A Parsimonious Parametric Model for Generating Margin Requirements for Futures

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Although regulatory rules for derivatives margin requirements have not yet been implemented they are currently under active discussion. In the USA, margins of derivative positions cleared by a central counter-party (CCP) must adhere to the 2010 Dodd-Frank Act, which reinforces the role of their supervision by the Securities Exchange Commission and the Commodity Futures Trading Commission. In Europe, EMIR regulations will require more stable margin requirements and an increased confidence level for CCP losses when a client defaults.

Clearing houses will need to modify their margin requirements for derivatives in order to comply with these new regulations. The houses in most large exchanges currently employ the Standard Portfolio Analysis of Risk (SPAN) margining tool, but any major modification to SPAN could prove rather difficult – at present it requires the cumbersome resetting of hundreds of parameters every day because it is based on a complex, product-specific system with no overarching econometric foundation.

We take the stance that SPAN should be replaced with a simpler, more coherent general methodology for calculating margin requirements. So we ask: "Is it possible to design a simple parametric margin model which produces margins similar to SPAN's and which is also simple enough to be effectively adapted as regulations for margin requirements continue to change?"

Our report demonstrates that the answer to this question is a very clear yes. Whenever SPAN margins are risk-based (and not all are, for instance, SPAN's S&P 500 futures margins are much higher than any risk-based assessment would predict) then our model can easily mimic the characteristics of SPAN. Indeed, it can be calibrated to most properties that regulators and CCPs may agree – e.g. maximizing stability plus covering losses effectively, as EMIR currently recommends.

The risk-based margin model we propose consists of two parts: (a) an accurate risk model; and, (b) a margin model, which consists of a simple parametric rule for translating the risk metric into a margin requirement.

Regarding (a), we argue that the median tail loss (MTL) is a better risk metric for margining than Value-at-Risk or expected tail loss (which is also sometimes called expected shortfall or conditional VaR). Then we employ state-of-the-art model validation techniques to select a superior set of statistical volatility models for accurately predicting MTL in both upper and lower tail simultaneously.

Regarding (b), the motivation behind the formulation of the margin model (and the meaning of the parameters) is the regulatory requirement that a margin be both stable and prudential – at the same time as being competitive for the exchange. Once the MTL is forecast our proposed margin model requires a maximum of five parameters which may be calibrated using a variety of objectives. Even with just three parameters, i.e. those governing the time period before a margin reset and the size of the reset when it exceeds the risk-based boundaries, we are normally able to mimic the characteristics of SPAN very closely.

The report includes an empirical study of the performance of the risk and margin models using a term structure of futures contracts for a selection of underlyings, viz.: WTI Crude Oil, the Euro-Dollar exchange rate, Gold and the S&P 500 Index. Except for the index, which has SPAN margins so high that they appear to be decoupled from a risk model, we demonstrate how to tailor the calibration objective so that resultant margins have similar characteristics to SPAN. Alternatively, when calibrating the margin model parameters the CCP (and/or regulator) may prefer to target certain statistical characteristics, such as maximizing the stability of the requirement over time, changing the buffer or limiting the size of margin changes.

The CCP is also free to select different statistical volatility models for predicting the MTL for different futures contracts. However, our volatility model validation yields a useful recommendation: it is hard to better the performance of an asymmetric generalized autoregressive conditional heteroscedasticity (GARCH) model with a Student *t* innovation, although the performance of the far simpler exponentially weighted moving average – which was first introduced by RiskMetrics in the 1990's – is often indistinguishable from a GARCH.

The complete paper (Alexander, C., Kaeck, A., Sumawong, A. “A Parsimonious Parametric Model for Generating Margin Requirements for Futures”, 2016) can be found on the GRI website.