

WHITEPAPER
MARCH 2015**An Enhanced Liquidity Risk Management
Framework for Banks**

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Summary

Basel III emphasizes the elevated importance of liquidity risk management. As per the regulations, most of the requirements are articulated around a set of qualitative and quantitative requirements to effectively monitor and proactively manage a financial institution's liquidity risk profile. This whitepaper reviews the requirements and discusses how institutions can meet the regulatory requirements on liquidity risk management by enhancing their liquidity risk analytics, funds transfer pricing methodologies, liquidity stress testing frameworks, and enterprise risk management stages. This paper also highlights the planned European Banking Authority's (EBA) Additional Liquidity Monitoring Metrics (ALMM), funding plans for credit institutions requirements, and the Federal Reserve's Comprehensive Liquidity and Asset Review (CLAR) framework. The paper shows the advantages of including internal behavioral models into an institution's liquidity risk management practices to enhance returns and exploit competitive advantages related to their balance sheet composition, funding structure, and business model.

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Understanding Liquidity Risk

Financial industry regulators have identified “ineffective” liquidity management as a key characteristic of the crisis and highlighted the lack of attention that liquidity risk received relative to other risks. For example, the UK Financial Services Authority (FSA) stated that “measuring and managing bank liquidity risk is as important as capital or 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.”

The market turbulence that began in late 2007 demonstrated the interconnectedness between liquidity risk and both financial (i.e. market and credit risk) and non-financial risks (i.e. operations/reputational risk), and the need to manage them from an enterprise-wide risk management context. For example, the 2007–2008 crisis began with credit quality deterioration of structured credit assets linked to the performance of subprime mortgages. Subsequently, this event triggered SIV funding problems, which eventually led to liquidity and solvency difficulties. From a practical point of view, liquidity risk to a bank's earnings and capital arises from its inability to timely meet obligations when they come due and at a reasonable cost. Although liquidity risk is inherent to the banking business, given the maturity transformation¹ between assets and liabilities, it has not been explicitly addressed in a global regulatory framework² until recently.

In general, there are three central topics that must be managed in order to effectively address firm-wide exposure to liquidity risk:

- » Market liquidity risk which is oriented around price changes and P&L impacts.
- » Funding liquidity risk which addresses cash flow estimation (assets as well as liabilities).
- » Contingency planning (including liquidity stress testing) which considers how, in the absence of market or funding liquidity, a financial institution can continue to meet obligations, particularly during periods of stress.

Banks must also be mindful of future developments in the regulations. For example, the EBA's 2014 announcement of the ALMM and Funding Plan requirements, add an additional level of complexity to a bank's liquidity risk management and compliance.

Having a liquidity risk management program is a necessary condition for effective liquidity risk compliance. A program should begin first with an enterprise-wide governance framework addressing the core liquidity risk questions at the institution:

- » What is the connection between reputation, credit, interest rate, and funding risk?
- » How does credit risk impact market liquidity risk?
- » What is the right funds transfer price given the institution's balance sheet composition and business model?
- » What assets and liabilities should be subject to funds transfer pricing?
- » What asset and liability behaviors might affect the liquidity risk of the institution?
- » Can non-contractual commitments create capital and funding problems?
- » What is the funding cost under different stress test scenarios?

