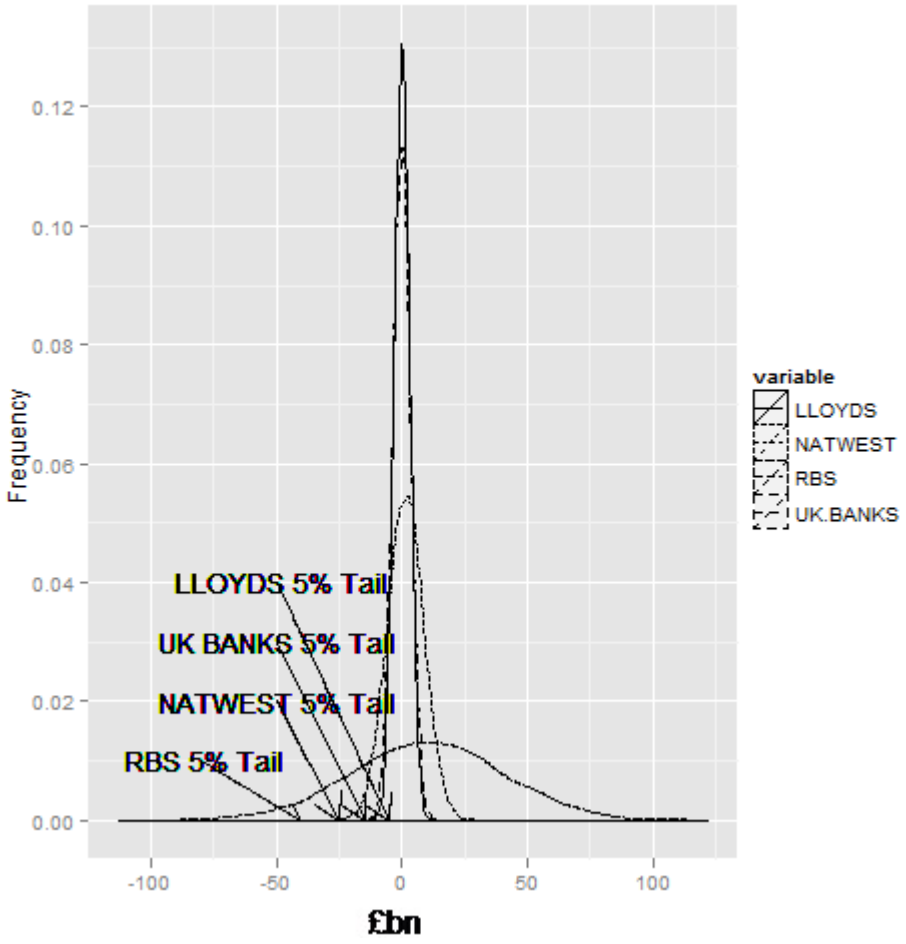
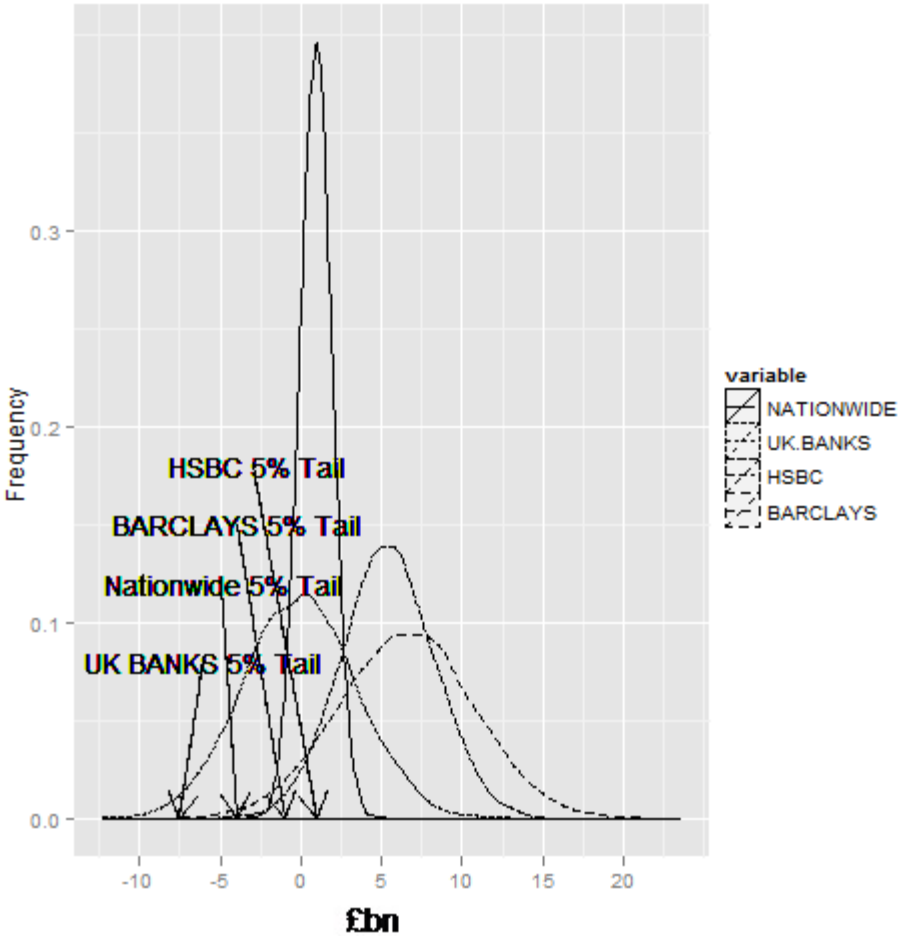


Figure 5.9: UK Banks' Simulated Cash Flow Distributions: A Comparison ($cont^d$)



5.6 Summary and Conclusions

For a long time of period, the banking industry (and its regulators) considered solvency to be more important than liquidity within their risk management operations. But the global financial crisis of 2008/09 has changed all that (Duttweiler, 2009).

In recognition of the potentially-serious risks associated with illiquidity and the undeveloped state of liquidity risk modeling, this chapter uses a cash flow model to estimate UK banks' liquidity risk. The results demonstrate that the UK banking industry suffers variable funding pressure. The negative forecasted average CFaR (at -£0.06 billion) indicates that the UK banking industry would be slightly illiquid by the end of 2011. Of the six biggest UK banks, only HSBC maintains positive CFaR throughout the 1997-2011 period, while RBS faces the largest liquidity risk, with a 5% chance that CFaR would be less than -£40.29 billion during 2011. Meanwhile, Lloyds TSB and Natwest have the most volatile cash flows, as measured by downside cash flow at risk as a percent of expected cash flow.

I acknowledge, however, that the chapter has several limitations. First, with only fourteen years of annual data, the accuracy of the exposure-based cash flow model might be compromised. Second, I are currently only able to estimate annual CFaR because of data limitations; it would be nice to have quarterly and half-yearly data to analyze shorter-term liquidity positions. And third, the estimated future cash flows are sensitive to the selection of target cash flow data (e.g. profit before tax). Notwithstanding this, I do my best to quantify liquidity risk for the UK banking industry with a single number. My results support the work of the Basel Committee on Banking Supervision which, under Basel III (BCBS, 2010*b*), pays attention to both liquidity and solvency, a major change in emphasis on previous iterations of the Basel Capital Accord. In addition, this chapter recommends an internal risk manangmeent framework, the cash flow approach, instead of dependency on emergency central bank liquidity.

Chapter 6

Cost Benefit Analysis of Basel III: Some Evidence from the UK

6.1 Introduction

Banking crises have been much more frequent than we would like. The annual probability of a crisis is 4-5% in both industrial and emerging market countries (Walter, 2010). There are many factors that contribute to the vulnerability of the banking sector. At the top of the list are too little high-quality capital and too much unsecured liquidity. Moreover, banking crises are usually associated with significant economic losses. In order to promote financial stability, the Basel Committee (BCBS, 2010*c*) has therefore established stronger capital and liquidity requirements (i.e. Basel III).

This chapter assesses the long-term United Kingdom economic impact of the Basel III capital and liquidity requirements ('the requirements'). The results suggest that, in terms of the impact on output, there is considerable room to further tighten capital and liquidity requirements, while still providing positive effects for the United Kingdom economy.

Similar to the cross-country analyses conducted by the Basel Committee on Banking Supervision (BCBS)(2010*a*) and Angelini et al. (2011), the benefit of the requirements is assumed to be represented by the forestalled loss (in terms of the level of GDP) of a banking crisis, which in turn is determined by the extent to which the requirements reduce the probability of a banking crisis occurring and the associated GDP loss. Therefore, I identify the benefit of the new requirements as the reduction in the probability of a banking crisis multiplied by the expected loss arising from a one-off crisis. The main channel driving

the economic costs of the requirements is the bank credit market, in which higher lending rates reduce output levels. Here, I quantify the cost of the new requirements as a negative function of the lending spread.

Comparing with previous studies, the first contribution of this chapter is to estimate the long-term economic impact of *both* tighter capital and liquidity requirements for the UK economy. Second, I calculate the capital and liquidity ratios based on the Basel III definitions, rather than the more commonly used Tier 1 capital ratio and the Loans-to-Deposits liquidity ratio. Third, I choose a non-linear-in-factor probit model including bank capital and liquidity to forecast the probability of a bank crisis by considering the imperfect substitutability between UK banks' capital and liquidity. And fourth, I estimate the long-run cost of the requirements with a Vector Error Correction Model (VECM), which shows holding higher capital and liquidity would reduce output by a small amount but increase bank profitability in the long run.

I use quarterly data over the period 1997:q1 to 2010:q2. The bank-specific data were collected from Bankscope and banks' annual reports. The macroeconomic data were collected from the the Bank of England (BOE) database, the Office for National Statistics (ONS) database, and the International Financial Statistics (IFS) database. My maximum temporary net benefit and permanent net benefit is shown to be 1.284% and 35.484% of pre-crisis GDP [1] respectively when the tangible common equity ratio stays at 10%. Assuming all UK banks also meet the Basel III long-term liquidity requirements, the temporary net benefit and permanent net benefit will be 0.347% and 14.318% of pre-crisis GDP respectively.

The structure of the chapter is as follows: Section 6.2 reviews the existing literature on the economic benefits and costs of the Basel III requirements. Section 6.3 explains the data used. Section 6.4 describes the methodology I use to estimate benefit and cost. Section 6.5 presents the main empirical results. And Section 6.6 summarises and concludes.

6.2 Literature Review

6.2.1 Economic Benefits

The economic benefits of the enhanced capital and liquidity regulations reflect mainly the fact that a more robust banking system would be less prone to crises, which can impose large losses in terms of forgone output. This section synthesizes the evidence on these two

[1] The pre-crisis GDP in this chapter is expressed as real GDP in 2007:q4.

effects. It firstly reviews the literature on the impact of capital and liquidity regulation on the probability of systemic banking crises occurring. It then proceeds to review the approaches adopted to assess the GDP loss associated with a specific banking crisis.

The impact of capital and liquidity requirements on the probability of banking crises occurring

Table 6.1 shows the main methods used to estimate the relationship between regulatory requirements and the probability of a banking crisis occurring in a given year; reduced-form models, calibrated portfolio models and calibrated stress test models. The results, summarized in Table 6.1, point to a clear role for capital. But the impact of liquidity is addressed by far fewer models, even though liquidity has been shown to be just as important for maintaining the stability of banking systems. It is worth noting that the definitions of both bank capital and bank liquidity used in these models are not exactly the same as those specified by Basel III. I will discuss this in greater detail below.

Barrell et al. (2009), Kato et al. (2010) and Wong et al. (2010) adopt reduced-from probit models for a panel of countries over a period of years. The probability of a crisis occurring is based on the statistical relationship between the incidence of crisis episodes and aggregate data on bank capital and liquidity, as well as other variables that serve as controls. Comparing with Barrell et al. (2009), Kato et al. (2010) use a general-to-specific approach to choose the preferred specification by considering the substitutability between Japanese banks' capital and liquidity.

Tarashev and Zhu (2008) use a standard portfolio credit risk model to estimate links between capital and the probability of bank default, which is treated as a signal for a systemic banking crisis. They interpret the banking system as a portfolio of banks and estimate the loss distribution arising from bank defaults. Bank failures are correlated and the correlations can be estimated from market information.

Gauthier et al. (2010) use a stress testing model to generate loss distributions under severe but plausible scenarios. This methodology assumes losses arise from systemic spillover effects, either from counter-party exposures in the interbank markets or from asset fire sales that affect the mark-to-market value of banks' portfolios. In this context, a greater capital buffer can only be beneficial insofar as it helps the bank avoid asset fire sales. Therefore, the probability of bank asset fire sales, which depends on holdings of capital, is a key trigger of systemic banking crises. Meanwhile, Miles et al. (2011) use an assumed probability

distribution for changes in annual GDP to calculate the probability of a banking crisis occurring in any given year for different levels of bank capital. They generate distributions of GDP with added stressed shocks by using calibrated parameters.

However, neither the portfolio model nor the stress testing models can assess the impact of liquidity requirements. With this in mind, I estimate the reduced-form relationship between the probability of a banking crisis occurring and UK banks' capital and liquidity ratios.

Table 6.1: Crisis prediction/simulation models

Article	Model type	Reference country	Bank capital	Bank liquidity	Main findings
Barrell et al. (2009)	Reduced	Euro area	yes	yes	Increasing the levels of capital and liquidity by 1% would have reduced the probability of a crisis in the UK by more than 6%, and by smaller amounts in other countries.
Kato et al. (2010)	Reduced	Japan	yes	yes	By introducing a 1% increase in the capital ratio, the probability of a crisis occuring will fall by 3.10% without any increase in liquidity. The probability of a crisis occuring will fall by 2.8% when a 1% increase in the capital ratio as well as a 10% increase in the deposits-to-total-assets-ratio are implemented.
Wong et al. (2010)	Reduced	Hong Kong	yes	yes	Further reductions in the probability of a banking crisis from an increase in the tangible common equity ratio beyond 7% may not be significant. The marginal benefit becomes virtually zero when the TCE/RWA ratio is higher than 11%.

Continued on next page

Table 6.1 –continued from previous page

Article	Model type	Reference country	Bank capital	Bank liquidity	Main findings
Tarashev and Zhu (2008)	Portfolio	Euro area	yes	no	Increasing capital ratios from 6% to 9%, without any increase in liquidity, decreases the likelihood of a systemic crisis by more than a half (e.g.from 4.9% to 2.3%).
Miles et al. (2011)	Stress testing	UK	yes	no	The probability of a crisis occurring will fall from 4.57% to 0.75%, if banks increase their capital ratio from 5% to 20%.
Gauthier et al. (2010)	Stress testing	Canada	yes	no	Increasing capital ratios from 7% to 8%, without any increase in liquidity, decreases the likelihood of a systemic crisis by two thirds (e.g.from 4.7% to 1.7%).

Expected GDP loss associated with a banking crisis

The paths of GDP over the different phases of a banking crisis are generally measured from the peak of the business cycle prior to the crisis to a subsequent trough point for GDP; the end phase is when GDP remains on a new sustainable path. Therefore, two types of GDP loss might occur in a specific banking crisis. The first one is a temporary GDP loss since the path of GDP may regain its pre-crisis trend growth rate. The second is a permanent GDP loss because of a permanently lower GDP growth trend than the pre-crisis one (see Figure 6.1).

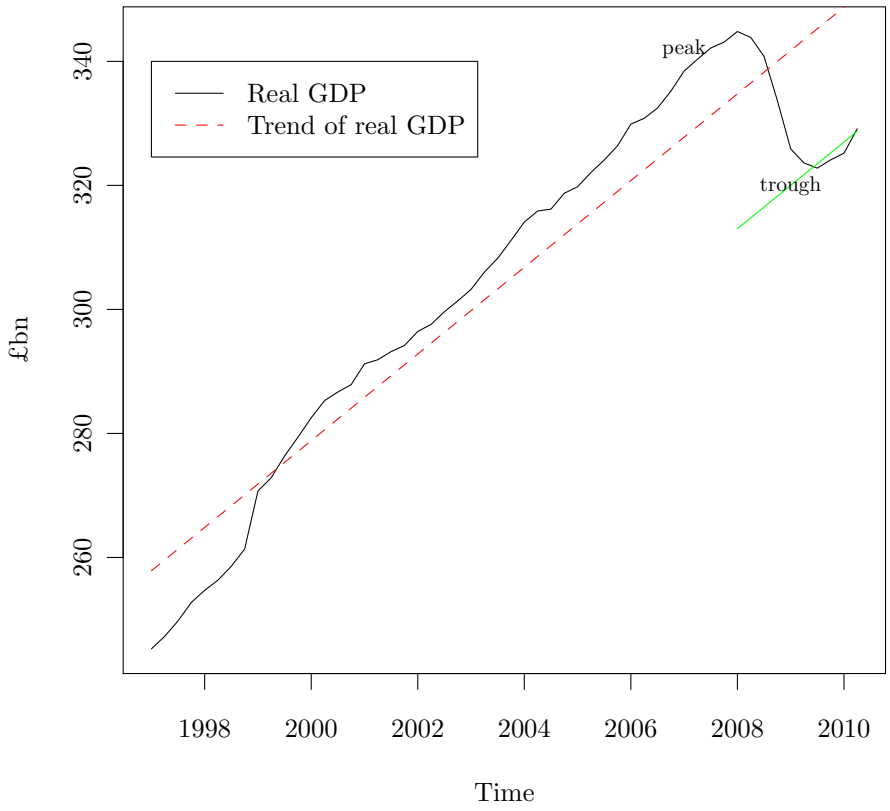
Bordo et al. (2001), Demirguc-Kunt et al. (2000), and Hutchison and Noy (2002) measure the temporary GDP loss from the pre-crisis cycle peak to the point when the pre-crisis trend growth rate has been retrieved. Cecchetti et al. (2009), Laeven and Valencia (2008), and Haugh et al. (2009) measure the cumulative temporary GDP loss through the period of a given banking crisis, which comprises the peak to trough loss of output plus the loss of output until the pre-crisis trend growth rate has been reached. Hoggarth et al. (2002) measure both types of temporary GDP loss. Their findings are summarised in Table 6.2.

Table 6.2: Studies looking at the cost of a banking crisis (relative to pre-crisis GDP)

Study	**Estimated mean losses**	**Estimated cumulative losses**
Temporary losses		
Bordo et al. (2001)	6	
Demirguc-Kunt et al. (2000)	7	
Hutchison and Noy (2002)	10	
Laeven and Valencia (2008)		20
Haugh et al. (2009)		21
Cecchetti et al. (2009)		18
Hoggarth et al. (2002)	14	16
Permanent losses		
Cerra and Saxena (2008)	7.5	158
Röger et al. (2010)	9.4	197
Furceri and Zdzienicka (2010)	4.5	210
Barrell, Davis and Liadze (2010)	2	42
Boyd et al. (2005)		302
Haldane (2010)		200

In contrast, Cerra and Saxena (2008), Röger et al. (2010), Furceri and Zdzienicka (2010)

Figure 6.1: Real UK GDP, 1997-2010



Note: The trend of real GDP is estimated by regressing the real GDP on a constant and a linear time trend.

and Barrell, Davis and Liadze (2010) calculate the permanent GDP loss from the pre-crisis cycle peak to the point when the new, lower trend growth rate has been established as well as the cumulative permanent loss in GDP, over the pre-crisis cycle peak to trough period plus the period until the new lower growth trend rate is established. Meanwhile, Boyd et al. (2005) and Haldane (2010) calculate just the cumulative permanent loss in GDP. Again, their findings are presented in Table 6.2.

6.2.2 Economic Costs

The main channel through which changes in capital and liquidity regulation affect economic activity is via an increase in the cost of bank intermediation. Banks will increase lending rates to compensate for the cost of holding more capital and liquidity. Owing to imperfect substitutability between bank credit and other forms of market financing, this leads to lower investment and lower output.

The computation of the steady-state economic costs of higher capital and liquidity requirements for the level of output are based on a variety of macroeconomic models (see Table 6.3 for the details and findings of the authors). The models differ in many respects. First, they refer to different countries or areas. Second, some are almost fully estimated, whereas others are entirely calibrated (the value of the coefficients are taken from unrelated, generally microeconomic, studies casting light on the specific parameters). Finally, some models explicitly feature a banking sector and a role for bank capital and liquidity, while others do not.

Gambacorta (2011) and Wong et al. (2010) use an error correction model to estimate long-term output reduction caused by higher lending spreads arising from stronger capital and liquidity standards. The main advantage of this approach is that it helps to disentangle loan demand and loan supply factors in the steady state. Based on aggregated historical data, it can establish the long-run relationship between capital (or liquidity) and the reduction in output. The main disadvantage is that it does not allow for the conduct of counter-factual experiments, such as the introduction of countercyclical capital buffers (BCBS, 2010*a*).

Röger et al. (2010) calibrate the costs for an Euro Area crisis from both higher capital and liquidity using a DSGE model including financial frictions and a banking sector. Their model features banks' balance sheets and credit markets explicitly. It provides a unified framework to analyze how changes in capital and liquidity requirements affect banking

conditions (spreads and lending) and output. DSGE models also allow counter-factual policy experiments in a conceptually consistent manner. However, since it is fully calibrated, the estimation process is often daunting. And the other DSGE models cited here (i.e. Van den Heuvel (2008),Dellas et al. (2010), and Meh and Moran (2008)) are still experimental, so that they are not fully integrated to the policy-making process.

Locarno (2004) uses semi-structural models; however, these models do not directly incorporate banks' balance sheet conditions and income statements as input variables. Instead, these effects must be incorporated into other variables, such as lending spreads. This means that the first step is to map the impact of the higher capital and liquidity requirements on lending spreads. Therefore, it is difficult to estimate the impact of the cost effect of capital (or liquidity) on output. Moreover, the computation of long-term effects is difficult due to the size of the models, and cost can be approximated only by simulations over a reasonably large number of years.

Miles et al. (2011) assume an alternative channel through which changes in capital affect economic activity, that is via an increase in the funding cost of bank intermediation. The rising bank funding costs (typically referred to in corporate finance theory as the weighted average cost of capital, WACC) are passed on, one-for-one, by banks to their customers, who will suffer a higher cost of capital for external financing. They assume that output is produced with firms' capital and labour in a way described by a single standard production function. The steady-state output will be changed by higher bank capital requirements. Therefore, they apply a production function with a calibrated constant elasticity of substitution to estimate the calibrated output loss caused by banks' higher WACC.

To estimate the long-term cost effect of both higher bank capital and liquidity requirements, we follow Gambacorta (2011) and use a Vector Error Correction Model to estimate the long-run relationships among a small set of variables for the UK. This analysis focuses on the long run effects on interest rates, lending, GDP and bank profitability of the Basel III requirements. It establishes a framework to estimate the effects of higher bank capital and liquidity on output and bank profitability.

Table 6.3: Long-term cost estimation/calibration models

Article	Model type	Reference country	Estimated /Calibrated	Bank capital	Bank liquidity	Main findings
Gambacorta (2011)	VECM	US	estimated	yes	yes	The impact of changes in capital and liquidity ratios on long-term output are quite small.
Wong et al. (2010)	ECM	Hong Kong	estimated	yes	no	A 1% increase in capital will reduce output by 4.2 basis points in the long run.
Röger et al. (2010)	DSGE	Euro area	calibrated	yes	yes	A 6% increase in capital with no changes of liquidity will reduce output by 0.81%. Fiscal policy appears to matter for the impact of banking crises on headline growth but not on potential output.
Van den Heuvel (2008)	DSGE	US	calibrated	yes	no	The welfare cost of current capital adequacy regulation is found to be equivalent to a permanent loss in consumption of between 0.1% and 1%.
Dellas et al. (2010)	DSGE	US	estimated	no	yes	Monetary policy becomes less accommodating to liquidity shocks under equity market frictions.

Continued on next page

Table 6.3 –continued from previous page

Article	Model type	Reference country	Estimated /Calibrated	Bank capital	Bank liquidity	Main findings
Meh and Moran (2008)	DSGE	US	calibrated	yes	no	Bank capital increases an economy's ability to absorb shocks. Following adverse shocks, well-capitalized banking sectors experience smaller decreases in bank lending and less pronounced downturns.
Locarno (2004)	Semi-structural	Italy	estimated	no	no	The mean results are the same as those of the DSGE models.
Miles et al. (2011)	Single equation	UK	calibrated	yes	no	Doubling capital (from 8.4% to 16.8%) would reduce by output 15% where there is no tax effect and 45% M-M offset.

6.3 Data description

6.3.1 Definitions of Capital and Liquidity

It is crucial to clarify the definitions of capital and liquidity before doing empirical work. In most recent banking sector research, the Tier 1 capital ratio [2] , is the variable chosen to represent bank capital. Likewise, the most commonly used variable for liquidity is the Loans-to-Deposits ratio. However, under Basel III, the focus is on very different ratios.

For the capital base, the first breakthrough in Basel III is to focus on the ratio of tangible common equity capital (i.e. paid-up capital plus retained earnings net of regulatory adjustments) to risk-weighted assets (TCE/RWA), since tangible common equity is the highest-quality component of bank capital:

$$\text{TCE/RWA} = \frac{\text{Common Equity-Intangibles-Goodwill}}{\text{Risk Weighted Assets}} \tag{6.1}$$

Therefore, any analysis about the Basel III capital requirements should use TCE/RWA as the key capital variable. However, since this variable is only available for a few banks since 2009, most studies have used the core Tier 1 ratio in their analyses, translating the core Tier 1 ratio into the TCE/RWA ratio by assuming a linear link between the two in order to assess the long-run impact of stronger Basel III capital requirements. Luckily for me, I am able to get accurate historical UK bank data for the TCE/RWA ratio based on information from the Bankscope database and UK banks' annual reports.

For liquidity, Basel III evaluates banks' long-term [3] liquidity adequacy using a 'net stable funding ratio' (NSFR), which is the available amount of stable funding (ASF) divided by the required amount of stable funding (RSF). The ASF includes equity, debt and other liabilities (Liabs) with an effective maturity of 1 year or greater, 85% of stable deposits (StbDeposits) with residual maturity less than 1 year, and 70% of less stable deposits (OtherDeposits) with a residual matuirty of less than one year. The RSF includes 5% of government debt (GovetDebt), 50% of Corporate loans (CorpLoans) with less than 1 year to maturity, 85% of Retail loans (RetLoans) having a maturity of less than 1 year and 100% of Other Assets

[2] The overall Tier 1 capital ratio includes common equity plus other qualifying financial instruments having a loss-absorbing capacity on a 'going concern' basis in the numerator, with risk weighted assets (RWA) comprising the denominator.

[3] The BCBS also uses a 'liquidity coverage ratio' (LCR) to assess the short-term (i.e. up to 30 days) liquidity adequacy of banks-see BCBS (2010*b*).

(excluding cash and interbank loans, which attract a 0% weighting) [4]. Accordingly,

$$\text{NSFR} = \frac{\text{Equity} + \text{Debt}_{\geq 1yr} + \text{Liabs}_{\geq 1yr} + 85\%\text{StbDeposits}_{<1yr} + 70\%\text{OtherDeposits}_{<1yr}}{5\%\text{GovtDebt} + 50\%\text{CorpLoans}_{<1yr} + 85\%\text{RetLoans}_{<1yr} + 100\%\text{OtherAssets}} \tag{6.2}$$

Basel III requires that the NSFR should be more than 1 which means the sources of funding are bigger than the uses of funding. Previous studies have used the same approach to assess the impact of Basel III's liquidity requirements by translating the NSFR into a Loans-to-Deposits ratio. Wong et al. (2010) estimate a one percentage-point increase in NSFR roughly corresponds to a decrease of 46 basis points in the Loans-to-Deposits ratio on average, with the assumption that there is a linear relationship between the two ratios. Even though it is impossible for me to estimate the relationship between the NSFR and the Loans-to-Deposits ratio with a small sample of data, I can get an approximated NSFR by checking UK banks' historical balance sheets and income statements. Accordingly,

$$\text{NSFR} \approx \frac{\text{Equity} + \text{Snrdebt}_{\geq 1yr} + \text{Liabs}_{\geq 1yr} + 85\%\text{RetDeposits}_{<1yr} + 70\%\text{OtherDeposits}_{<1yr}}{5\%\text{Itbloans}_{<1yr} + 50\%\text{DebtSecurities}_{<1yr} + 85\%\text{AdvLoans}_{<1yr} + \text{OtherAssets}}$$

where Snrdebt is senior debts, RetDeposits are retail deposits, Itbloans are interbank loans, and AdvLoans are advances and loans. Given the recent global financial crisis, it might be too optimistic to exclude cash and interbank loans from the RSF. Therefore, I assume 5% of interbank loans would be funded by ASF. Similarly, since I do not clearly know the portfolio structure of each bank's asset holdings, I apply a 50% discount factor to all less than 1 year Debt Securities, which includes both Government Debt and Corporate Loans. Given the 5% discount factor applied by Basel III to Government Debt, my approximated NSFR is thus less than the real NSFR.

6.3.2 Data

I use quarterly data over the period 1997:q1 to 2010:q2. The bank-specific data were collected from Bankscope and banks' annual reports. Tables 6.4 and 6.5 show that I included

[4] N.B. I have used the December 2009 definition of the NSFR here (BCBS, 2009) to allow for comparision with other studies of its effects, especially (BCBS, 2010*a*). For the final version see (BCBS, 2010*c*).

only 12 (17) out of a total of 190 UK banks [5] from the Bankscope database for the calculation of the industry capital (liquidity) ratio, because of the unbalanced data limitation. However, those selected banks accounted for 91.48% of total UK bank assets in 2010. The macroeconomic data were collected from the the Bank of England (BOE) database, the Office for National Statistics (ONS) database, and the International Financial Statistics (IFS) database. Detailed description of the variables used is given in Table 6.6.

Table 6.4: Sample of UK banks used to calculate the capital ratio

Incorporated banks in the UK	Building Societies
Barclays Bank plc	Bradford & Bingley Building Society
Clydesdale Bank plc	
Co-operative Bank plc	
HSBC Bank plc	
Investec Bank plc	
Lloyds TSB Bank plc	
NatWest Bank plc	
Northern Rock plc	
Royal Bank of Scotland plc	
Santander UK	
Standard Chartered Bank	

Source: Bankscope; FSA.

To estimate the probitability of a banking crisis occurring, I use a dependent variable-binary banking crisis dummy (one for 2008:q1-2010:q2 and zero otherwise). There are two reasons to identify the first quarter of 2008 as the beginning of the systemic banking crisis in the United Kingdom. First of all, it is the peak point of the business cycle prior to the crisis. Second, the Bank of England announced in February 2008 that it would accept a broad range of mortgage-backed securities and swap those for Treasury Bills for a period of one year to aid banks with liquidity problems. And the reason for identifying the second quarter of 2010 as the end of the systemic banking crisis is because its real GDP growth rate had caught up with its pre-crisis level. Finally,the explanatory variables in this model include the sample UK banks' average tangible common equity capital ratio (TCE/RWA), the average UK banks' net stable funding ratio (NSFR), the real estate price inflation ratio

[5] There were 121 incorporated banks operating in the UK, according to the FSA, on 30 June 2011, and 69 building societies. However, this sample does not include banks incorporated outside the UK but accepting deposits through a branch in the UK.

Table 6.5: Sample of UK banks used to calculate the liquidity ratio

Incorporated banks in the UK	Building Societies
Barclays Bank plc	Britannia Building Society
Clydesdale Bank plc	Bradford & Bingley Building Society
Co-operative Bank plc	Nationwide Building Society
HSBC Bank plc	Newcastle Building Society
Investec Bank plc	Skipton Building Society
Lloyds TSB Bank plc	West Bromwich Building Society
NatWest Bank plc	
Northern Rock plc	
Royal Bank of Scotland plc	
Santander UK	
Standard Chartered Bank	

Source: Bankscope; FSA.

(RPI) and the ratio of current account balance to nominal GDP (CA).

The reason for including real estate price inflation has been explained by Barrell et al. (2009). Basically, real estate price inflation , rather than other financial factors such as interest rates or returns on assets, has a superior predictive power than the others. Or, as Kato et al. (2010) argue, the RPI may contain a larger information set than the others. For instance, when housing markets are booming, interest rates would quite frequently remain low as a backdrop to those asset market bubbles. Finally, the reason for including the current account balance ratio is more straightforward. I know from history that a banking crisis usually tended to coincide with a currency crisis, which were well acknowledged as the 'twin crises'. Given that a large current account deficit can frequently precede a currency crisis, the CA term can thus also predict a banking crisis.

To estimate the steady-state economic cost, I use the following variables: real GDP and real [6] bank lending (L) to the private sector, which includes lending to both banking and non-bank financial firms; the real short term interest rate ($i - \pi$), as given by the 3-month interbank rate minus CPI inflation; the lending spread ($r - i$), as given by the 3-month clearing banks' lending rate for different types of loans minus the 3-month interbank rate; the average return on equity (ROE) of UK banks; the average UK banks' tangible common equity capital ratio (TCE/RWA); and the average UK banks' net stable funding

[6]The real bank lending is calculated by seasonal adjusted bank lending over one plus the inflation rate.

Table 6.6: Description of Variables and Sources Used

Variable	Definitions	Source	Dataset Name/Code
TCE/RWA	The quarterly average ratio of tangible common equity to risk-weighted assets.	Bankscope & FAR*	
NSFR	The quarterly average net stable funding ratio calculated based on the definition in the December 2009 proposal.	Bankscope & FAR*	
ROE	The quarterly average return on equity ratio.	Bankscope	
i	The quarterly average 3-month interbank rate.	BOE	IUQAAMIJ
π	The quarterly inflation rate (CPI % change).	IFS	64....XZF
r	The quarterly average 3-month clearing banks ' lending rate for different types of loans.	IFS	60p...ZF
RPI	The quarterly real estate price inflation rate (% change of real estate price index).	ONS	rpi1q
CA	The quarterly ratio of current account balance to nominal GDP.	ONS	pnbp:B:HBOP & YBHA
GDP(Y)	United Kingdom's quarterly real GDP.	IFS	99B.RWF
L	Quarterly amount of real bank lending to private sector.	BOE & IFS	LPQVQJM & 64....XZF

Note: * FAR is Financial Annual Reports of UK banks.

ratio (NSFR).

