Setting margin levels in futures markets: An extreme value method

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ABSTRACT

There are of course different types of margin requirements in futures clearinghouses, and this study focuses on setting initial and maintenance margin levels. This study provides an approach, the VaR-x method that incorporates a modification of the Hill estimator based on extreme value theory (EVT) into a Student-t distribution, for setting the unconditional and conditional margin levels (i.e. initial and maintenance margin levels). Empirical applications are based on daily data for three stock index futures returns: the FTSE100, Nasdaq100 and Nikkei225. The empirical results demonstrate that given lower probabilities of margin violation, the VaR-x approach to setting unconditional margin levels is more accurate than either the normal approach or the Hill non-parametric approach proposed by Cotter [J. Cotter, Margin exceedences for European Stock Index Futures using extreme value theory, Journal of Banking and Finance 25 (2001) 1475–1502]. Additionally, this study demonstrates that using the conditional VaR-x approach to setting margin levels can better capture extreme events, thus ensuring adequate prudence, something that is particularly crucial in periods of strong fluctuation. These empirical findings suggest that the proposed approach is very useful to setting the initial and maintenance margin levels.

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1. Introduction

Margin committees face the difficult task of appropriate margin levels to balance the costs of trader default against the benefits of increased market liquidity [1]. The key problem margin committee face is that setting the margin level too high will lead to high transaction costs and thus reduced trading volume. Meanwhile, if the margin level is set too low, it may not adequately cover extreme price changes, thus incurring default risk. For guarding against default, this paper focuses on setting prudent margins designed to protect futures positions from extreme price movements.

The academic literature has implemented two approaches to setting appropriate margin levels. First, the application of economic models that assume margin levels are endogenously determined for minimizing broker costs. For example, Brennan [2] and Fenn and Kupiec [3] used the concept of efficient contract design to identify economic factors determining the optimal margin level. Second is the application of statistical approaches, which is used to set margin levels that represent an amount not to be exceeded by a price change over a specified time period at an acceptable probability level. These statistical approaches include parametric and non-parametric methods that rely on Gaussian and non-normal distribution assumptions for the underlying distribution of futures price changes. Figlewski [4] and Gay et al. [5] are two examples of
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The empirical investigation applies the proposed unconditional and conditional VaR-x approach to estimate the margin levels for three different daily stock index futures series: the US Nasdaq 100, the British FTSE 100 and the Japanese Nikkei 225. Moreover, margin levels may differ between long and short positions owing to the behavior of left and right tail price movements. Therefore, this empirical investigation respectively deals with the estimation of the margin levels for long and short positions. The proposed VaR-x approach is compared with two different methods, which are the normal method [4,10] and the Hill non-parametric method [13].

The remainder of this paper is organized as follows. Section 2 presents the theoretical foundations used to estimate unconditional and conditional margin levels. Section 3 then details the stylized fact of the empirical data. Subsequently, Section 4 illustrates the empirical results. Finally, Section 5 presents conclusions.

2 Cotter and Longin [25] extended the work of Cotter [13], applying modified Hill estimator based on EVT [14] to set daily margin levels by considering the intraday dynamics of market prices. They found that the modified Hill estimator could easily extend the multi-period margin estimation.
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