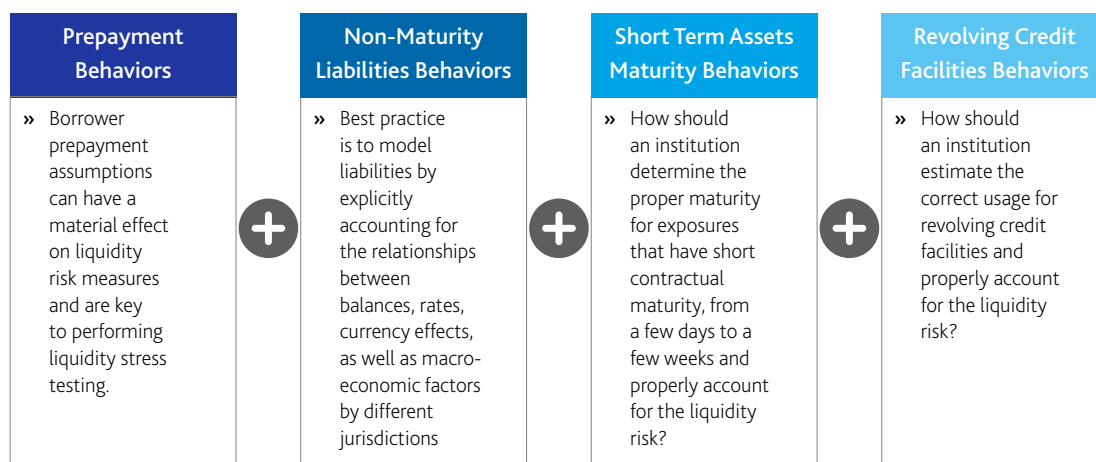
¹ Banks' assets and liabilities are often maturity-mismatched, with long-term assets funded through short-term liabilities.

² Basel III liquidity standards, Financial Services Authority revised liquidity standards, Federal Reserve proposed rules on liquidity risk, Hong Kong Monetary Authority LM-2, Chinese Banking Regulatory Commission, Monetary Authority of Singapore, and Committee of European Banking Supervisors guidelines on liquidity buffers, among others.

Modeling Custom Behaviors Is Critical To Liquidity Risk Management

A central aspect of the Basel III regulations involves accurate measurement of the liquidity profile of the balance sheet. This, in turn, relies on a comprehensive characterization of behaviors of both assets and liabilities under different scenarios. Figure 1 shows the major behaviors that should be modeled for the purpose of liquidity risk management.

Figure 1 Behavioral Models: Building Blocks



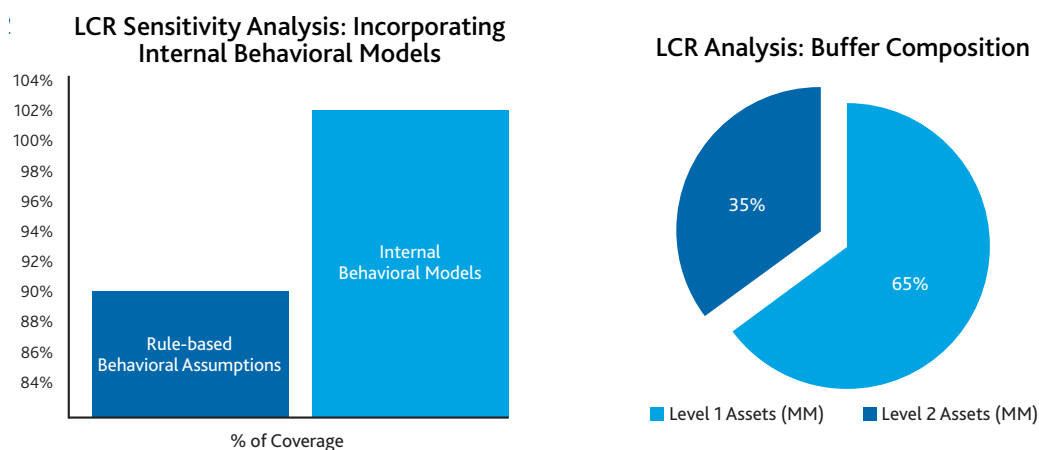
Institutions around the world are adjusting their business models, balance sheet composition, and strategy in response to the effects of the liquidity risk regulatory requirements: i.e., portfolios with shorter maturities, simpler deal structures, limited exposure to illiquid assets, and increasing competition for deposits. In this case, institutions should leverage internal behavioral models, exploit hidden competitive advantages and reduce their liquidity-driven regulatory costs.