6.4 Methodology

6.4.1 Estimation of the economic benefit of new capital and liquidity requirements

The benefit of the new requirements is measured as the reduction in the probability of a financial crisis occurring multiplied by the expected loss arising from a one-off banking crisis. Thus,

$$\text{Benefit} = \Delta Pr * \text{expected loss from a financial crisis.} \tag{6.3}$$

Therefore, estimation of the expected long-term benefit from the regulatory reforms consists of two parts. The first part involves an estimation of the impact of higher capital and liquidity requirements on the probability of a banking crisis occurring. The second part is an estimation of output losses arising from a one-off banking crisis.

The impact of higher capital and liquidity requirements on the probability of a banking crisis occurring

Normally, in the binary-state model, the probability depends on each explanatory variable linearly:

$$Pr_t = \Phi(\alpha_i \text{TCE/RWA}_t + \beta_i \text{NSFR}_t + \gamma_i Z_{it}) \tag{6.4}$$

where TCE/RWA_t and NSFR_t denote the tangible common equity capital ratio and net stable funding ratio, respectively, and Z_t represents a vector of macroeconomic variables, including the real estate price inflation ratio (RPI_t) and the current account balance ratio (CA_t). All of these variables are in log form. Φ denotes a cumulative normal distribution function typically used in the standard probit models. Accordingly, Pr denotes the probability of a financial crisis materializing.

However, linear formation, as in the plain-vanilla probit models, gives rise to some difficulties in estimating the cumulative impacts of the regulatory tools used to reduce the probability of crises occurring (Kato et al., 2010). The linear-probit model, imposing the perfect substitution between variables, requires a bank to make a take-it-or-leave-it choice between capital and liquidity. But, both factors are of equal importance to a bank. Indeed, liquidity might be even more important than capital during a systemic banking crisis. As

a result, I employ a slightly more flexible (and sensible) form, a non-linear probit model, with a few cross-terms to allow for imperfect substitutability between capital and liquidity indicators. The estimated benchmark specification of the non-linear-in-factor probit model can be expressed as:

$$Pr_t = \Phi(\alpha_i \text{TCE/RWA}_t * \text{NSFR}_t + \beta_i Z_{it}) \tag{6.5}$$

Estimation of output losses arising from a one-off banking crisis

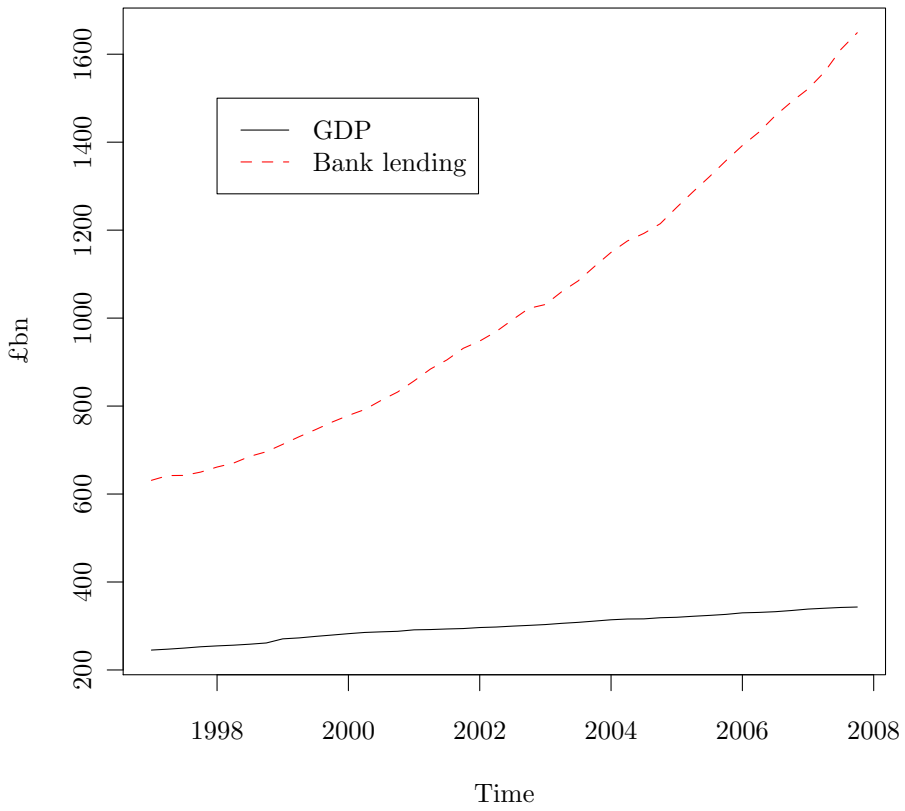
As noted earlier, the paths of GDP over the different phases of a banking crisis of relevance are from the peak of the business cycle prior to the crisis to a subsequent trough point of GDP; the end phase is when GDP returns to a new path. Therefore, two types of GDP loss might occur in a specific banking crisis. The first one is a temporary GDP loss since the path of GDP may regain its pre-crisis trend growth rate. The second is a permanent GDP loss because of a permanently lower GDP growth trend than before the crisis. Both possibilities are examined in this chapter.

6.4.2 Estimation of the output loss arising from higher capital and liquidity requirements

Since it is difficult to measure the long-run relationships between variables during the financial turmoil post-2008, I use quarterly data for the period of 1997:q1-2007:q4 in the VECM model. Figure 6.2 compares the behavior of real GDP and real bank credit. It shows a high correlation between the two series, suggesting the possibility that they have a long-run relationship. Kashyap et al. (1993) mention that better economic conditions usually increase the number of profitable projects in terms of expected net present value and hence increase the demand for credit. The behavior of the spread and the real short term interest rate are shown in Figure 6.3. As can be seen, the spreads remained extremely low over the decade under easy bank lending conditions, as did real interest rates. However, a year before the 2008 financial turmoil began, the lending spreads were at a ten year high. It was a warning sign of future systemic financial instability. As can been in Figure 6.4, both the capital ratio and the liquidity ratio remained quite low over the period, mostly because of the widespread use of securitization techniques and cheap wholesale funding. While the significant decrease in bank profitability from 2001 to 2002 is due to the fragile financial system, especially against the background of the 11th September terrorist attack, the collapse of Enron and Argentina's default. To reduce the heteroskedastic problem, I also take logarithmic forms of

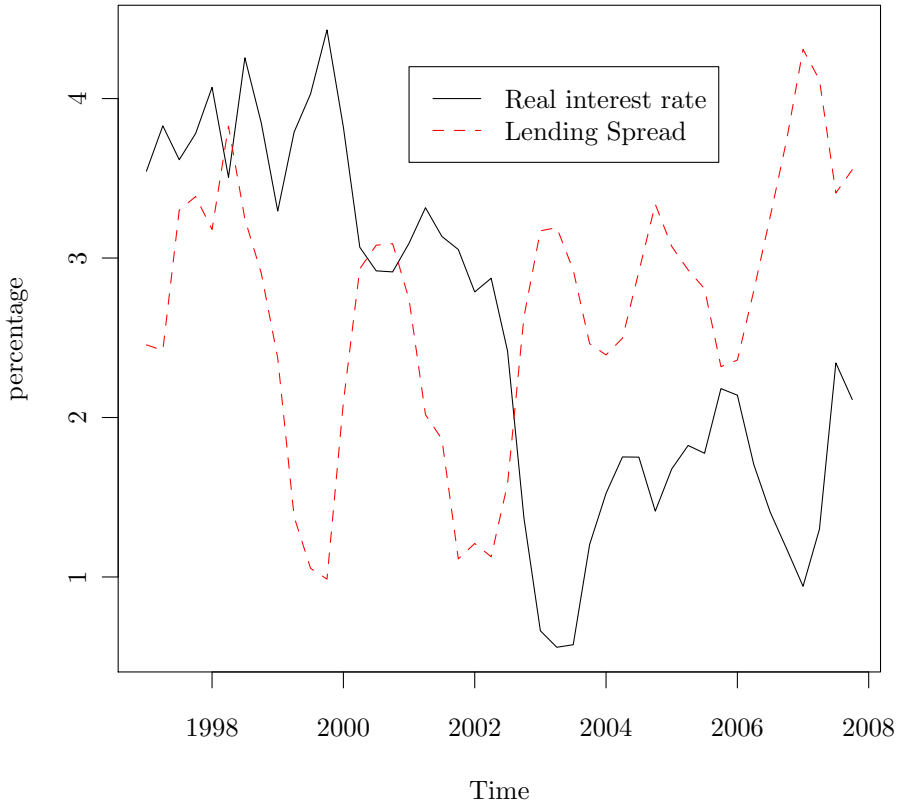
real GDP (Y), real bank lending (L), return on equity (ROE), the capital ratio (TCE/RWA) and the liquidity ratio (NSFR).

Figure 6.2: Bank lending and GDP, 1997-2007



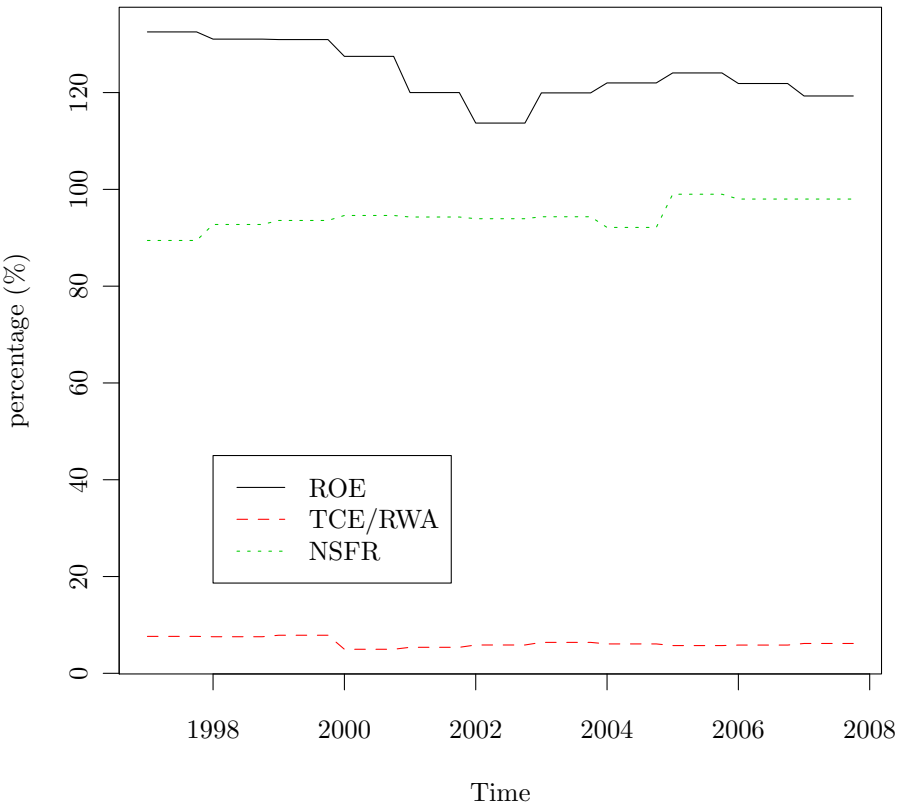
Note: GDP is gross domestic product (output measure) at constant prices. The real bank lending series includes lending to both banking and non-bank financial firms.

Figure 6.3: Short term real interest rates and lending spreads, 1997-2007



Note: The short term real interest rate is given by the 3-month interbank rate minus CPI inflation. The spread is the difference between the lending rate and the 3-month interbank rate.

Figure 6.4: Bank profitability, the capital ratio and the liquidity ratio, 1997-2007



Note: The return on equity of UK banks is in real terms; and the tangible common equity capital ratio and net stable funding ratio are calculated using data from Bankscope as well as banks' annual reports.

In order to estimate the the output loss arising from higher capital and liquidity requirements, I firstly set these seven variables in a VAR system in which all variables are treated as endogenous:

$$
\begin{aligned}
& z_t = \mu + \sum_{k=1}^{p} \Phi_t z_{t-k} + \epsilon_t \\
& t = 1, 2..., T \\
& \epsilon_t \sim VWN(0, \Sigma)
\end{aligned} \tag{6.6}
$$

where $z_t = [Y, i - \pi, r - i, L, \text{ROE}, \text{NSFR}, \text{TCE/RWA}]$. The deterministic part of the model includes a constant and ϵ_t is a vector of white noise residuals. The number of lags(p) has been set equal to 3 based on the Akaike information criteria (AIC). Normality of the VAR may be achieved with the dummy for 1999:q1 and 2004:q1.

Based on the Augmented Dickey Fuller (ADF) test, I found that all of these data have one unit root. The $I(1)$ nature of the variables included in z_t may imply existing cointegrating relationships. Equation (6.6) therefore can be rearranged as a reduced-form error correction model:

$$
\begin{aligned}
& \Delta z_t = \Pi(\mu, z_{t-1}) + \sum_{k=1}^{p-1} \Gamma_k \Delta z_{t-k} + \eta dum_t + \epsilon_t \\
& t = 1, 2..., T \\
& \Pi = (\Theta_1 - \mathrm{I}) = \alpha \beta^{'}.
\end{aligned} \tag{6.7}
$$

This framework can be used to apply Johansen's trace test to verify the order of integration of the matrix Π. In fact, the rank of Π determines the number of cointegrating vectors r such that α is an $n * r$ matrix of loading coefficients and β is an $n * r$ matrix of cointegrating vectors. The results show the presence of four cointegrating vectors in the model (see Table 6.7). So there might be four possible long term relationships amongst the variables.

Table 6.7: Johansen Cointegration Test (Trace)

	test	10pct	5pct	1pct
r <= 6	7.16	7.52	9.24	12.97
r <= 5	11.51	13.75	15.67	20.2
r <= 4	23.47	19.77	22	26.81
r <= 3	29.54	25.56	28.14	33.24
r <= 2	31.93	31.66	34.4	39.79
r <= 1	42.65	37.45	40.3	46.82
r = 0	61.71	43.25	46.45	51.91

Note: Trace test indicates 4 cointegrating equation(s) at the 0.01 level.

The first long run relationship represents the banks' loan supply curve. Freixas and Rochet (1997) argue that each bank sets the lending rate as the sum of the exogenous cost of the bank's refinancing on the money market, other costs (such as bank capital and liquidity requirements) and a constant mark-up in a model of imperfect competition. Therefore, a bank's spread-setting can be represented as:

$$r - i = \gamma_0 + \gamma_1 \text{TCE/RWA} + \gamma_2 \text{NSFR}. \tag{6.8}$$

The second long run relationship is a Commodities and Credit (CC) curve (Bernanke and Blinder, 1988), where the IS curve is modified to take account of the existence of the credit market. Under the assumption of the imperfect substitutability between loans and other forms of firms' financing, an increase in the lending spread captures a tightening in loan supply that should produce a drop in investment and output. The CC curve has the following form:

$$Y = \alpha_0 + \alpha_1(i - \pi) + \alpha_2(r - i) + \alpha_3 \text{ROE}. \tag{6.9}$$

The third long term relationship is a lending demand curve. Demand for bank lending should be a positive function of real GDP and a negative function of the spread. Similar to Gambacorta (2011), I suppose the existence of a log-linear long run relationship of the

following type:

$$L = \beta_0 + \beta_1 Y + \beta_2(r - i). \tag{6.10}$$

The fourth long term relationship is the bank profitability equation. A bank's profit depends on lending volume and the spreads:

$$\text{ROE} = \delta_0 + \delta_1 L + \delta_2(r - i) + \delta_2(i - \pi). \tag{6.11}$$

6.5 Results

6.5.1 Economic Benefit

The probit model estimation results are set out in Table 6.8. I took a general-to-specific approach to finally choose the most preferred specification (i.e. spec 12 in Table 6.8). All coefficients have the expected signs. The negative coefficient of the non-linear-in-factors imply that higher capital and liquidity requirements can prevent the occurrence of a banking crisis. The positive sign of the estimated coefficient on RPI_t shows that higher real estate price inflation would increase the probability of crisis. And the insignificance of the CA_t term implies a limited chance of a currency crisis following the 2008 banking crisis in the UK.

Table 6.8: Estimation Results

Variable /	Nest				Linear-term-only				Nonlinear-term-included			
Spec	1	2	3	4	5	6	7	8	9	10	11	12
Pr(crisis)=0 or 1												
TCE/RWA*NSFR	844.36	NA	NA	NA					2.06	0.58	-1.99	-4.383*
TCE/RWA	42.31	0.48	-2.7	-6.24*	1.78	0.48	-2.7	-6.24*				
NSFR	2360.02	3.44	10.43	19.41	8.62	3.44	10.43	19.41				
RPI	4.77	0.038	-1.41	-3.14*	0.81	0.04	-1.41	-3.14*	0.85	0.05	1.24	2.518*
CA	-0.02	-0.005	0.5172	0.88*	0.1	-0.006	0.52	0.88*	0.004	-0.049	-0.3	-0.447
lag	0	1	2	3	0	1	2	3	0	1	2	3
Log likelihood	-8.11	-16.8	-15.19	-12.51	-15.68	-16.81	-15.2	-12.51	-15.84	-16.84	-15.75	-14.22

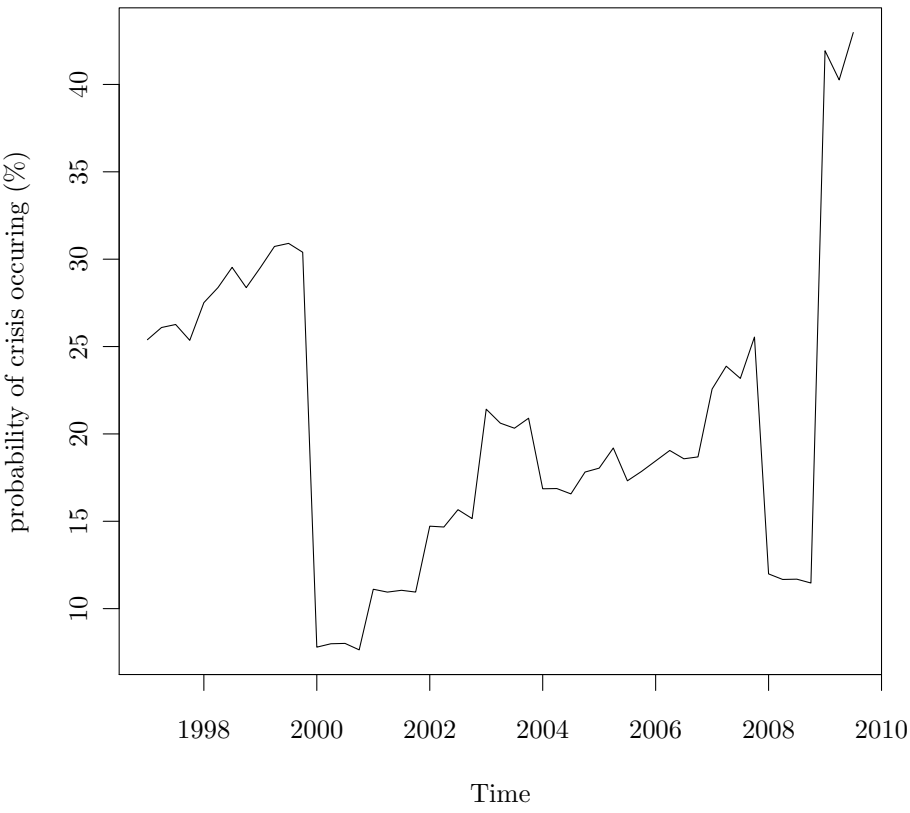
Note: *denotes the 5% level of significance.

The non-linear-in-factor model does not only capture the high probability of a crisis occurring in 2008 (see Figure 6.5), but also provides useful information to help assess the cumulative impact of the multiple regulatory requirements. Table 6.9 shows the relationship between TCE/RWA (or NSFR) and changes in the probability of a crisis occurring. I firstly estimated the base-line probability of a crisis at the mean level of all variables. The average UK historical TCE/RWA (or NSFR) is 6% (or 0.95). Holding other factors constant, a 1% increase in the TCE/RWA ratio will reduce the probability of a crisis occuring by around 3.211%. The probability of a crisis will be reduced by 4.996% when the capital ratio increases to 12%. If the NSFR ratio remains at 1, the reduction in the probability of a crisis will be 2.036%.

Table 6.9: The relationship between TCE/RWA (or NSFR) and changes in the probability of a banking crisis occurring

TCE/RWA	Reduction in the probability of a crisis	NSFR	Reduction in the probability of a crisis
7%	3.211%	0.96	0.612%
8%	4.634%	0.97	1.020%
9%	4.930%	0.98	1.389%
10%	4.984%	0.99	1.727%
11%	4.993%	1	2.036%
12%	4.996%		
13%	4.996%		
14%	4.996%		
15%	4.996%		

Figure 6.5: Crisis Prediction



I calculate that the cumulative temporary GDP loss associated with a systemic banking crisis from 2008:q1 to 2010:q2 is 10% of pre-crisis UK GDP. Using a conservative discount factor of 5% (i.e.the same as that used by BCBS (2010*a*)), the converted cumulative permanent GDP loss is estimated to be 210% [7] (see Table 6.10). Using the probability of crisis estimated by the model presented in the previous section, it is straightforward to quantify the marginal benefit from raising capital (or liquidity) requirements by increaments of one percent. Tables 6.11 and 6.12 summarise the economic benefits of higher capital and

[7] Assuming a current temporary loss of (δ), a growth rate (g) equal to 0 and an interest rate (r) equal to 5% in the infinite horizon, then the present value of the future permanent loss can be calculated as $\delta(\frac{1+r}{r-g})$.

liquidity requirements. If the TCE/RWA catio stays between 7% and 12%, the range of temporary expected benefit will be from 1.102% to 1.714%, and the range of the permanent expected benefit will be from 23.136% to 35.997%. If the NSFR stays at 1, the temporary and permanent expected benefits will be 0.699% and 14.670% respectively.

Table 6.10: Output losses associated with a banking crisis (as a percentage of pre-crisis GDP)

	Difference between GDP at beginning and end of period	Cumulative discounted loss
Period from peak to trough	6	
Period until growth rate recovers	4	
Period from peak to end of crisis		10
Infinite horizon		210*

Notes: *assumes a conservative discount factor of 5%.

Table 6.11: Economic benefit of higher capital requirements

TCE/RWA	Temporary expected benefit(%)	Permanent expected benefit(%)
7%	1.102	23.136
8%	1.590	33.389
9%	1.691	35.521
10%	1.710	35.910
11%	1.713	35.975
12%	1.714	35.997
13%	1.714	35.997
14%	1.714	35.997
15%	1.714	35.997

Table 6.12: Economic benefit of higher liquidity requirements

NSFR	Temporary expected benefit(%)	Permanent expected benefit(%)
0.96	0.210	4.410
0.97	0.350	7.349
0.98	0.477	10.008
0.99	0.593	12.443
1	0.699	14.670

6.5.2 Economic Cost

These are the estimated long run relationships from the VECM model (with standard errors in brackets):

$$\begin{array}{rcccccc} r-i & = & 17.83 & + & 5.27\text{TCE/RWA} & + & 10.04\text{NSFR} \\ & & & & (1.135) & & (4.083) \end{array} \tag{6.12}$$

$$\begin{array}{rcccccccc} Y & = & 5.8 & - & 0.084(r-i) & - & 0.216(i-\pi) & + & 3.04\text{ROE} \\ & & & & (0.027) & & (0.021) & & (0.420) \end{array} \tag{6.13}$$

$$\begin{array}{rcccccc} L & = & -11.75 & + & 3.21Y & + & 0.15(r-i) \\ & & & & (0.185) & & (0.021) \end{array} \tag{6.14}$$

$$\begin{array}{rcccccccc} \text{ROE} & = & -0.074 & + & 0.11L & + & 0.73(r-i) & + & 0.18(i-\pi). \\ & & & & (0.028) & & (0.072) & & (0.074) \end{array} \tag{6.15}$$

As for the estimated coefficients, the long run elasticities between the spread and the two regulatory variables are quite low. For a 1% increase in the capital (or liquidity) ratio , the spread increases by 5% (10%). As expected, there is a negative relationship between GDP and both the real interest rate and the spread. The semi-elasticity between GDP and the lending spread is -0.084. The long-run elasticity between lending and GDP is equal to 3.21. Bank lending, spreads and the short term real interest rate all positively impact bank profitability. The long-run elasticity between ROE and lending is 0.11, and the semi-elasticitiy between ROE and the lending spread (or real short term interest rate) is 0.73 (or 0.18).

Table 6.13 summarises the long-run impact of TCE/RWA (or NSFR) on output, based on the estimation results. Other things being equal, a one percentage-point increase in the capital ratio will cause a 0.238% loss of pre-crisis output. The maximum reduction in output will be 0.598% when the capital ratio increases to 15%. If the NSFR liquidity requirement is met, the loss of output will be 0.352%.

Table 6.13: The relationship between TCE/RWA (or NSFR) and reduction in output

TCE/RWA	Reduction in output	NSFR	Reduction in output
7%	0.238%	0.96	0.318%
8%	0.318%	0.97	0.327%
9%	0.377%	0.98	0.336%
10%	0.426%	0.99	0.344%
11%	0.468%	1	0.352%
12%	0.505%		
13%	0.539%		
14%	0.570%		
15%	0.598%		

6.5.3 Net Benefit

The estimated net benefit for the United Kingdom is dependent on whether banking crises are assumed to result in a temporary or permanent GDP loss. As mentioned in previous sections, the estimated cumulative temporary GDP loss is 10% of pre-crisis UK GDP, and the permanent GDP loss during the recent crisis is estimated to be 210%. The expected economic benefit can thus be quantified as the product of the marginal reduction in probability of a crisis occuring because of increasing capital (or liquidity) requirements and the two types of expected GDP loss arising from a banking crisis. From Table 6.14, I can see that the maximum net benefit (temporary plus permanent) occurs when the TCE/RWA ratio is set at 10%. At this capital level, the temporary net benefit and permanent net benefit will be 1.284% and 35.484% of pre-crisis GDP respectively. Assuming all UK banks meet the new long-term liquidity requirement, the temporary net benefit and permanent net benefit will be 0.347% and 14.318% respectively (see Table 6.15).

Table 6.14: Economic impact of higher capital requirements

		Temporary GDP loss		Permanent GDP loss	
TCE/RWA	Expected cost(%)	Expected benefit(%)	Net benefit(%)	Expected benefit(%)	Net benefit(%)
7%	0.238	1.102	0.864	23.136	22.898
8%	0.318	1.590	1.272	33.389	33.071
9%	0.377	1.691	1.314	35.521	35.144
10%	0.426	1.710	1.284	35.910	35.484
11%	0.468	1.713	1.245	35.975	35.507
12%	0.505	1.714	1.209	35.997	35.492
13%	0.539	1.714	1.175	35.997	35.458
14%	0.57	1.714	1.144	35.997	35.427
15%	0.598	1.714	1.116	35.997	35.399

Table 6.15: Economic impact of higher liquidity requirements

		Temporary GDP loss		Permanent GDP loss	
NSFR	Expected cost(%)	Expected benefit(%)	Net benefit(%)	Expected benefit(%)	Net benefit(%)
0.96	0.318	0.210	-0.108	4.410	4.092
0.97	0.327	0.350	0.023	7.349	7.022
0.98	0.336	0.477	0.141	10.008	9.672
0.99	0.344	0.593	0.249	12.443	12.099
1	0.352	0.699	0.347	14.670	14.318

6.6 Summary and Conclusions

In summary, the Basel III reforms are expected to generate a significant positive net benefit for the United Kingdom economy. My estimated optimal level of tangible common equity (the highest quality, loss-absorbing capital) is 10% of risk weighted assets, which is higher than the normal Basel III target for the minimum common equity capital ratio of 7% [8], and even that set for 'systemically important financial institutions' (SIFIs) [9]. This finding supports those who argue for tighter capital standards under Basel III, at least as far as the UK is concerned.

In addition, I estimate the maximum net benefit when banks also meet the Basel III long-term liquidity requirements (i.e. when the NSFR stays at 1). Our results prove there is a clear role for liquidity to prevent banking crises and economic downturns. Overall, my results are consistent with the proposition that the reforms are likely to increase financial stability in the UK by strengthening the quality of both banks' capital bases and funding structures.

My estimated temporary net benefit is similar to the average estimation for selected economies of the BCBS (2010*a*). However, the permanent net benefit is higher than the average permanent net benefit calculated by the BCBS (2010*a*). The temporary net benefit is estimated by me to range from 0.864% to 1.314% compared to the BCBS estimates of 0 to 1.96%; while the permanent net benefit is estimated to range from 22.898% to 35.507% compared to the BCBS estimates of 0 to 5.90%. The reason for the higher expected

[8]The target, which has to be met by Janurary 2019, comprises a minimum 4.5% common equity capital ratio requirement (to be met by January 2015) and a minimum 2.5% conservation buffer requirment.

[9]The BCBS agreed in June 2011 to phase in (between 2016 and 2019) a capital surcharge of up to 2.5% of RWA for such institutions.

permanent benefit is that my estimated permanent GDP loss is 210%, which is higher than the average estimate of 158% of the BCBS (2010*a*).

I acknowledge, however, that the chapter has several limitations. First, because only one UK banking crisis has occurred since 1997, I cannot use out-of-sample tests to evaluate the forecasting ability of the non-linear-in-factor probit model. Second, other possible economic benefits and costs arising from the Basel III requirements have not been taken into account in this study due to difficulties in quantification [10]. And third, the estimated benefits (or costs) of the NSFR requirements are sensitive to the assumptions used to calculate the NSFR. Notwithstanding this, I do my best to quantify the long-term economic impact of the new requirements for the UK economy in one of the first stand-alone country analyses of the combined impact of the recently-agreed changes to the international standards for banks' capital and liquidity.

[10]For a broad cost-benefit style of analysis of the Basel Capital Accord see (Hall, 2004).

Chapter 7

Conclusions

7.1 Main findings and Contributions

This thesis makes a number of contributions to the theoretical and empirical literature. First, I review the history of financial regulation and point out that financial deregulation or 'non-regulation' would not help to build up a healthy financial system and boost the real economy in the long term. Learning from the global financial crisis of 2007-2009, I find out that: the collapse of an illiquid bank might be eventually followed by a large number of other liquid banks since banks are susceptible to the domino model of contagion and the difficulties in the financial system would greatly harm the real economy; it is easy for banks to mislead customers and regulators or even commit frauds with their informational advantages; it may be impossible for individual consumers to monitor the fiduciary role of financial institutions, especially for long term investment products; without financial regulation, market confidence might easily disappear since consumers would worry that no one cares about their benefits; without restraining risky actions, the potential 'Grid Lock' problems could be caused by the herd behavior of banks who are chasing short-term profits without concern for the stability of financial markets and social welfare. I also explain that building up banking liquidity regulation and supervision is a crucial part of improving modern financial regulation frameworks since banks have extended market shares and secured higher returns by increasing dependence on higher levels of debt and over funding from short-term wholesale markets in the last decade.

Second, I discussed the meaning of liquidity risk as well as the the respective framework of liquidity regulation and the liquidity provision operation of central banks. I explained

that liquidity is neither an amount nor a ratio, but only relates to cash flow. I also argued that central banks' liquidity support is uncertain ans socially costly. The involvement of the central banks is necessary to maintain financial stability. However, the rational liquidity regulation should require banks to manage their risk activities effectively and reduce reliance on central banks.

Third, I demonstrate that the Principles of 2008 represent a substantial improvement on the Principles of 2000 and reflect the lessons of the financial market turmoil since 2007. It explains that the work is drawn from recent and ongoing work on liquidity risk by the public and private sectors and is intended to strengthen banks' liquidity risk frameworks to withstand a range of stress events, including those that affect secured and unsecured funding. All the 30 interested parties welcomed the Principles 2008, but they preferred a more flexible application of the principles. I also explain the compositions of the Basel liquidity ratios and examine the side effects of the Basel liquidity standards; for example, it will reshape interbank deposit markets and bond markets as a result of the increase in demand for 'liquid assets' and 'stable funding'.

Fourth, I found out that the FSA's risk-assessment framework is too general without specifically considering banks' liquidity risk, which has low probability but high impact. I also review the failure of FSA's role as banking supervisor for high impact banks, like the Northern Rock. These failures included the frequently-changing supervisory responsibility, inadequate ARROW panel meetings to review risk positions, non-availability of regular management information to identify emerging risks and re-assess business risks, and little emphasis on liquidity risk and the use of market intelligence. I also manage to explain the limitations of the FSA's banking liquidity regimes before 2008. The Sterling Stock regime applied to large UK retail banks is no longer appropriate since it cannot cover 'core outflow' at a given time. The Maturity Mismatch regime for other banks did not update the discounts applying to marketable assets. Some regularly-traded assets may no longer be as marketable as previously thought during the last decade. The Building Society regime only reflected a simpler business model for UK building societies, although they had engaged in more complex activities especially after 2005. Finally, I examine whether the new regimes would have coped with UK banks' liquidity risks if they had been applied properly. The fundamental changes in the FSA's liquidity supervision reflect three considerations. First, it introduces a systemic control requirement by measuring individual firms' liquidity risks with a market-wide stress or combination of idiosyncratic and market-wide stresses. Second, it emphasizes the monitoring of business model risks and the capability of senior

managers. Third, it allows both internal and external managers to access more information by increasing the liquidity reporting frequencies.

Fifth, I refers to some contrasted views on the revision of Basel III's LCR and FSA's liquidity buffer. Some universal banks or even financial regulators welcome the eased requirement as giving them more time to adapt new liquidity regulation. While others criticized these changes are exactly a 'watering-down' effect on Basel III by powerful lobbies.

Sixth, I use quantitative balance sheet liquidity analysis, based upon modified versions of the BCBS (2010*b*) and Moody's (2001) models, to estimate UK banks' short and long-term liquidity positions respectively. The study also presents fundamental financial information to facilitate analysis of banks' business models and funding strategies. Different from the Basel liquidity ratios (BCBS, 2010*b*), my short-term liquidity framework is built to measure whether a bank's liquid assets can cover its cash outflow for up to one year or not since the severe liquidity stress can drag on for a year or more. And my long-term liquidity framework is built to measure whether a bank's long-term funding due to mature in more than a year can cover its illiquid assets and securities or not. My quantitative balance sheet liquidity framework also measures a UK bank's liquidity risk by considering the real contractual maturities of its assets and liabilities, which has not been undertaken in previous studies.

