The power of cashflow based risk metrics

In our last Business Briefing we looked at how Value-at-Risk is still the most commonly used risk profile measuring tool in the energy industry but that, in practice, it provides very limited meaningful information. In this Business Briefing we turn to an alternative – cashflow based metrics - and address how the risks faced by energy and commodity firms can be assessed via metrics that allow for longer-term outlooks and incorporate risks from asset-backed trading.

Overview

Senior financial management typically focus on current and forecasted gross margins, revenue, earnings, cashflow, or profits – across their entire set of operations – and their impact on operating cashflow and ability to service debt repayments and pay dividends. Why then would more relevant cashflow based "at-risk" metrics such as: gross margin (GMaR), revenue (RaR) and cashflow (CFaR), not be used as the basis for risk management and reporting rather than the more short-term, market value based, Value-at-Risk (VaR) metric?

Too often there is a failure to address enterprise-wide risk management

In our previous Business Briefing we focussed on the risk metric that anecdotal evidence and recent surveys suggest is the staple metric for most firms – Value at Risk (VaR), but pointed to the fact that this is in practice often limited to only a part of the firm's activities, and should be reassessed with respect to the alternatives that are available to assess energy company's risks at the enterprise level.

Enterprise-wide risk management can be defined as "a systematic and disciplined process of identification, measurement, reporting and mitigation of risks across all business units and company operations, using a unified and conceptually coherent framework". For the purposes of this paper, the key part of this definition is that the risks are mitigated "across all business units and company operations". Too often, when you delve into the risk framework that many market participants work within, it is obvious that their risk measurement efforts focus on a (often small) part of the firm's activities. For a number of organizations the risk management function produces a VaR metric on their trading book, but within these organisations the trading book exists to hedge their physical asset portfolio, which is not even included in the risk calculation. Further, there are risk limits imposed on the trading book – even though the trading book is not linked to the physical asset portfolio.

The "new order" energy company - multiple commodities, multiple markets, multiple instruments, and multiple assets

Many energy & commodity firms have established asset-backed trading groups whose objective is to enhance the risk adjusted profitability of the physical assets based on market variables, their uncertainty, and the physical characteristics of the assets.

The typical portfolio make up of an energy company these days has 3 main components.

- The first is a mixture of physical assets, such as thermal, hydro & wind power plants, gas storage facilities, and pipelines or transmission lines. These assets are characterized by physical flexibilities and operational constraints, such as capacities, injection and withdrawal rates and costs, minimum up and down times, ramp up rates, minimum stable generation, and flow constraints.

- A second component of the portfolio is often a small number, but large volume, of complex financial transactions which are linked to the physical assets. These types of trade include virtual gas storage facilities, power and gas off-take agreements, tolling agreements, power purchase agreements, etc., and as these contracts essentially back-to-back the physical assets, they generally inherit the same flexibilities and constraints – tolling agreements for example often have clauses involving minimum up and down times, and scheduled maintenance periods.

- The third component of a typical energy company portfolio is a larger number of standard financial hedge contracts, such as futures & forward agreements, swaps, and options.

Traders and managers in the energy industry therefore transact in & manage across multiple commodities, multiple markets, multiple instruments, and multiple assets. In addition to the financial price variables of their banking counterparts, they are exposed to uncertainty in non price variables, such as temperature, wind, system & customer loads, hydrological flows, snow melt, etc.

A new approach to risk management is required

Investors, customers, credit rating agencies, and legislation are all increasingly pressing for transparent reporting and an objective display of an energy company's enterprise risk.

Any coherent framework that looks at mitigating risks across all business units needs to address this portfolio make up we have just described. This is very difficult to do, if not impossible, if the risk focus in an organization is on VaR.