For example, including institution-specific, forward-looking behavioral assumptions on the cash flow analysis and liquidity ratios calculation has significant advantages over a rule-based approach because the balance sheet composition, strategy, and funding profile are taken into account in the simulation. This results in more realistic results produced through the better management of assets and liabilities' behaviors. Liquidity cost reductions for the liquidity ratios calculation are also achieved, and customer stickiness can be maximized. Overall, this represents an opportunity for return enhancement over using standard behavioral assumptions that often don't accurately reflect an institution's business model—with the resulting ratios being too severe

Figure 2 shows an example. In this case, incorporating internal behavioral models into the liquidity coverage ratio (LCR)³ calculation increases the ratio from 90% to 102% thus reflecting the real liquidity risk and funding profile of the institution. Moreover, the internal behavioral models reflect competitive advantages that can be used to enhance an institution's returns.

³ Please see the "Basel III standard liquidity ratios" in this document for further information.

Figure 2: LCR Sensitivity Analysis and Buffer Composition



An internal set of behavioral models enhances the cash flow simulation and forecasting analysis by explicitly reflecting an institution's business and funding model. For example, the parameterization of behavioral assumptions in asset liability management (ALM) systems is a crucial step to setting up those systems. However, institutions usually do not pay enough attention to the behavioral analysis in order to reflect accurately their balance sheet structure in the calculation. As a result, institutions may be incurring significant inaccuracy in their cash flows projections, funds transfer pricing metrics, funding assumptions, and liquidity analysis.

For example, analyzing borrower prepayments can have a material effect on liquidity risk measures and funds transfer pricing calculations. At this stage, behavior of retail and corporate borrowers must be modeled separately. The prepayment decision of corporate borrowers usually follows a function of a state-dependent rational exercise. Retail borrowers' prepayments should be analyzed using a set of explanatory factors, capturing borrower specific information, seasonal variation, market rates, marketing campaigns, and macro-economic factors. The determination of the proper maturity for exposures that have short contractual maturity but are typically subject to review and renewal at contractual maturity can also affect an institution's liquidity gap metric, net interest income, or earnings at risk measures. The lack of granularity on the utilization measurements for revolving credit facilities⁴ also has a material effect on liquidity buffers and funding as well: higher usage implies higher funding needs and therefore higher liquidity risk.

Finally, developing internal behavioral models helps institutions to overcome data limitations and granularity problems for balance sheet analysis, facilitates the empirical validation of their internal behavioral assumptions for regulatory purposes, and enhances returns.

Enhancing Basel III Standard Liquidity Ratio Analysis

Basel III⁵ introduced two minimum standard ratios to proactively manage and monitor liquidity risk at financial institutions: the liquidity coverage ratio (LCR) and the net stable funding ratio (NSFR). The regulatory standard requires that institutions should meet a minimum ratio of 100% continuously. Both ratios are being deployed under a transition observation period⁶ to ensure that institutions have the necessary time to adjust their funding structure and implement the necessary analytics and enterprise-wide risk architecture to support their calculation and reporting during the process.

⁴ "Measuring the exposure at default of credit lines", Jing Zhang, Moody's Analytics.

⁵ "International framework for liquidity risk measurement, standard, and monitoring". Bank of International Settlements.

⁶ The LCR ratio comes into effect in 2015, and the NSFR in 2018.

The LCR⁷ reflects a bank's ability to convert high-quality, unencumbered liquid assets to cash to offset projected cash flows during a one month period. Therefore, it is related to an institution's amount of available liquid assets to offset the projected amount of outflows over a thirty days period.

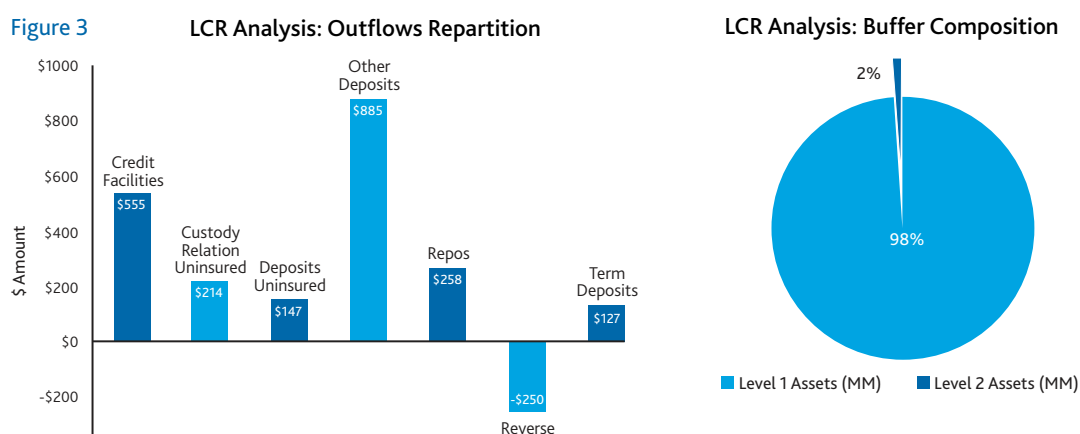
The NSFR⁸ requires banks to maintain enough funding that is expected to be stable to cover potential uses of funds over a one-year period. It relates to an institution's amount of stable funding needed to offset the liquidity of the assets being funded over a one year period.