I analyze eight UK banks' liquidity positions from 2005 to 2010 using consistent financial reporting information. My results show that only Barclays Bank remained liquid on a short-term basis throughout the sample period (2005-2010); while the HSBC Bank also proved liquid on a short-term basis, although not in 2008 and 2010. On a long-term basis, RBS has remained liquid since 2008 after receiving government support; while Santander UK also proved liquid, except in 2009. The other banks, especially Natwest, are shown to have faced challenging conditions, on both a short-term and long-term basis, over the sample period.

Seventh, I use a relatively-new quantitative model for estimating UK banks' liquidity risks. The model is called the Exposure-Based Cash-Flow-at-Risk (CFaR) model, which not only measures a bank's liquidity risk tolerance, but also helps to improve liquidity risk management through the provision of additional risk exposure information. Specially, I clarify the difference between VaR and CFaR. Researchers typically choose VaR as the basis for risk management systems within financial institutions, and CFaR when assessing risk management among non-financial firms, because there is an argument that a financial institutions's VaR is also their CFaR, since portfolio holdings by financial firms are marked-to-market (Shimko, 1998). But, VaR, unlike CFaR, will capture only a small part of the firm's overall exposure since it ignores the risk of its underlying commercial cash flow.

Moreover, I successfully demonstrate that reducing the maximum shortfall of value cannot fully reflect the volatility of cash flow. Therefore, VaR is not an efficient tool to manage liquidity risk. Banks should develop more advanced cash flow models to control liquidity risk.

I use annual data over the period 1997 to 2010 for forecast banks' CFaRs. By the end of 2011, the (102) UK banks' average CFaR at the 95% confidence level was forecast be -£5.76 billion, Barclays Bank's (Barclays') CFaR to be -£0.34 billion, the Royal Bank of Scotland's (RBS's) CFaR to be -£40.29 billion, HSBC Bank's (HSBC's) CFaR to be £0.67 billion, Lloyds TSB Bank's (Lloyds TSB's) CFaR to be -£4.90 billion, National Westminister Bank's (Natwest's) CFaR to be -£10.38 billion, and Nationwide Buidling Society's (Nationwide's) CFaR to be -£0.72 billion. Moreover, it is clear that Lloyds TSB and Natwest are associated with the largest risk, according to the biggest percentage difference between downside cash flow and expected cash flow (3600% and 816% respectively). Since I summarize a bank's liquidity risk exposure in a single number (CFaR), which is the maximum shortfall given the targeted probability level, it can be directly compared to the bank's risk tolerance and used to guide corporate risk management decisions. My exposure-based CFaR model also can help senior managers to develop a proper strategy to manage liquidity risk, since the model involves the estimation of the set of exposure coefficients that provide information about how various macroeconomic and market variables are expected to affect the banks' cash flow, and that also attempt to take account of inter-dependencies and correlations among such effects. For these reasons, they can also be used to predict how a hedging contract or change in financial structure will affect a bank's risk profile.

Finally, I assess the long-term United Kingdom economic impact of the Basel III capital and liquidity requirements ('the requirements'). I identify the benefit of the new requirements as the reduction in the probability of a banking crisis multiplied by the expected loss arising from a one-off crisis. The main channel driving the economic costs of the requirements is through the bank credit market, in which higher lending rates reduce output levels. Here, I quantify the cost of the new requirements as a negative function of the lending spread.

Comparing with previous studies, I focus on estimating the impact of *both* tighter capital and liquidity requirements for the UK economy. And I calculate the capital and liquidity ratios based on the Basel III definitions, rather than the more commonly used Tier 1 capital ratio and the Loans-to-Deposits liquidity ratio. Based on quarterly data over the period 1997:q1 to 2010:q2, I choose a non-linear-in-factor probit model, which shows increasing

bank capital and liquidity would reduce the probability of a bank crisis significantly. I also estimate the long-run cost of the requirements with a Vector Error Correction Model (VECM), which shows holding higher capital and liquidity would reduce output by a small amount but increase bank profitability in the long run. My maximum temporary net benefit and permanent net benefit is shown to be 1.284% and 35.484% of pre-crisis GDP respectively when the tangible common equity ratio stays at 10%. Assuming all UK banks also meet the Basel III long-term liquidity requirements, the temporary net benefit and permanent net benefit will be 0.347% and 14.318% of pre-crisis GDP respectively. Therefore, the results suggest that, in terms of the impact on output, there is considerable room to further tighten capital and liquidity requirements, while still providing positive benefits for the United Kingdom economy.

7.2 Directions for Future Research

In order to extend the research using quantitative balance-sheet analysis, it would also be helpful to include a model to measure the imposed weights for each asset or liability items according to the remaining period to maturity. Also, research that linked bank liquidity and financing conditions for corporates would be very interesting.

In the area of measuring banks' downside liquidity risk, the study currently is only able to estimate *annual* CFaR because of data limitation; it would be nice to have quarterly and half-yearly data to analyze shorter-term liquidity positions, which would make it easier for senior managers and regulators to adjust their operational strategies in terms of bearing unpredictable liquidity pressures. Significant data limitation problems help to explain why both regulators and bank managers ignored liquidity risk for a long time, and retarded the development of bank liquidity modeling. Since the SEC has already asked all US listed companies to publicly disclose their quarterly financial reports, I would also like to propose that the FSA requires banks to release at least quarterly financial data.

In the cost-benefit analysis of the Basel III requirements for the UK economy, the key problem is that the paper tries to derive the relationship between the causal factors and financial crises using a single crisis event. There are potential problems with using only one crisis to estimate the links with regulation and macroeconomic factors. To enrich the analysis, therefore, it is suggested that future research uses a sample of crises a cross countries. Again, it would be nice to have a longer period for the VECM with more banking sector data for satisfactory cointegration.

Improved regulation of liquidity is essential not just at the micro level, but also at the macro level. There are at least two important issues waiting to be addressed: How to guide financial institutions to '*service*' the real economy and how to design and provide stable liquidity to the markets. Therefore, further possible research could be undertaken to assess the liquidity regulation and supervision at the macro-prudential level. For macro-prudential supervision, it is very important to understand the roles of both supervisor and regulator. Policymakers' decisions should be based on fundamental Financial Economic theory and be independent from short-term political pressures. It is very frustrate to see inconsistent policies which not only reduce market confidence, but also slow down the growth of real economy.

Appendix A

Commentators' Opinions of the of Basel Liquidity Principles of 2008

Table A.1: Commentators' Opinions on Principle 1

Affinity Group	Principle 1: a bank should establish a robust liquidity risk management framework and supervisors should assess the adequacy of this framework.
Financial service industry associations	Febelfin (2008) believes the text proposal is too prescriptive in nature, and advocate that the principle of materiality could be taken into account when finalizing the document. In order to avoid overregulation and to support the high-level principles and the proportional approach, ESBG-WSBI (2008) would encourage the Basel Committee to insert also a reference to the materiality principle. Thereby it would be ensured that the regulatory guidance applies primarily to cases of material risks and in material circumstances. As regards the requirement for the integration of liquidity risk management with other types of risk, Zentraler Kreditausschuss (2008) suggests integration should not be excessively deep because this would overextend the banks' operational and organizational capabilities.
Supervisors	They believe implementation of the liquidity management framework should be consistent with the supervisory objectives.

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Table A.1 –continued from previous page

Affinity Group	Principle 1
Financial institutions	In considering what constitutes the highest quality of liquid assets, the authorities must recognize that eligibility as collateral at central banks in both normal and stressed times will be a consideration. RBS (2008) would counter the Basel Committee's argument that banks should not rely on central bank support in times of stress. RBS thinks that whilst this may be true for a bank-specific event, where there is a risk to the system as a whole then the banks will need to have support from the central banks. Systemic problems are after all a shared problem between the private and public sectors.
Others	Independent Audit Limited (2008) suggests that the Board of directors is ultimately responsible for the operations and financial soundness of the bank. While Carrel (2008) agrees with the concept of a cushion, it believes stronger emphasis should be made on prevention and exposure monitoring as the cornerstone of a liquidity risk management framework. Moreover, Desrochers and Préfontaine (2008) emphasizes that it should be stated in the formulation of the fundamental principle that supervisors should communicate and coordinate their actions with other bodies such as central banks, deposit insurers education and protection agencies.

Table A.2: Commentators' Opinions on Principle 2

Affinity Group	Principle 2: a bank should clearly articulate a liquidity risk tolerance.
Financial service industry associations	Firstly, a bank should determine its liquidity risk tolerance in quantitative and qualitative terms that are appropriate for the bank, and expect that national supervisors' liquidity risk rules will confirm this practice (CBA, 2008). Secondly, with respect to liquidity risk, a firm's risk tolerance may change depending on market conditions. Provided change is congruent with the firm's liquidity risk and risk-management strategies and practices, this is entirely appropriate and necessary (IIF, 2008). Thirdly, there is an important difference between short-term and long-term stress which require a different type of liquidity risk tolerance. Moreover, liquidity risk tolerance cannot be defined and evaluated independently of other significant types of risk (Zentraler Kreditausschuss, 2008).
Supervisors	It is useful to have access to technical discussion about ways of defining and measuring liquidity risk tolerance (RBNZ, 2008).
Financial institutions	It is important that the tolerance level is understood at all levels of the bank. In expressing liquidity risk tolerance a bank will therefore be balancing prudence against profitability and this is clearly an issue of the utmost importance to the Board. There is no need to disclose publicly a bank's liquidity risk tolerance (RBS, 2008).
Others	Firstly, the concept of risk tolerance is complex and difficult to define and use; it continues to evolve in use in their institutions (Independent Audit Limited, 2008). Secondly, liquidity risks should indeed be considered and aligned with the overall risk policy of a bank when making decisions such as entering a new market or embarking on new strategies (Carrel, 2008).

Table A.3: Commentators' Opinions on Principle 3

Affinity Group	Principle 3: senior management should develop a strategy to manage liquidity risk and report to the board of directors on a regular basis. Board of directors should review and approve the strategy.
Financial service industry associations	For big banks, it is not realistic that the Board of Directors ensures that senior management has carefully executed such a far-reaching review. Smaller banks, due to limited resources, will have problems to ensure operational independence in control functions (EACB, 2008). Furthermore, the segregation of operational and monitoring functions between the Board of Directors and Executive Committee should be done according to the organizational structure of the banking group (FBF, 2008).
Supervisors	They suggest a close coordination of Treasury functions with respect to liquidity risk management, incorporating information on all relevant business activities. Since the Treasury department has full view of all liquidity risk, operations, involvement of the Treasury department may help to ensure greater completeness of liquidity risk capture.

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Table A.3 –continued from previous page

Affinity Group	Principle 3
Financial institutions	In order to ensure that personnel in independent control functions have the skills and authority to challenge information and modeling assumptions, they would recommend that, in large banks, there be an independent committee comprised of senior risk functions covering liquidity risk, market risk and credit risk. This would ensure professionalism, consistency and continuity of risk measurement methodologies applied (Credit Suisse, 2008). Moreover, supervisors and central banks should cooperate to increase consistency between the eligibility criteria of assets that may be used, on the one hand, as a prudential liquidity buffer and, on the other hand, as underlying collateral for central banks' credit operations which, by definition, also make highly liquid non-marketable assets, such as credit claims (UniCredit Group, 2008). As regards the Board's responsibilities, the principle as written does not state that the Board has the discretion to delegate its liquidity management obligation rather than assign responsibility to other agencies (USbank, 2008). In terms of asking for personnel in independent control functions, they recommend that the Committee clarify its intent on independent control functions (USbank, 2008).

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Table A.3 –continued from previous page

Affinity Group	Principle 3
Others	Firstly, liquidity requirements must be estimated on a daily basis and not only based on internal measurements but also on external factors such as cross-industry business outlook, cross-market correlations, counterparties' own funding needs, business continuity and connectivity of the network related to each business activity (Carrel, 2008). Secondly, it can be extremely difficult for small banks to have operationally-independent personnel for ensuring the adequacy of internal controls (Matz and Fiedler, 2008). Furthermore, inside auditors, if any, rarely have the necessary training or experience. Matz and Fiedler (2008) suggest that the regulatory guidance permit alternatives to operationally-independent personnel. Possible alternative includes: strong internal controls that require Board approval before they can be modified; annual reviews by outside auditors; and/or periodic reviews by outside experts.

Table A.4: Commentators' Opinions on Principle 4

Affinity Group	Principle 4:a bank should incorporates liquidity cost, benefits and risks in the product pricing.
Financial service industry associations	While the principle sets out appropriate goals, UK Joint Trade Association (2008) request that reasonable flexibility be allowed in evaluating how banks go about meeting this principle. They encourage the insertion of a concept of materiality into this principle. In aligning prices with liquidity costs the industry cautions against the use of liquidity pricing models which are overly complex and burdensome, especially for smaller, non-complex banks (EACB, 2008). JBA (2008) agree the need to consider liquidity costs in product pricing and performance measurement. However, they do not think it rational to present only quantitative approaches as guidance for regulatory authorities, because doing so would necessarily exclude other approaches (for example, techniques that qualitatively consider these factors from the perspective of liquidity risk governance). NVB (2008) would like the expression to be amended to something more flexible that would allow for multiple options in light of the objectives of this principle. Moreover, supervisors should allow the banks' methods of calculating liquidity costs to reflect their business models (Zentraler Kreditausschuss, 2008). Regulatory requirements should not go into excessive detail. Incorporating liquidity risk costs in pricing could exaggerate financial market volatility in business dynamics. This innovation of using liquidity costs entails keeping in mind that appropriate regulations and necessary implementable interventions need to be carried out in a time frame which is not short (Association Bancaria Italiana, 2008).
Supervisors	No comments.

Continued on next page

Table A.4 –continued from previous page

Affinity Group	Principle 4
Financial institutions	This does imply a need to educate customers regarding how liquidity issues impact product pricing. For the avoidance of doubt liquidity costs, benefits and risks should be incorporated in international product pricing (RBS, 2008). Whether or not a bank can, or is willing to, adjust external product pricing (i.e. vs. its customers) depends on the competitive environment, the integration of client relationship vs. product management and organizational aspects (Credit Suisse, 2008). Furthermore, internal charging should be introduced carefully to ensure that it encourages the right behaviour and does not create an atmosphere of internal cost avoidance (RBS, 2008). Charging is only one way, after all, to encourage the right behaviour.
Others	Matz and Fiedler (2008) would like to see a more carefully articulated discussion of attributing liquidity cost and benefits at the product or transaction levels versus at line-of-business or more aggregated levels. Both deposits and contingent liabilities merit particular attention. Off balance sheet commitments are a major area requiring more attention being paid to the liquidity cost. Banks should remain free to pass on funding costs or not to their customers. Strong directives in this field may lead to the abandonment of some products and a shift to unregulated markets or products (Carrel, 2008).

Table A.5: Commentators' Opinions on Principle 5

Affinity Group	Principle 5: a bank should have a sound process for identifying, measuring, monitoring and controlling liquidity risk.
Financial service industry associations	They urge more specific attention be paid to any liquidity risk requirements applicable to 'monoline insurers' and SPVs (Miles et al., 2011). In assessing the stickiness of funding sources, it is preferable to focus on 'core' or 'relationship' deposits, rather than just 'retail' deposits, because there is certainly a range of commercial and business deposits that may be very stable and as 'sticky' as retail deposits (IIF, 2008). Evaluating the creditworthiness of each counterparty in off-balance-sheet positions should always be considered when determining the liquidity demand relating to every off-balance-sheet position (CBA, 2008). MICA (2008) urge adoption of the proposed treatment for recourse, guarantee and similar off balance sheet obligations, as these risks are painfully apparent in current financial markets but ill captured under current capital and risk management requirements. In terms of matching incoming flows with outgoing resources, this is acceptable if it refers to only the short term; while for an extended timeframe these rules should not translate into an excessive limitation to the transformation of maturity (Association Bancaria Italiana, 2008). UK Joint Trade Association (2008) recommend that reference is made to the significance of monitoring and managing liquidity in the 'immediate future', as longer term liquidity projections are very difficult to make in anything but the broadest terms. They believe it unnecessary to project cash flows on an intraday basis, since they consider the existing special requirements for the management of intraday liquidity to be sufficient. Finally, the Basel Committee takes the view that the banks should consider not only outgoing and incoming nominal amounts when projecting cash flows but also outgoing and incoming interest. The associations believe it is inappropriate to make the consideration of interest mandatory. The principles of materiality and proportionality demand that this decision also be left to the banks.

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Table A.5 –continued from previous page

Affinity Group	Principle 5
Supervisors	Reference to underlying risk factors that could result in liquidity demands understanding the underlying risk factors, and how these can be conducted to liquidity stress is important. It would be worth emphasizing this throughout the document. Banks' monitoring should thus address the underlying macroeconomic and financial market conditions, and should not be confined to the immediate indicators of liquidity problems (RBNZ, 2008).
Financial institutions	When incorporating contingent cash flows, it is important not just to look at the individual credit-worthiness of the counterparties but also at the aggregate exposures to major business lines as a number of counterparties operating in the same businesses could be affected in some stress scenarios (Credit Suisse, 2008). Moreover, setting up liquidity back-stop facilities should strongly depend on the nature of the business and organization of the bank (Dexia, 2008).

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Table A.5 –continued from previous page

Affinity Group	Principle 5
Others	Matz and Fiedler (2008) suggest that the time horizon guidelines be a bit more specific. For example, experience shows that whole sale funded banks need to focus on daily time buckets over short time horizons, while predominately retail deposit funded banks may find longer time horizons more appropriate. Similarly, bank- specific liquidity events triggered by credit problems seem to unfold over quarters while market-driven problems unfold much more quickly. Secondly, cash flows determining the future liquidity exposure should not only stem from the existing assets and liabilities on the balance sheet, but in specific scenarios as well as from anticipated new business. Projecting cash-flows arising from assets, liabilities and off-balance-sheet items and aggregating them under a broad range of business scenarios is central to managing funding requirements (Carrel, 2008). To assess liquidity risks, the scenarios would have to be cross-asset and cross-industry, involving correlation changes and unprecedented volatility swings in particular. A realistic scenario on liquidity risk would need to take into consideration many qualitative criteria such as the price transparency of the assets, the probable reactions of customers or counterparties to similar market moves and the availability of prices and data under extreme market conditions.

Table A.6: Commentators' Opinions on Principle 6

Affinity Group	Principle 6:a bank should actively manage liquidity risk exposures and funding needs within and across legal entities, business lines and currencies.
Financial service industry associations	IBFed (2008) suggests that the role of cross-border groups could be more thoroughly taken into account by stressing the need for enhanced flexibility with regard to the international transferability of collateral and liquidity. The principle should encourage the reduction of barriers to the transfer of liquidity to enhance the ability of firms to perform effective liquidity-risk management and reduce risk in the system overall (IIF, 2008). Zentraler Kreditausschuss (2008) recommends that the requirement always to manage risk at both a solo/business line and group level should be dropped. The sole key point should be for liquidity risk management to be organized in a way which is appropriate to the structure of the group involved. It should be able to capture all material risks adequately while avoiding duplicate and unproductive work.
Supervisors	Similar to the principle that asks a bank to have expertise about country-specific features of the legal and regulatory regime that influence liquidity risk management, RBNZ (2008) believes that supervisors-both home and host-should understand the liquidity rules and the legal and regulatory regimes in the countries in which a bank is active. This promotes consistency of rules, where possible. It also promotes clarity about actions that supervisors would need to take in the event of liquidity stress.

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Table A.6 –continued from previous page

Affinity Group	Principle 6
Financial institutions	There might be possible conflicting goals of regulators and globally managed banks in the management of liquidity. Regulators want to protect depositors in their jurisdiction whilst the global banks more likely want to seek to support depositors throughout their global operations. RBS (2008) believes the problem is not insurmountable if regulators establish a form of understanding on how global banks are to be regulated-e.g. via 'colleges of regulators' and if global banks are prepared to articulate the contingency plans in respect of cross-border support. It is probably worth making a distinction between jurisdictions whose currencies are readily traded and those where the liquidity of the currency is lower. Moreover, UniCredit Group (2008) suggests that all efforts should be undertaken to ensure that those limitations to the transferability of liquidity are removed. There are national legal impediments that may hamper the capability of the parent company from managing effectively the group liquidity risks, especially under stress conditions. For example, there are restrictions to intra-group transfers of assets or liquidity on a cross-border basis.
Others	In this principle, it may be helpful to be rather more explicit about the distinction between a branch operation and that of a subsidiary. In countries that do not follow the 'separate entity' liquidation doctrine, it is not possible to shield a branch from a shortage of liquidity at head office, but this point is not fully reflected in current supervisory orthodoxy. By contrast, such a policy is possible in the case of a subsidiary. The Institute of Chartered Accountants (2008) points out that it is essential to consider or design how the liquidity position of a subsidiary based on its business model.

Table A.7: Commentators' Opinions on Principle 7

Affinity Group	Principle 7: a bank should establish a funding strategy that provides effective diversification in the sources and tenor of funding.
Financial service industry associations	CBA (2008) recommends that the principles be more flexible to allow for a more dynamic monitoring of funding sources. Any analysis of the reliance on wholesale funding should consider both the funding terms of such type of funding and the bank's capacity for accessing unused wholesale funding. Over-reliance on internal funding can be a risk in some instances, but in others not maximizing internal funding creates unneeded additional costs. Limiting concentration on any one funding source might not be possible (EACB, 2008). In particular, recent events have shown that retail deposits are a relatively-stable form of funding. A limitation on deposits would have a significant impact and would reduce stability. Furthermore, a mechanistic focus on diversification could result in a diminution of a bank's market participation (IIF, 2008). In terms of maintaining a relationship with the central bank for liquidity access, WOCCU (2008) suggests such a relationship must be a two-way street. Central banks must be willing to provide liquidity access to financial institutions that mobilize deposits in their countries. They strongly believe that the consultative paper should be modified to provide such guidance to central banks.
Supervisors	It is wrong to think a capital cushion can strengthen a bank's repayment ability. They suggest consultative paper should distinguish between capital and liquidity (IOSCO, 2008).

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Table A.7 –continued from previous page

Affinity Group	Principle 7
Financial institutions	The funding plan should also consider capacity constraints to ensure further diversification. The funding plan should also be tested with regard to appropriate tenors to make the liquidity position resilient to a sudden loss of funding capacity (Credit Suisse, 2008). From that analysis a bank should be able to determine if it is overly reliant on any one source of funds when assessing its liquidity risk tolerance and then to take steps to reduce that risk (RBS, 2008). Another efficient mitigating possibility is to reduce or stop the asset origination activity if the re-distribution channels are not working as planned.
Others	Regulators should be extremely careful not to drive entire segments of the industry toward uniform tactics and funding strategies. There could be systemic risk in doing so (Carrel, 2008).

Table A.8: Commentators' Opinions on Principle 8

Affinity Group	Principle 8: a bank should actively manage its intraday liquidity positions and risks.
Financial service industry associations	Intraday cash and collateral management goes beyond liquidity risk management (CBA, 2008). Therefore, there should be a flexible demarcation between what firms choose to cover in their liquidity policies and other risk policies. While roles overlap, there should be further discussions regarding coordination between liquidity, credit, and operational risk managers to ensure that intraday liquidity risk is appropriately managed (EAPB, 2008). Also, a review of the role of the banking supervisor vs. the central bank in intraday liquidity management and settlement systems would be useful. The stress-testing of the intraday processes and systems would be very difficult and costly. While stress-situations should certainly be considered, EACB (2008) wonder whether intra-day systems should really be subject to systematic stress-tests. Furthermore, EACB (2008) doubt that the described requirement could be fulfilled by smaller, non-complex banks. They recommend that these principles be more focused on the liquidity risk manager's role in intraday liquidity management. WOCCU (2008) also believe that accessing central bank liquidity, the maintenance of reserve accounts at a central bank and direct accessing to national clearing and settlement systems can strengthen the retail financial systems and institutions.
Supervisors	No comments.

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Table A.8 –continued from previous page

Affinity Group	Principle 8
Financial institutions	Credit Suisse (2008) argues that asking key customers, including customer banks, to forecast their intraday liquidity flows is not realistic, as such information from customers is not legally binding and can be changed at any time by them possibly leading to wrong decisions at the bank and ultimately additional costs or missed opportunities. Since intra-day exposures are supported by collateral placed into settlement systems and controlled by close monitoring of the payments through the settlement systems, there is a danger of forcing banks to treat ALL collateral in payment systems as ring-fenced i.e. the minimum it needs plus discretionary amounts (RBS, 2008). If this happens, banks may look to minimize collateral in settlement systems and this could slow down the settlement process. This risk could be further exacerbated if banks look to recover the cost of intra-day liquidity through charging those counterpaties who are, for example, time sensitive. A correct collateral mobilization could help intraday liquidity management (UniCredit Group, 2008). First, central banks' collateralisation procedures are not always harmonized across countries. Second, collateral management would substantially benefit if the option to re-use collateral was effectively provided, especially within the operational framework of the central banks.
Others	Carrel (2008) sees difficulty in considering 'stressed conditions' in the case of liquidity risk. There could be danger in relying on a commonly-accepted definition, as liquidity issues tend to occur in unexpected times and conditions. It is precisely because they are widely unexpected that the issue has come to be of exceptional severity, leading to changes in behaviour and tactical decisions that trigger liquidity holes.

Table A.9: Commentators' Opinions on Principle 9

Affinity Group	Principle 9: a bank should actively manage its collateral positions, differentiating between encumbered and unencumbered assets.
Financial service industry associations	Measures of available collateral do not necessarily need to be adjusted down for tied assets if the firm can demonstrate that these assets can be funded with third parties on a secured basis (e.g., under the normal course of business conditions, or in a pre-defined stress scenario). Therefore, it is necessary to explicitly recognize that a bank' capability and capacity to fund 'tied assets' on a secured basis is another key determinant of the degree of liquidity of these assets (CBA, 2008). Furthermore, although the principle, which requires that banks should monitor both the legal entity and the physical location where collateral is held, is reasonable in principle, it would be unnecessarily cumbersome where the ECB system is concerned. Owing to the ECB's common money market and collateral policy, it is irrelevant in which country of the Euro area collateral is held (Zentraler Kreditausschuss, 2008).
Supervisors	In terms of the management of a bank's collateral positions, it is useful to monitor available collateral at the legal-entity level and at the location level by the jurisdictional borders (RBNZ, 2008).
Financial institutions	This principle states that the bank should also monitor the physical location where collateral is held. This is often not possible as banks often use custodians (such as Euroclear, Clearstream, etc.) who in turn use sub-custodians (Credit Suisse, 2008). Moreover, since collateral is used in a variety of ways, it is clear that a bank must be able to identify what collateral is available to generate liquidity in times of stress in the same way it must be aware of any collateral calls that occur in such times (RBS, 2008).

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Table A.9 –continued from previous page

Affinity Group	Principle 9
Others	This recommendation may prove difficult to implement in extreme market conditions. Liquidity dries up when securities previously known as unencumbered become encumbered. If a market turns illiquid progressively as participants lose interest and shift to more profitable activities, then firms have enough time and margin of manoeuvre to re-assess pledges and shift toward collateral with satisfactory depth, transparency and resilience. Liquidity crises, however, typically strike because unexpected effects or turns of event take everyone by surprise (Carrel, 2008).

Table A.10: Commentators' Opinions on Principle 10

Affinity Group	Principle 10: a bank should conduct stress tests on a regular basis for a variety of institution-specific and market-wide stress scenarios.
Financial service industry associations	It may not be meaningful to conduct separate stress tests at the unit level, especially if the unit is integrated (CBA, 2008). Instead of recommending that banks do not discount severe scenarios as 'implausible', it would be preferable to include scenarios that are 'extreme but plausible' (EACB, 2008). Focus on too many highly unusual scenarios would be counterproductive if the need for a significantly larger cushion were automatically inferred from highly unlikely scenarios since this would have an adverse effect on the bank's refinancing (IBFed, 2008). Stress testing should be flexible and based on a creative dialogue between the risk and liquidity management departments and senior management to explore possible outcomes (IIF, 2008). It is important to note that good stress testing must include the possibility that it may be appropriate not to take specific action in response to a stress test, provided that it is evaluated carefully.

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Table A.10 –continued from previous page

Affinity Group	Principle 10
	The principles do not distinguish between unexpected liquidity conditions and conditions of severe stress, therefore resulting in ambiguity of the principles themselves. Rather it should be recognized that the techniques for measuring liquidity risk are at such a level that, in the absence of solid quantitative models to measure unexpected liquidity to assess cash flows linked to defined techniques, it would be advisable to use 'judgmental' stress tests, but not necessarily for severe stress. Association Bancaria Italiana (2008) proposes that the frequent references to stress tests should be further specified.
Supervisors	The document is right to emphasize that banks should analyze a range of material and relevant stress scenarios, and not just the scenarios that supervisors specify for the purposes of requiring banks to meet survival requirements. Where regulatory requirements focus on particular scenarios, there is a risk that banks can focus excessively on those regulatory scenarios at the expense of a wider range of analysis (RBNZ, 2008).
Financial institutions	Before any stress test can be undertaken a bank must first collect data on a contractual basis from across all its businesses (RBS, 2008). Once that has been done the bank should set out how it expects normal behaviour to impact the resulting liquidity risk. These normal assumptions should be clearly documented and can be based on historical data since, by definition, they represent what customers have done previously. Stress testing will then take those normal assumptions and tailor them to the particular stress scenario being tested. The important thing is that the normal assumptions are used as a starting base and the movement away from the norm is recorded together with the underlying argument for the move. Credit Suisse (2008) suggest, including stress testing assumptions about market shocks that can impact liquidity via reduced asset prices, FX cash flow impact, etc.

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Table A.10 –continued from previous page

Affinity Group	Principle 10
Others	The difficulty arises in defining what 'stress' means, how it applies not only to the bank's exposure but also its effects on the bank's clients, what could be the unexpected, as yet unseen, correlations of the future and what could be the effect on all other counterparties, including external providers of pricing services. Desrochers and Préfontaine (2008) believes that the focus of stress testing should be for the firms to identify points of failure in the more extreme scenarios, and use these to decide on mitigating action. Banks should endeavor continuously to refine and adapt those scenarios and avoid relying on a false sense of safety.

Table A.11: Commentators' Opinions on Principle 11

Affinity Group	Principle 11: a bank should have a formal contingency funding plan.
Financial service industry associations	Each individual crisis will need to be handled in an individual way. Contingency fonding plans (CFPs)can therefore only set a sensible framework for action and define a basic structure within which to act (EAPB, 2008). There should be one CFP setting out a basic structure and various options for action for different types of crisis. Regular testing of the CFP by the board would be enough for the approval to be given by the responsible members of the board (Zentraler Kreditausschuss, 2008). UK Joint Trade Association (2008) recommend that central banks actively involve themselves in the formulation of testing funding plans with the industry to avoid negative impact on a firm's reputation in terms of funding ability. Finally, they disagree with any suggestions that there can be prescriptive actions designated ahead of a crisis. A response will need to be tailormade, based on the facts and circumstances existing at the time of a disruption.

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Table A.11 –continued from previous page

Affinity Group	Principle 11
Supervisors	Objectives such as maintaining confidence and addressing liquidity shortfalls could be treated as elements of that goal rather than being stated explicitly in the Principle. The focus of ex ante identification of particular actions to be taken by managers would better be placed on the framework and tools for decision-making, as is the case in much of the other discussion of contingency planning (RBNZ, 2008).
Financial institutions	UniCredit Group (2008) considers itself to be aligned concerning the group wide contingency plan. RBS (2008) agrees with this principle.
Others	Although The Clearing House (2008) agrees with designating clear roles in decision making related to liquidity disruptions and identifying a range of alternatives through the liquidity planning process, it disagree with any suggestion that there can be prescriptive actions designated ahead of a crisis. A response will need to be tailormade based on the facts and circumstances existing at the time of disruption. The means of addressing liquidity shortfalls in emergency situation should not derive from an overarching strategy, but should rather be a series of tactical emergency actions. The ability to take such actions effectively requires flexibility and adaptability. It should not be thought of as a 'strategy' to be implemented with well-established processes within the boundaries of discipline and escalation procedures, as this may impede the agility of a firm's response (Carrel, 2008).

Table A.12: Commentators' Opinions on Principle 12

Affinity Group	Principle 12: a bank should maintain a cushion of unencumbered, high quality liquid assets.
Financial service industry associations	In terms of the definition of liquid assets the only relevant criterion is the liquidity-raising capacity of an asset. CBA (2008) suggests that high quality liquid assets should not be limited to a prescribed list, such as those that are eligible at central banks. The potential moral hazard and the unintended consequences that could arise from adopting such a definition, need to be considered. It should be up to each firm to defend their choice of highly liquid assets after consideration is given to its demonstrated capabilities and capacities to monetize these assets under various conditions. In terms of the size of liquidity cushion, IBFed (2008) recommends reference to a bank's risk tolerance as a flexible tool to establish appropriate individual liquidity requirements. IMMFA (2008) considers that money market funds could provide a valuable means through which financial institutions manage their liquidity risk, and should be considered as a liquid asset. Zentraler Kreditausschuss (2008) points out that there is a need, first, to clarify that not all liquid assets need to be managed as a liquidity cushion and it must be structured around sustaining liquidity for a planned 'survival' period. Second, the liquidity cushion is not intended to cover needs in an unlikely stress scenario. Third, the cushion should not be so big that it enables the bank to overcome a serious stress scenario without the need to make any adjustments to its business model.
Supervisors	Relating to the requirement that banks 'should' have marketable assets, they would suggest bank 's can' have those marketable assets for insuring against less severe stress and longer duration events (IOSCO, 2008).
Financial institutions	Regulators should recognize that some assets can be regarded as liquid in many scenarios but only a very few will be liquid in all circumstances (RBS, 2008).

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Table A.12 –continued from previous page

Affinity Group	Principle 12
Others	Carrel (2008) recommends that the regulators maintain an aggregated view of the unencumbered assets used as collateral for the cushions as there are risks of building new concentrations if all adopt a homogeneous methodology across segments and regions.

