

## Research of liquidity adjusted VaR and ES in Chinese stock market— based on extreme value theory\*

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**Abstract.** China stock market's value at risk and liquidity adjusted expected shortfall were analyzed by combining extreme value theory with a new constructed liquidity risk measurement indicator. The results of the present paper shows there are some difference between liquidity and price value at risk about the sensitivity of the confidence level, but there is little difference between liquidity and price risk's expected shortfall about the sensitivity of the confidence level; under different confidence level, the value of both La\_VaR and La\_ES of Shanghai index are less than those of Shenzhen index, that is to say that the risk in Shanghai market is lower relative to Shenzhen market's, and the relationship is immune to the degree of market extremity. In the term of liquidity, whether absolute quantity or relative quantity, Shanghai stock market is better than Shenzhen market, but the difference between them is not very significant; The ratio of liquidity risk had more sensitivity to the confidence level, but the ratio of liquidity expected shortfall lacked elasticity to the confidence level.

**Keywords:** extreme value theory, liquidity adjusted value at risk, liquidity adjusted expected shortfall

### 1 Introduction

VaR, which is abbreviation of Value at Risk<sup>[10]</sup>, to measure the market risk that assets faced, was first developed by J. P. Morgan in 1990s. It refers to a portfolio or a financial asset's biggest loss under a certain level of probability within a specific period of time in future. More strictly, VaR measures the quantile of the projected distribution of gains and losses over a given time horizon. If is the selected confidence level, VaR is the  $1 - q$  lower tail level. VaR, which integrated the potential risk and happen probability to with a single figure, it is more useful for the Banks and the Supervisory authorities risk management and regulation. It has been popularized in the Basle Committee in 2006, and has been became the basis of theory and international standard of modern risk management. But there are still some disadvantages in VaR itself. One is that it doesn't take into account the tail risk, that is, it ignores the situation when losses exceed the value of VaR; the other is that it doesn't satisfy the subadditivity, so it is not a consistent risk measurement. To make up for these deficiencies, Artzner (1997)<sup>[1, 2]</sup> proposed a concept of Expected Shortfall, it is abbreviation of ES. ES measures the average loss of the tail which represent the average level of excess loss. Therefore, the definition of the ES is VaR-based. The regulation that combines both VaR and ES could provide the enterprises and financial institutions with more suitable and more effective risk measure standards. Recently, they pay more attention to VaR and ES.

The assumption about the cumulative distribution function of the price change is the key to VaR calculation. Some available methods are the following: Riskmetrics, the GARCH approach, quantile estimation, and

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