The LCR and NSFR calculation assigns a rule-based set of weights based on a set of standard behavioral assumptions to an institution's assets and liabilities to reflect future stressed market conditions. These weights may make some assets more attractive than others when calculating the ratios. The ratios mean a stronger integration between credit and liquidity risk management, and their calculation requires credit and liquidity risk information. As a consequence, institutions must analyze their cash flow data, credit data, and other supplementary data to facilitate the calculation and ratios parameterization. At this stage, an analysis of the assets that can be eligible to be included for the liquidity ratios calculation must be performed as well. From a methodological perspective, institutions should be able to calculate both ratios based on their own internal behavioral models to accurately reflect their real funding profile and balance sheet composition. This would help to enhance returns as well. For example, small changes when defining an institution's amount of core deposits can have a significant effect on the required capital to fund new assets when computing the NSFR to offset a reduction of available funding. Therefore, an accurate characterization of an institution's internal behaviors is critical for the allocation and calculation of liquidity requirements in a way that does not overestimate the cost of the liquidity buffers (thus enhancing returns).

From an operational perspective, an institution's liquidity management platform should be able to drill down into each ratio to see the detailed underlying liquidity position and asset composition during the calculation process. The institutions should also have a warning indicators framework to monitor ratios, data accuracy and quality, and take actions before changes occur.

Figure 3 shows the outflows repartition dashboard and buffer composition analysis for the LCR⁹ for a sample balance sheet.

Figure 3: The Outflows Repartition Dashboard and Buffer Composition Analysis for the LCR



7 Formally, the LCR is defined as $\frac{\text{Stock of high-quality liquid assets}}{\text{Total net cash out flows over the next 30 calendar days}} > 100\%$

8 Formally, the NSFR is defined as $\frac{\text{Amount of stable funding}}{\text{Required amount of stable funding}} > 100\%$

9 For illustrative purposes only: analysis generated using Moody's Analytics RiskAuthority™ regulatory capital management solution

Managing Regulatory Enhancements

As banks have begun to implement the core Basel III regulations covering liquidity, some regulators have continued to fine tune the regulations. Their aim is to provide greater transparency and reduce the impact on tax payers and the real economy, in the event of a future banking crisis. These additional regulations will typically be implemented on a regional basis, creating an additional level of management complexity for banks.

For example, in 2014, the EBA published two draft regulations, that cover ALMM and the funding plans of credit institutions. The ALMM requirements highlighted the need for additional liquidity requirements covering:

- » A maturity ladder
- » Concentration of funding by counterparty
- » Concentration of funding by product type
- » Concentration of counterbalancing capacity by issuer/counterparty
- » Prices of various lengths of funding
- » Rollover of funding
- » Forecasting of LCR and NSFR

The requirements will provide an additional data collection, calculation and reporting challenge for banks. As well as reporting these results, banks will need to align them to their LCR and NSFR reports, as well as Pillar 1 and 3 reports, COREP and FINREP reports and other stakeholder reports.

The EBA has also published draft requirements for funding plans of credit institutions, designed to mitigate the need for banks to draw on government funding, should they need to be liquidated at a future date. This draft regulation is different from other regulations, as banks do not have to adhere to specific ratios. Instead, banks have to satisfy their regulators that their rolling 3-year business plans, covering assets and liabilities, can be properly funded, without government support, based on current projections. The EBA has published templates, that cover, for example, projected assets, liabilities, liquidity forecast ratios, asset yields, funding costs, funding mismatches, and identified re-structuring costs.