Table A.13: Commentators' Opinions on Principle 13

Affinity Group	Principle 13: a bank should publicly disclose information on a regular basis.
Financial service industry associations	The possibility that making quantitative information publicly available, especially during times of market volatility, could mislead investors and further aggravate liquidity pressures (i.e. contagion effect) (CBA, 2008). Assumptions used for quantitative disclosures can be discussed with informed readers, such as regulators and rating agencies, but it is much more difficult to do so with the public at large. There will be need for further discussion regarding the range of practices that are appropriate for public disclosures related to liquidity risk (IIF, 2008). EACB (2008) thinks that expectations regarding public disclosure should not be too high, but realistic. The amount of information to be disclosed should be appropriate. Furthermore, the focus of the disclosure should be on qualitative information. IBFed (2008) believes that disclosing quantitative information now is too early. And they believe that disclosure requirements should be developed in a dialogue between banks and market participants, not initiated by regulators.

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Table A.13 –continued from previous page

Affinity Group	Principle 13
Supervisors	BCDB (2008) argues that the use of the term liquidity position may induce some misunderstanding, as it could be interpreted that the financial institution should disclose quantitative information concerning its liquidity position. The disclosure of liquidity positions may have an incremental effect on Financial crises, rather than mitigating them. The intention of disclosure refers to information regarding the composition of assets, and the breakdown of certain unconsolidated instruments. As seen in recent events, the lack of information on off-balance-sheet conduits and firms' holdings of ABS were a problem. BCDB (2008) suggests a change in the wording of principle 13, which states that 'A bank should publicly disclose information on a regular basis that enables market participants to make an informed judgment about the soundness of its liquidity risk management framework and liquidity position' to 'A bank should public disclose information on a regular basis that enables market participants to make an informed judgment about the soundness of its liquidity risk management framework'. The use of the term liquidity position may induce some misunderstanding, as it could be interpreted that the financial institution should disclose quantitative information concerning its liquidity position.

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Table A.13 –continued from previous page

Affinity Group	Principle 13
Financial institutions	There is a need to balance public disclosure of quantitative information with confidentiality and an increase in qualitative information disclosure (RBS, 2008). In setting regulatory quantitative measures it is recognized that one size does not fit all and therefore the publication of any quantitative measure is open to misinterpretation. Furthermore, in stressed conditions, a bank's contingency plan will expect to make use of liquidity buffers to supply liquidity. If a bank is forced to publish how it has used those buffers there is the possibility that observers assume that the bank has a problem. The buffer then becomes the minimum level of liquid assets it must have-i.e. the liquidity buffer is no longer liquid! UniCredit Group (2008) also recommends that a re-pricing of market liquidity risk, including promoting market discipline, is crucial.
Others	The extent of financial groups' liquidity risk management public disclosure is not satisfactory. Desrochers and Préfontaine (2008) suggests the principle could provide further examples of quantitative disclosures and qualitative disclosures for banks. Disclosures of the composition of a bank's liquidity reserve may be counter-productive. Experience shows that potential counterparties will take advantage of information about the seller's positions. Since disclosing the size of a bank's liquidity cushion is meaningless by itself, disclosing the counter-balancing capacity is only meaningful to the extent that it is sufficient or insufficient to meet potential risks. Instead of disclosing the size of the liquidity cushion, The Institute of Chartered Accountants (2008) suggests that banks be required to disclose a range of survival horizon forecasts, much as they currently disclose interest rate risk for a range of different future interest rate environments.

Table A.14: Commentators' Opinions on Principles 14-17

Affinity Group	Principle 14-17: supervisors should regularly assess and monitor a bank's liquidity risk management framework, intervene to require timely remedial action by a bank to address liquidity problem, and communicate with other supervisors and public authorities.
Financial service industry associations	There should not be 'one size fits all' standardization of liquidity risk management practices (CBA, 2008). But a further harmonization of supervisory standards should be imposed at the international level. Supervisors and central banks should clarify their role and requirements during times of stress as it is not feasible for each bank to make such preparations in isolation (IBFed, 2008). Central banks should provide clarity as to the stress situations under which they will provide liquidity to the markets, learning from the current stress situation. Also supervisors should consider such factors as asset size, business model, liquidity stress levels, and the roles of central banks when assessing each bank's liquidity risk management (EAPB, 2008). IIF (2008) warmly welcomes the recommendation for supervisors to cooperate with one another on monitoring liquidity risk. With this in mind, mechanisms such as joint training workshops for staff and joint on-site inspections can be very helpful in promoting the convergence of supervisory practices. Moreover, communications with rating agencies also need to be taken into account.

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Table A.14 –continued from previous page

Affinity Group	Principles 14-17
Supervisors	IOSCO (2008) argues that supervisors should perform a comprehensive assessment on an ongoing basis (not just be periodic) of a bank's overall liquidity risk management framework and liquidity position to determine whether they deliver an adequate level of resilience to liquidity stress and, if found to be inadequate, advise the bank to, among other things, consider seeking longer term financing and/ or reducing their illiquid positions. Furthermore, the Basel Committee's Liquidity CP should work hard to distinguish different between capital and liquidity. With respect to the composition of its liquidity cushion, a bank should hold a core of the most reliably liquid assets to guard against the most severe stress scenarios. For insuring against less severe, longer duration stress events, a bank can also hold unencumbered liquid assets which are marketable without resulting in excessive losses or discounts (RBNZ, 2008).
Financial institutions	Regulators will have a unique view of how banks manage liquidity across their jurisdiction and will also be able to discuss that with regulators from other jurisdictions (RBS, 2008). In some countries where the group is present, supervisors use quantitative criteria for subsidiaries which negatively affects the group's efficiency and effectiveness. Supervisors should consider the conditions for replacing those requirements with adequate internal methodologies, consistent across the group (UniCredit Group, 2008).

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Table A.14 –continued from previous page

Affinity Group	Principles 14-17
Others	In respect of the role of supervisors, first, there is a strong need for more consistent regulation of liquidity across the globe, and supervisors should work toward the adoption of consistent regulations along the lines of the Principles. Supervisors should communicate with other relevant supervisors and public authorities, such as central banks, deposit insurance agencies and protection agencies. Second, supervisors should intervene to require remedial action by a bank that shows certain weaknesses or excessive liquidity risk, including requiring higher capital levels (The Clearing House, 2008). Furthermore, supervisors involved in liquidity management should be involved in product and marketing strategies before a financial institution enters a new market or activity (Carrel, 2008). Both Desrochers and Préfontaine (2008) and Carrel (2008) suggest to create an industry-wide liquidity risk data workgroup to provide an effective means of conveying the information back to the supervisors for any follow-up action.

Appendix B

FSA's post-mortem on Northern Rock

In the March 2008 internal audit report on NR[1], the FSA (2008*c*) admitted to failing to exercise its supervisory powers properly in seven main ways:

1. the Responsibility for the Supervision of Northern Rock;
2. the ARROW Assessment;
3. the Close and Continuous (C&C) Supervision;
4. the Emerging Business Risks;
5. the Emerging Control Risks;
6. the Capital, Liquidity and Stress Testing; and
7. the Use of Intelligence.

The lessons and recommendations under each heading will now be addressed in turn.

1. Responsibilities under the Supervision of Northern Rock
   Lessons learned embraced the following:

[1] The FSA provided its regulatory and supervisory response on RBS's failures in October 2008 (FSA, 2008*b*) and December 2011 (FSA, 2011*b*).

(a) supervising a high impact firm away from its peers is an obstacle to informal discussion between colleagues and formal peer group comparison;

(b) frequent divisional re-organizations, entailing high impact firms switching between departments, makes it difficult for Heads of Departments (HoDs) to build up a good knowledge of a firm;

(c) as a result of the relatively short tenure, HoDs could not have enough engagement with one of the high impact firms in their portfolio; and

(d) staff have not been appropriately trained to supervise high impact firms based on the size, complexity and risk profiles of the firms in their portfolio.

In April 2004, the FSA effected a major re-organization. The principal outcome was to create different Business Units for 'group supervision' of wholesale and retail firms. As a part of this exercise, responsibility for the supervision of NR was firstly transferred from the former Deposit Takers Division (DTD) into the Major Retail Groups Division Department 1(MRGD1), which was primarily responsible for supervising insurance groups. After June 2006, responsibility for the supervision of NR was transferred to MRGD2, in which managers could not get benefit from direct oversight of other banks. And after February 2007, NR was supervised by MRGD3, which directly supervises banking groups and building societies. However, the lack of regular dialog up within departments about information in the banking sector and the frequent switching between supervisory departments, made it more difficult for the banking sector supervisors to pick up and be alert to emerging issues affecting NR. According to these lessons, the Internal Audit Division of the FSA recommended how to improve the FSA's senior management as follows FSA (2008*c*, chap.E, 2, 5.3, 6.3, and 7.1):

(a) the Major Retail Group Division director should consider whether there is a case for a divisional reorganization to facilitate more effective peer comparison in firm supervision;

(b) the presumption of tenure for a supervisory lead associate or manager, for a high impact firm, should be a minimum of two years and a maximum of four years; and

(c) HoDs responsible for supervising high impact firms should formally review the supervision of each firm every six months.

2. The ARROW assessment

Problems with the ARROW assessment programme comprise the following:

(a) a number of early ARROW discovery meetings (e.g. communication records with NR's Chief Executive and Deputy Chief Executive) were not written up and therefore no record existed in either the FSA's NR paper or electronic records;

(b) in the course of preparing for a high impact firm ARROW panel, the supervisory team's content and recommendations did unduly influence the Panel Chairman and members and fetter the panel's discretion;

(c) there was no checkpoint mechanism for the FSA to exercise when granting any 'regulatory dividend' to a high impact firm, such as the presence of a risk mitigation programme (RMP) to ensure all aspects of the risk profile have been assessed ;

(d) there was no uniform version of panel minutes. The Internal Audit Division of the FSA found three different versions of the ARROW Panel minutes on 20th February 2006 in the electronic filing structure, all of which had the 'DRAFT' watermark on the documents;

(e) an independent manager without appropriate experience can sit on the ARROW Panel; before the Panel meetings, MRGD would e-mail all MRGD managers to ask for a volunteer to attend as independent manager. Although it did not happen in the NR case, this 'blanket approach' could easily have resulted in a manager without the appropriate experience sitting on the Panel;

(f) the insufficient pack of information presented to an ARROW Panel for a high impact firm would influence the judgment of the Panel. In the Northern Rock case, papers provided to the Panel did not contain some important financial information such as the 'borrow short, lend long' business model, the highest year-on-year growth in gross lending, and the lowest net interest margin;

(g) the ARROW Panel did not challenge the team on all the ARROW core risk areas; and

(h) Panel recommendations or explicit agreed actions were not followed up.

Based on these faults, formal records of each meeting and a maximum 24 month supervisory period for high impact firms were asked for by the Internal Audit Division

of the FSA. It also recommended that Panel information packs for high impact firms should include more substantive, in-depth comparative financial analysis, which should always cover the business model of the firm in question and its peers (FSA, 2008*c*, chap.E, 2, 2.1, 7.1 and 7.7).

3. Close and Continuous supervision
   Without a clear and consistent definition of 'Close and Continuous' for all high impact firms, the FSA failed to get regular management information to identify emerging risks and re-assess the business risks of high impact firms. Therefore, the Internal Audit Division of the FSA recommended that a single Close and Continuous (C&C) approach should be defined and applied to all high impact firms, as well as being consistent across Business Units. The C&C approach should include, inter alia, the annual review discussion of firms' business/strategic plans, regular meetings with key contacts at firms, and the minimum level of HoDs' engagement. If a change in the assessment of the control environment occurs, the C&C relationship should be reappraised (FSA, 2008*c*, chap.E, 2, 2.1).

4. Emerging Business Risks
   The supervisory team failed to deliver an on-going assessment of NR's emerging business risks during a long supervisory period (i.e. 36 months). In the early 2008, the FSA still assured that the quality of NR's loan asset portfolio is good, even though a significant number of NR's borrowers cannot pay back mortgages as the Bank of England raised interest rates to head off inflation (Mullineux, 2008). The Internal Audit Division of the FSA recommended that there should be an on-going supervisory assessment of all appropriate core ARROW risk areas for high impact firms. Panel packs from high impact firms should include more substantive, in-depth comparative financial analysis, the parameters of which should change with market conditions. This analysis should always cover the business model of the firm in question and its peers (FSA, 2008*c*, chap.E , 2, 3.1 and 5.1).

5. Emerging Control Risks
   The following lessons from Emerging Control Risks are made:

   (a) in assessing the composition of the boards of high impact firms, supervisors did not assess each member and take account of longevity of service, in particular if the business profile of the firm is changing;

(b) without assessing the size and competence of the firms' executive team alongside the business plan, supervisors failed to discover whether there is undue management stretch, or undue reliance on external advisors or specialists; and

(c) supervisors did not pay attention to the effect of dominant or aggressive individuals among the executives of high impact firms .

The Internal Audit Division of the FSA suggested supervisors of high impact firms should monitor the behaviour of firms' management, challenge any lack of openness of the firm in the supervisory relationship, and meet the firms' external auditors at least once a year (FSA, 2008*c*, chap.E, 2.8-2.10).

6. Capital, Liquidity and Stress Testing
Lessons relating to the FSA's risk management of capital and liquidity embrace the following:

(a) supervisors should factor into their general assessment of a firm learning points which arise outside the Risk Mitigation Programme-for example, through special project exercises, e.g. Basel, assessing a firm for suitability to operate a trading book, thematic work, etc.;

(b) all breaches of high impact firm' capital and liquidity requirements should be reported to the Firms and Markets Committee (FMC);

(c) the FSA should improve Handbook material on Liquidity Risk;

(d) as a part of the prudential supervision element of the ARROW process, the assessment of liquidity of high impact deposit-takers and investment firms should be reprioritized. A minimum level of consideration of liquidity must be maintained;

(e) supervisors should call for relevant management information from some high impact firms whose regulatory returns do not adequately capture the circumstances of the business on a regular basis and analyses it;

(f) arrangements between the Major Retail Groups Division and the Contact, Revenue and Information Management Department (CRIM) were not effective in ensuring that all regulatory returns were checked[2] ; and

[2]CRIM was responsible for monitoring capital adequacy and liquidity returns submitted by MTGD firms for breaches of regulatory limits. Once CRIM completed its routine checks, an e-mail alert was sent to the supervisor to confirm that the returns were available for their use. However, CRIM does not appear to have

(g) more emphasis on stress testing should be given in the supervision of high impact firms.

The Internal Audit Division of the FSA's recommendations in this area comprise the following (FSA, 2008*c*, chap.E, 2.4, 3.1-3.7):

(a) The Interim Risk Manager (IRM) should provide updated information to reflect firms' day-to-day supervision;

(b) firms should provide more details to explain the linkage between the level of stress to test a firm's resilience and the FSA's risk appetite; and to explain the relationship between the proposed quantitative framework and the qualitative material;

(c) the FSA should confirm firms' effective compliance with existing Handbook liquidity risk material, qualitative and quantitative, and as a priority develop clear timetables for the implementation of changes to the qualitative and quantitative Handbook material on liquidity ; and

(d) the FSA should re-confirm the approach to stress testing taken following its 2006 thematic review, including the decision not to add further Handbook rules or guidance; and consider the case for amendment of the Handbook to make it easier to understand the body of material on stress testing and how its parts fit together.

7. Use of Intelligence

With respect to the use of intelligence, supervisors need to improve their understanding of high impact firms by using internal data sources (such as the Financial Risk Outlook) and external data sources (such as Bank of England reports, share prices, market analysts' reports, senior credit default swap spreads and warning signals in the securitization markets). To make better use of intelligence, management should clarify supervisors' responsibilities in relation to the use of analysts' reports and market data in the supervision of their firms (FSA, 2008*c*, chap.E , 2, 4.2).

checked any of the capital or liquidity returns submitted by NR during the January 2005 to August 2007 period. Moreover, NR supervisory team was under the mistaken impression that the returns were being checked by CRIM so, in the event, on one was actively monitoring for breaches.

Appendix C

Overview of the FSA's risk-assessment framework

The FSA introduced a new risk-based regulation framework called 'ARROW', the Advanced Risk Responsive Operating framework in August 2006, to replace the 'RATE' framework in January 2000. The main similarities between ARROW and RATE are:

1. they include a structured assessment and the formally communicated mitigation plans; and
2. they include a concept of business risk (i.e. that which is inherent to a business) and a separate assessment of controls.

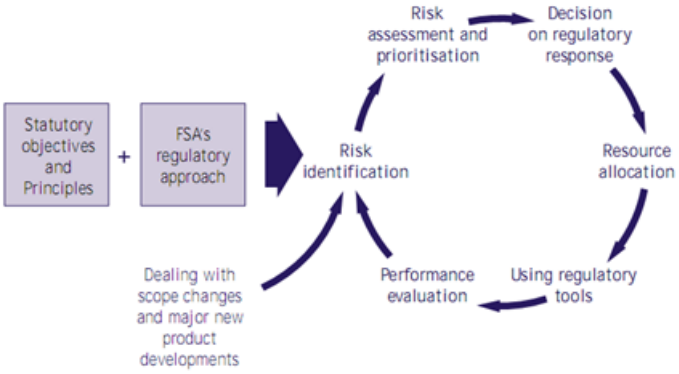
However, the main difference are as follows:

1. ARROW covers all types of financial firms, but RATE just applied to banks;
2. ARROW explicitly includes a measure of impact (i.e. the potential harm the firm could cause), whereas RATE had no such concept; and
3. ARROW is a universal model-it covers all types of risks, whereas RATE was a simple prudential tool.

The ARROW model (see Figure C.1) starts by distinguishing different types of risks, such as credit risk, market risk, liquidity risk, interest risk, etc.

In order to assess overall risk, the FSA uses a simple four-point scale to score the risk against a number of probability and impact factors, which are each rated as either:

Figure C.1: The FSA's new operating framework (ARROW)



Source: FSA (2000, pg.44).

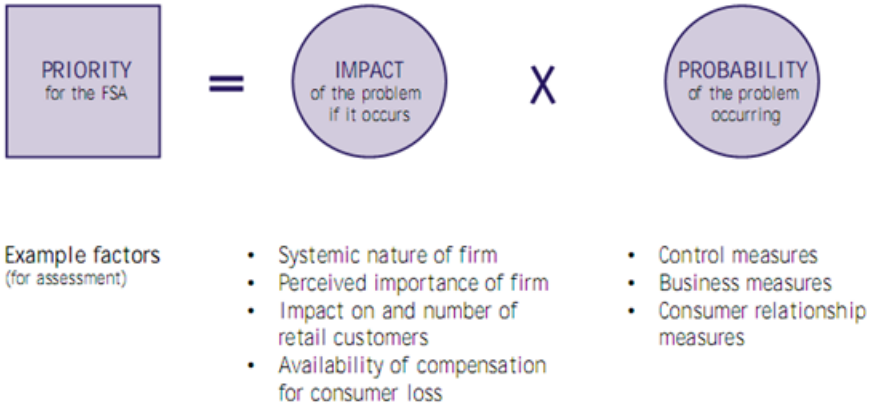
1. low;
2. medium low;
3. medium high; or
4. high.

The probability factors interpret the likelihood of the event happening, and the impact factors relate to the scale and significance of the problem if it were to occur. Following the Arthur Andersen (1996), who argued that liquidity regulation of banks should be overhauled, the FSA required banks to provide a cashflow forecast out to six months from the reporting date. After April 1999, the FSA also approved a new credit risk model introduced by the Basel Committee. Following the adoption of the new Capital Adequacy Directive (CAD2) regulation, the FSA allowed Value at Risk models for both banks and investment firms to be used to assess capital requirements in respect of the foreign exchange and commodity position risk of bank, as well as the interest rate and derivative risk of the bank on its trading book. The production of the probability and impact factors gives a measure of the priority level to be assigned by the FSA, to allow it to prioritize its resources.

The choice of impact factors and probability factors is dependent on the sources of risk. The FSA clarified two types of risk: firm-specific risks which have arisen as a result of particular problems within a significant firm or group; and consumer and industry-wide risks which have arisen as a result of a new product being marketed direct to the public.

Since risks in the banking industry mainly arise from the major banks with large market shares, the FSA's banking supervision approach should focus on controlling firm-specific risks. In respect of firm-specific risk, the assessment of impact is carried out prior to the measurement of the probability of a problem occurring. Figure C.2 illustrates how the ARROW model is used to calculate firm-specific risks.

Figure C.2: Risk assessment and prioritisation under ARROW: firm-specific risk



Source: FSA (2000, pg.16).

The nature and intensity of the FSA's relationship with a supervised firm consequently depends on the risk-grading of a firm. The FSA uses a resource-intensive approach for 'high impact' graded firms, and remote monitoring for low-impact ones. In addition to considering these impact and probability gradings, the FSA also takes into account several further factors, such as the reliability of the information provided, and the quality of the home regulatory regime.

After assessing and prioritizing risks, the next stage is to make decisions and take supervisory responses. There are five popular approaches chosen by the FSA to respond to firm-specific risks, namely market monitoring, desk-based reviews, on-site visits, firm-specific standards, and investigations. The FSA has focused on theme projects in recent years to deal with the most important risks, mainly because of limitations of resources.

In 2006, the FSA overhauled risk management processes under the name 'ARROW II' within the confines of six key objectives:

1. to build a better communication with firms;

2. to increase the efficiency of the FSA's management of risk;

3. to improve staff's skills and supervisory knowledge; and

4. to fully integrate the ARROW II into current capital adequacy assessments- including Pillar 2 of the Capital Requirements Directive (CRD) and Individual Capital Adequacy Standards (ICAS) for insurance companies.

However, in its internal audit report on Northern Rock (FSA, 2008*c*), the FSA admitted to failing to achieve these aims. Without sufficient formal records of early ARROW discovery meetings, some of which were even missed, the FSA cannot build a good knowledge of NR. Besides, it failed to update comprehensive understanding about risk positions of NR and improve risk management skills because of the lack information (e.g. NR's management information on liquidity was not received by the FSA every month). In addition, although NR failed the ARROW in 2006, the FSA did not subsequently prescribe a risk mitigation programme (RMP) nor increase NR's liquidity insurance (Heffernan, 2009).

Appendix D

FSA's Liquidity Regulation Since 1998

- The Sterling Stock regime applied to large UK retail banks and required banks to hold 'eligible assets', such as cash, UK Treasury bills and gilts (Hall, 1999) to cover their five-day wholesale net outflow and 5% of retail deposits withdrawable over the same period:

$$\text{sterling liquidity ratio} = \frac{\text{stock of sterling liquid assets}}{\begin{array}{c}[(\text{wholesale sterling net outflow over next 5 working days - allowable certificates of deposits}) \\ +5\%\ \text{sterling retail deposits contractually withdrawable over next 5 working days}]\end{array}} \geq 100\% \tag{D.1}$$

- The Maturity Mismatch Regime applied to all other banks in 1998-2008.

Table D.1: Procedures adopted in the assessment of liquidity adequacy for banks other than large UK retail banks

Annexe1: discounts applying to marketable assets

Continued on next page

Table D.1 –continued from previous page

UK central government debt, local authority paper and eligible bank bills (and comparable assets from other Zone A countries):	
The following benchmark discounts will apply to assets' market values:	
• Central government and central government-guaranteed marketable securities with 12 or fewer months' residual maturity, including Treasury bills; and, in addition, eligible local authority paper and eligible bank bills	0%
• Other central government, central government-guaranteed and local authority marketable debt with five or fewer years residual maturity or at variable rates	5%
• Other central government, central government-guaranteed and local authority marketable debt with over five years' residual maturity	10%
Other securities denominated in freely tradeable currencies (usually Zone A):	
The following benchmark discounts will apply to assets' market values:	
• Non-government debt securities which are classified as 'qualifying' by the Supervision and Surveillance Division of the Bank of England (S&S) in its implementation of the CAD, and which have six or fewer months' residual maturity.	5%
• Non-government debt securities which are classified as 'qualifying' by the Supervision and Surveillance Division of the Bank of England (S&S) in its implementation of the CAD, and which have five or fewer years' residual maturity	10%
• Non-government debt securities which are classified as 'qualifying' by the Supervision and Surveillance Division of the Bank of England (S&S) in its implementation of the Capital Adequacy Directive (CAD), and which have more than five years' residual maturity	15%
• Equities which implement of the CAD qualify for a specific risk weight no higher than 4%	20%
Zone B central government debt:	

Continued on next page

Table D.1 –continued from previous page

where it is actively traded, a benchmark discount of 40% will apply to market values. Note however, that where debt is denominated in local currency, it will only usually be deemed to be available to provide liquidity in that currency.

Annexe 2: The system of measurement

		Sight-8 days	8 days-1 month	1-3 months	3-6 months	6-12 months
	Liabilities					
	Deposits					
	Commitments					
Less	Assets					
	Marketable					
	Non-marketable					
	Standby facilities available					
=	Net position					
±	Carried forward					
=	Net cumulative position					

Source: Hall (1999); Bank of England, 1982, p402, as modified by S&S/1996/1 (Bank of England, 1996).

Table D.2: Stress Scenarios

First two weeks of stress	Remainder out to three months
Idiosyncratic impact	
Inability to roll over wholesale funding	Sustained leakage of funds
Sizable retail outflow	Sustained outflow
Reduction in amount of inter-day credit provided to a customer by its settlement banks; Increase in payments withheld to a direct participant by its counterparties; and Increase in need for all firms to make payments	N/A
Closure of foreign exchange markets	N/A
Intra-group deposits repaid at maturity, intra-group loans treated as evergreen	
Downgrade of long-term rating, proportional impact of all other downgrade triggers.	
Market-wide impact	
Uncertainty as to the accuracy of the valuation of a firm's assets and those of its counterparties.	
Inability to realize or ability to realize only at excessive cost particular classes of assets.	
Risk aversion among participants in the markets on which the firm relies for funding.	
Uncertainty as to whether many firms will be able to meet liabilities as they fall due.	

Source: FSA (2009*d*, pg.33).

Table D.3: Simpler firms identified by the FSA

Business model	Simplified ILAS eligibility criteria
Building societies	No foreign currency exposures in assets or liabilities.
UK incorporated banks	Wholesale funding is no more than 30% of total funding. The material majority of assets are mortgages secured on residential property.
Simple retail banks	Holding assets in US dollars, Euro or sterling and around 0.5% of assets and liabilities may be held in other currencies. At least 75% of the firm's total assets are accounted for by loans to individuals. Less than 25% of the firm's total funding is from wholesale sources.
'Money box' banks	Holding assets in US dollars, Euro or sterling and around 0.5% of assets and liabilities may be held in other currencies. At least 75% of the firm's total assets are accounted for by certain specified assets, such as in money market instruments with less than three months residual maturity. Less than 25% of the firm's total funding is from wholesale sources.
Small wholesale banks	Holding assets in US dollars, Euro or sterling and around 0.5% of assets and liabilities may be held in other currencies. 80% of the total funding is from the parent. Total balance sheet assets must be less than £1bn.

Source: FSA (2009*d*, pg.43).

Table D.4: The composition of short term sterling treasury bills

Short term sterling treasury bills	>	peak cumulative contractual net outflow over three months, excluding retail deposits and inflows from treasury bills	+	5% of all retail deposits due within 90 business days	+	25% of un-drawn commitments

Table D.5: Reporting-what to report

Data item	Description	Frequency	Submission deadlines
FSA047 Daily Flows	Collects daily flows out to three months to analyze survival periods and spot potential liquidity squeezes early	Business-as-usual (BAU): Weekly	BAU:end-of-day (22.00 London time) Monday for the week ending the previous Friday
		Firm-specific and/or market-wide liquidity stress:Daily (respectively monthly and weekly for simplified and low frequency firms)	Stress:end-of-the-following-business-day for the previous business day (respectively 15 days and end of Monday for simplified and low frequency firms)
FSA048 Enhanced Mismatch Report	Captures the ILAS risk drivers and contractual flows across the full maturity spectrum	As above	As above
FSA 050 Liquidity BUFFER	Qualifying Securities Provides more granular analysis of firms' marketable asset holdings	Monthly	15 business days after month end

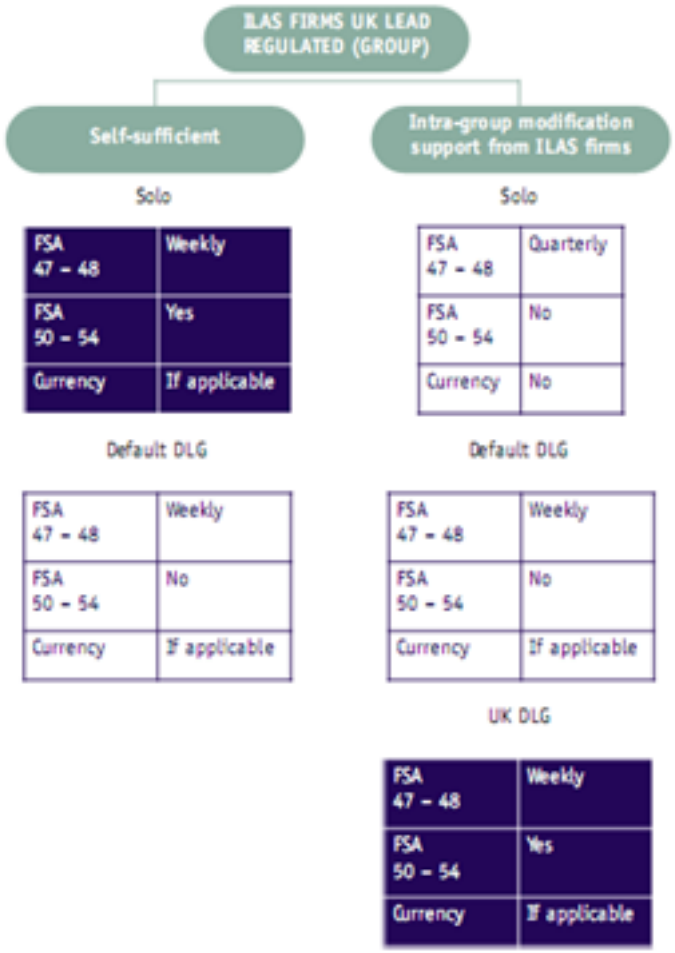
Continued on next page

Table D.5 –continued from previous page

Data item	Description	Frequency	Submission deadlines
FSA 051 Funding Concentration	Captures firms' borrowings from unsecured wholesale funders (excluding primary issuance) by counterparty class	Monthly	15 business days after month end
FSA052 Wholesale Liabilities	Collects daily transaction prices and transacted volumes for wholesale unsecured liabilities	Weekly (becomes monthly for simplified and low frequency firms)	End-of-day Tuesday for the week ending the previous Friday, T+2, (15 business days after month end for simplified and low frequency firms)
FSA053 Retail, SME and Large Enterprises And Corporate Funding	Captures firms' retail and corporate funding profiles and the stickiness of various retail deposits	Quarterly	15 business days after quarter end
FSA054 Currency analysis	Provides an analysis of foreign exchange exposures on firms' balance sheets	Quarterly	15 business days after quarter end

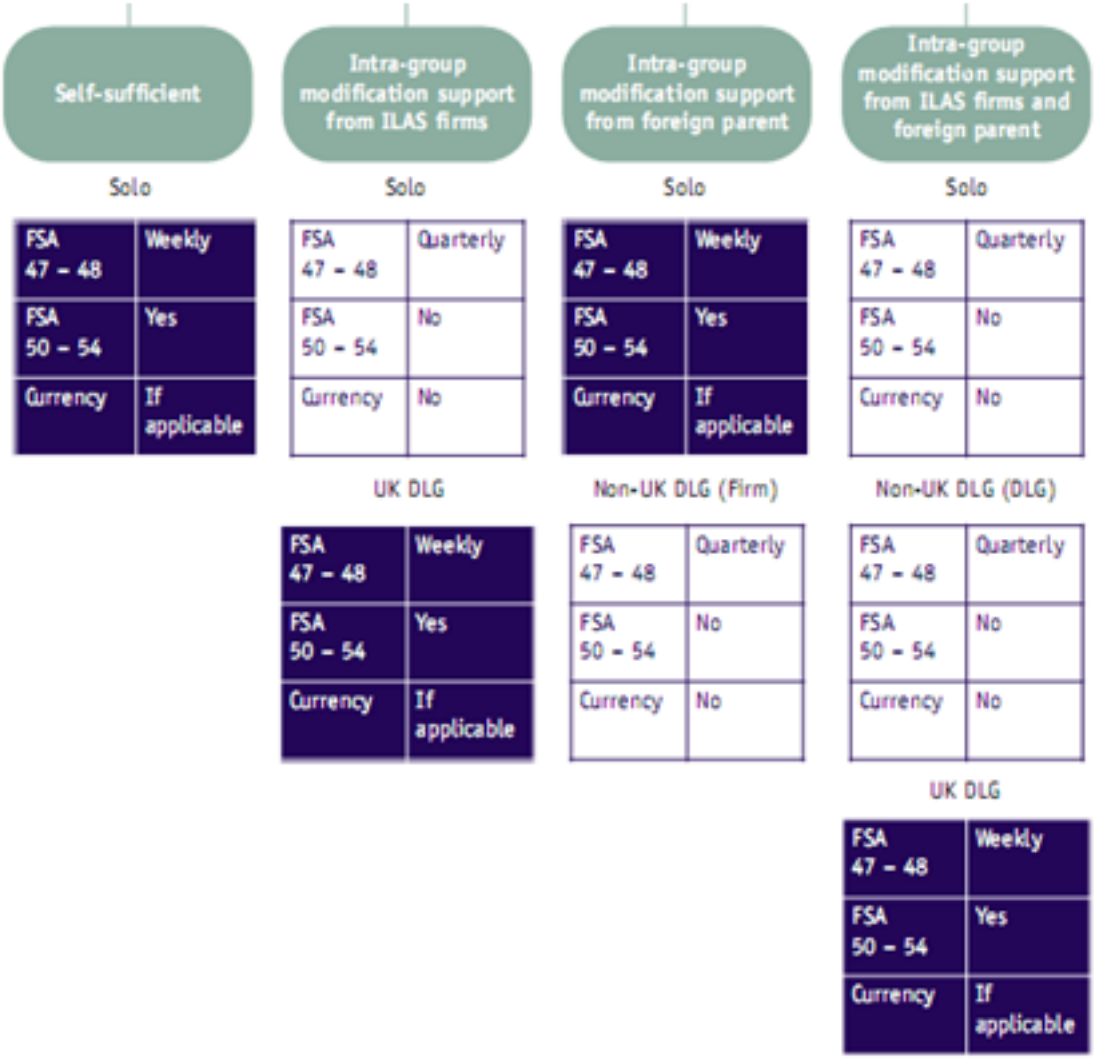
Source: Lombard Risk (2009).