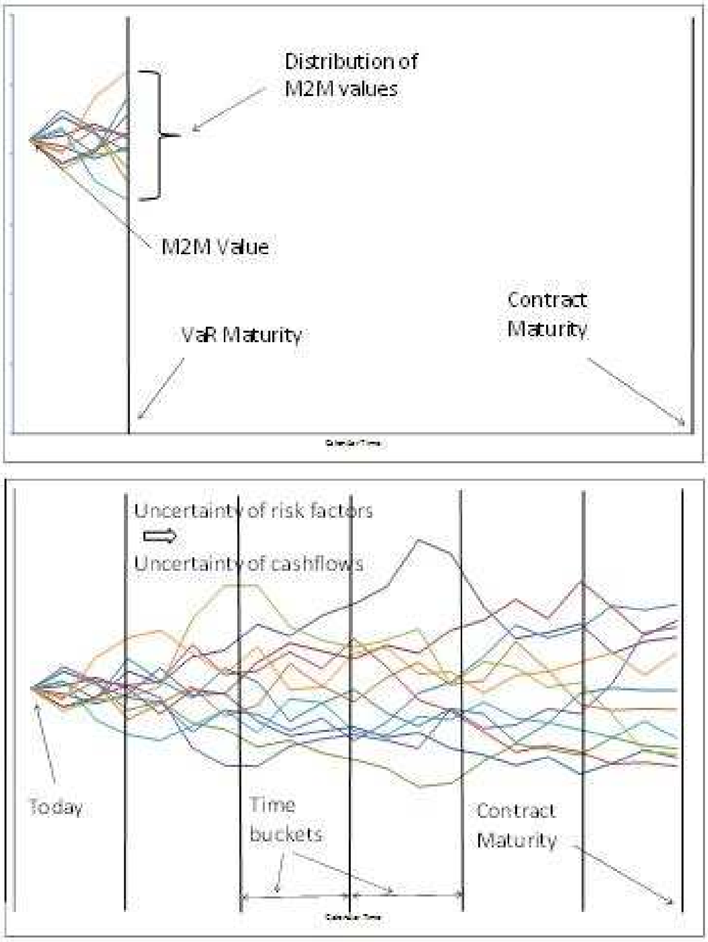
In energy markets, market value tends to be an insufficient statistic for corporate risk management decisions – additional factors not reflected in the 'market values' of assets and contracts affect shareholder value. Senior financial management meetings are typically focussed on current and forecasted gross margins, revenue, earnings, cashflow, or profits – across their entire set of operations – and their impact on operating cashflow and ability to service debt repayments and pay dividends. Gross margin (GMaR), revenue (RaR), cashflow (CFaR), etc. are therefore the relevant "at-risk" metrics that should be considered in this context. Although there are differences in these risk metrics for how cashflows are aggregated, in the following we will use the term Cash Flow at Risk (CFaR) to generically describe all of them.

So, how do cashflow based risk metrics differ from VaR?

1. *Time horizon.* The first main difference is in the time horizon typically considered. In the banking industry, the market value of financial products can normally be measured every day without too much effort. It is also equally easy to cover open financial positions quickly, with the use of standard derivative contracts. Therefore, financial institutions generally use a short-term time horizon of between 1 and 5 days for their reported risk metrics. With energy industry portfolios the asset and structured transaction components are not liquid, and a similar short term risk measurement horizon makes very little sense.

2. *Whole of life cashflow distributions vs a market value on a set date.* Secondly, CFaR looks at generating the cashflows associated with operating an asset, or generated under a financial contract such as a virtual storage contract or PPA, over the whole life of the asset, or at least for a number of years into the future. For example, for a thermal power plant, the hourly (or half hourly for many European markets) cashflows associated with operating the asset are calculated and involve the hourly revenue from selling the power and the associated costs of the generating fuel, emissions, variable operations & maintainance, etc, subject to the operating constraints of the asset. These cashflows are then aggregated up into distributions and reported for the risk metric. In contrast, VaR, characterises the potential mark to market value of all the contracts in the portfolio at a single point forward in time (e.g. 1 day).