Again these results must be calculated, and reported, and remain consistent with other reports submitted to regulators and stakeholders. Furthermore, the calculations and models used to forecast the results need to be robust, realistic and practical.

In the US, in addition to the LCR and NSFR ratios, the Federal Reserve has introduced an additional liquidity test, the Comprehensive Liquidity and Asset Review (CLAR). The goal is to measure liquidity risk at both an institution and system level in a similar fashion to the Comprehensive Capital Analysis and Review (CCAR), but only for some large institutions initially. CLAR tests a bank's ability to meet funding obligations under periods of stress. Depending on the results of this test, banks may be forced to change their funding sources or structure. Unlike the CCAR, the results of the CLAR and their methodological framework are not made public.

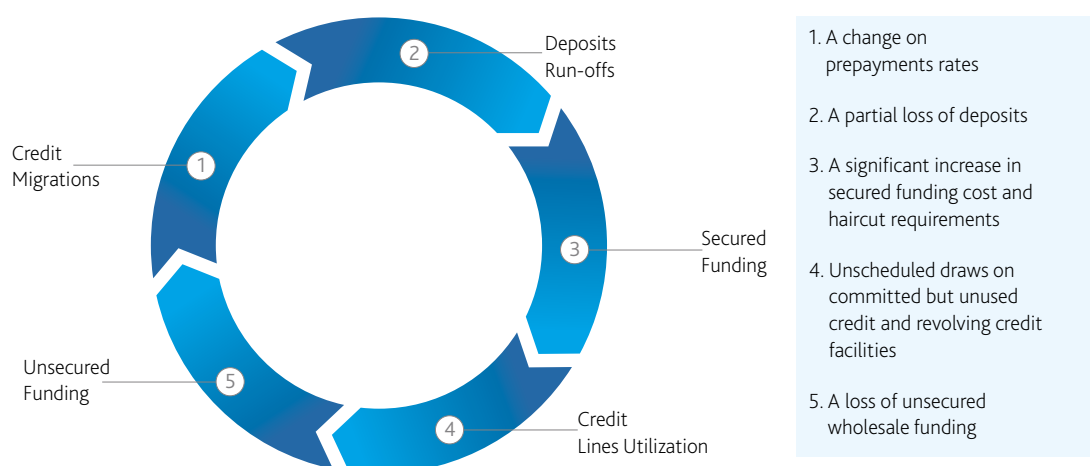
The CLAR requires institutions to calculate a series of liquidity and funding stress testing metrics based on behavioral assumptions and projections that accurately reflect their true funding profile and balance sheet composition under different scenarios.

Again these results must be calculated, reported, as well as remain consistent with other reports submitted to regulators and stakeholders.

Liquidity Stress Testing As A Liquidity Planning Tool

The goal of liquidity stress testing is to analyze if an institution's funding sources would be enough to withstand unexpected market disruptions given its balance sheet composition, funding profile, and business strategy. From a regulatory point of view, the institutions should have a set of qualitative and quantitative tools to meet Basel III's liquidity risk management requirements and streamline their liquidity stress testing process. An institution should have a contingency funding plan ("CFP") to address its liquidity needs and incorporate quantitative information generated during the liquidity stress testing process as well. This CFP should be regularly updated to include any new regulatory and/or business model changes. Figure 4 outlines some of the elements that should be considered when performing liquidity stress testing to determine the resiliency of an institution's balance sheet.