Figure D.1: Consolidation levels for UK lead regulated firms' reporting



Source: FSA (2009*d*, pg.66).

Figure D.2: Consolidation levels for non-UK lead regulated firms' reporting



Source: FSA (2009*d*, pg.66).

Table D.6: Reporting- when to report

Class of firm	FSA047, 048, 052	FSA050,051,053,054
Sterling stock bank	1 June 2010	1 November 2010
Building Society (standard ILAS)	1 June 2010	1 November 2010
Building Society (simplified ILAS)	1 October 2010	1 November 2010
Mismatch banks	1 October 2010	1 November 2010
Branches, with or without GLCs, Investment firms	1 November 2010	1 November 2010

Source: Lombard Risk (2009).

Appendix E

UK Banks' Balance Sheets Under GAAP Before 2004

Table E.1: UK Banks' Balance Sheets Under GAAP

	On demand	< 3 months	3-6 months	6 mon-1 year	1-5 years	5-10 years	> 10 years	Total
Assets								
Cash and balances at central banks								
Items in the course of collection from other banks								
Treasury bills and other eligible bills								
Net Loans -banking/ trading								
Debt securities								
Equity securities								
Equity investments								
Intangible assets								
Fixed assets								
Other assets								
Liabilities								
Deposits from banks-banking/ trading								
Items in the course of collection from other banks								
Customer accounts -banking/trading								
Senior debt securities in issue								
Subordinated liabilities								
Other liabilities								
Equity reconciliation								
Equity								
Hybrid capital securities accounted for as equity								
Other adjustments								
Published equity								

Appendix F

UK Banks' Liquidity Positions from 2005 to 2010

Table F.1: Barclays Bank's Normal Short-term Liquidity Position

Barclays Bank plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**28,157.29**	**132,838.22**	**148,265.91**	**332,441.23**	**244,718.71**	**366,568.35**
Liquidity Coverage Ratio (%)		**108.75**	**132.50**	**128.45**	**131.17**	**139.52**	**161.12**
Stock of high-quality liquid assets	**Weights**						
Cash and deposits with central banks	100%	3,506.00	6,795.00	5,801.00	30,019.00	81,483.00	97,630.00
Items in course of collection from other banks	100%	1,901.00	2,408.00	1,836.00	1,695.00	1,593.00	1,384.00
Trading portfolio assets at fair value due in 1 year	100%	45,776.00	177,884.00	193,726.00	185,646.00	151,395.00	168,930.00
Financial assets designated at fair value due in 1 year	100%	66,874.00	5,111.00	8,789.00	22,031.00	15,609.00	10,350.00
Derivative cash flow due in 1 year	100%	33,496.00	137,470.00	247,157.00	983,010.00	416,058.00	418,817.00
Treasury and other bills	98%	2,178.54	2,371.60	2,668.54	3,922.94	4,805.60	5,886.86
Debt securities without government sponsorship	0%	0.00	0.00	0.00	0.00	0.00	0.00
Debt securities with government sponsorship	90%	13,596.30	12,262.50	32,431.41	50,354.59	2,046.20	51,288.30
Other debt securities, including foreign debt	67%	21,342.85	21,829.27	1,755.06	1,512.47	1,734.63	1,342.01
Equity securities	85%	1062.5	1377.00	1581.00	1820.70	5817.40	4939.35
Repos (and security borrowing)	100%	160,398.00	174,090.00	173,679.00	118,973.00	43,431.00	205,772.00
Cash outflow	**Weights**						
Interbank deposits (on demand)	100%	13,924.00	19,163.00	16,288.00	10,850.00	3,861.00	5,754.00
Interbank deposits due in 1 year	50%	29,138.00	28,921.50	36,008.50	50,698.00	35,214.00	35,081.50
Stable Retail deposits (on demand)	100%	144,015.00	153,642.00	175,145.00	195,728.00	205,894.00	230,895.00

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Table F.1 –continued from previous page

Barclays Bank plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**28,157.29**	**132,838.22**	**148,265.91**	**332,441.23**	**244,718.71**	**366,568.35**
Liquidity Coverage Ratio (%)		**108.75**	**132.50**	**128.45**	**131.17**	**139.52**	**161.12**
Stable Retail deposits due in 1 year	5%	4,223.90	4,913.85	5,572.55	6,603.50	5,332.35	5,149.40
Other less stable deposits (on demand)	100%	2,238.00	2,154.00	1,781.00	1,633.00	1,373.00	1,312.00
Other less stable deposits due in 1 year	10%	10.30	6.70	1.10	0.20	9.30	0.90
Trading portfolio liabilities (level 1)	10%	0.00	0.00	0.00	4,277.70	4,223.80	3,024.70
Trading portfolio liabilities (level 2)	75%	5,310.75	53,905.50	48,781.50	12,329.25	6,702.00	31,758.75
Trading portfolio liabilities (level 3)	100%	0.00	0.00	0.00	258.00	78.00	101.00
Financial liabilities designated at fair value due in 1 year (level 1)	10%	0.00	0.00	0.00	1.00	3.93	0.13
Financial liabilities designated at fair value due in 1 year (level 2)	75%	72,871.50	19,053.00	25,455.75	23,981.42	22,722.79	23,291.42
Financial liabilities designated at fair value due in 1 year (level 3)	100%	0.00	0.00	0.00	1,375.80	1,381.60	1,200.45
Derivative cash flow due in 1 year (level 1)	10%	0.00	0.00	0.00	350.77	237.95	255.51
Derivative cash flow due in 1 year (level 2)	75%	25,335.00	104,809.50	185,533.50	710,171.13	293,131.15	221,491.27
Derivative cash flow due in 1 year (level 3)	100%	0.00	0.00	0.00	15,376.49	9,654.57	6,225.05

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Table F.1 –continued from previous page

Barclays Bank plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**28,157.29**	**132,838.22**	**148,265.91**	**332,441.23**	**244,718.71**	**366,568.35**
Liquidity Coverage Ratio (%)		**108.75**	**132.50**	**128.45**	**131.17**	**139.52**	**161.12**
Senior debt (on demand)	100%	894.00	17.00	90,201.00	2,567.00	64.00	17.00
Senior debt due in 1 year	25%	7,687.40	8,478.50	9,020.10	10,684.60	8,055.90	10,188.90
Subordinated debt (on demand)[1]	100%	2.00	-	-	4.52	1.54	8.07
Subordinated debt due in 1 year	25%	65.25	-	-	147.50	50.25	263.25
Other financial liabilities designated at fair value (on demand)[2]	100%	434.00	-	-	133.85	145.14	125.71
Other financial liabilities designated at fair value due in 1 year	25%	3,707.00	-	-	1,143.25	1,239.75	1,073.75
Repos (and security lending)	10%	12,117.80	13,695.60	16,942.90	18,228.50	19,878.10	22,553.40

Notes: 1. On demand subordinated debt for 2008 to 2010 is calculated based on the 2005 ratio of on demand subordinated debt to subordinated debt due in 1 year. 2. Other on demand financial liabilities designated at fair value for 2008 to 2010 is calculated based on the 2005 ratio of other on demand liabilities designated at fair value to other financial liabilities designated at fair value due in 1 year. 3. ' - ' denotes no information provided by the bank.

Table F.2: Barclays Bank's Stress Short-term Liquidity Position

Barclays Bank plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**90.03**	**79,165.52**	**75,218.37**	**119,691.80**	**144,748.53**	**259,942.38**
Liquidity Coverage Ratio (%)		**100.18**	**119.37**	**114.43**	**111.22**	**123.37**	**143.34**
Stock of high-quality liquid assets	**Weights**						
Cash and deposits with central banks	100%	3,506.00	6,795.00	5,801.00	30,019.00	81,483.00	97,630.00
Items in course of collection from other banks	100%	1,901.00	2,408.00	1,836.00	1,695.00	1,593.00	1,384.00
Trading portfolio assets at fair value due in 1 year	100% /85%	38,909.60	151,201.40	164,667.10	156,185.85	134,957.85	145,980.55
Financial assets designated at fair value due in 1 year	100% /85%	56,842.90	4,344.35	7,470.65	13.175.30	10,316.30	6,687.46
Derivative cash flow due in 1 year	100% /85%	28,471.60	116,849.50	210,083.45	816,954.51	345,775.18	348,068.12
Treasury and other bills	83%	1,845.09	2,008.60	2,260.09	3,322.49	4,070.05	4,985.81
Debt securities without government sponsorship	0%	0.00	0.00	0.00	0.00	0.00	0.00
Debt securities with government sponsorship	77%	11,632.39	10,491.25	27,746.87	43,081.15	35,972.86	43,879.99
Other debt securities, including foreign debt	57%	18,157.35	18,571.17	1,493.11	1,286.73	1,475.73	1,141.71
Equity securities	72%	900.00	1,166.40	1,339.20	1,542.24	4,927.68	4,183.92
Repos (and security borrowing)	100%	160,398.00	174,090.00	173,679.00	118,973.00	143,431.00	205,772.00
Cash outflow	**Weights**						
Interbank deposits (on demand)	100%	13,924.00	19,163.00	16,288.00	10,850.00	3,861.00	5,754.00
Interbank deposits due in 1 year	50%	29,138.00	28,921.50	36,008.50	50,698.00	35,214.00	35,081.50
Stable Retail deposits (on demand)	100%	144,015.00	153,642.00	175,145.00	195,728.00	205,894.00	230,895.00

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Table F.2 –continued from previous page

Barclays Bank plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**90.03**	**79,165.52**	**75,218.37**	**119,691.80**	**144,748.53**	**259,942.38**
Liquidity Coverage Ratio (%)		**100.18**	**119.37**	**114.43**	**111.22**	**123.37**	**143.34**
Stable Retail deposits due in 1 year	5%	4,223.90	4,913.85	5,572.55	6,603.50	5,332.35	5,149.40
Other less stable deposits (on demand)	100%	2,238.00	2,154.00	1,781.00	1,633.00	1,373.00	1,312.00
Other less stable deposits due in 1 year	10%	10.30	6.70	1.10	0.20	9.30	0.90
Trading portfolio liabilities (level 1)	10%	0.00	0.00	0.00	4,277.70	4,223.80	3,024.70
Trading portfolio liabilities (level 2)	75%	5,310.75	53,905.50	48,781.50	12,329.25	6,702.00	31,758.75
Trading portfolio liabilities (level 3)	100%	0.00	0.00	0.00	258.00	78.00	101.00
Financial liabilities designated at fair value due in 1 year (level 1)	10%	0.00	0.00	0.00	1.00	3.93	0.13
Financial liabilities designated at fair value due in 1 year (level 2)	75%	72,871.50	19,053.00	25,455.75	23,981.42	22,722.79	23,291.42
Financial liabilities designated at fair value due in 1 year (level 3)	100%	0.00	0.00	0.00	1,375.80	1,381.60	1,200.45
Derivative cash flow due in 1 year (level 1)	10%	0.00	0.00	0.00	350.77	237.95	255.51
Derivative cash flow due in 1 year (level 2)	75%	25,335.00	104,809.50	185,533.50	710,171.13	293,131.15	221,491.27
Derivative cash flow due in 1 year (level 3)	100%	0.00	0.00	0.00	15,376.49	9,654.57	6,225.05

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Table F.2 –continued from previous page

Barclays Bank plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**90.03**	**79,165.52**	**75,218.37**	**119,691.80**	**144,748.53**	**259,942.38**
Liquidity Coverage Ratio (%)		**100.18**	**119.37**	**114.43**	**111.22**	**123.37**	**143.34**
Senior debt (on demand)	100%	894.00	17.00	90,201.00	2,567.00	64.00	17.00
Senior debt due in 1 year	25%	7,687.40	8,478.50	9,020.10	10,684.60	8,055.90	10,188.90
Subordinated debt (on demand)[1]	100%	2.00	-	-	4.52	1.54	8.07
Subordinated debt due in 1 year	25%	65.25	-	-	147.50	50.25	263.25
Other financial liabilities designated at fair value (on demand)[2]	100%	434.00	-	-	133.85	145.14	125.71
Other financial liabilities designated at fair value due in 1 year	25%	3,707.00	-	-	1,143.25	1,239.75	1,073.75
Repos (and security lending)	10%	12,117.80	13,695.60	16,942.90	18,228.50	19,878.10	22,553.40

Notes: 1. On demand subordinated debt for 2008 to 2010 is calculated based on the 2005 ratio of on demand subordinated debt to subordinated debt due in 1 year. 2. Other on demand financial liabilities designated at fair value for 2008 to 2010 is calculated based on the 2005 ratio of other on demand liabilities designated at fair value to other financial liabilities designated at fair value due in 1 year. 3. ' - ' denotes no information provided by the bank.

Table F.3: Barclays Bank's Normal Long-term Liquidity Position

Barclays Bank plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital (£m)		**(22,002.81)**	**(38,764.63)**	**(58,357.93)**	**(160,560.17)**	**(131,190.64)**	**(108,152.48)**
Net Cash Capital Ratio(%)		**90.27**	**84.18**	**80.72**	**61.14**	**62.77**	**68.71**
Long-term Funding	**Weights**	**204,076.00**	**206,197.00**	**244,358.00**	**252,579.00**	**221,209.00**	**237,540.00**
Deposits by banks due in more than 1 year	100%	2,927.00	2,556.00	2,241.00	2,664.00	2,157.00	2,058.00
Customer deposits due in more than 1 year	100%	10,191.00	4,835.00	9,248.00	7,707.00	9,914.00	11,919.00
Financial liabilities designated at fair value due after 1 year	100%	21,341.00	28,583.00	40,548.00	43,531.00	54,484.00	63,525.00
Derivative cash flow due in more than 1 year	100%	104,191.00	573.00	734.00	2,293.00	1,106.00	1,877.00
Senior debt due in more than 1 year	100%	25,560.00	26,335.00	30,027.00	40,154.00	55,279.00	54,717.00
Other funding due in more than 1 year	100%	3,423.00	102,423.00	111,589.00	82,814.00	13,754.00	13,357.00
Subordinated debt due in more than 1 year	100%	12,200.00	13,786.00	18,150.00	29,842.00	25,816.00	27,446.00
Equity	100%	24,213.00	27,072.00	31,775.00	43,514.00	58,639.00	62,581.00
Hybrid capital securities	100%	30.00	34.00	46.00	60.00	60.00	60.00
Total Illiquid Assets	**Weights**	**210,762.00**	**230,850.00**	**297,896.80**	**405,773.40**	**345,248.80**	**337,702.00**
Net loans	100%	268,896.00	282,300.00	345,398.00	461,815.00	420,224.00	427,942.00
(Residential mortgages)	-80%	(71,600.00)	(78,560.00)	(85,295.20)	(108,061.60)	(119,279.20)	(134,444.00)
Equity investments	100%	546.00	228.00	377.00	341.00	422.00	518.00
Held-to-hedge financial instruments	100%	657.00	1,080.00	1,138.00	2,806.00	1,177.00	1,307.00
Held-to-maturity financial instruments	100%	866.00	13,196.00	23,334.00	30,057.00	22,390.00	22,352.00
Investment in property	100%	2,754.00	2,492.00	2,996.00	4,674.00	5,626.00	6,140.00

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Table F.3 –continued from previous page

Barclays Bank plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital (£m)		**(22,002.81)**	**(38,764.63)**	**(58,357.93)**	**(160,560.17)**	**(131,092.57)**	**(108,032.34)**
Net Cash Capital Ratio(%)		**90.27**	**84.18**	**80.72**	**61.14**	**62.79**	**68.74**
Intangible assets	100%	1,269.00	1,215.00	1,282.00	2,777.00	2,356.00	2,478.00
Fixed assets	100%	2,754.00	2,492.00	2,996.00	4,674.00	5,626.00	6,140.00
Other assets	100%	4,620.00	6,407.00	5,671.00	6,691.00	6,707.00	5,269.00
Total Illiquid Securities	**Weights**	**15,316.81**	**14,111.63**	**4,819.13**	**7,365.77**	**7150.84**	**7990.48**
Treasury and other bills	2%	44.46	48.40	54.46	80.06	98.07	120.14
Debt securities	10%-100%	15,084.85	13,820.23	4,485.67	6,964.41	6,026.17	6,998.69
Equity securities	15%	187.50	243.00	279.00	321.30	1,026.60	871.65

Notes: 1. ‘ - ’ denotes no information provided by the bank.

Table F.4: Barclays Bank's Stress Long-term Liquidity Position

Barclays Bank plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital(£m)		**(27,648.17)**	**(44,367.58)**	**(63,954.67)**	**(168,938.27)**	**(139,148.15)**	**(117,417.57)**
Net Cash Capital Ratio(%)		**88.07**	**82.29**	**79.26**	**59.92**	**61.39**	**66.92**
Long-term Funding	**Weights**	**204,076.00**	**206,197.00**	**244,358.00**	**252,579.00**	**221,209.00**	**237,540.00**
Deposits by banks due in more than 1 year	100%	2,927.00	2,556.00	2,241.00	2,664.00	2,157.00	2,058.00
Customer deposits due in more than 1 year	100%	10,191.00	4,835.00	9,248.00	7,707.00	9,914.00	11,919.00
Financial liabilities designated at fair value due after 1 year	100%	21,341.00	28,583.00	40,548.00	43,531.00	54,484.00	63,525.00
Derivative cash flow due in more than 1 year	100%	104,191.00	573.00	734.00	2,293.00	1,106.00	1,877.00
Senior debt due in more than 1 year	100%	25,560.00	26,335.00	30,027.00	40,154.00	55,279.00	54,717.00
Other funding due in more than 1 year	100%	3,423.00	102,423.00	111,589.00	82,814.00	13,754.00	13,357.00
Subordinated debt due in more than 1 year	100%	12,200.00	13,786.00	18,150.00	29,842.00	25,816.00	27,446.00
Equity	100%	24,213.00	27,072.00	31,775.00	43,514.00	58,639.00	62,581.00
Hybrid capital securities	100%	30.00	34.00	46.00	60.00	60.00	60.00
Total Illiquid Assets	**Weights**	**210,762.00**	**230,850.00**	**297,896.80**	**405,773.40**	**345,248.80**	**337,702.00**
Net loans	100%	268,896.00	282,300.00	345,398.00	461,815.00	420,224.00	427,942.00
(Residential mortgages)	-80%	(71,600.00)	(78,560.00)	(85,295.20)	(108,061.60)	(119,279.20)	(134,444.00)
Equity investments	100%	546.00	228.00	377.00	341.00	422.00	518.00
Held-to-hedge financial instruments	100%	657.00	1,080.00	1,138.00	2,806.00	1,177.00	1,307.00
Held-to-maturity financial instruments	100%	866.00	13,196.00	23,334.00	30,057.00	22,390.00	22,352.00
Investment in property	100%	2,754.00	2,492.00	2,996.00	4,674.00	5,626.00	6,140.00

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Table F.4 –continued from previous page

Barclays Bank plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital(£m)		**(27,648.17)**	**(44,367.58)**	**(63,954.67)**	**(168,938.27)**	**(138,314.53)**	**(116,396.38)**
Net Cash Capital Ratio(%)		**88.07**	**82.29**	**79.26**	**59.92**	**61.53**	**67.11**
Intangible assets	100%	1,269.00	1,215.00	1,282.00	2,777.00	2,356.00	2,478.00
Fixed assets	100%	2,754.00	2,492.00	2,996.00	4,674.00	5,626.00	6,140.00
Other assets	100%	4,620.00	6,407.00	5,671.00	6,691.00	6,707.00	5,269.00
Total Illiquid Security	**Weights**	**20,962.17**	**19,714.58**	**10,415.87**	**15,743.87**	**15,108.35**	**17,255.57**
Treasury and other bills	17%	377.91	411.40	462.91	680.51	833.62	1,021.19
Debt securities	23%-100%	20,234.26	18,849.58	9,432.16	14,463.60	12,358.41	14,607.30
Equity securities	28%	350.00	453.60	520.80	599.76	1,916.32	1,627.08

Notes: 1. ‘ - ’ denotes no information provided by the bank.

Table F.5: Bank of Scotland's Normal Short-term Liquidity Position

Bank of Scotland		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(144,027.85)**	**(126,985.94)**	**(234,414.76)**	**(229,868.04)**	**(270,520.45)**	**(235,673.82)**
Liquidity Coverage Ratio (%)		**36.33**	**41.71**	**31.51**	**29.37**	**22.02**	**22.12**
Stock of high-quality liquid assets	**Weights**						
Cash and deposits with central banks	100%	1,384.00	1,641.00	2,571.00	2,502.00	2,905.00	2,375.00
Items in course of collection from other banks	100%	603.00	733.00	945.00	445.00	534.00	319.00
Trading portfolio assets at fair value due in 1 year	100%	41,766.00	49,139.00	54,681.00	23,430.00	27,867.00	24,696.00
Financial assets designated at fair value due in 1 year	100%	-	-	-	-	-	-
Derivative cash flow due in 1 year	100%	9,711.00	8,383.00	13,794.00	50,517.00	30,222.00	29,451.00
Treasury and other bills	98%	-	-	-	-	72.52	473.34
Debt securities without government sponsorship	0%	0.00	0.00	0.00	0.00	0.00	0.00
Debt securities with government sponsorship	90%	526.37	544.20	615.06	342.00	293.40	71.10
Other debt securities, including foreign debt	67%	27,576.53	28,510.51	32,222.98	16,440.46	12,870.03	7,702.99
Equity securities	85%	617.95	1,920.15	2,992.85	1,918.45	1,643.90	1,841.95
Repos (and security borrowing)	100%	-	-	-	-	-	-
Cash outflow	**Weights**						
Interbank deposits (on demand)	100%	38,450.00	39,713.00	23,563.00	49,711.00	82,967.00	68,614.00
Interbank deposits due in 1 year	50%	13,360.50	61,362.50	8,391.00	22,795.00	43,843.00	25,916.00
Stable Retail deposits (on demand)	100%	68,292.00	68,065.00	194,728.00	176,183.00	159,232.00	147,597.00

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Table F.5 –continued from previous page

Bank of Scotland		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(144,027.85)**	**(126,985.94)**	**(234,414.76)**	**(229,868.04)**	**(270,520.45)**	**(235,673.82)**
Liquidity Coverage Ratio (%)		**36.33**	**41.71**	**31.51**	**29.37**	**22.02**	**22.12**
Stable Retail deposits due in 1 year	5%	555.00	871.65	2,339.30	2,971.35	2,623.25	1,887.45
Other less stable deposits (on demand)	100%	-	-	-	-	-	-
Other less stable deposits due in 1 year	10%	-	-	-	-	-	-
Trading portfolio liabilities (level 1)	10%	0.00	0.00	0.00	0.00	51.10	86.40
Trading portfolio liabilities (level 2)	75%	18,755.25	16,750.50	17,028.75	14,138.25	20,145.75	13,441.50
Trading portfolio liabilities (level 3)	100%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 1)	10%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 2)	75%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 3)	100%	0.00	0.00	0.00	0.00	0.00	0.00
Derivative cash flow due in 1 year (level 1)	10%	0.00	0.00	0.00	5.50	2.20	0.00
Derivative cash flow due in 1 year (level 2)	75%	6,421.50	7,003.50	9,120.00	29,752.50	20,425.50	20,425.50
Derivative cash flow due in 1 year (level 3)	100%	0.00	0.00	0.00	1,102.00	196.00	34.00

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Table F.5 –continued from previous page

Bank of Scotland		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(144,027.85)**	**(126,985.94)**	**(234,414.76)**	**(229,868.04)**	**(270,520.45)**	**(235,673.82)**
Liquidity Coverage Ratio (%)		**36.33**	**41.71**	**31.51**	**29.37**	**22.02**	**22.12**
Senior debt (on demand)	100%	19,290.00	15,247.00	26,990.00	21,684.00	14,169.00	18,168.00
Senior debt due in 1 year	25%	6,072.70	7,931.90	9,098.60	6,589.60	3,066.00	2,032.60
Subordinated debt (on demand)	100%	-	-	-	28.00	28.00	2,084.00
Subordinated debt due in 1 year	25%	-	-	-	502.75	179.50	2,317.75
Other financial liabilities designated at fair value (on demand)	100%	51,492.00	647.00	48,395.00	-	-	-
Other financial liabilities designated at fair value due in 1 year	25%	3,523.75	264.75	2,583.00	-	-	-
Repos (and security lending)	10%	-	-	-	-	-	-

Notes: 1. ‘ - ’ denotes no information provided by the bank.

Table F.6: Bank of Scotland's Stress Short-term Liquidity Position

Bank of Scotland		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(156,035.84)**	**(140,241.82)**	**(250,041.98)**	**(246,034.10)**	**(282,043.60)**	**(245,849.40)**
Liquidity Coverage Ratio (%)		**31.02**	**35.63**	**26.94**	**24.40**	**18.70**	**18.76**
Stock of high-quality liquid assets	**Weights**						
Cash and deposits with central banks	100%	1,384.00	1,641.00	2,571.00	2,502.00	2,905.00	2,375.00
Items in course of collection from other banks	100%	603.00	733.00	945.00	445.00	534.00	319.00
Trading portfolio assets at fair value due in 1 year	100% / 85%	35,501.10	41,768.15	46,478.85	18,103.60	23,162.85	20,677.45
Financial assets designated at fair value due in 1 year	100% / 85%	-	-	-	-	-	-
Derivative cash flow due in 1 year	100% / 85%	8,254.35	7,125.55	11,724.90	42,473.95	25,628.80	24,808.10
Treasury and other bills	83%	-	-	-	-	61.42	400.89
Debt securities without government sponsorship	0%	0.00	0.00	0.00	0.00	0.00	0.00
Debt securities with government sponsorship	77%	450.34	465.59	526.22	292.60	251.02	60.83
Other Debt securities, including foreign debt	57%	23,460.63	24,255.21	27,413.58	13,986.66	10,949.13	6,553.29
Equity securities	72%	523.44	1,626.48	2,535.12	1,625.04	1,392.48	1,560.24
Repos (and security borrowing)	100%	-	-	-	-	-	-
Cash outflow	**Weights**						
Interbank deposits (on demand)	100%	38,450.00	39,713.00	23,563.00	49,711.00	82,967.00	68,614.00
Interbank deposits due in 1 year	50%	13,360.50	61,362.50	8,391.00	22,795.00	43,843.00	25,916.00
Stable Retail deposits (on demand)	100%	68,292.00	68,065.00	194,728.00	176,183.00	159,232.00	147,597.00

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Table F.6 –continued from previous page

Bank of Scotland		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(156,035.84)**	**(140,241.82)**	**(250,041.98)**	**(246,034.10)**	**(282,043.60)**	**(245,849.40)**
Liquidity Coverage Ratio (%)		**31.02**	**35.63**	**26.94**	**24.40**	**18.70**	**18.76**
Stable Retail deposits due in 1 year	5%	555.00	871.65	2,339.30	2,971.35	2,623.25	1,887.45
Other less stable deposits (on demand)	100%	-	-	-	-	-	-
Other less stable deposits due in 1 year	10%	-	-	-	-	-	-
Trading portfolio liabilities (level 1)	10%	0.00	0.00	0.00	0.00	51.10	86.40
Trading portfolio liabilities (level 2)	75%	18,755.25	16,750.50	17,028.75	14,138.25	20,145.75	13,441.50
Trading portfolio liabilities (level 3)	100%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 1)	10%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 2)	75%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 3)	100%	0.00	0.00	0.00	0.00	0.00	0.00
Derivative cash flow due in 1 year (level 1)	10%	0.00	0.00	0.00	5.50	2.20	0.00
Derivative cash flow due in 1 year (level 2)	75%	6,421.50	7,003.50	9,120.00	29,752.50	20,425.50	20,425.50
Derivative cash flow due in 1 year (level 3)	100%	0.00	0.00	0.00	1,102.00	196.00	34.00

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Table F.6 –continued from previous page

Bank of Scotland		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(156,035.84)**	**(140,241.82)**	**(250,041.98)**	**(246,034.10)**	**(282,043.60)**	**(245,849.40)**
Liquidity Coverage Ratio (%)		**31.02**	**35.63**	**26.94**	**24.40**	**18.70**	**18.76**
Senior debt (on demand)	100%	19,290.00	15,247.00	26,990.00	21,684.00	14,169.00	18,168.00
Senior debt due in 1 year	25%	6,072.70	7,931.90	9,098.60	6,589.60	3,066.00	2,032.60
Subordinated debt (on demand)	100%	-	-	-	28.00	28.00	2,084.00
Subordinated debt due in 1 year	25%	-	-	-	502.75	179.50	2,317.75
Other financial liabilities designated at fair value (on demand)	100%	51,492.00	647.00	48,395.00	-	-	-
Other financial liabilities designated at fair value due in 1 year	25%	3,523.75	264.75	2,583.00	-	-	-
Repos (and security lending)	10%	-	-	-	-	-	-

Notes: 1. ‘ - ’ denotes no information provided by the bank.

Table F.7: Bank of Scotland's Normal Long-term Liquidity Position

Bank of Scotland		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital(£m)		**(36,163.47)**	**(61,561.74)**	**(60,867.77)**	**(85,513.89)**	**(65,477.15)**	**(38,596.62)**
Net Cash Capital Ratio (%)		**78.49**	**70.35**	**80.18**	**73.05**	**75.11**	**82.90**
Long-term Funding	**Weights**	**131,970.00**	**146,065.00**	**246,178.00**	**231,824.00**	**197,538.00**	**187,126.00**
Deposits by banks due in more than 1 year	100%	22,208.00	2,348.00	1,302.00	1,920.00	4,774.00	25,407.00
Customer deposits due in more than 1 year	100%	20,907.00	31,840.00	47,013.00	55,928.00	56,264.00	52,712.00
Financial liabilities designated at fair value due after 1 year	100%	153.00	367.00	242.00	0.00	134.00	102.00
Derivative cash flow due in more than 1 year	100%	6,729.00	8,458.00	6,168.00	25,234.00	5,370.00	15,295.00
Senior debt due in more than 1 year	100%	46,470.00	77,877.00	112,536.00	110,245.00	89,941.00	69,148.00
Other funding due in more than 1 year	100%	26,027.00	12,770.00	57,073.00	-	-	-
Subordinated debt due in more than 1 year	100%	-	-	-	26,572.00	18,702.00	4,419.00
Equity	100%	9,476.00	12,405.00	21,844.00	11,925.00	22,353.00	20,043.00
Hybrid capital securities	100%	-	-	-	-	-	-
Total Illiquid Assets	**Weights**	**153,824.00**	**193,245.40**	**290,646.60**	**308,003.80**	**256,256.00**	**221,390.00**
Net loans	100%	179,650.00	217,339.00	460,267.00	488,213.00	439,538.00	405,525.00
(Residential mortgages)	-80%	(34,156.00)	(31,249.60)	(188,686.40)	(210,915.20)	(202,196.00)	(197,352.00)
Equity investments	100%	374.00	633.00	1,739.00	193.00	423.00	401.00
Held-to-hedge financial instruments	100%	3,695.00	2,518.00	4,816.00	22,082.00	8,945.00	6,608.00
Held-to-maturity financial instruments	100%	0.00	0.00	0.00	0.00	0.00	0.00
Investment in property	100%	37.00	39.00	34.00	43.00	30.00	789.00
Intangible assets	100%	108.00	164.00	476.00	108.00	91.00	58.00

Continued on next page

Table F.7 –continued from previous page

Bank of Scotland		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital(£m)		**(36,163.47)**	**(61,561.74)**	**(60,867.77)**	**(85,513.89)**	**(65,477.15)**	**(38,596.62)**
Net Cash Capital Ratio (%)		**78.49**	**70.35**	**80.18**	**73.05**	**75.11**	**82.90**
Fixed assets	100%	487.00	455.00	1,291.00	1,187.00	4,903.00	3,433.00
Other assets	100%	3,629.00	3,347.00	10,710.00	7,093.00	4,522.00	1,928.00
Total Illiquid Securities	**Weights**	**14,309.47**	**14,381.34**	**16,399.17**	**9,334.09**	**6,759.15**	**4,332.62**
Treasury and other bills	2%	-	-	-	-	1.48	9.66
Debt securities	10%-100%	13,582.47	14,042.49	15,871.02	8,995.54	6,467.57	3,997.91
Equity securities	15%	727.00	338.85	528.15	338.55	290.10	325.05

Notes: 1. ‘ - ’ denotes no information provided by the bank.

