

A liquid diet



In the last of the five part series, **Carlos Blanco***, **Kevin Dowd*** and **Robert Mark*** look at liquidity risk

A firm's survival depends on its ability to manage its liquidity, and the management of liquidity risk is an increasingly important concern for energy and commodity trading firms. Recent policy, methodology and infrastructure developments in risk management create the potential for additional value-creation through proactive liquidity risk management.

Components

A liquidity risk management framework can be defined in terms of a policies-methodologies-infrastructure framework (see Figure 1). The components of this framework are:

□ **Policies** – A clearly articulated liquidity risk strategy set out in written policies and procedures, with clear lines of authority and effective disclosure

□ **Methodologies** – Metrics to measure and monitor liquidity risk, including stress-tests and performance measurement

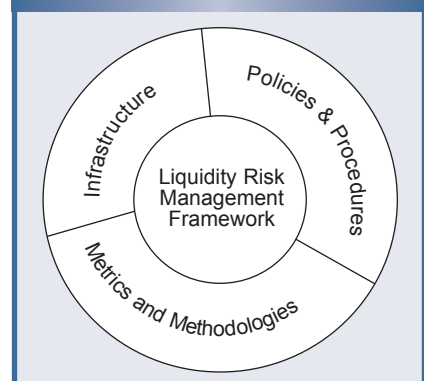
□ **Infrastructure** – Having in place the right people with access to the right information in a timely fashion.

The first step within the policies component is to form a liquidity risk strategy which can be translated into procedures that set out operating standards. These procedures should be congruent with the business strategy and cover both funding liquidity and trading liquidity risk.

Liquidity risk management should not be mistaken for 'crisis management', even though it is commonly the case that lack of planning often forces companies to address liquidity risk management issues only when crises occur. For example, it should be self evident that firms should secure adequate access to

credit lines before a stress event takes place. In doing so, a key goal is to avoid concentration of debt payments, particularly in short-term maturities. It is also very important to maintain cordial relations with banks and other suppliers of

Figure 1. Policies, methodologies and infrastructure framework



Types of liquidity risk

There are two main types of liquidity risks:

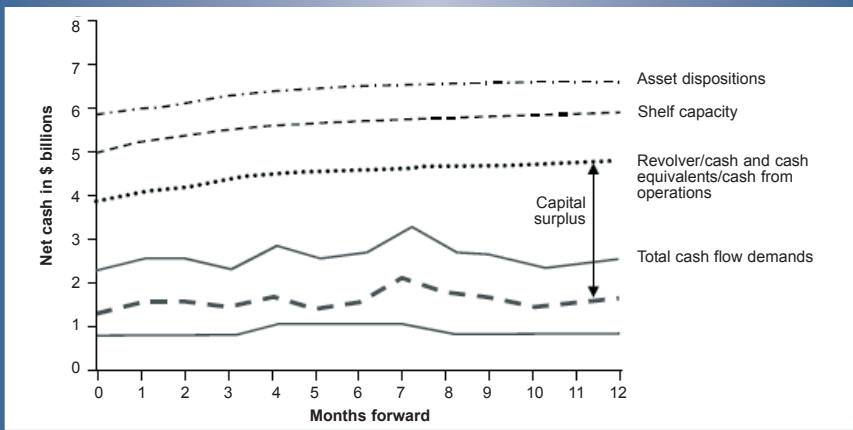
Funding liquidity risk is the risk arising from not being able to meet collateral and margin calls, not being able to honour cash obligations and not being able to access the capital markets or other sources of finance when funds are needed. China Aviation Oil Singapore recently experienced a \$550m loss which arose when the firm was unable to meet collateral and margin calls

Trading liquidity risk is the risk of not being able to exit a trading position without incurring significant costs. The classic example was in 1993, when Metallgesellschaft AG (MG) lost \$1.4bn after a failed hedging strategy put together by one of its traders (commonly referred to by his colleagues as a “cowboy without cattle”). The hedging strategy consisted of building large exposures in long-term forward contracts which were hedged by regularly ‘rolling over’ futures contracts. This hedging strategy was poorly designed because it failed to take account of the very large liquidity risks it created. Large margin requirements then put unbearable pressure on MG’s liquidity, and led to the company having to liquidate its hedges at massive loss. □

Should we use VaR or LaR?