Figure 4: Liquidity Stress Testing: Determining An Institution Balance Sheet's Resilience



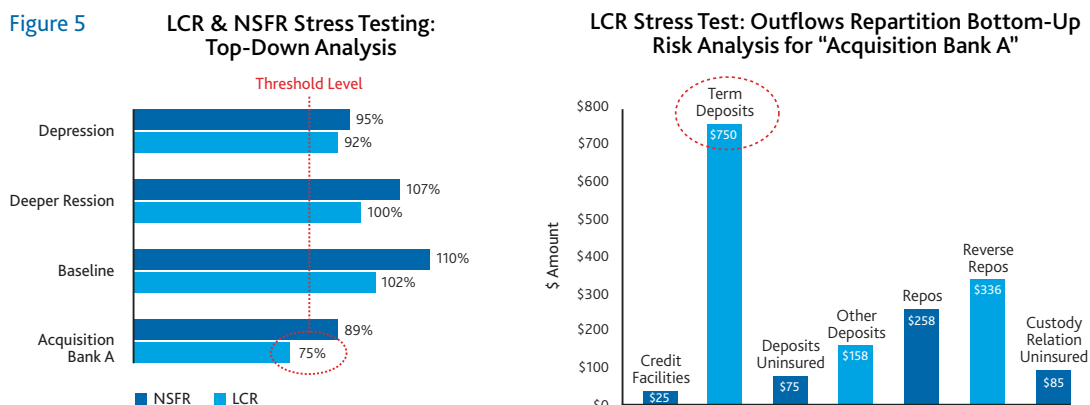
An early warning indicators framework should facilitate the monitoring of emerging liquidity stress events (that impact an institution's liquidity ratios). Proper liquidity policies and governance frameworks should be developed and updated according to Basel III requirements to review business line and product liquidity risk.

Institutions should have the infrastructure and liquidity analytics in place to perform cash flow projections under different scenarios and generate the necessary stressed regulatory required buffers and contingent liquidity metrics. In order to accurately reflect the business model of the institution, customized, forward-looking scenarios should be developed and incorporate custom financial, behavioral, and economic variables according to the institutions' balance sheet composition and jurisdiction-specific regulatory requirements.

Figure 5 shows an example¹⁰. In this case, the stressed liquidity ratios are calculated under a set of scenarios using a top-down approach. This calculation has the advantage of reducing the computational time and analysis cost because no cash flows are re-calculated using an ALM system at this stage. Then, the stressed levels are compared against a threshold for liquidity planning and compliance purposes. This calculation allows senior management to identify potential scenarios that are sources of liquidity and funding risk. Finally, a detailed, granular, bottom-up analysis of those high-risk scenarios is performed as well (scenario "Acquisition Bank A").

¹⁰ For illustrative purposes only: liquidity stress test analysis generated using Moody's Analytics Scenario Analyzer™ and RiskAuthority, Moody's Analytics solution for regulatory capital management.

Figure 5: LCR & NSFR Stress Testing: Top Down and Bottom-up Analysis



The institution should analyze the uncertainty of rolling-over assets, its ability to maintain a competitive and profitable position and generate new businesses under periods of liquidity stress. A limits framework to identify potential sources of liquidity risk and concentrations of funding should be designed, implemented, and updated regularly. Finally, institutions should have a customized set of liquidity stress testing reports by jurisdictions to meet the regulatory and internal stakeholder requirements. In order to do this, an enterprise liquidity risk solution should centralize the relevant information and methodologies relating to liquidity management and liquidity stress testing. An enterprise-wide risk management solution would facilitate a consistent analysis across scenarios of the credit, funding, liquidity, and solvency risk profile of an institution as well.

Including Contingent Liquidity In Funds Transfer Pricing

Regulators have emphasized the role of contingent liquidity in the new regulations across jurisdictions, and the need of including this metric into an institution's liquidity risk management framework. Contingent liquidity relates to the cost of maintaining a sufficient cushion of high quality liquid assets to meet sudden or unexpected funding obligations and absorb potential losses. A funds transfer pricing (FTP) process¹¹ is the central component of asset and liability management, as it facilitates risk transfer, profitability measurement, capital allocation, and business unit incentive alignment. The contingent liquidity comes with a real cost for the institutions because it is related to the cost of the liquidity buffers. Therefore, contingent liquidity should be allocated into the institutions' FTP framework in order to manage origination activities.

The FTP components depend on the assets and liabilities to be transferred, which is driven by the business model, balance sheet composition, and desired future state. For example, for corporate loans, the FTP components should include a credit spread, which compensates the financial institution for bearing credit risk associated with the exposure, as well as an option spread, which is a premium that compensates the bank for any embedded options in the contract (e.g. prepayment options).