Table F.8: Bank of Scotland's Stress Long-term Liquidity Position

Bank of Scotland		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital (£m)		**(39,755.93)**	**(66,110.71)**	**(66,134.90)**	**(88,310.50)**	**(67,702.95)**	**(40,110.75)**
Net Cash Capital Ratio (%)		**76.85**	**68.84**	**78.82**	**72.41**	**74.47**	**82.35**
Long-term Funding	**Weights**	**131,970.00**	**146,065.00**	**246,178.00**	**231,824.00**	**197,538.00**	**187,126.00**
Deposits by banks due in more than 1 year	100%	22,208.00	2,348.00	1,302.00	1,920.00	4,774.00	25,407.00
Customer deposits due in more than 1 year	100%	20,907.00	31,840.00	47,013.00	55,928.00	56,264.00	52,712.00
Financial liabilities designated at fair value due after 1 year	100%	153.00	367.00	242.00	0.00	134.00	102.00
Derivative cash flow due in more than 1 year	100%	6,729.00	8,458.00	6,168.00	25,234.00	5,370.00	15,295.00
Senior debt due in more than 1 year	100%	46,470.00	77,877.00	112,536.00	110,245.00	89,941.00	69,148.00
Other funding due in more than 1 year	100%	26,027.00	12,770.00	57,073.00	-	-	-
Subordinated debt due in more than 1 year	100%	-	-	-	26,572.00	18,702.00	4,419.00
Equity	100%	9,476.00	12,405.00	21,844.00	11,925.00	22,353.00	20,043.00
Hybrid capital securities	100%	-	-	-	-	-	-
Total Illiquid Assets	**Weights**	**153,824.00**	**193,245.40**	**290,646.60**	**308,003.80**	**256,256.00**	**221,390.00**
Net loans	100%	179,650.00	217,339.00	460,267.00	488,213.00	439,538.00	405,525.00
(Residential mortgages)	-80%	(34,156.00)	(31,249.60)	(188,686.40)	(210,915.20)	(202,196.00)	(197,352.00)
Equity investments	100%	374.00	633.00	1,739.00	193.00	423.00	401.00
Held-to-hedge financial instruments	100%	3,695.00	2,518.00	4,816.00	22,082.00	8,945.00	6,608.00
Held-to-maturity financial instruments	100%	0.00	0.00	0.00	0.00	0.00	0.00
Investment in property	100%	37.00	39.00	34.00	43.00	30.00	789.00
Intangible assets	100%	108.00	164.00	476.00	108.00	91.00	58.00

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Table F.8 –continued from previous page

Bank of Scotland		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital (£m)		**(39,755.93)**	**(66,110.71)**	**(66,134.90)**	**(88,310.50)**	**(67,702.95)**	**(40,110.75)**
Net Cash Capital Ratio (%)		**76.85**	**68.84**	**78.82**	**72.41**	**74.47**	**82.35**
Fixed assets	100%	487.00	455.00	1,291.00	1,187.00	4,903.00	3,433.00
Other assets	100%	3,629.00	3,347.00	10,710.00	7,093.00	4,522.00	1,928.00
Total Illiquid Security	**Weights**	**17,901.93**	**18,930.31**	**21,666.30**	**12,130.70**	**8,984.95**	**5,846.75**
Treasury and other bills	17%	-	-	-	-	12.58	82.11
Debt securities	23%-100%	17,698.37	18,297.79	20,680.42	11,498.74	8,430.85	5,157.88
Equity securities	28%	203.56	632.52	985.88	631.96	541.52	606.76

Notes: 1. ‘ - ’ denotes no information provided by the bank.

Table F.9: HSBC Bank Plc's Normal Short-term Liquidity Position

HSBC Bank Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**36,590.52**	**45,665.12**	**40,751.37**	**(4,338.31)**	**55,953.44**	**10,048.64**
Liquidity Coverage Ratio (%)		**161.43**	**147.96**	**122.79**	**98.50**	**129.57**	**103.82**
Stock of high-quality liquid assets	**Weights**						
Cash and deposits with central banks	100%	1,711.00	3,618.00	7,146.00	9,470.00	14,274.00	24,495.00
Items in course of collection from other banks	100%	3,595.00	2,937.00	2,434.00	1,917.00	2,082.00	1,932.00
Trading portfolio assets at fair value due in 1 year	100%	48,510.00	85,994.00	153,206.00	172,026.00	165,008.00	159,552.00
Financial assets designated at fair value due in 1 year	100%	316.00	794.00	2,267.00	1,634.00	774.00	556.00
Derivative cash flow due in 1 year	100%	16,049.00	18,631.00	16,467.00	37,199.00	15,428.00	27,312.00
Treasury and other bills	98%	3,871.00	3,135.02	1,844.36	10,350.76	2,302.02	9,166.92
Debt securities without government sponsorship	0%	0.00	0.00	0.00	0.00	0.00	0.00
Debt securities with government sponsorship	90%	13,646.93	11,247.16	16,393.05	11,127.60	13,498.20	9,060.30
Other Debt securities, including foreign debt	67%	6,620.69	12,922.59	17,217.31	52,187.64	41,661.27	51,561.86
Equity securities	85%	1,836.85	1,610.75	2,594.20	2,267.80	1,968.60	1,212.10
Repos (and security borrowing)	100%	-	-	-	-	-	-
Cash outflow	**Weights**						
Interbank deposits (on demand)	100%	-	-	-	-	-	-
Interbank deposits due in 1 year	50%	15,090.00	17,087.50	22,211.00	29,758.50	28,228.00	24,343.00
Stable Retail deposits (on demand)	100%	-	-	-	-	-	-

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Table F.9 –continued from previous page

HSBC Bank Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**36,590.52**	**45,665.12**	**40,751.37**	**(4,338.31)**	**55,953.44**	**10,048.64**
Liquidity Coverage Ratio (%)		**161.43**	**147.96**	**122.79**	**98.50**	**129.57**	**103.82**
Stable Retail deposits due in 1 year	5%	10,053.80	11,196.60	13,248.80	18,327.35	16,457.30	16,921.90
Other less stable deposits (on demand)	100%	-	-	-	-	-	-
Other less stable deposits due in 1 year	10%	-	-	-	-	-	-
Trading portfolio liabilities (level 1)	10%	-	-	-	5,822.60	6,073.50	71,714.40
Trading portfolio liabilities (level 2)	75%	15,977.25	39,060.00	88,090.50	47,861.25	41,521.50	43,080.00
Trading portfolio liabilities (level 3)	100%	-	-	-	2,409.00	2,784.00	3,176.00
Trading portfolio liabilities (level 1)	10%	0.00	0.00	0.00	5,822.60	6,073.50	71,714.40
Trading portfolio liabilities (level 2)	75%	15,977.25	39,060.00	88,090.50	47,861.25	41,521.50	43,080.00
Trading portfolio liabilities (level 3)	100%	0.00	0.00	0.00	2,409.00	2,784.00	3,176.00
Financial liabilities designated at fair value due in 1 year (level 1)	10%	0.00	0.00	0.00	10.34	23.66	40.26
Financial liabilities designated at fair value due in 1 year (level 2)	75%	2,982.00	256.50	3,562.50	204.48	304.05	1,843.08
Financial liabilities designated at fair value due in 1 year (level 3)	100%	0.00	0.00	0.00	0.00	0.00	0.00

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Table F.9 –continued from previous page

HSBC Bank Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**36,590.52**	**45,665.12**	**40,751.37**	**(4,338.31)**	**55,953.44**	**10,048.64**
Liquidity Coverage Ratio (%)		**161.43**	**147.96**	**122.79**	**98.50**	**129.57**	**103.82**
Derivative cash flow due in 1 year (level 1)	10%	0.00	0.00	0.00	486.60	71.40	60.10
Derivative cash flow due in 1 year (level 2)	75%	12,938.25	24,557.25	46,154.25	177,067.50	86,222.25	94,907.25
Derivative cash flow due in 1 year (level 3)	100%	0.00	0.00	0.00	2,128.00	3,012.00	2,060.00
Senior debt (on demand)	100%	-	-	-	-	-	-
Senior debt due in 1 year	25%	2,257.90	2,805.30	3,967.50	4,111.50	3,128.60	3,733.20
Subordinated debt (on demand)	100%	-	-	-	-	-	-
Subordinated debt due in 1 year	25%	1.50	30.75	0.00	17.75	1.25	5.50
Other financial liabilities designated at fair value (on demand)	100%	-	-	-	-	-	-
Other financial liabilities designated at fair value due in 1 year	25%	265.25	230.50	1,583.00	1,676.25	1,391.25	1,156.75
Repos (and security lending)	10%	-	-	-	-	-	-

Notes: 1. ‘ - ’ denotes no information provided by the bank.

Table F.10: HSBC Bank Plc's Stress Short-term Liquidity Position

HSBC Bank Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**23,026.45**	**25,572.74**	**9,343.68**	**(32,777.97)**	**37,126.50**	**(9,396.11)**
Liquidity Coverage Ratio (%)		**138.66**	**126.86**	**105.23**	**88.69**	**119.62**	**96.43**
Stock of high-quality liquid assets	**Weights**						
Cash and deposits with central banks	100%	1,711.00	3,618.00	7,146.00	9,470.00	14,274.00	24,495.00
Items in course of collection from other banks	100%	3,595.00	2,937.00	2,434.00	1,917.00	2,082.00	1,932.00
Trading portfolio assets at fair value due in 1 year	100% / 85%	41,233.50	73,094.90	130,225.10	159,479.85	155,155.75	150,858.75
Financial assets designated at fair value due in 1 year	100% / 85%	268.60	674.90	1,926.95	1,521.72	734.69	524.76
Derivative cash flow due in 1 year	100% / 85%	13,641.65	15,836.35	13,996.95	205,542.50	13,503.80	25,349.04
Treasury and other bills	83%	3,278.50	2,655.17	1,562.06	8,766.46	1,949.67	7,763.82
Debt securities without government sponsorship	0%	0.00	0.00	0.00	0.00	0.00	0.00
Debt securities with government sponsorship	77%	11,675.70	9,622.57	14,025.17	9,520.28	11,548.46	7,751.59
Other Debt securities, including foreign debt	57%	5,632.53	10,993.85	14,647.56	44,398.44	35,443.17	43,866.06
Equity securities	72%	1,555.92	1,364.40	2,197.44	1,920.96	1,667.52	1,026.72
Repos (and security borrowing)	100%	-	-	-	-	-	-
Cash outflow	**Weights**						
Interbank deposits (on demand)	100%	-	-	-	-	-	-
Interbank deposits due in 1 year	50%	15,090.00	17,087.50	22,211.00	29,758.50	28,228.00	24,343.00
Stable Retail deposits (on demand)	100%	-	-	-	-	-	-

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Table F.10 –continued from previous page

HSBC Bank Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**23,026.45**	**25,572.74**	**9,343.68**	**(32,777.97)**	**37,126.50**	**(9,396.11)**
Liquidity Coverage Ratio (%)		**138.66**	**126.86**	**105.23**	**88.69**	**119.62**	**96.43**
Stable Retail deposits due in 1 year	5%	10,053.80	11,196.60	13,248.80	18,327.35	16,457.30	16,921.90
Other less stable deposits (on demand)	100%	-	-	-	-	-	-
Other less stable deposits due in 1 year	10%	-	-	-	-	-	-
Trading portfolio liabilities (level 1)	10%	0.00	0.00	0.00	5,822.60	6,073.50	71,714.40
Trading portfolio liabilities (level 2)	75%	15,977.25	39,060.00	88,090.50	47,861.25	41,521.50	43,080.00
Trading portfolio liabilities (level 3)	100%	0.00	0.00	0.00	2,409.00	2,784.00	3,176.00
Financial liabilities designated at fair value due in 1 year (level 1)	10%	0.00	0.00	0.00	10.34	23.66	40.26
Financial liabilities designated at fair value due in 1 year (level 2)	75%	2,982.00	256.50	3,562.50	204.48	304.05	1,843.08
Financial liabilities designated at fair value due in 1 year (level 3)	100%	0.00	0.00	0.00	0.00	0.00	0.00
Derivative cash flow due in 1 year (level 1)	10%	0.00	0.00	0.00	486.60	71.40	60.10
Derivative cash flow due in 1 year (level 2)	75%	12,938.25	24,557.25	46,154.25	177,067.50	86,222.25	94,907.25
Derivative cash flow due in 1 year (level 3)	100%	0.00	0.00	0.00	2,128.00	3,012.00	2,060.00

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Table F.10 –continued from previous page

HSBC Bank Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**23,026.45**	**25,572.74**	**9,343.68**	**(32,777.97)**	**37,126.50**	**(9,396.11)**
Liquidity Coverage Ratio (%)		**138.66**	**126.86**	**105.23**	**88.69**	**119.62**	**96.43**
Senior debt (on demand)	100%	-	-	-	-	-	-
Senior debt due in 1 year	25%	2,257.90	2,805.30	3,967.50	4,111.50	3,128.60	3,733.20
Subordinated debt (on demand)	100%	-	-	-	-	-	-
Subordinated debt due in 1 year	25%	1.50	30.75	0.00	17.75	1.25	5.50
Other financial liabilities designated at fair value (on demand)	100%	-	-	-	-	-	-
Other financial liabilities designated at fair value due in 1 year	25%	265.25	230.50	1,583.00	1,676.25	1,391.25	1,156.75
Repos (and security lending)	10%	-	-	-	-	-	-

Notes: 1. ‘ - ’ denotes no information provided by the bank.

Table F.11: HSBC Bank Plc's Normal Long-term Liquidity Position

HSBC Bank Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital (£)		**(138,535.25)**	**(138,143.82)**	**(177,058.48)**	**(227,051.82)**	**(188,847.38)**	**(178,629.26)**
Net Cash Capital Ratio (%)		**23.11**	**28.09**	**25.43**	**21.08**	**26.28**	**31.48**
Long-term Funding	**Weights**	**41,649.00**	**53,966.00**	**60,374.00**	**60,642.00**	**67,332.00**	**82,049.00**
Deposits by banks due in more than 1 year	100%	4,018.00	4,338.00	4,364.00	1,914.00	1,273.00	(399.00)
Customer deposits due in more than 1 year	100%	4,399.00	3,418.00	3,293.00	3,333.00	3,750.00	5,685.00
Financial liabilities designated at fair value due after 1 year	100%	4,209.00	9,118.00	10,909.00	14,808.00	17,522.00	25,075.00
Derivative cash flow due in more than1 year	100%	-	-	-	-	-	-
Senior debt due in more than 1 year	100%	4,222.00	10,037.00	11,246.00	11,193.00	8,054.00	10,787.00
Other funding due in more than 1 year	100%	381.00	860.00	358.00	1,545.00	1,511.00	1,159.00
Subordinated debt due in more than 1 year	100%	4,786.00	5,257.00	5,205.00	7,188.00	6,794.00	7,385.00
Equity	100%	18,455.96	19,708.61	23,999.00	18,911.00	26,678.00	30,607.00
Hybrid capital securities	100%	1,178.04	1,229.39	1,000.00	1,750.00	1,750.00	1,750.00
Total Illiquid Assets	**Weights**	**162,814.72**	**178,721.34**	**205,991.40**	**272,347.00**	**243,184.60**	**246,069.40**
Net loans	100%	182,629.00	200,416.00	227,687.00	298,304.00	274,659.00	285,218.00
(Residential mortgages)	-80%	(33,445.28)	(36,702.66)	(38,381.60)	(48,192.00)	(54,422.40)	(57,861.60)
Equity investments	100%	845.00	923.00	118.00	73.00	79.00	76.00
Held-to-hedge financial instruments	100%	862.00	444.00	367.00	1,952.00	1,671.00	1,335.00
Held-to-maturity financial instruments	100%	207.00	76.00	38.00	25.00	4,851.00	4,281.00
Investment in property	100%	-	-	-	-	-	-

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Table F.11 –continued from previous page

HSBC Bank Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital (£)		**(138,535.25)**	**(138,143.82)**	**(177,058.48)**	**(227,051.82)**	**(188,847.38)**	**(178,629.26)**
Net Cash Capital Ratio (%)		**23.11**	**28.09**	**25.43**	**21.08**	**26.28**	**31.48**
Intangible assets	100%	491.00	856.00	903.00	1,131.00	1,184.00	1,283.00
Fixed assets	100%	4,319.00	4,408.00	4,119.00	4,697.00	4,090.00	2,108.00
Other assets	100%	6,907.00	8,301.00	11,141.00	14,357.00	11,073.00	9,630.00
Total Illiquid Security	**Weights**	**17,369.53**	**13,388.48**	**31,441.08**	**15,346.82**	**12,994.78**	**14,608.86**
Treasury and other bills	2%	79.00	63.98	37.64	211.24	46.98	187.08
Debt Securities[1]	10%-100%	16,966.38	13,040.25	30,945.64	14,735.38	12,600.40	14,207.88
Equity securities	15%	324.15	284.25	457.80	400.20	347.40	213.90

Notes: 1. Debt Securities for 2008 to 2010 does not include MBS or ABS without government sponsorship. 2. ' - ' denotes no information provided by the bank.

Table F.12: HSBC Bank Plc's Stress Long-term Liquidity Position

HSBC Bank Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital(£m)		**(142,368.06)**	**(142,423.35)**	**(182,675.17)**	**(236,417.94)**	**(195,858.56)**	**(187,386.57)**
Net Cash Capital Ratio (%)		**22.63**	**27.48**	**24.84**	**20.41**	**25.58**	**30.45**
Long-term Funding	**Weights**	**41,649.00**	**53,966.00**	**60,374.00**	**60,642.00**	**67,332.00**	**82,049.00**
Deposits by banks due in more than 1 year	100%	4,018.00	4,338.00	4,364.00	1,914.00	1,273.00	(399.00)
Customer deposits due in more than 1 year	100%	4,399.00	3,418.00	3,293.00	3,333.00	3,750.00	5,685.00
Financial liabilities designated at fair value due after 1 year	100%	4,209.00	9,118.00	10,909.00	14,808.00	17,522.00	25,075.00
Derivative cash flow due in more than1 year	100%	-	-	-	-	-	-
Senior debt due in more than 1 year	100%	4,222.00	10,037.00	11,246.00	11,193.00	8,054.00	10,787.00
Other funding due in more than 1 year	100%	381.00	860.00	358.00	1,545.00	1,511.00	1,159.00
Subordinated debt due in more than 1 year	100%	4,786.00	5,257.00	5,205.00	7,188.00	6,794.00	7,385.00
Equity	100%	18,455.96	19,708.61	23,999.00	18,911.00	26,678.00	30,607.00
Hybrid capital securities	100%	1,178.04	1,229.39	1,000.00	1,750.00	1,750.00	1,750.00
Total Illiquid Assets	**Weights**	**162,814.72**	**178,721.34**	**205,991.40**	**272,347.00**	**243,184.60**	**246,069.40**
Net loans	100%	182,629.00	200,416.00	227,687.00	298,304.00	274,659.00	285,218.00
(Residential mortgages)	-80%	(33,445.28)	(36,702.66)	(38,381.60)	(48,192.00)	(54,422.40)	(57,861.60)
Equity investments	100%	845.00	923.00	118.00	73.00	79.00	76.00
Held-to-hedge financial instruments	100%	862.00	444.00	367.00	1,952.00	1,671.00	1,335.00
Held-to-maturity financial instruments	100%	207.00	76.00	38.00	25.00	4,851.00	4,281.00
Investment in property	100%	-	-	-	-	-	-

Continued on next page

Table F.12 –continued from previous page

HSBC Bank Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital(£m)		**(142,368.06)**	**(142,423.35)**	**(182,675.17)**	**(236,417.94)**	**(195,858.56)**	**(187,386.57)**
Net Cash Capital Ratio (%)		**22.63**	**27.48**	**24.84**	**20.41**	**5.58**	**30.45**
Intangible assets	100%	491.00	856.00	903.00	1,131.00	1,184.00	1,283.00
Fixed assets	100%	4,319.00	4,408.00	4,119.00	4,697.00	4,090.00	2,108.00
Other assets	100%	6,907.00	8,301.00	11,141.00	14,357.00	11,073.00	9,630.00
Total Illiquid Security	**Weights**	**21,202.35**	**17,668.01**	**37,057.77**	**24,712.94**	**20,005.96**	**23,366.17**
Treasury and other bills	17%	671.50	543.83	319.94	1,795.54	399.33	1,590.18
Debt Securities [1]	23%-100%	19,925.77	16,593.58	35,883.27	22,170.36	18,958.15	21,376.71
Equity securities	28%	605.08	530.60	854.56	747.04	648.48	399.28

Notes: 1. Debt Securities for 2008 to 2010 does not include MBS or ABS without government sponsorship. 2. ' - ' denotes no information provided by the bank.

Table F.13: Lloyds TSB's Normal Short-term Liquidity Position

Lloyds TSB		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(94,695.32)**	**(110,520.48)**	**(151,082.14)**	**(20,783.74)**	**(208,150.03)**	**(176,674.78)**
Liquidity Coverage Ratio (%)		**43.56**	**43.01**	**34.53**	**85.26**	**35.94**	**60.71**
Stock of high-quality liquid assets	**Weights**						
Cash and deposits with central banks	100%	1,156.00	1,898.00	4,330.00	5,008.00	36,089.00	38,115.00
Items in course of collection from other banks	100%	1,310.00	1,431.00	1,242.00	946.00	1,045.00	1,368.00
Trading portfolio assets at fair value due in 1 year	100%	60,567.00	67,928.00	58,096.00	45,115.00	48,894.00	156,276.00
Financial assets designated at fair value due in 1 year	100%	-	-	-	-	-	-
Derivative cash flow due in 1 year	100%	5,878.00	5,565.00	8,688.00	28,884.00	18,797.00	49,600.00
Treasury and other bills	98%	85.26	1,730.68	1,594.46	28,624.82	2,481.36	5,946.64
Debt securities without government sponsorship	0%	0.00	0.00	0.00	0.00	0.00	0.00
Debt securities with government sponsorship	90%	1,017.00	523.80	291.60	792.00	7,535.70	11,322.90
Other Debt securities, including foreign debt	67%	3,019.02	4,309.44	5,423.65	10,848.64	1,861.26	8,401.13
Equity securities	85%	39.10	12.75	24.65	34.85	68.85	1,916.75
Repos (and security borrowing)	100%	-	-	-	-	-	-
Cash outflow	**Weights**						
Interbank deposits (on demand)	100%	23,859.00	28,157.00	35,466.00	49,620.00	76,070.00	24,938.00
Interbank deposits due in 1 year	50%	3,169.00	2,685.00	1,849.00	7,548.50	31,574.50	8,052.50
Stable Retail deposits (on demand)	100%	112,551.00	124,726.00	144,213.00	15,164.00	152,423.00	307,622.00

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Table F.13 –continued from previous page

Lloyds TSB		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(94,695.32)**	**(110,520.48)**	**(151,082.14)**	**(20,783.74)**	**(208,150.03)**	**(176,674.78)**
Liquidity Coverage Ratio (%)		**43.56**	**43.01**	**34.53**	**85.26**	**35.94**	**60.71**
Stable Retail deposits due in 1 year	5%	442.10	412.30	618.90	896.65	919.90	2,413.40
Other less stable deposits (on demand)	100%	-	-	-	-	-	-
Other less stable deposits due in 1 year	10%	-	-	-	-	-	-
Trading portfolio liabilities (level 1)	10%	0.00	0.00	0.00	0.60	0.00	86.40
Trading portfolio liabilities (level 2)	75%	4,938.00	888.00	2,404.50	5,061.00	4,771.50	19,423.50
Trading portfolio liabilities (level 3)	100%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 1)	10%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 2)	75%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 3)	100%	0.00	0.00	0.00	0.00	0.00	0.00
Derivative cash flow due in 1 year (level 1)	10%	0.00	0.00	0.00	214.70	1.00	4.20
Derivative cash flow due in 1 year (level 2)	75%	0.00	4,407.75	5,813.25	19,950.75	12,542.25	31,800.00
Derivative cash flow due in 1 year (level 3)	100%	0.00	0.00	0.00	136.00	0.00	203.00

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Table F.13 –continued from previous page

Lloyds TSB		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(94,695.32)**	**(110,520.48)**	**(151,082.14)**	**(20,783.74)**	**(208,150.03)**	**(176,674.78)**
Liquidity Coverage Ratio (%)		**43.56**	**43.01**	**34.53**	**85.26**	**35.94**	**60.71**
Senior debt (on demand)	100%	20,411.00	29,672.00	20,307.00	24,381.00	26,315.00	31,225.00
Senior debt due in 1 year	25%	1,230.10	1,862.10	1,557.60	3,613.60	4,246.80	9,369.20
Subordinated debt (on demand)	100%	746.00	737.00	27.00	34.00	151.00	178.00
Subordinated debt due in 1 year	25%	348.50	327.75	319.25	173.25	173.25	1,273.00
Other financial liabilities designated at fair value (on demand)	100%	50.00	37.00	18,197.00	14,243.00	15,734.00	12,944.00
Other financial liabilities designated at fair value due in 1 year	25%	22.00	7.25	-	-	-	89.00
Repos (and security lending)	10%	-	-	-	-	-	-

Notes: 1. ‘ - ’ denotes no information provided by the bank.

Table F.14: Lloyds TSB's Stress Short-term Liquidity Position

Lloyds TSB		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(105,278.60)**	**(122,530.14)**	**(162,199.18)**	**(33,508.27)**	**(215,946.65)**	**(197,608.76)**
Liquidity Coverage Ratio (%)		**37.25**	**36.81**	**29.71**	**76.24**	**33.54**	**56.05**
Stock of high-quality liquid assets	**Weights**						
Cash and deposits with central banks	100%	1,156.00	1,898.00	4,330.00	5,008.00	36,089.00	38,115.00
Items in course of collection from other banks	100%	1,310.00	1,431.00	1,242.00	946.00	1,045.00	1,368.00
Trading portfolio assets at fair value due in 1 year	100% / 85%	51,481.95	57,738.80	49,381.60	42,636.90	45,450.95	147,415.55
Financial assets designated at fair value due in 1 year	100% / 85%	-	-	-	-	-	-
Derivative cash flow due in 1 year	100% / 85%	4,996.30	4,730.25	7,384.80	24,757.85	16,200.05	41,619.25
Treasury and other bills	83%	72.21	1,465.78	1,350.41	24,243.47	2,101.56	5,036.44
Debt securities without government sponsorship	0%	0.00	0.00	0.00	0.00	0.00	0.00
Debt securities with government sponsorship	77%	870.10	448.14	249.48	677.60	6,447.21	9,687.37
Other Debt securities, including foreign debt	57%	2,568.42	3,666.24	4,614.15	9,229.44	1,583.46	7,147.23
Equity securities	72%	33.12	10.80	20.88	29.52	58.32	1,623.60
Repos (and security borrowing)		-	-	-	-	-	-
Cash outflow	**Weights**						
Interbank deposits (on demand)	100%	23,859.00	28,157.00	35,466.00	49,620.00	76,070.00	24,938.00
Interbank deposits due in 1 year	50%	3,169.00	2,685.00	1,849.00	7,548.50	31,574.50	8,052.50
Stable Retail deposits (on demand)	100%	112,551.00	124,726.00	144,213.00	15,164.00	152,423.00	307,622.00

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Table F.14 –continued from previous page

Lloyds TSB		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(105,278.60)**	**(122,530.14)**	**(162,199.18)**	**(33,508.27)**	**(215,946.65)**	**(197,608.76)**
Liquidity Coverage Ratio (%)		**37.25**	**36.81**	**29.71**	**76.24**	**33.54**	**56.05**
Stable Retail deposits due in 1 year	5%	442.10	412.30	618.90	896.65	919.90	2,413.40
Other less stable deposits (on demand)	100%	-	-	-	-	-	-
Other less stable deposits due in 1 year	10%	-	-	-	-	-	-
Trading portfolio liabilities (level 1)	10%	0.00	0.00	0.00	0.60	0.00	86.40
Trading portfolio liabilities (level 2)	75%	4,938.00	888.00	2,404.50	5,061.00	4,771.50	19,423.50
Trading portfolio liabilities (level 3)	100%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 1)	10%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 2)	75%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 3)	100%	0.00	0.00	0.00	0.00	0.00	0.00
Derivative cash flow due in 1 year (level 1)	10%	0.00	0.00	0.00	214.70	1.00	4.20
Derivative cash flow due in 1 year (level 2)	75%	0.00	4,407.75	5,813.25	19,950.75	12,542.25	31,800.00
Derivative cash flow due in 1 year (level 3)	100%	0.00	0.00	0.00	136.00	0.00	203.00

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Table F.14 –continued from previous page

Lloyds TSB		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(105,278.60)**	**(122,530.14)**	**(162,199.18)**	**(33,508.27)**	**(215,946.65)**	**(197,608.76)**
Liquidity Coverage Ratio (%)		**37.25**	**36.81**	**29.71**	**76.24**	**33.54**	**56.05**
Senior debt (on demand)	100%	20,411.00	29,672.00	20,307.00	24,381.00	26,315.00	31,225.00
Senior debt due in 1 year	25%	1,230.10	1,862.10	1,557.60	3,613.60	4,246.80	9,369.20
Subordinated debt (on demand)	100%	746.00	737.00	27.00	34.00	151.00	178.00
Subordinated debt due in 1 year	25%	348.50	327.75	319.25	173.25	173.25	1,273.00
Other financial liabilities designated at fair value (on demand)	100%	50.00	37.00	18,197.00	14,243.00	15,734.00	12,944.00
Other financial liabilities designated at fair value due in 1 year	25%	22.00	7.25	-	-	-	89.00
Repos (and security lending)	10%	-	-	-	-	-	-

Notes: 1. ‘ - ’ denotes no information provided by the bank.

Table F.15: Lloyds TSB's Normal Long-term Liquidity Position

Lloyds TSB		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital(£m)		**(6,810.62)**	**(3,127.53)**	**(93,088.44)**	**(109,860.29)**	**(59,383.63)**	**(33,431.78)**
Net Cash Capital Ratio (%)		**94.80**	**97.61**	**38.96**	**38.44**	**66.97**	**91.38**
Long-term Funding	**Weights**	**124,160.00**	**127,605.00**	**59,416.00**	**68,614.00**	**120,408.00**	**354,607.00**
Deposits by banks due in more than 1 year	100%	1,330.00	2,867.00	26.00	1,991.00	782.00	11,477.00
Customer deposits due in more than 1 year	100%	9,677.00	6,370.00	2,449.00	3,000.00	22,850.00	67,931.00
Financial liabilities designated at fair value due after 1 year	100%	-	-	-	-	4,497.00	9,177.00
Derivative cash flow due in more than 1 year	100%	6,393.00	6,892.00	3,440.00	11,021.00	566.00	19,732.00
Senior debt due in more than 1 year	100%	6,634.00	5,825.00	19,399.00	17,132.00	55,329.00	126,368.00
Other funding due in more than 1 year	100%	78,245.00	83,151.00	-	-	-	38,063.00
Subordinated debt due in more than 1 year	100%	10,261.00	10,024.00	20,663.00	25,898.00	22,671.00	34,127.00
Equity	100%	11,620.00	12,476.00	13,439.00	9,572.00	13,713.00	47,732.00
Hybrid capital securities	100%	-	-	-	-	-	-
Total Illiquid Assets	**Weights**	**120,194.00**	**127,932.20**	**139,642.80**	**163,067.60**	**165,649.80**	**372,671.20**
Net loans	100%	176,635.00	190,135.00	209,814.00	242,735.00	245,226.00	611,089.00
(Residential mortgages)	-80%	(71,116.00)	(76,480.80)	(82,191.20)	(91,714.40)	(92,279.20)	(285,008.80)
Equity investments	100%	-	-	-	-	56.00	429.00
Held-to-hedge financial instruments	100%	490.00	487.00	264.00	435.00	995.00	7,406.00
Held-to-maturity financial instruments	100%	0.00	0.00	0.00	0.00	0.00	7,905.00
Investment in property	100%	4,260.00	4,739.00	3,722.00	2,631.00	2,340.00	5,997.00

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Table F.15 –continued from previous page

Lloyds TSB		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital(£m)		**(6,810.62)**	**(3,127.53)**	**(93,088.44)**	**(109,860.29)**	**(59,383.63)**	**(33,431.78)**
Net Cash Capital Ratio (%)		**94.80**	**97.61**	**38.96**	**38.44**	**66.97**	**91.38**
Intangible assets	100%	50.00	138.00	149.00	197.00	205.00	3,496.00
Fixed assets	100%	4,291.00	4,252.00	2,839.00	2,965.00	4,125.00	8,190.00
Other assets	100%	5,584.00	4,662.00	5,046.00	5,819.00	4,982.00	13,168.00
Total Illiquid Securities	**Weights**	**10,779.62**	**2,800.33**	**12,861.64**	**15,406.69**	**14,141.83**	**15,367.58**
Treasury and other bills	2%	1.74	35.32	32.54	584.18	50.64	121.36
Debt securities	10%-100%	10,770.98	2,762.76	12,824.75	14,816.36	14,079.04	14,907.97
Equity securities	15%	6.90	2.25	4.35	6.15	12.15	338.25

Notes: 1. ‘ - ’ denotes no information provided by the bank.

Table F.16: Lloyds TSB's Stress Long-term Liquidity Position

Lloyds TSB		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital (£m)		**(7,427.15)**	**(13,914.24)**	**(94,187.88)**	**(115,980.57)**	**(61,140.25)**	**(37,524.56)**
Net Cash Capital Ratio (%)		**94.36**	**90.17**	**38.68**	**37.17**	**66.32**	**90.43**
Long-term Funding	**Weights**	**124,160.00**	**127,605.00**	**59,416.00**	**68,614.00**	**120,408.00**	**354,607.00**
Deposits by banks due in more than 1 year	100%	1,330.00	2,867.00	26.00	1,991.00	782.00	11,477.00
Customer deposits due in more than 1 year	100%	9,677.00	6,370.00	2,449.00	3,000.00	22,850.00	67,931.00
Financial liabilities designated at fair value due after 1 year	100%	-	-	-	-	4,497.00	9,177.00
Derivative cash flow due in more than 1 year	100%	6,393.00	6,892.00	3,440.00	11,021.00	566.00	19,732.00
Senior debt due in more than 1 year	100%	6,634.00	5,825.00	19,399.00	17,132.00	55,329.00	126,368.00
Other funding due in more than 1 year	100%	78,245.00	83,151.00	-	-	-	38,063.00
Subordinated debt due in more than 1 year	100%	10,261.00	10,024.00	20,663.00	25,898.00	22,671.00	34,127.00
Equity	100%	11,620.00	12,476.00	13,439.00	9,572.00	13,713.00	47,732.00
Hybrid capital securities	100%	-	-	-	-	-	-
Total Illiquid Assets	**Weights**	**120,194.00**	**127,932.20**	**139,642.80**	**163,067.60**	**165,649.80**	**372,671.20**
Net loans	100%	176,635.00	190,135.00	209,814.00	242,735.00	245,226.00	611,089.00
(Residential mortgages)	-80%	(71,116.00)	(76,480.80)	(82,191.20)	(91,714.40)	(92,279.20)	(285,008.80)
Equity investments	100%	-	-	-	-	56.00	429.00
Held-to-hedge financial instruments	100%	490.00	487.00	264.00	435.00	995.00	7,406.00
Held-to-maturity financial instruments	100%	0.00	0.00	0.00	0.00	0.00	7,905.00
Investment in property	100%	4,260.00	4,739.00	3,722.00	2,631.00	2,340.00	5,997.00
Intangible assets	100%	50.00	138.00	149.00	197.00	205.00	3,496.00

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Table F.16 –continued from previous page

Lloyds TSB		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital (£m)		**(7,427.15)**	**(13,914.24)**	**(94,187.88)**	**(115,980.57)**	**(61,140.25)**	**(37,524.56)**
Net Cash Capital Ratio (%)		**94.36**	**90.17**	**38.68**	**37.17**	**66.32**	**90.43**
Fixed assets	100%	4,291.00	4,252.00	2,839.00	2,965.00	4,125.00	8,190.00
Other assets	100%	5,584.00	4,662.00	5,046.00	5,819.00	4,982.00	13,168.00
Total Illiquid Securities	**Weights**	**11,399.83**	**13,588.24**	**13,963.40**	**21,530.25**	**15,904.93**	**19,640.76**
Treasury and other bills	17%	14.79	300.22	276.59	4,965.53	430.44	1,031.56
Debt securities	23%-100%	11,368.48	13,282.62	13,676.37	16,549.96	15,445.33	17,797.40
Equity securities	28%	12.88	4.20	8.12	11.48	22.68	631.40

Notes: 1. ‘ - ’ denotes no information provided by the bank.

