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Market risk in commodity markets: a VaR approach

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Abstract

We put forward Value-at-Risk models relevant for commodity traders who have long and short trading positions in commodity markets. In a 5-year out-of-sample study on aluminium, copper, nickel, Brent crude oil and WTI crude oil daily cash prices and cocoa nearby futures contracts, we assess the performance of the RiskMetrics, skewed Student APARCH and skewed student ARCH models. While the skewed Student APARCH model performs best in all cases, the skewed Student ARCH model delivers good results and its estimation does not require non-linear optimization procedures. As such this new model could be relatively easily integrated in a spreadsheet-like environment and used by market practitioners.

JEL classifications: C52; C53; G15

Keywords: Value-at-Risk; Skewed Student distribution; ARCH; APARCH; Commodity markets

1. Introduction

Managing and assessing risk is a key issue for financial institutions. The 1988 Basel Accord set guidelines for credit and market risk, enforcing the 8% rule or Cooke ratio. Regarding market risk, the total capital requirement for a financial institution is defined as the sum of the requirements for positions in equities, interest rates, foreign exchange and gold and commodities. This sum is a major determinant

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of the eligible capital of the financial institution based on the 8% rule. Because of this rather arbitrary 8% rule (which originates from credit risk) and the fact that diversification is not rewarded (computing the sum of the parts assumes a correlation of 1 across assets), the 1988 rules were much criticized by market participants and led to the introduction of the 1996 Amendment for computing market risk. This framework suggests an alternative approach as to how the market risk capital requirement should be computed, allowing the use of an internal model to compute the maximum loss over 10 trading days at a 99% confidence level. This set the stage for the so-called Value-at-Risk models, where a VaR model can be broadly defined as a quantitative tool whose goal is to assess the possible loss that can be incurred by a financial institution over a given time period and for a given portfolio of assets: 'in the context of market risk, VaR measures the market value exposure of a financial instrument in case tomorrow is a statistically defined bad day' (Saunders and Allen, 2002). VaR's popularity and widespread use in financial institutions stem from its easy-to-understand definition and the fact that it aggregates the likely loss of a portfolio of assets into one number expressed in percent or in a nominal amount in the chosen currency. Next to the regulatory framework, VaR models are also used to quantify the risk/return profile of active market participants such as traders or asset managers. Further general information about VaR techniques and regulation issues are available in Dowd (1998), Jorion (2000) and Saunders (2000). Most studies in the VaR literature focus on the computation of the VaR for financial assets such as stocks or bonds, and they usually deal with the modelling of VaR for negative returns.[1] Recent examples are the books by Dowd (1998) and Jorion (2000) or the papers by van den Goorbergh and Vlaar (1999), Danielsson and de Vries (2000), Vlaar (2000) and Giot and Laurent (2003).

In this paper, we address the computation of the VaR for long and short trading positions in commodity markets. Quite interestingly, few papers deal with commodity markets and market risk management in this framework. Some recent work on the modelling of volatility and VaR in commodity markets include Kroner et al. (1994) and Manfredo and Leuthold (1998). Thus, we model VaR for commodity traders having either bought the commodity (long position) or short-sold it (short position).[2] In the first case, the risk comes from a drop in the price of the commodity, while the trader loses money when the price increases in the second case (because he would have to buy back the commodity at a higher price than the one he got when he sold it). Correspondingly, one focuses in the first case on the left side of the distribution of returns, and on the right side of the distribution in the second case. Note that this type of VaR modelling could be undertaken with a non-parametric model that would first model the quantile in the left tail of the distribution of returns, and then deal with the right tail. Our approach is, however, a pure parametric one, where we consider models that jointly deliver accurate VaR

[1] Indeed, it is assumed that traders or portfolio managers have long trading positions, i.e. they bought the traded asset and are concerned when the price of the asset falls.

[2] An asset is short-sold by a trader when it is first borrowed and subsequently sold in the market. By doing this, the trader hopes that the price will fall, so that he can then buy the asset at a lower price and give it back to the lender.