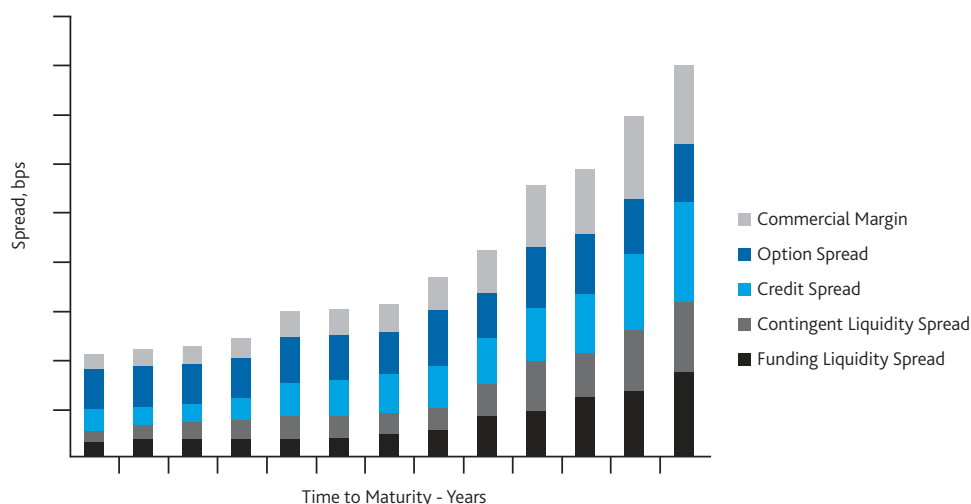
The FTP framework at the institution should be also able to include in the calculation the funding liquidity spread, which is the expected cost of funds required to support the exposure to its remaining life, and the contingent liquidity spread to compensate for the cost of maintaining a sufficient cushion of high quality liquid assets to meet unexpected obligations. Figure 6 illustrates the effect of including contingent liquidity¹² into the FTP components for a wholesale loan portfolio under different effective¹³ maturities: the longer a loan's maturity, the higher the contingent liquidity buffer.

¹¹"Implementing High Value Funds Transfer Pricing Systems". Robert Wyle and Yaakov Tsaig. Moody's Analytics modeling methodology paper.

¹² For illustrative purposes: contingent liquidity analysis performed using Moody's Analytics behavioral models suite and Moody's Analytics FTP model.

¹³ The effective maturity takes into account potential optionalities (i.e. prepayments) embedded in the loans. Therefore, it is usually different than the contractual maturity.

Figure 6: Funds Transfer Pricing Grid: Spread Decomposition Analysis

Figure 6 Fund Transfer Pricing Grid: Spread Decomposition Analysis

Integrating Liquidity Risk Within Enterprise Risk Management

A liquidity risk management framework should be integrated into an institution's enterprise risk management platform. It is best practice to integrate data management infrastructure, behavioral analytics, cash flow calculation systems, and liquidity reporting systems into an enterprise risk management platform to reduce costs, improve efficiency, and automate the calculation of the regulatory requirements. This integration facilitates a consistent liquidity analysis across jurisdictions and reporting for the regulators and internal stakeholders as well. From a liquidity compliance perspective, institutions should have the infrastructure and systems to generate pre-configured liquidity ratios reports by different regulatory jurisdictions. The institutions should also maintain the liquidity metrics history for trend analysis, auditing, and benchmarking. From a workflow and data management perspective, institutions should develop centralized liquidity risk management infrastructures that strive to integrate data, analytics, and reporting. All information critical to calculating, managing, reporting, and monitoring the liquidity ratios should be easily and cost-effectively available. Finally, a liquidity risk management platform should allow the integration of customized scenarios and internal behavioral assumptions in order to analyze, calculate, and report liquidity metrics effectively across several dimensions and for each legal entity of an institution.

About Us

Moody's Analytics provides an end-to-end enterprise risk management solutions for the risk management needs faced by institutions across the globe. Moody's Analytics solutions draw upon unique software, cutting-edge analytics, data and resources.

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