Table F.17: Natwest's Normal Short-term Liquidity Position

Natwest		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(181,808.27)**	**(210,594.80)**	**(227,507.48)**	**(223,969.40)**	**(248,395.63)**	**(35,018.84)**
Liquidity Coverage Ratio (%)		**2.45**	**2.30**	**2.58**	**3.36**	**2.08**	**17.94**
Stock of high-quality liquid assets	**Weights**						
Cash and deposits with central banks	100%	1,568.00	1,525.00	1,363.00	1,285.00	1,805.00	1,824.00
Items in course of collection from other banks	100%	-	-	-	-	-	-
Trading portfolio assets at fair value due in 1 year	100%	-	-	-	-	-	-
Financial assets designated at fair value due in 1 year	100%	-	-	-	-	-	-
Derivative cash flow due in 1 year	100%	791.00	1,111.00	1,230.00	2,719.00	1,007.00	3,769.00
Treasury and other bills	98%	45.08	49.00	45.08	-	-	-
Debt securities without government sponsorship	0%	0.00	0.00	0.00	0.00	0.00	0.00
Debt securities with government sponsorship	90%	782.10	832.50	2,034.00	2,443.50	1,403.10	1,132.20
Other Debt securities, including foreign debt	67%	740.35	531.31	566.15	490.44	268.00	196.31
Equity securities	85%	644.30	918.00	787.10	848.30	795.60	733.55
Repos (and security borrowing)	100%	-	-	-	-	-	-
Cash outflow	**Weights**						
Interbank deposits (on demand)	100%	29,351.00	29,353.76	28,472.65	33,650.04	33,412.86	32,224.00
Interbank deposits due in 1 year	50%	6,531.00	7,477.12	7,252.68	8,571.48	8,511.07	665.00
Stable Retail deposits (on demand)	100%	141,464.00	156,274.73	176,620.72	171,434.05	192,915.26	1,528.00

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Table F.17 –continued from previous page

Natwest		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(181,808.27)**	**(210,594.80)**	**(227,507.48)**	**(223,969.40)**	**(248,395.63)**	**(35,018.84)**
Liquidity Coverage Ratio (%)		**2.45**	**2.30**	**2.58**	**3.36**	**2.08**	**17.94**
Stable Retail deposits due in 1 year	5%	648.25	1,079.16	1,219.66	1,183.85	1,332.19	79.30
Other less stable deposits (on demand)	100%	-	-	-	-	-	-
Other less stable deposits due in 1 year	10%	-	-	-	-	-	-
Trading portfolio liabilities (level 1)	10%	0.00	0.00	0.00	0.00	0.00	0.00
Trading portfolio liabilities (level 2)	75%	0.00	0.00	0.00	0.00	0.00	0.00
Trading portfolio liabilities (level 3)	100%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 1)	10%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 2)	75%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 3)	100%	0.00	0.00	0.00	0.00	0.00	0.00
Derivative cash flow due in 1 year (level 1)	10%	0.00	0.00	0.00	8.55	13.07	30.00
Derivative cash flow due in 1 year (level 2)	75%	549.00	876.75	986.25	1,645.52	604.69	2,325.00
Derivative cash flow due in 1 year (level 3)	100%	0.00	0.00	0.00	28.49	0.00	200.00

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Table F.17 –continued from previous page

Natwest		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(181,808.27)**	**(210,594.80)**	**(227,507.48)**	**(223,969.40)**	**(248,395.63)**	**(35,018.84)**
Liquidity Coverage Ratio (%)		**2.45**	**2.30**	**2.58**	**3.36**	**2.08**	**17.94**
Senior debt (on demand)	100%	3,040.00	2,423.53	3,063.64	2,457.02	1,168.58	1,528.00
Senior debt due in 1 year	25%	722.60	582.65	736.54	590.70	280.94	158.60
Subordinated debt (on demand)	100%	326.00	16.78	28.96	155.93	139.15	95.00
Subordinated debt due in 1 year	25%	454.25	24.05	41.51	223.52	199.46	194.00
Other financial liabilities designated at fair value (on demand)	100%	3,061.00	-	-	-	-	3,647.00
Other financial liabilities designated at fair value due in 1 year	25%	232.00	994.50	861.00	672.75	860.25	-
Repos (and security lending)	10%	-	-	-	-	-	-

Notes: 1. On demand interbank deposits for 2006 to 2009 are calculated based on the 2005 ratio of on demand interbank deposits to interbank deposits due in 1 year. 2. On demand stable retail deposits for 2006 to 2009 are calculated based on the 2005 ratio of on demand stable retail deposits to stable retail deposits due in 1 year. 3. On demand senior debt for 2006 to 2009 is calculated based on the 2005 ratio of on demand senior debt to senior debt due in 1 year. 4. On demand subordinated debt for 2006 to 2009 is calculated based on the 2005 ratio of on demand subordinated debt to subordinated debt due in 1 year. 5. ' - ' denotes no information provided by the bank.

Table F.18: Natwest's Stress Short-term Liquidity Position

Natwest		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(182,282.87)**	**(211,261.40)**	**(228,245.48)**	**(225,716.89)**	**(248,977.45)**	**(37,489.63)**
Liquidity Coverage Ratio (%)		**2.20**	**1.99**	**2.26**	**2.61**	**1.85**	**12.15**
Stock of high-quality liquid assets	**Weights**						
Cash and deposits with central banks	100%	1,568.00	1,525.00	1,363.00	1,285.00	1,805.00	1,824.00
Items in course of collection from other banks	100%	-	-	-	-	-	-
Trading portfolio assets at fair value due in 1 year	100% / 85%	-	-	-	-	-	-
Financial assets designated at fair value due in 1 year	100% / 85%	-	-	-	-	-	-
Derivative cash flow due in 1 year	100% / 85%	316.40	444.40	492.00	971.51	425.18	1,298.21
Treasury and other bills	83%	45.08	49.00	45.08	-	-	-
Debt securities without government sponsorship	0%	0.00	0.00	0.00	0.00	0.00	0.00
Debt securities with government sponsorship	77%	782.10	832.50	2,034.00	2,443.50	1,403.10	1,132.20
Other Debt securities, including foreign debt	57%	740.35	531.31	566.15	490.44	268.00	196.31
Equity securities	72%	644.30	918.00	787.10	848.30	795.60	733.55
Repos (and security borrowing)		-	-	-	-	-	-
Cash outflow	**Weights**						
Interbank deposits (on demand)	100%	29,351.00	29,353.76	28,472.65	33,650.04	33,412.86	32,224.00
Interbank deposits due in 1 year	50%	6,531.00	7,477.12	7,252.68	8,571.48	8,511.07	665.00
Stable Retail deposits (on demand)	100%	141,464.00	156,274.73	176,620.72	171,434.05	192,915.26	1,528.00

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Table F.18 –continued from previous page

Natwest		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(182,282.87)**	**(211,261.40)**	**(228,245.48)**	**(225,716.89)**	**(248,977.45)**	**(37,489.63)**
Liquidity Coverage Ratio (%)		**2.20**	**1.99**	**2.26**	**2.61**	**1.85**	**12.15**
Stable Retail deposits due in 1 year	5%	648.25	1,079.16	1,219.66	1,183.85	1,332.19	79.30
Other less stable deposits (on demand)	100%	-	-	-	-	-	-
Other less stable deposits due in 1 year	10%	-	-	-	-	-	-
Trading portfolio liabilities (level 1)	10%	0.00	0.00	0.00	0.00	0.00	0.00
Trading portfolio liabilities (level 2)	75%	0.00	0.00	0.00	0.00	0.00	0.00
Trading portfolio liabilities (level 3)	100%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 1)	10%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 2)	75%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 3)	100%	0.00	0.00	0.00	0.00	0.00	0.00
Derivative cash flow due in 1 year (level 1)	10%	0.00	0.00	0.00	8.55	13.07	30.00
Derivative cash flow due in 1 year (level 2)	75%	549.00	876.75	986.25	1,645.52	604.69	2,325.00
Derivative cash flow due in 1 year (level 3)	100%	0.00	0.00	0.00	28.49	0.00	200.00

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Table F.18 –continued from previous page

Natwest		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(182,282.87)**	**(211,261.40)**	**(228,245.48)**	**(225,716.89)**	**(248,977.45)**	**(37,489.63)**
Liquidity Coverage Ratio (%)		**2.20**	**1.99**	**2.26**	**2.61**	**1.85**	**12.15**
Senior debt (on demand)	100%	3,040.00	2,423.53	3,063.64	2,457.02	1,168.58	1,528.00
Senior debt due in 1 year	25%	722.60	582.65	736.54	590.70	280.94	158.60
Subordinated debt (on demand)	100%	326.00	16.78	28.96	155.93	139.15	95.00
Subordinated debt due in 1 year	25%	454.25	24.05	41.51	223.52	199.46	194.00
Other financial liabilities designated at fair value (on demand)	100%	3,061.00	-	-	-	-	3,647.00
Other financial liabilities designated at fair value due in 1 year	25%	232.00	994.50	861.00	672.75	860.25	-
Repos (and security lending)	10%	-	-	-	-	-	-

Notes: 1. On demand interbank deposits for 2006 to 2009 are calculated based on the 2005 ratio of on demand interbank deposits to interbank deposits due in 1 year. 2. On demand stable retail deposits for 2006 to 2009 are calculated based on the 2005 ratio of on demand stable retail deposits to stable retail deposits due in 1 year. 3. On demand senior debt for 2006 to 2009 is calculated based on the 2005 ratio of on demand senior debt to senior debt due in 1 year. 4. On demand subordinated debt for 2006 to 2009 is calculated based on the 2005 ratio of on demand subordinated debt to subordinated debt due in 1 year. 5. ' - ' denotes no information provided by the bank.

Table F.19: Natwest's Normal Long-term Liquidity Position

Natwest		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital(£m)		**(116,294.17)**	**(124,293.99)**	**(133,367.67)**	**(131,943.76)**	**(88,656.90)**	**(105,623.33)**
Net Cash Capital Ratio (%)		**26.45**	**28.51**	**26.53**	**29.66**	**43.05**	**29.37**
Long-term Funding	**Weights**	**41,817.00**	**49,579.00**	**48,168.00**	**55,626.00**	**67,018.00**	**43,912.41**
Deposits by banks due in more than 1 year	100%	3,588.00	1,950.00	1,883.00	2,840.00	10,998.00	1,451.00
Customer deposits due in more than 1 year [1]	100%	3,495.00	3,361.00	4,505.00	5,273.00	7,904.00	6,467.68
Financial liabilities designated at fair value due after 1 year	100%	-	-	-	-	-	-
Derivative cash flow due in more than 1 year[2]	100%	1,925.00	1,174.00	1,936.00	5,758.00	3,578.00	2,476.44
Senior debt due in more than 1 year	100%	535.00	6,085.00	10,494.00	8,848.00	7,492.00	42.00
Other funding due in more than 1 year	100%	17,585.00	20,296.00	11,511.00	10,400.00	13,503.00	-
Subordinated debt due in more than 1 year	100%	4,505.00	5,528.00	5,737.00	9,049.00	8,062.00	5,877.00
Equity	100%	10,184.00	11,185.00	12,102.00	13,458.00	15,481.00	16,369.00
Hybrid capital securities	100%	-	-	-	-	-	-
Total Illiquid Assets	**Weights**	**156,651.00**	**172,430.80**	**180,214.00**	**186,739.00**	**155,118.60**	**147,490.80**
Net loans	100%	159,943.00	182,411.00	188,976.00	198,267.00	164,403.00	155,133.00
(Residential mortgages)	-80%	(13,384.00)	(19,075.20)	(16,744.00)	(21,812.00)	(21,114.40)	(20,951.20)
Equity investments	100%	-	-	-	-	-	904.00
Held-to-hedge financial instruments	100%	0.00	0.00	0.00	0.00	0.00	0.00
Held-to-maturity financial instruments	100%	0.00	0.00	0.00	0.00	0.00	0.00
Investment in property	100%	1,531.00	1,719.00	1,514.00	1,970.00	3,300.00	3,191.00

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Table F.19 –continued from previous page

Natwest		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital(£m)		**(116,294.17)**	**(124,293.99)**	**(133,367.67)**	**(131,943.76)**	**(88,656.90)**	**(105,623.33)**
Net Cash Capital Ratio (%)		**26.45**	**28.51**	**26.53**	**29.66**	**43.05**	**29.37**
Intangible assets	100%	438.00	490.00	471.00	421.00	385.00	683.00
Fixed assets	100%	1,462.00	1,517.00	1,404.00	1,758.00	1,696.00	3,191.00
Other assets	100%	6,661.00	5,369.00	4,593.00	6,135.00	6,449.00	5,340.00
Total Illiquid Securities	**Weights**	**1,460.17**	**1,442.19**	**1,321.67**	**830.76**	**556.30**	**2,044.94**
Treasury and other bills	2%	0.92	1.00	0.92	-	-	-
Debt securities	10%-100%	1,345.55	1,279.19	1,181.85	681.06	415.90	1,915.49
Equity securities	15%	113.70	162.00	138.90	149.70	140.40	129.45

Notes: 1. Customer deposits due in more than 1 year in 2010 are calculated based on the average historical ratio of customer deposits due in more than 1 year to total customer deposits from 2005 to 2009. 2. Derivative cash flow due in more than 1 year in 2010 is calculated based on the average historical ratio of derivative cash flow due in more than 1 year to total derivative cash flow from 2005 to 2009. 3.‘ - ’ denotes no information provided by the bank.

Table F.20: Natwest's Stress Long-term Liquidity Position

Natwest		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital (£m)		**(116,623.08)**	**(124,086.44)**	**(133,873.25)**	**(132,499.65)**	**(89,021.25)**	**(105,928.36)**
Net Cash Capital Ratio (%)	%	**26.39**	**28.55**	**26.46**	**29.57**	**42.95**	**29.31**
Long-term Funding	**Weights**	**41,817.00**	**49,579.00**	**48,168.00**	**55,626.00**	**67,018.00**	**43,912.41**
Deposits by banks due in more than 1 year	100%	3,588.00	1,950.00	1,883.00	2,840.00	10,998.00	1,451.00
Customer deposits due in more than 1 year[1]	100%	3,495.00	3,361.00	4,505.00	5,273.00	7,904.00	6,467.68
Financial liabilities designated at fair value due after 1 year	100%	-	-	-	-	-	-
Derivative cash flow due in more than 1 year[2]	100%	1,925.00	1,174.00	1,936.00	5,758.00	3,578.00	2,476.44
Senior debt due in more than 1 year	100%	535.00	6,085.00	10,494.00	8,848.00	7,492.00	42.00
Other funding due in more than 1 year	100%	17,585.00	20,296.00	11,511.00	10,400.00	13,503.00	-
Subordinated debt due in more than 1 year	100%	4,505.00	5,528.00	5,737.00	9,049.00	8,062.00	5,877.00
Equity	100%	10,184.00	11,185.00	12,102.00	13,458.00	15,481.00	16,369.00
Hybrid capital securities	100%	-	-	-	-	-	-
Total Illiquid Assets	**Weights**	**156,651.00**	**172,430.80**	**180,214.00**	**186,739.00**	**155,118.60**	**147,490.80**
Net loans	100%	159,943.00	182,411.00	188,976.00	198,267.00	164,403.00	155,133.00
(Residential mortgages)	-80%	(13,384.00)	(19,075.20)	(16,744.00)	(21,812.00)	(21,114.40)	(20,951.20)
Equity investments	100%	-	-	-	-	-	904.00
Held-to-hedge financial instruments	100%	0.00	0.00	0.00	0.00	0.00	0.00
Held-to-maturity financial instruments	100%	0.00	0.00	0.00	0.00	0.00	0.00
Investment in property	100%	1,531.00	1,719.00	1,514.00	1,970.00	3,300.00	3,191.00

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Table F.20 –continued from previous page

Natwest		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital (£m)		**(116,623.08)**	**(124,086.44)**	**(133,873.25)**	**(132,499.65)**	**(89,021.25)**	**(105,928.36)**
Net Cash Capital Ratio (%)	**%**	**26.39**	**28.55**	**26.46**	**29.57**	**42.95**	**29.31**
Intangible assets	100%	438.00	490.00	471.00	421.00	385.00	683.00
Fixed assets	100%	1,462.00	1,517.00	1,404.00	1,758.00	1,696.00	3,191.00
Other assets	100%	6,661.00	5,369.00	4,593.00	6,135.00	6,449.00	5,340.00
Total Illiquid Security	**Weights**	**1,789.08**	**1,234.64**	**1,827.25**	**1,386.65**	**920.65**	**2,349.97**
Treasury and other bills	17%	7.82	8.50	7.82	-	-	-
Debt Securities	23%-100%	1,569.02	923.74	1,560.15	1,107.21	658.57	2,108.33
Equity securities	28%	212.24	302.40	259.28	279.44	262.08	241.64

Notes: 1. Customer deposits due in more than 1 year in 2010 are calculated based on the average historical ratio of customer deposits due in more than 1 year to total customer deposits from 2005 to 2009. 2. Derivative cash flow due in more than 1 year in 2010 is calculated based on the average historical ratio of derivative cash flow due in more than 1 year to total derivative cash flow from 2005 to 2009. 3.‘ - ’ denotes no information provided by the bank.

Table F.21: RBS Bank Plc's Normal Short-term Liquidity Position

RBS Bank Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(377,384.49)**	**(446,726.82)**	**(600,492.56)**	**(592,871.78)**	**(520,712.64)**	**(398,333.61)**
Liquidity Coverage Ratio (%)		**13.14**	**11.39**	**9.75**	**25.60**	**20.40**	**27.30**
Stock of high-quality liquid assets	**Weights**						
Cash and deposits with central banks	100%	4,759.00	6,121.00	5,559.00	6,806.00	27,060.00	49,838.00
Items in course of collection from other banks	100%	-	-	-	-	-	-
Trading portfolio assets at fair value due in 1 year	100%	-	-	-	-	-	-
Financial assets designated at fair value due in 1 year	100%	-	-	-	-	-	-
Derivative cash flow due in 1 year	100%	23,881.00	28,367.00	41,432.00	175,147.00	70,023.00	62,662.00
Treasury and other bills	98%	5,427.24	5,388.04	-	-	-	-
Debt securities without government sponsorship	0%	0.00	0.00	0.00	0.00	0.00	0.00
Debt securities with government sponsorship	90%	15,890.40	12,955.50	11,767.50	13,247.10	31,971.60	32,737.50
Other Debt securities, including foreign debt	67%	5,722.47	3,023.04	4,813.28	7,264.81	2,891.72	3,182.50
Equity securities	85%	1,393.15	1,542.75	1,331.95	1,563.15	1,538.50	1,157.70
Repos (and security borrowing)	100%	-	-	-	-	-	-
Cash outflow	**Weights**						
Interbank deposits (on demand)	100%	69,383.00	86,874.00	92,282.16	113,057.34	71,190.23	51,841.75
Interbank deposits due in 1 year	50%	15,479.50	18,962.50	25,818.42	31,630.83	19,917.38	14,504.12
Stable Retail deposits (on demand)	100%	286,738.00	324,718.00	430,297.00	438,114.00	436,337.00	385,404.36

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Table F.21 –continued from previous page

RBS Bank Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(377,384.49)**	**(446,726.82)**	**(600,492.56)**	**(592,871.78)**	**(520,712.64)**	**(398,333.61)**
Liquidity Coverage Ratio (%)		**13.14**	**11.39**	**9.75**	**25.60**	**20.40**	**27.30**
Stable Retail deposits due in 1 year	5%	2,212.25	2,471.95	21,514.85	21,905.70	21,816.85	3,585.08
Other less stable deposits (on demand)	100%	-	-	-	-	-	-
Other less stable deposits due in 1 year	10%	-	-	-	-	-	-
Trading portfolio liabilities (level 1)	10%	0.00	0.00	0.00	0.00	0.00	0.00
Trading portfolio liabilities (level 2)	75%	0.00	0.00	0.00	0.00	0.00	0.00
Trading portfolio liabilities (level 3)	100%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 1)	10%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 2)	75%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 3)	100%	0.00	0.00	0.00	0.00	0.00	0.00
Derivative cash flow due in 1 year (level 1)	10%	0.00	0.00	29.04	12.80	4.77	24.83
Derivative cash flow due in 1 year (level 2)	75%	18,333.75	22,560.75	33,418.46	122,446.44	52,282.56	46,163.47
Derivative cash flow due in 1 year (level 3)	100%	0.00	0.00	513.70	1,882.22	803.68	709.61

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Table F.21 –continued from previous page

RBS Bank Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(377,384.49)**	**(446,726.82)**	**(600,492.56)**	**(592,871.78)**	**(520,712.64)**	**(398,333.61)**
Liquidity Coverage Ratio (%)		**13.14**	**11.39**	**9.75**	**25.60**	**20.40**	**27.30**
Senior debt (on demand)	100%	19,272.00	19,573.00	27,431.13	42,238.74	33,355.14	27,665.95
Senior debt due in 1 year	25%	4,524.00	2,004.70	5,212.09	8,025.63	6,337.69	5,256.70
Subordinated debt (on demand)	100%	530.00	746.00	130.71	299.62	220.16	173.42
Subordinated debt due in 1 year	25%	886.00	774.25	170.07	389.85	286.46	225.64
Other financial liabilities designated at fair value (on demand)	100%	16,533.00	25,102.00	27,905.88	16,498.92	11,371.39	12,065.46
Other financial liabilities designated at fair value due in 1 year	25%	566.25	337.00	672.78	397.77	274.15	290.88
Repos (and security lending)	10%	-	-	-	-	-	-

Notes: 1. On demand interbank deposits for 2007 to 2010 are calculated based on the average historical ratio of on demand interbank deposits to interbank deposits due in 1 year from 2005 to 2006. 2. On demand stable retail deposits in 2010 are calculated based on the average historical ratio of on demand stable retail deposits to stable retail deposits due in 1 year from 2005 to 2009. 3. On demand senior debt for 2007 to 2010 is calculated based on the average historical ratio of on demand senior debt to senior debt due in 1 year from 2005 to 2006. 4. On demand subordinated debt for 2007 to 2010 is calculated based on the average historical ratio of on demand subordinated debt to subordinated debt due in 1 year from 2005 to 2006. 5. Other on demand financial liabilities designated at fair value for 2007 to 2010 is calculated based on the average historical ratio of on demand other financial liabilities designated at fair value to other financial liabilities designated at fair value due in 1 year from 2005 to 2006. 6.‘ - ’ denotes no information provided by the bank.

Table F.22: RBS Bank Plc's Stress Short-term Liquidity Position

RBS Bank Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(385,159.79)**	**(454,365.07)**	**(609,829.02)**	**(623,341.98)**	**(537,227.54)**	**(413,759.32)**
Liquidity Coverage Ratio (%)		**11.35**	**9.87**	**8.35**	**21.78**	**17.88**	**24.48**
Stock of high-quality liquid assets	**Weights**						
Cash and deposits with central banks	100%	4,759.00	6,121.00	5,559.00	6,806.00	27,060.00	49,838.00
Items in course of collection from other banks	100%	-	-	-	-	-	-
Trading portfolio assets at fair value due in 1 year	100% /85%	-	-	-	-	-	-
Financial assets designated at fair value due in 1 year	100% /85%	-	-	-	-	-	-
Derivative cash flow due in 1 year	100% /85%	20,298.85	24,111.95	34,717.40	147,913.64	58,793.12	52,617.09
Treasury and other bills	83%	4,596.54	4,563.34	-	-	-	-
Debt securities without government sponsorship	0%	0.00	0.00	0.00	0.00	0.00	0.00
Debt securities with government sponsorship	77%	13,595.12	11,084.15	10,067.75	11,333.63	27,353.48	28,008.75
Other Debt securities, including foreign debt	57%	4,868.37	2,571.84	4,094.88	6,180.51	2,460.12	2,707.50
Equity securities	72%	1,180.08	1,306.80	1,128.24	1,324.08	1,303.20	980.64
Repos (and security borrowing)	100%	-	-	-	-	-	-
Cash outflow	**Weights**						
Interbank deposits (on demand)	100%	69,383.00	86,874.00	92,282.16	113,057.34	71,190.23	51,841.75
Interbank deposits due in 1 year	50%	15,479.50	18,962.50	25,818.42	31,630.83	19,917.38	14,504.12
Stable Retail deposits (on demand)	100%	286,738.00	324,718.00	430,297.00	438,114.00	436,337.00	385,404.36

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Table F.22 –continued from previous page

RBS Bank Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(385,159.79)**	**(454,365.07)**	**(609,829.02)**	**(623,341.98)**	**(537,227.54)**	**(413,759.32)**
Liquidity Coverage Ratio (%)		**11.35**	**9.87**	**8.35**	**21.78**	**17.88**	**24.48**
Stable Retail deposits due in 1 year	5%	2,212.25	2,471.95	21,514.85	21,905.70	21,816.85	3,585.08
Other less stable deposits (on demand)	100%	-	-	-	-	-	-
Other less stable deposits due in 1 year	10%	-	-	-	-	-	-
Trading portfolio liabilities (level 1)	10%	0.00	0.00	0.00	0.00	0.00	0.00
Trading portfolio liabilities (level 2)	75%	0.00	0.00	0.00	0.00	0.00	0.00
Trading portfolio liabilities (level 3)	100%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 1)	10%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 2)	75%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 3)	100%	0.00	0.00	0.00	0.00	0.00	0.00
Derivative cash flow due in 1 year (level 1)	10%	0.00	0.00	29.04	12.80	4.77	24.83
Derivative cash flow due in 1 year (level 2)	75%	18,333.75	22,560.75	33,418.46	122,446.44	52,282.56	46,163.47
Derivative cash flow due in 1 year (level 3)	100%	0.00	0.00	513.70	1,882.22	803.68	709.61

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Table F.22 –continued from previous page

RBS Bank Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(385,159.79)**	**(454,365.07)**	**(609,829.02)**	**(623,341.98)**	**(537,227.54)**	**(413,759.32)**
Liquidity Coverage Ratio (%)		**11.35**	**9.87**	**8.35**	**21.78**	**17.88**	**24.48**
Senior debt (on demand)	100%	19,272.00	19,573.00	27,431.13	42,238.74	33,355.14	27,665.95
Senior debt due in 1 year	25%	4,524.00	2,004.70	5,212.09	8,025.63	6,337.69	5,256.70
Subordinated debt (on demand)	100%	530.00	746.00	130.71	299.62	220.16	173.42
Subordinated debt due in 1 year	25%	886.00	774.25	170.07	389.85	286.46	225.64
Other financial liabilities designated at fair value (on demand)	100%	16,533.00	25,102.00	27,905.88	16,498.92	11,371.39	12,065.46
Other financial liabilities designated at fair value due in 1 year	25%	566.25	337.00	672.78	397.77	274.15	290.88
Repos (and security lending)	10%	-	-	-	-	-	-

Notes: 1. On demand interbank deposits for 2007 to 2010 are calculated based on the average historical ratio of on demand interbank deposits to interbank deposits due in 1 year from 2005 to 2006. 2. On demand stable retail deposits in 2010 are calculated based on the average historical ratio of on demand stable retail deposits to stable retail deposits due in 1 year from 2005 to 2009. 3. On demand senior debt for 2007 to 2010 is calculated based on the average historical ratio of on demand senior debt to senior debt due in 1 year from 2005 to 2006. 4. On demand subordinated debt for 2007 to 2010 is calculated based on the average historical ratio of on demand subordinated debt to subordinated debt due in 1 year from 2005 to 2006. 5. Other on demand financial liabilities designated at fair value for 2007 to 2010 is calculated based on the average historical ratio of on demand other financial liabilities designated at fair value to other financial liabilities designated at fair value due in 1 year from 2005 to 2006. 6.‘ - ’ denotes no information provided by the bank.

Table F.23: RBS Bank Plc's Normal Long-term Liquidity Position

RBS Bank Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital (£m)		**(172,965.34)**	**(176,361.27)**	**(171,042.47)**	**325,967.66**	**49,214.02**	**103,754.30**
Net Cash Capital Ratio (%)		**53.54**	**57.05**	**65.63**	**153.59**	**109.40**	**121.64**
Long-term Funding	**Weights**	**199,326.00**	**234,275.00**	**326,636.00**	**934,231.00**	**572,809.00**	**583,135.00**
Deposits by banks due in more than 1 year	100%	9,547.00	7,393.00	7,589.00	5,663.00	5,113.00	4,370.00
Customer deposits due in more than 1 year	100%	11,857.00	10,563.00	12,685.00	15,015.00	16,965.00	15,219.00
Financial liabilities designated at fair value due after 1 year	100%	-	-	-	-	-	-
Derivative cash flow due in more than 1 year	100%	72,060.00	88,032.00	157,710.00	742,897.00	353,576.00	354,161.00
Senior debt due in more than 1 year	100%	21,710.00	42,986.00	50,580.00	57,447.00	75,681.00	84,429.00
Other funding due in more than 1 year	100%	25,190.00	23,026.00	23,252.00	27,867.00	31,926.00	36,402.00
Subordinated debt due in more than 1 year	100%	24,348.00	23,943.00	26,985.00	38,092.00	33,351.00	30,947.00
Equity	100%	34,614.00	38,332.00	47,835.00	47,250.00	56,197.00	57,607.00
Hybrid capital securities	100%	-	-	-	-	-	-
Total Illiquid Assets	**Weights**	**361,245.60**	**404,241.60**	**489,933.20**	**566,861.40**	**486,684.80**	**447,659.40**
Net loans	100%	418,920.00	468,506.00	551,449.00	619,503.00	536,169.00	518,321.00
(Residential mortgages)	-80%	(87,306.40)	(95,238.40)	(93,888.80)	(110,997.60)	(112,159.20)	(116,541.60)
Equity investments	100%	-	-	5,509.00	2,691.00	2,405.00	2,340.00
Held-to-hedge financial instruments	100%	1,096.00	1,181.00	919.00	4,254.00	2,835.00	4,625.00
Held-to-maturity financial instruments	100%	788.00	561.00	500.00	11,756.00	10,291.00	6,680.00
Investment in property	100%	4,346.00	4,884.00	3,431.00	-	-	4,170.00
Intangible assets	100%	1,044.00	937.00	978.00	759.00	8,017.00	1,107.00

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Table F.23 –continued from previous page

RBS Bank Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital (£m)		**(172,965.34)**	**(176,361.27)**	**(171,042.47)**	**325,967.66**	**49,214.02**	**103,754.30**
Net Cash Capital Ratio (%)		**53.54**	**57.05**	**65.63**	**153.59**	**109.40**	**121.64**
Fixed assets	100%	10,396.00	10,166.00	9,594.00	16,628.00	17,309.00	11,973.00
Other assets	100%	11,962.00	13,245.00	11,442.00	22,268.00	21,818.00	14,985.00
Total Illiquid Securities	**Weights**	**11,045.74**	**6,394.67**	**7,745.27**	**41,401.94**	**36,910.18**	**31,721.30**
Treasury and other bills	2%	110.76	109.96	-	-	-	-
Debt securities	10%-100%	10,689.13	6,012.46	7,510.22	41,126.09	36,638.68	31,517.00
Equity securities	15%	245.85	272.25	235.05	275.85	271.50	204.30

Notes: 1.‘ - ’ denotes no information provided by the bank.

Table F.24: RBS Bank Plc's Stress Long-term Liquidity Position

RBS Bank Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital (£m)		**(177,158.49)**	**(179,744.47)**	**(173,664.33)**	**322,730.82**	**43,929.00**	**98,373.49**
Net Cash Capital Ratio (%)		**52.94**	**56.59**	**65.29**	**152.78**	**108.31**	**120.29**
Long-term Funding	**Weights**	**199,326.00**	**234,275.00**	**326,636.00**	**934,231.00**	**572,809.00**	**583,135.00**
Deposits by banks due in more than 1 year	100%	9,547.00	7,393.00	7,589.00	5,663.00	5,113.00	4,370.00
Customer deposits due in more than 1 year	100%	11,857.00	10,563.00	12,685.00	15,015.00	16,965.00	15,219.00
Financial liabilities designated at fair value due after 1 year	100%	-	-	-	-	-	-
Derivative cash flow due in more than 1 year	100%	72,060.00	88,032.00	157,710.00	742,897.00	353,576.00	354,161.00
Senior debt due in more than 1 year	100%	21,710.00	42,986.00	50,580.00	57,447.00	75,681.00	84,429.00
Other funding due in more than 1 year	100%	25,190.00	23,026.00	23,252.00	27,867.00	31,926.00	36,402.00
Subordinated debt due in more than 1 year	100%	24,348.00	23,943.00	26,985.00	38,092.00	33,351.00	30,947.00
Equity	100%	34,614.00	38,332.00	47,835.00	47,250.00	56,197.00	57,607.00
Hybrid capital securities	100%	-	-	-	-	-	-
Total Illiquid Assets	**Weights**	**361,245.60**	**404,241.60**	**489,933.20**	**566,861.40**	**486,684.80**	**447,659.40**
Net loans	100%	418,920.00	468,506.00	551,449.00	619,503.00	536,169.00	518,321.00
(Residential mortgages)	-80%	(87,306.40)	(95,238.40)	(93,888.80)	(110,997.60)	(112,159.20)	(116,541.60)
Equity investments	100%	-	-	5,509.00	2,691.00	2,405.00	2,340.00
Held-to-hedge financial instruments	100%	1,096.00	1,181.00	919.00	4,254.00	2,835.00	4,625.00
Held-to-maturity financial instruments	100%	788.00	561.00	500.00	11,756.00	10,291.00	6,680.00
Investment in property	100%	4,346.00	4,884.00	3,431.00	-	-	4,170.00
Intangible assets	100%	1,044.00	937.00	978.00	759.00	8,017.00	1,107.00

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Table F.24 –continued from previous page

RBS Bank Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital (£m)		**(177,158.49)**	**(179,744.47)**	**(173,664.33)**	**22,730.82**	**43,929.00**	**98,373.49**
Net Cash Capital Ratio (%)		**52.94**	**56.59**	**65.29**	**152.78**	**108.31**	**120.29**
Fixed assets	100%	10,396.00	10,166.00	9,594.00	16,628.00	17,309.00	11,973.00
Other assets	100%	11,962.00	13,245.00	11,442.00	22,268.00	21,818.00	14,985.00
Total Illiquid Securities	**Weights**	**15,370.01**	**9,923.07**	**10,492.49**	**44,785.90**	**42,340.00**	**37,211.07**
Treasury and other bills	17%	941.46	934.66	-	-	-	-
Debt securities	23%-100%	13,838.51	8,335.01	9,928.37	44,123.86	41,688.40	36,720.75
Equity securities	28%	458.92	508.20	438.76	514.92	506.80	381.36

Notes: 1.‘ - ’ denotes no information provided by the bank.