Let’s assume that we have a large market-risk position that we hedge with a futures contract that closely follows the behaviour of the underlying exposure. The futures hedge leaves us exposed to the possibility of margin calls, and our exposure to margin calls will be related to the size of the futures position, which corresponds to the gross size of our original position. In this case, the Value at Risk (VaR) depends largely on the netted or hedged position, whilst the Loss at Risk (LaR) depends on the larger gross position. If the hedge is a good one, the basis risk (or the VaR) will be low relative to the gross risk of the hedge position (or the LaR), and so the LaR can easily be an order of magnitude greater than the VaR. On the other hand, there are also many market risk positions that have positive VaR, but little or no cashflow risk (eg, a portfolio of long european option positions, which generates no cashflows until the position is sold or the options expire), and in such cases the VaR will dwarf the LaR. So the LaR can be much greater than the VaR or much less than it, depending on the circumstances. □

Figure 2.
Example of forward-looking liquidity adequacy disclosure



Source: CCRO Emerging Practices to Assess Capital Adequacy (White Paper)

capital while simultaneously aiming to avoid excessive dependency on external sources of financing. Firms should bear in mind some ‘committed’ lines of credit might not be honored in times of stress and in such circumstances a firm may have limited ability to secure new funds at short notice.

The policy should also outline contingency plans as well as the role and authority of the liquidity management team in the event of a crisis. Contingency plans should detail strategies to handle unexpected events that might severely strain the firm’s liquidity and also ensure that firms get secure access to cash under such circumstances.

A key building block of best practice liquidity management is to disclose liquidity-related risks promptly and effectively. This disclosure should be both internal (ie, to other parties within the firm) and external (ie, to external

stakeholders). Good disclosure promotes confidence in the firm and enhances its credibility. In Figure 2, we can see a forward-looking disclosure suggested by the Committee of Chief Risk Officers (CCRO) of the expected liquidity supply and demand conditions 12 months forward. The disclosure is broken down by the largest supply and demand components and the chart reports the likely capital surplus/deficit. This information allows interested parties to evaluate the liquidity or cash flow health of the firm.

The major sources of liquidity risk can also affect the firm’s exposures to market risk, credit risk and operative risk (defined as the sum of operational and operations risk). These risks are often interrelated, and therefore modelling of market, credit and operative events should be done jointly in order to understand a firm’s overall liquidity risk profile.

Liquidity risk modelling

A best-practices liquidity risk management framework rests on an appropriate system of metrics that can provide insights into the liquidity position of the firm at any time and identify scenarios that could result in liquidity shortfalls.

In order to estimate liquidity risk, we need a framework that explicitly focuses on the potential demand and supply of cash. This framework should address medium- and long-term horizons as well as the cost of liquidating positions in a stressed market environment. The horizon choice should also take into account the expected “unwinding” or “neutralisation” period for the different instruments and assets in the portfolio.

The modelling framework must also take account of the complexities involved with liquidity, particularly for long horizons, and the number of risk factors involved. One-step simulations tend to over-simplify both market events

and portfolio response to those events. We can think of modelling liquidity risk as the equivalent of modelling a path-dependent option such as a barrier or digital option, where insolvency results if the barrier is hit at any point during the period being modelled. In addition, the modelling must also take account of dynamic portfolio management, or the way in which the institution responds to events (eg, through stop-loss triggers, VaR-based limits, and so on).

In many ways, the ideal is a multi-period dynamic framework in which portfolio positions are allowed to evolve dynamically as scenarios unfold. This would take account of pre-specified trading rules, dynamic hedging, and the ways in which prices and the amounts traded depend on the market liquidity. This type of framework could also take account of important features of liquidity crises, such as large drops in asset prices, large increases in volatilities, and crisis-driven changes to bid-ask spreads.

It is also important to use the appropriate approaches for tail risks (eg, such as power-law tail or extreme-value approaches), and to use superior risk measures (ie, coherent risk measures such as the expected tail loss (ETL), rather than the VaR).