The following figures illustrates this difference.



The first panel shows that the VaR maturity horizon is typically much shorter than the contract maturity (e.g. a 1 day VaR on a 3 year swap). The underlying uncertainty is evolved only until the VaR time horizon where the potential future mark-to-market values of the financial contract are calculated, a distribution formed, and a percentile calculation is made to obtain the VaR magnitude.

The second panel shows that for CFaR the underlying risk factors are simulated out until the end of the life of the asset, or contract, and this is implemented at the granularity of the market – typically hourly, or half hourly for power, and daily for other variables. At each time step a cashflow is calculated for every asset and contract in the portfolio. These cashflows are then aggregated into time buckets, often monthly for shorter time horizons, and moving to quarterly, seasonal and annual buckets for longer time horizons. Distributions of aggregate cashflows for each bucket are formed and percentiles calculated as before.

3. *Accurately considers asset operations.* Thirdly, for the majority of VaR calculations, we are only interested in the terminal (at the VaR time horizon) distributions of the underlying energy price. For example, to value a European power option on a particularly monthly or seasonal forward price at the VaR time horizon, we typically are interested only in the forward price at the time horizon. By using simple price processes, such as Geometric Brownian Motion, we can jump directly to the forward date from the initial forward curve and are not concerned with the path of the variable's evolution. With simulating for the CFaR analysis, however, the path of the underlying variable(s) over the whole contract or asset period is crucial. Using the example of our power plant we need to be able to characterise with confidence the hourly evolution of the power, gas, and emissions prices to be able to work out if it is economical to dispatch the asset in that particular hourly period, which in turn yields the relevant set of cashflows. This dispatch decision is also highly path dependent, if we switched off the asset in the previous hour, and the asset has a minimum down time of 4 hours, then no matter how favourable the relative power & gas price spread, the asset has to remain off in the current hour, further requiring accurate modelling of the relevant variables.

4. *Accurately considers complex business optimisation decisions.* Fourthly, and related to the previous two points, to properly characterise the cashflow distribution, often requires complex optimization. For example, the daily cashflows accruing to operating a gas storage facility are driven entirely by the physical operation of the asset – the operator, typically daily, decides between injecting gas (resulting in a negative cashflow equal to the product of the injection rate and gas price, plus the cost of injecting), withdrawing gas (positive cashflow), or doing nothing (zero cashflow). This decision is not only dependent on the price level of gas on the given day, but on the current level of gas in the facility (the sum of all the daily trading decisions made up until that point in time), the capacity of the facility, and terminal constraints associated with the end of the contract, as well as the costs involved (which can depend on the level of gas in the facility, the price of gas, and the time of year). This optimization has to be able to be performed accurately to characterise the cashflows under the CFaR simulations.

5. *Insight into the potential hedging program.* In addition to giving senior management risk information across their entire portfolio of physical assets and structured financial contracts of the operating cashflow distribution of the organization, a further advantage of this cash flow analysis is that it gives valuable insights into a company's

potential hedging program. Because the analysis focuses on cashflows, CFaR can be applied to the asset with and without potential hedges (complex or simple), yielding a very clear picture of the effectiveness of the hedge, how much hedge should be applied, the appropriate hedge instruments, and their tenor.

Conclusion

If the focus of senior management meetings is typically on the current and forecasted gross margin, earnings, cashflow, or profits, then these should form the basis of the 'at risk' measure, and not just value at risk. Adopting a cashflow based 'at risk' measure will give greater insight into the business operations, enhance profitability and give insight into the effectiveness of hedging programs.

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In this series, we intend to provoke your thinking on how the unique attributes of energy and commodities drive risk and valuation issues, and offer guidance for management on how to more effectively manage risks and increase profitability of their organisations in fast changing energy markets of today. For further information, including copies of previous Business Briefing Series papers, visit **www.lacimagroup.com** or email **info@lacimagroup.com**

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