Table F.25: Santander UK Plc's Normal Short-term Liquidity Position

Santander UK Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(9,740.00)**	**(172,253.54)**	**(44,377.90)**	**(69,962.56)**	**(77,660.36)**	**(53,489.55)**
Liquidity Coverage Ratio (%)		**91.27**	**31.79**	**64.10**	**53.07**	**48.55**	**63.56**
Stock of high-quality liquid assets	**Weights**						
Cash and deposits with central banks	100%	991.00	888.00	1,038.00	4,017.00	4,163.00	26,502.00
Items in course of collection from other banks	100%	-	-	-	-	-	-
Trading portfolio assets at fair value due in 1 year	100%	58,231.00	62,314.00	56,427.00	26,264.00	33,290.00	35,461.00
Financial assets designated at fair value due in 1 year	100%	30,597.00	8,713.00	11,783.00	11,377.00	12,358.00	6,777.00
Derivative cash flow due in 1 year	100%	11,855.00	8,336.00	9,951.00	35,125.00	22,827.00	24,377.00
Treasury and other bills	98%	-	-	-	-	-	-
Debt securities without government sponsorship	0%	0.00	0.00	0.00	0.00	0.00	0.00
Debt securities with government sponsorship	90%	-	-	-	2,144.70	364.50	112.50
Other Debt securities, including foreign debt[1]	67%	-	5.36	5.36	157.45	229.14	17.33
Equity securities	85%	110.50	12.75	27.20	38.25	42.50	42.50
Repos (and security borrowing)	100%	-	-	-	-	-	-
Cash outflow	**Weights**						
Interbank deposits (on demand)	100%	845.00	102.00	416.00	2,375.00	3,716.00	3,478.00
Interbank deposits due in 1 year	50%	2,385.00	3,277.00	3,787.50	4,614.00	971.50	462.00
Stable Retail deposits (on demand)	100%	53,326.00	57,009.00	55,766.00	102,170.00	105,157.00	104,664.00

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Table F.25 –continued from previous page

Santander UK Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(9,740.00)**	**(172,253.54)**	**(44,377.90)**	**(69,962.56)**	**(77,660.36)**	**(53,489.55)**
Liquidity Coverage Ratio (%)		**91.27**	**31.79**	**64.10**	**53.07**	**48.55**	**63.56**
Stable Retail deposits due in 1 year	5%	583.45	392.40	610.45	1,236.20	1,269.85	1,670.30
Other less stable deposits (on demand)	100%	-	-	-	-	-	-
Other less stable deposits due in 1 year	10%	-	-	-	-	-	-
Trading portfolio liabilities (level 1)	10%	0.00	0.00	0.00	0.00	107.10	111.80
Trading portfolio liabilities (level 2)	75%	39,498.00	43,267.50	41,922.75	31,021.50	33,810.75	31,281.75
Trading portfolio liabilities (level 3)	100%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 1)	10%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 2)	75%	5,961.00	6,246.75	6,867.00	4,675.50	3,237.75	2,662.50
Financial liabilities designated at fair value due in 1 year (level 3)	100%	0.00	0.00	0.00	0.00	109.00	137.00
Derivative cash flow due in 1 year (level 1)	10%	0.00	0.00	0.00	0.00	0.00	0.00
Derivative cash flow due in 1 year (level 2)	75%	8,448.00	141,363.00	12,736.50	0.00	0.00	0.00
Derivative cash flow due in 1 year (level 3)	100%	0.00	0.00	0.00	0.00	0.00	0.00

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Table F.25 –continued from previous page

Santander UK Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(9,740.00)**	**(172,253.54)**	**(44,377.90)**	**(69,962.56)**	**(77,660.36)**	**(53,489.55)**
Liquidity Coverage Ratio (%)		**91.27**	**31.79**	**64.10**	**53.07**	**48.55**	**63.56**
Senior debt (on demand)[2]	100%	74.00	147.75	251.71	520.01	444.05	387.43
Senior debt due in 1 year	25%	327.30	653.50	1,113.30	2,300.00	1,964.00	1,713.60
Subordinated debt (on demand)	100%	-	-	-	-	-	-
Subordinated debt due in 1 year	25%	26.25	-	104.25	135.50	116.00	210.50
Other financial liabilities designated at fair value (on demand)	100%	-	-	-	-	-	-
Other financial liabilities designated at fair value due in 1 year	25%	50.50	63.75	34.00	38.25	31.50	-
Repos (and security lending)	10%	-	-	-	-	-	-

Notes: 1. Other debt securities(including foreign debt)in 2010 is calculated based on the average historical ratio of other debt securities (including foreign debt) to total debt securities from 2005 to 2009. 2. On demand senior debt for 2006 to 2010 is calculated based on the 2005 ratio on demand senior debt to senior debt due in 1 year. 3. ' - ' denotes no information provided by the bank.

Table F.26: Santander UK Plc's Stress Short-term Liquidity Position

Santander UK Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(24,859.35)**	**(184,160.74)**	**(56,107.01)**	**(81,216.60)**	**(87,028.46)**	**(61,166.24)**
Liquidity Coverage Ratio (%)		**77.71**	**27.07**	**54.61**	**45.52**	**42.34**	**58.33**
Stock of high-quality liquid assets	**Weights**						
Cash and deposits with central banks	100%	991.00	888.00	1,038.00	4,017.00	4,163.00	26,502.00
Items in course of collection from other banks	100%	-	-	-	-	-	-
Trading portfolio assets at fair value due in 1 year	100% / 85%	49,496.35	52,966.90	47,962.95	22,324.40	30,901.00	32,919.00
Financial assets designated at fair value due in 1 year	100% / 85%	26,007.45	7,406.05	10,015.55	9,670.45	9,021.90	5,445.10
Derivative cash flow due in 1 year	100% / 85%	10,076.75	7,085.60	8,458.35	29,856.25	19,277.35	20,599.55
Treasury and other bills	83%	-	-	-	-	-	-
Debt securities without government sponsorship	0%	0.00	0.00	0.00	0.00	0.00	0.00
Debt securities with government sponsorship	77%	-	-	-	1,834.91	311.85	96.25
Other Debt securities, including foreign debt[1]	57%	-	4.56	4.56	133.95	194.94	14.75
Equity securities	72%	93.60	10.80	23.04	32.40	36.00	36.00
Repos (and security borrowing)	100%	-	-	-	-	-	-
Cash outflow	**Weights**						
Interbank deposits (on demand)	100%	845.00	102.00	416.00	2,375.00	3,716.00	3,478.00
Interbank deposits due in 1 year	50%	2,385.00	3,277.00	3,787.50	4,614.00	971.50	462.00
Stable Retail deposits (on demand)	100%	53,326.00	57,009.00	55,766.00	102,170.00	105,157.00	104,664.00

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Table F.26 –continued from previous page

Santander UK Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(24,859.35)**	**(184,160.74)**	**(56,107.01)**	**(81,216.60)**	**(87,028.46)**	**(61,166.24)**
Liquidity Coverage Ratio (%)		**77.71**	**27.07**	**54.61**	**45.52**	**42.34**	**58.33**
Stable Retail deposits due in 1 year	5%	583.45	392.40	610.45	1,236.20	1,269.85	1,670.30
Other less stable deposits (on demand)	100%	-	-	-	-	-	-
Other less stable deposits due in 1 year	10%	-	-	-	-	-	-
Trading portfolio liabilities (level 1)	10%	0.00	0.00	0.00	0.00	107.10	111.80
Trading portfolio liabilities (level 2)	75%	39,498.00	43,267.50	41,922.75	31,021.50	33,810.75	31,281.75
Trading portfolio liabilities (level 3)	100%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 1)	10%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 2)	75%	5,961.00	6,246.75	6,867.00	4,675.50	3,237.75	2,662.50
Financial liabilities designated at fair value due in 1 year (level 3)	100%	0.00	0.00	0.00	0.00	109.00	137.00
Derivative cash flow due in 1 year (level 1)	10%	0.00	0.00	0.00	0.00	0.00	0.00
Derivative cash flow due in 1 year (level 2)	75%	8,448.00	141,363.00	12,736.50	0.00	0.00	0.00
Derivative cash flow due in 1 year (level 3)	100%	0.00	0.00	0.00	0.00	0.00	0.00

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Table F.26 –continued from previous page

Santander UK Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(24,859.35)**	**(184,160.74)**	**(56,107.01)**	**(81,216.60)**	**(87,028.46)**	**(61,166.24)**
Liquidity Coverage Ratio (%)		**77.71**	**27.07**	**54.61**	**45.52**	**42.34**	**58.33**
Senior debt (on demand)[2]	100%	74.00	147.75	251.71	520.01	444.05	387.43
Senior debt due in 1 year	25%	327.30	653.50	1,113.30	2,300.00	1,964.00	1,713.60
Subordinated debt (on demand)	100%	-	-	-	-	-	-
Subordinated debt due in 1 year	25%	26.25	-	104.25	135.50	116.00	210.50
Other financial liabilities designated at fair value (on demand)	100%	-	-	-	-	-	-
Other financial liabilities designated at fair value due in 1 year	25%	50.50	63.75	34.00	38.25	31.50	-
Repos (and security lending)	10%	-	-	-	-	-	-

Notes: 1. Other debt securities(including foreign debt) in 2010 is calculated based on the average historical ratio of other debt securities (including foreign debt) to total debt securities from 2005 to 2009. 2. On demand senior debt for 2006 to 2010 is calculated based on the 2005 ratio of on demand senior debt to senior debt due in 1 year. 3. ' - ' denotes no information provided by the bank.

Table F.27: Santander UK Plc's Normal Long-term Liquidity Position

Santander UK Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital (£m)		**31,860.30**	**31,098.11**	**70,919.56**	**36,734.40**	**(1,130.06)**	**17,772.40**
Net Cash Capital Ratio (%)		**209.82**	**212.56**	**374.12**	**150.09**	**98.52**	**122.14**
Long-term Funding	**Weights**	**60,872.00**	**58,725.00**	**96,791.00**	**110,076.00**	**75,095.00**	**98,044.00**
Deposits by banks due in more than 1 year	100%	2.00	-	-	3,123.00	159.00	3,441.00
Customer deposits due in more than 1 year	100%	894.00	1,662.00	2,086.00	4,353.00	14,130.00	15,672.00
Financial liabilities designated at fair value due after 1 year	100%	15,248.00	7,431.00	8,371.00	6,309.00	5,678.00	4,394.00
Derivative cash flow due in more than 1 year	100%	10,437.00	17,933.00	15,746.00	2,267.00	1,978.00	2,271.00
Senior debt due in more than 1 year	100%	17,929.00	22,543.00	56,052.00	69,536.00	29,715.00	36,812.00
Other funding due in more than 1 year	100%	5,348.00	1,335.00	3,818.00	6,231.00	7,623.00	11,808.00
Subordinated debt due in more than 1 year	100%	6,100.00	4,705.00	7,276.00	10,750.00	8,590.00	11,372.00
Equity	100%	3,110.00	2,813.84	3,108.23	6,902.00	6,334.00	11,380.00
Hybrid capital securities	100%	1,804.00	302.16	333.77	605.00	888.00	894.00
Total Illiquid Assets	**Weights**	**28,992.20**	**27,622.00**	**25,864.00**	**73,019.00**	**76,064.20**	**80,251.60**
Net loans	100%	95,467.00	103,146.00	112,147.00	186,863.00	193,183.00	200,600.00
(Residential mortgages)	-80%	(75,484.80)	(81,692.00)	(88,696.00)	(127,344.00)	(128,372.80)	(132,858.40)
Equity investments	100%	24.00	22.00	29.00	35.00	75.00	2.00
Held-to-hedge financial instruments	100%	741.00	727.00	432.00	3,412.00	1,355.00	2,426.00
Held-to-maturity financial instruments	100%	0.00	0.00	0.00	6,687.00	6,379.00	5,468.00
Investment in property	100%	-	415.00	528.00	1,202.00	1,250.00	1,705.00

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Table F.27 –continued from previous page

Santander UK Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital (£m)		**31,860.30**	**31,098.11**	**70,919.56**	**36,734.40**	**(1,130.06)**	**17,772.40**
Net Cash Capital Ratio (%)		**209.82**	**212.56**	**374.12**	**150.09**	**98.52**	**122.14**
Intangible assets	100%	1,756.00	-	90.00	88.00	183.00	284.00
Fixed assets	100%	314.00	415.00	528.00	754.00	938.00	1,470.00
Other assets	100%	6,175.00	4,589.00	806.00	1,322.00	1,074.00	1,155.00
Total Illiquid Securities	**Weights**	**19.50**	**4.89**	**7.44**	**322.60**	**160.86**	**20.00**
Treasury and other bills	2%	-	-	-	-	-	-
Debt securities	10%-100%	-	2.64	2.64	315.85	153.36	12.50
Equity securities	15%	19.50	2.25	4.80	6.75	7.50	7.50

Notes: 1. ‘ - ’ denotes no information provided by the bank.

Table F.28: Santander UK Plc's Stress Long-term Liquidity Position

Santander UK Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital (£m)		**31,843.40**	**31,095.36**	**70,914.60**	**36,395.26**	**(1,223.41)**	**17,749.65**
Net Cash Capital Ratio (%)		**209.70**	**212.54**	**374.05**	**149.40**	**98.40**	**122.11**
Long-term Funding	**Weights**	**60,872.00**	**58,725.00**	**96,791.00**	**110,076.00**	**75,095.00**	**98,044.00**
Deposits by banks due in more than 1 year	100%	2.00	-	-	3,123.00	159.00	3,441.00
Customer deposits due in more than 1 year	100%	894.00	1,662.00	2,086.00	4,353.00	14,130.00	15,672.00
Financial liabilities designated at fair value due after 1 year	100%	15,248.00	7,431.00	8,371.00	6,309.00	5,678.00	4,394.00
Derivative cash flow due in more than 1 year	100%	10,437.00	17,933.00	15,746.00	2,267.00	1,978.00	2,271.00
Senior debt due in more than 1 year	100%	17,929.00	22,543.00	56,052.00	69,536.00	29,715.00	36,812.00
Other funding due in more than 1 year	100%	5,348.00	1,335.00	3,818.00	6,231.00	7,623.00	11,808.00
Subordinated debt due in more than 1 year	100%	6,100.00	4,705.00	7,276.00	10,750.00	8,590.00	11,372.00
Equity	100%	3,110.00	2,813.84	3,108.23	6,902.00	6,334.00	11,380.00
Hybrid capital securities	100%	1,804.00	302.16	333.77	605.00	888.00	894.00
Total Illiquid Assets	**Weights**	**28,992.20**	**27,622.00**	**25,864.00**	**73,019.00**	**76,064.20**	**80,251.60**
Net loans	100%	95,467.00	103,146.00	112,147.00	186,863.00	193,183.00	200,600.00
(Residental mortgages)	-80%	(75,484.80)	(81,692.00)	(88,696.00)	(127,344.00)	(128,372.80)	(132,858.40)
Equity investments	100%	24.00	22.00	29.00	35.00	75.00	2.00
Held-to-hedge financial instruments	100%	741.00	727.00	432.00	3,412.00	1,355.00	2,426.00
Held-to-maturity financial instruments	100%	0.00	0.00	0.00	6,687.00	6,379.00	5,468.00
Investment in property	100%	-	415.00	528.00	1,202.00	1,250.00	1,705.00

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Table F.28 –continued from previous page

Santander UK Plc		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Stress Long-term		**£m**	**£m**	**£m**	**£m**	**£m**	**£m**
Net Cash Capital (£m)		**31,843.40**	**31,095.36**	**70,914.60**	**36,395.26**	**(1,223.41)**	**17,749.65**
Net Cash Capital Ratio (%)		**209.70**	**212.54**	**374.05**	**149.40**	**98.40**	**122.11**
Intangible assets	100%	1,756.00	-	90.00	88.00	183.00	284.00
Fixed assets	100%	314.00	415.00	528.00	754.00	938.00	1,470.00
Other assets	100%	6,175.00	4,589.00	806.00	1,322.00	1,074.00	1,155.00
Total Illiquid Securities	**weights**	**46.80**	**8.84**	**14.96**	**172.06**	**174.38**	**20.88**
Treasury and other bills	17%	-	-	-	-	-	-
Debt securities	23%-100%	-	3.44	3.44	155.86	156.38	2.88
Equity securities	28%	36.40	4.20	8.96	12.60	14.00	14.00

Notes: 1. ‘ - ’ denotes no information provided by the bank.

Table F.29: Standard Chartered's Normal Short-term Liquidity Position

Standard Chartered		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(57,154.32)**	**(65,845.80)**	**(81,341.29)**	**(158,420.90)**	**(134,695.46)**	**(149,127.35)**
Liquidity Coverage Ratio (%)		**30.09**	**30.32**	**32.71**	**45.62**	**33.94**	**37.73**
Stock of high-quality liquid assets	**Weights**						
Cash and deposits with central banks	100%	4,524.38	3,988.33	5,107.85	21,090.14	11,226.72	20,959.72
Items in course of collection from other banks	100%	-	-	-	-	-	-
Trading portfolio assets at fair value due in 1 year	100%	-	-	-	-	-	-
Financial assets designated at fair value due in 1 year	100%	5,835.05	8,141.94	11,524.92	13,464.48	13,898.56	17,306.95
Derivative cash flow due in 1 year	100%	5,291.24	6,815.09	13,154.41	60,803.60	23,649.11	30,653.69
Treasury and other bills	98%	3,187.27	3,294.03	2,881.33	12,479.85	7,123.29	7,194.42
Debt securities without government sponsorship	0%	0.00	0.00	0.00	0.00	0.00	0.00
Debt securities with government sponsorship	90%	2,880.31	2,846.35	3,099.50	13,967.54	8,046.98	7,903.07
Other Debt securities, including foreign debt	67%	2,628.58	3,226.09	3,233.68	10,063.67	4,715.10	5,443.62
Equity securities	85%	258.58	337.23	533.37	1,031.72	537.40	877.69
Repos (and security borrowing)	100%	-	-	-	-	-	-
Cash outflow	**Weights**						
Interbank deposits (on demand)	100%	9,372.33	12,490.87	12,813.05	27,206.55	21,499.24	17,014.88
Interbank deposits due in 1 year	50%	773.64	870.41	592.61	1,476.07	918.58	723.12
Stable Retail deposits (on demand)	100%	58,327.30	65,171.80	80,784.35	183,700.93	142,621.57	172,430.93

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Table F.29 –continued from previous page

Standard Chartered		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(57,154.32)**	**(65,845.80)**	**(81,341.29)**	**(158,420.90)**	**(134,695.46)**	**(149,127.35)**
Liquidity Coverage Ratio (%)		**30.09**	**30.32**	**32.71**	**45.62**	**33.94**	**37.73**
Stable Retail deposits due in 1 year	5%	408.02	493.78	398.66	945.96	687.25	1,199.78
Other less stable deposits (on demand)	100%	-	-	-	-	-	-
Other less stable deposits due in 1 year	10%	-	-	-	-	-	-
Trading portfolio liabilities (level 1)	10%	0.00	0.00	0.00	0.00	0.00	0.00
Trading portfolio liabilities (level 2)	75%	0.00	0.00	0.00	0.00	0.00	0.00
Trading portfolio liabilities (level 3)	100%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 1)	10%	0.00	0.00	0.00	0.00	268.79	409.41
Financial liabilities designated at fair value due in 1 year (level 2)	75%	2,642.37	3,873.70	5,365.13	10,133.06	4,720.16	6,525.89
Financial liabilities designated at fair value due in 1 year (level 3)	100%	0.00	0.00	0.00	0.00	0.00	199.20
Derivative cash flow due in 1 year (level 1)	10%	0.00	0.00	0.00	0.00	35.79	6.73
Derivative cash flow due in 1 year (level 2)	75%	4,177.65	5,324.64	9,890.66	44,370.60	16,651.53	22,455.61
Derivative cash flow due in 1 year (level 3)	100%	0.00	0.00	0.00	0.00	92.88	180.62

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Table F.29 –continued from previous page

Standard Chartered		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(57,154.32)**	**(65,845.80)**	**(81,341.29)**	**(158,420.90)**	**(134,695.46)**	**(149,127.35)**
Liquidity Coverage Ratio (%)		**30.09**	**30.32**	**32.71**	**45.62**	**33.94**	**37.73**
Senior debt (on demand)	100%	4,091.82	4,342.71	5,503.93	10,970.61	7,052.69	6,928.29
Senior debt due in 1 year	25%	800.07	477.48	584.18	506.37	565.58	579.78
Subordinated debt (on demand)	100%	-	-	-	737.60	447.68	3.20
Subordinated debt due in 1 year	25%	-	64.89	63.00	284.57	-	46.44
Other financial liabilities designated at fair value (on demand)	100%	1,083.66	1,312.35	4,785.57	10,617.08	8,162.29	10,346.00
Other financial liabilities designated at fair value due in 1 year	25%	82.87	67.74	90.86	372.51	168.58	416.65
Repos (and security lending)	10%	-	-	-	-	-	-

Notes: 1. ‘ - ’ denotes no information provided by the bank.

Table F.30: Standard Chartered's Stress Short-term Liquidity Position

Standard Chartered		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(60,159.03)**	**(69,537.76)**	**(86,496.13)**	**(175,148.66)**	**(142,736.56)**	**(158,429.65)**
Liquidity Coverage Ratio (%)		**26.42**	**26.41**	**28.44**	**39.88**	**29.99**	**33.84**
Stock of high-quality liquid assets	**Weights**						
Cash and deposits with central banks	100%	4,524.38	3,988.33	5,107.85	21,090.14	11,226.72	20,959.72
Items in course of collection from other banks	100%	-	-	-	-	-	-
Trading portfolio assets at fair value due in 1 year	100% /85%	-	-	-	-	-	-
Financial assets designated at fair value due in 1 year	100% /85%	4,959.79	6,920.65	9,796.18	11,444.81	12,458.18	15,881.01
Derivative cash flow due in 1 year	100% /85%	4,497.55	5,792.82	11,181.25	51,683.06	20,086.97	25,966.80
Treasury and other bills	83%	2,699.42	2,789.84	2,440.31	10,569.67	6,032.99	6,093.24
Debt securities without government sponsorship	0%	0.00	0.00	0.00	0.00	0.00	0.00
Debt securities with government sponsorship	77%	2,464.26	2,435.21	2,651.79	11,950.01	6,884.64	6,761.52
Other Debt securities, including foreign debt	57%	2,236.26	2,744.58	2,751.04	8,561.63	4,011.36	4,631.14
Equity securities	72%	219.04	285.65	451.79	873.93	455.21	743.45
Repos (and security borrowing)	100%	-	-	-	-	-	-
Cash outflow	**Weights**						
Interbank deposits (on demand)	100%	9,372.33	12,490.87	12,813.05	27,206.55	21,499.24	17,014.88
Interbank deposits due in less than 1 year	50%	773.64	870.41	592.61	1,476.07	918.58	723.12

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Table F.30 –continued from previous page

Standard Chartered		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(60,159.03)**	**(69,537.76)**	**(86,496.13)**	**(175,148.66)**	**(142,736.56)**	**(158,429.65)**
Liquidity Coverage Ratio (%)		**26.42**	**26.41**	**28.44**	**39.88**	**29.99**	**33.84**
Stable Retail deposits (on demand)	100%	58,327.30	65,171.80	80,784.35	183,700.93	142,621.57	172,430.93
Stable Retail deposits due in less than 1 year	5%	408.02	493.78	398.66	945.96	687.25	1,199.78
Other less stable deposits (on demand)	100%	-	-	-	-	-	-
Other less stable deposits due in less than 1 year	10%	-	-	-	-	-	-
Trading portfolio liabilities (level 1)	10%	0.00	0.00	0.00	0.00	0.00	0.00
Trading portfolio liabilities (level 2)	75%	0.00	0.00	0.00	0.00	0.00	0.00
Trading portfolio liabilities (level 3)	100%	0.00	0.00	0.00	0.00	0.00	0.00
Financial liabilities designated at fair value due in 1 year (level 1)	10%	0.00	0.00	0.00	0.00	268.79	409.41
Financial liabilities designated at fair value due in 1 year (level 2)	75%	2,642.37	3,873.70	5,365.13	10,133.06	4,720.16	6,525.89
Financial liabilities designated at fair value due in 1 year (level 3)	100%	0.00	0.00	0.00	0.00	0.00	199.20
Derivative cash flow due in 1 year (level 1)	10%	0.00	0.00	0.00	0.00	35.79	6.73
Derivative cash flow due in 1 year (level 2)	75%	4,177.65	5,324.64	9,890.66	44,370.60	16,651.53	22,455.61

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Table F.30 –continued from previous page

Standard Chartered		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Liquidity Coverage (£m)		**(60,159.03)**	**(69,537.76)**	**(86,496.13)**	**(175,148.66)**	**(142,736.56)**	**(158,429.65)**
Liquidity Coverage Ratio (%)		**26.42**	**26.41**	**28.44**	**39.88**	**29.99**	**33.84**
Derivative cash flow due in 1 year (level 3)	100%	0.00	0.00	0.00	0.00	92.88	180.62
Senior debt (on demand)	100%	4,091.82	4,342.71	5,503.93	10,970.61	7,052.69	6,928.29
Senior debt due in 1 year	25%	800.07	477.48	584.18	506.37	565.58	579.78
Subordinated debt (on demand)	100%	-	-	-	737.60	447.68	3.20
Subordinated debt due in 1 year	25%	-	64.89	63.00	284.57	-	46.44
Other financial liabilities designated at fair value (on demand)	100%	1,083.66	1,312.35	4,785.57	10,617.08	8,162.29	10,346.00
Other financial liabilities designated at fair value due in 1 year	25%	82.87	67.74	90.86	372.51	168.58	416.65
Repos (and security lending)	10%	-	-	-	-	-	-

Notes: 1. ‘ - ’ denotes no information provided by the bank.

Table F.31: Standard Chartered's Normal Long-term Liquidity Position

Standard Chartered		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital (£m)		**(28,120.29)**	**(37,071.34)**	**(34,856.37)**	**(68,860.20)**	**(62,809.21)**	**(78,170.46)**
Net Cash Capital Ratio (%)		**49.53**	**47.84**	**53.03**	**55.69**	**47.98**	**48.64**
Long-term Funding	**Weights**	**27,595.76**	**33,999.28**	**39,356.30**	**86,555.89**	**57,938.54**	**74,023.87**
Deposits by banks due in more than 1 year	100%	528.56	338.32	351.40	1,253.48	777.10	416.97
Customer deposits due in more than 1 year	100%	1,806.48	2,298.81	2,905.58	5,645.92	2,610.55	6,292.91
Financial liabilities designated at fair value due after 1 year	100%	-	-	-	-	-	-
Derivative cash flow due in more than 1 year	100%	1,812.12	2,931.93	6,242.87	30,170.92	12,364.80	16,708.72
Senior debt due in more than 1 year	100%	3,388.20	4,767.04	4,795.10	7,594.23	7,885.51	9,493.49
Other funding due in more than 1 year	100%	6,447.74	7,792.22	6,100.30	10,558.60	7,554.24	9,724.71
Subordinated debt due in more than 1 year	100%	5,844.08	6,319.78	7,649.48	12,951.22	9,911.53	10,019.98
Equity	100%	7,768.58	9,551.17	11,311.57	18,381.53	16,834.81	21,367.08
Hybrid capital securities	100%	-	-	-	-	-	-
Total Illiquid Assets	**Weights**	**51,027.53**	**61,044.41**	**67,398.72**	**144,437.37**	**110,980.70**	**140,180.73**
Net loans	100%	63,128.38	72,171.33	77,441.53	152,039.98	122,782.41	153,949.30
(Residential mortgages)	-80%	(19,909.51)	(20,563.60)	(20,375.98)	(33,216.99)	(28,551.06)	(36,207.21)
Equity investments	100%	72.28	112.95	135.04	446.05	318.27	404.16
Held-to-hedge financial instruments	100%	210.07	345.57	212.85	1,301.49	826.63	1,026.72
Held-to-maturity financial instruments	100%	121.41	70.98	50.20	32.30	19.20	16.01
Investment in property	100%	-	-	-	-	-	-
Intangible assets	100%	1,037.35	1,000.45	451.80	774.26	441.49	532.26

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Table F.31 –continued from previous page

Standard Chartered		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital (£m)		**(28,120.29)**	**(37,071.34)**	**(34,856.37)**	**(68,860.20)**	**(62,809.21)**	**(78,170.46)**
Net Cash Capital Ratio (%)		**49.53**	**47.84**	**53.03**	**55.69**	**47.98**	**48.64**
Fixed assets	100%	928.37	1,123.24	1,451.78	3,130.22	2,540.58	2,886.73
Other assets	100%	5,439.19	6,783.48	8,031.50	19,930.05	12,603.20	17,572.76
Total Illiquid Securities	**Weights**	**4,688.52**	**10,026.21**	**6,813.95**	**10,978.73**	**9,767.05**	**12,013.60**
Treasury and other bills	2%	115.19	129.75	117.14	291.78	234.78	229.23
Debt securities	10%-100%	4,492.52	9,781.59	6,509.31	10,478.37	9,379.12	11,542.55
Equity securities	15%	80.81	114.86	187.50	208.58	153.16	241.82

Notes: 1. ‘ - ’ denotes no information provided by the bank.

Table F.32: Standard Chartered's Stress Long-term Liquidity Position

Standard Chartered		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital (£m)		**(30,485.74)**	**(35,312.34)**	**(37,750.67)**	**(75,261.33)**	**(67,716.47)**	**(83,150.10)**
Net Cash Capital Ratio (%)	%	**47.51**	**49.05**	**51.04**	**53.49**	**46.11**	**47.10**
Long-term Funding	**Weights**	**27,595.76**	**33,999.28**	**39,356.30**	**86,555.89**	**57,938.54**	**74,023.87**
Deposits by banks due in more than 1 year	100%	528.56	338.32	351.40	1,253.48	777.10	416.97
Customer deposits due in more than 1 year	100%	1,806.48	2,298.81	2,905.58	5,645.92	2,610.55	6,292.91
Financial liabilities designated at fair value due after 1 year	100%	-	-	-	-	-	-
Derivative cash flow due in more than 1 year	100%	1,812.12	2,931.93	6,242.87	30,170.92	12,364.80	16,708.72
Senior debt due in more than 1 year	100%	3,388.20	4,767.04	4,795.10	7,594.23	7,885.51	9,493.49
Other funding due in more than 1 year	100%	6,447.74	7,792.22	6,100.30	10,558.60	7,554.24	9,724.71
Subordinated debt due in more than 1 year	100%	5,844.08	6,319.78	7,649.48	12,951.22	9,911.53	10,019.98
Equity	100%	7,768.58	9,551.17	11,311.57	18,381.53	16,834.81	21,367.08
Hybrid capital securities	100%	-	-	-	-	-	-
Total Illiquid Assets	**Weights**	**51,027.53**	**61,044.41**	**67,398.72**	**144,437.37**	**110,980.70**	**140,180.73**
Net loans	100%	63,128.38	72,171.33	77,441.53	152,039.98	122,782.41	153,949.30
(Residential mortgages)	-80%	(19,909.51)	(20,563.60)	(20,375.98)	(33,216.99)	(28,551.06)	(36,207.21)
Equity investments	100%	72.28	112.95	135.04	446.05	318.27	404.16
Held-to-hedge financial instruments	100%	210.07	345.57	212.85	1,301.49	826.63	1,026.72
Held-to-maturity financial instruments	100%	121.41	70.98	50.20	32.30	19.20	16.01
Investment in property	100%	-	-	-	-	-	-
Intangible assets	100%	1,037.35	1,000.45	451.80	774.26	441.49	532.26

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Table F.32 –continued from previous page

Standard Chartered		**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Net Cash Capital (£m)		**(30,485.74)**	**(35,312.34)**	**(37,750.67)**	**(75,261.33)**	**(67,716.47)**	**(83,150.10)**
Net Cash Capital Ratio (%)	**%**	**47.51**	**49.05**	**51.04**	**53.49**	**46.11**	**47.10**
Fixed assets	100%	928.37	1,123.24	1,451.78	3,130.22	2,540.58	2,886.73
Other assets	100%	5,439.19	6,783.48	8,031.50	19,930.05	12,603.20	17,572.76
Total Illiquid Security	**Weights**	**7,053.96**	**8,267.21**	**9,708.24**	**17,379.86**	**14,674.32**	**16,993.24**
Treasury and other bills	17%	979.09	1,102.90	995.66	2,480.09	1,995.59	1,948.50
Debt Securities	23%-100%	5,924.02	6,949.90	8,362.59	14,510.42	12,392.82	14,593.34
Equity securities	28%	150.84	214.41	349.99	389.35	285.90	451.40

Notes: 1. ‘ - ’ denotes no information provided by the bank.

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