In many cases, a well-designed set of tests which work to combine market, credit and operational events can provide powerful insights into potential exposure and associated liquidity problems under periods of market stress (see Figure 3). These should also attempt to model other participants' behaviour under stress circumstances

CFaR models focus on the potential demands on cash versus sources of cash available at any point in time. A best-practices framework models the key drivers that could increase the demand for cash relative to the available sources. For a potential distribution of outcome, those stress-tests could be probability-weighted by the modelers and a distribution of possible outcomes could be determined. CFaR and LaR metrics can then be calculated based on the results for these scenarios.

For each scenario:

1. Stress or simulate market prices at multiple horizons using a realistic model of the evolution of the spot price and forward price curves. As far as possible, the price processes should be

consistent with those from market and credit risk simulations, but the underlying assumptions about the price process should also be as realistic as possible. So, for example, if we are modelling electricity or natural gas price behaviour, price spikes should be incorporated in the models, even if market or credit risk models are based on other distributions

2. Calculate MtM by counterparty, legal entity or contract-by-contract basis

after taking into consideration netting agreements and other contract rules

3. Stress or simulate possible contingencies that could "trigger" collateral and margin calls or impact the financial liquidity of the firm. Those events could range from a possible company credit downgrade below investment grade to counterparty defaults, operational events that could impact the financial health of the firm, and so on

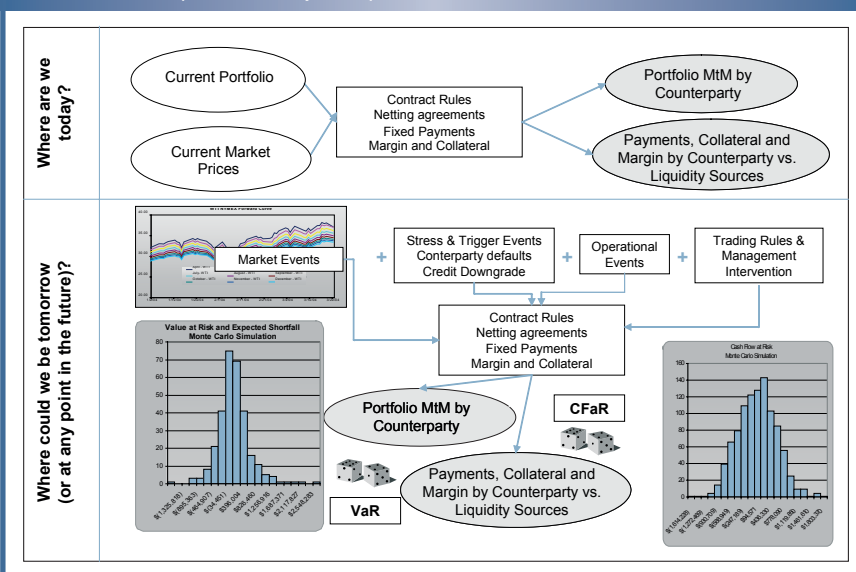
Limitations of traditional modelling assumptions

Traditional VaR models make simplifying assumptions about the behaviour of the material risk factors (eg, the joint probability distribution of their rate of return.) It is common practice to assume that the risk factors are lognormal, or equivalently that the percentage price change is normally distributed, ie, have a "smooth" behaviour that excludes the possibility of jumps and other extreme events. These simplifying assumptions reflect "normal market conditions". Traditional VaR models are, by construction, static. Increasing the risk horizon from one day, to ten days, one month or one year does not make the model more dynamic. They are one-period models, and the positions remain unchanged over the risk horizon. The model does not typically accommodate intra-day decisions to change the portfolio's structure.

VaR models also typically assume that the market regime is stationary. They are also supposed to exhibit constant volatilities and correlations, which are calibrated using data from normal market conditions with liquid markets. It is also common practice to assume that VaR models are based on sufficient data to estimate volatilities and correlations. Clearly, liquidity risk cannot be factored into this traditional static framework.

Choosing the right variables to model in the risk analysis (eg, mark to market (MtM), earnings or cash flows), the material risk factors (eg, spot versus forward prices, implied volatilities, volume, counterparty risk, rating downgrades and so on), trading strategy and liquidation period (eg, stop-loss, delta-neutral, taking positions until expiration), and the right risk metric (VaR, expected tail loss) are key decisions in terms of setting short-term and long-term capital requirements. □

Figure 3. Scenario analysis for liquidity risk



S&P guidelines for liquidity adequacy

S&P's liquidity adequacy guidelines focus on a company's liquidity under stress scenarios that combine a crisis of confidence in the firm's financial condition with large market moves. S&P indicates that these benchmark measures would allow them to establish minimum guidelines to enhance analytics and expedite comparisons between firms. S&P also clearly state that a shortfall from their guidelines could cause a rating downgrade.

S&P recommends that energy firms should stress-test their portfolio based on market-related events (such as a 30% shift in the next months in the forward curve and 20% in subsequent months) and credit events (such as a company downgrade to below investment grade that triggers collateral calls for all negative MtM positions).

The two key ratios analysed by S&P are:

- Credit event liquidity adequacy (CELA) = Primary liquidity/(negative current MtM + other liquidity calls)
- Market and credit risk liquidity adequacy (MCELA) = Primary liquidity (negative MtM with stress-test and other liquidity calls).

* Primary liquidity is defined as unrestricted cash on hand and availability under credit facilities, plus cash and letters of credit already posted to offset negative MtM exposures. However, secondary liquidity is also taken into account and includes a company's free cash flow, cash generated from selling inventory and receivables and uncommitted credit lines. Cash held as collateral is not considered as primary or secondary liquidity, and parent guarantees are only considered as liquidity under certain provisions.

Negative MtM and collateral exposures depend on the type of collateral triggers (eg, hard versus soft) in the event of a credit downgrade expressed in the trading agreement. Figure 4 presents a summary of margin and collateral arrangements common in energy and commodity trading contracts. □

the risks in illiquid positions. Such information can help to calibrate models and identify the liquidity consequences of particular types of events. Funding liquidity processes should also be regularly evaluated and tested, and these should also take into account the contingency plans developed for extreme circumstances.

Infrastructure

In the event of a liquidity crisis it is essential to have access to near real time information on current and expected major liquidity inflows and outflows. This requires that management information systems should produce timely, accurate, complete and meaningful information on all aspects of the firm's liquidity.

The company's systems should allow risk managers to conduct stress-tests on liquidity, and these should take into account both material contract clauses and aggregation rules by counterparty. Ideally, they should also allow for a pre-deal check against counterparty limits and provide an indication of the current and potential impact of trades on available liquidity. It is important to keep in mind that certain trades, particularly futures hedges, can severely drain the short-term liquidity of a firm.

Superior liquidity risk management is a key factor in maintaining a firm's financial health. One of the most talked-about issues in energy and commodity markets at the moment is the notion of a liquidity adequacy framework. Market participants, credit rating agencies, regulators and other stakeholders are pushing energy merchants to establish such frameworks in order to restore confidence in their ability to meet their financial obligations. Best-practices firms already have these in place, and other firms would be well-advised to follow suit as soon as they can. The old saying about international politics applies equally well to the energy markets: "Every man for himself, God for us all, and Devil take the hindmost". □

Figure 4.

Types of collateral and margin payments based on the credit worthiness of the counterparty

Collateral	Description
100% MtM	Based on negative, under-the-water or out-of-the-money MtM
>100%	To account for the high volatility and potential changes in exposure
Risk-based margin	Fixed amount or variable amount based on potential credit exposure or credit-VaR numbers
Credit rating based margin ladder	Variable collateral based on the credit rating. For strong credit ratings, the collateral may be below 100% of negative MtM, while for weakly rated counterparties, the collateral may be higher than 100%.

4. Stress or simulate operative events (eg, plant outage; pipeline blowup) that could have a material impact in the liquidity of the firm

5. Account for trading rules and management's intervention if certain thresholds are breached (eg, stop losses, VaR limits)

6. Determine cash inflows and outflows for each time step after taking into account fixed payments and contingent liquidity claims due to market and credit events.

The last building element in the model and methodologies component

of the framework is the regular validation and "backtesting" of the models used to manage trading and liquidity. The firm can also monitor trends in terms of liquidity use versus forecasts in order to diagnose discrepancies and correct for them.

Regarding trading liquidity risk, firms can collect information on bid-ask spread charges versus expected values, and monitor difficulties in closing down certain positions as well as evaluate alternative instruments (eg, futures contracts) and markets (eg, highly correlated commodities) to hedge some of

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