

# The Measurement of Operational Risk Based on CVaR: a Decision Engineering Technique

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## Abstract

In recent years, operational risks in Decision Engineering attract so much attention from the bank industry that Basel Committee includes it in the risk capital and considers it as a part of inspection criteria. According to its own traits, Conditional-Value-at-Risk model based on Peak Value Method of Extreme Value Theory is employed in the measurement of operational risks. Based on these results, strategies such as the provision of risk reserves, the allocation of economic capital, insurance and outsourcing are adopted in the control and management of operational risks.

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Keywords: CVaR, Operational Risks, Measurement; Decision Engineering

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## 1. Introduction

Operational risks have been in financial institutions for a long time. But the understandings of operational risks diverse among financial institutions. As defined in *Basel New Capital Accord(2003)*, operation risks are risks caused by incomplete or ineffective intra program, staff, and system, or extra events. At the same time, in the new accord, Basel Committee proposed three approaches for the calculation of operational risk regulatory capital requirement: Basic Indicator Approach, Standardized Approach and Advanced Measurement Approach.

After the announcement of this new capital accord, the operational risk management, especially the measurement models, are studied and researched by many international scholars. The models such as VaR, Extreme Value method and Bayesian networks are adopted in the measurement of operational risks. Many more advanced statistical and analytical techniques start to be applied by the bank industry. And new kinds of measurement methods are developed and employed. Giulio Mignola, R.Ugoccioni(2005)used Extreme Value Theory to carry out empirical analysis on operational risks and believed that the measurement of operational risks depended on the shape, scale and position characteristics of the loss distribution[1]. P. Embrechts, H. Furrer and R. Kaufmann (2003)developed a method, which is now widely used, to employ VaR and Extreme Value Theory in the calculation of operational risks [2]. Since 2004, some scholars have tried to make some modifications on Extreme Value Theory

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to get a closer and more precise value on the operational risk extremes and to calculate operational risk regulatory capital. Moscadelli (2004) derived the actual distribution function of operational losses over certain critical level, and the expected loss over expected threshold was calculated from sample mean extra function and adjusted coefficients, which was the reference of operational risk capital[3]. Tom Wilde (2005) employed credit risk model in the quantitative analysis of operational risks[4].

Recently in the wake of the booming cases concerning operational risks of commercial banks in China, the bank industry and academe pay more attention on operational risks. ZHONG Wei(2006) analyzed and believed that the main reasons for the frequent happenings of operational risk cases were issues concerning the high level management of banks, the report process of operational risks, operation flow and system construction[5]. Some scholars studied the management methods of operational risks and proposed that loss database should be constructed as soon as possible so that the accumulated loss data can be the foundation of operational risks' precise measurement[6]. Income model and securities factor model were used to make empirical analysis on operational risks of national joint-stock commercial banks. Bayesian network model was proposed in the management of operational risks. Monte Carlo techniques and loss distribution method, owing to the incomplete operational loss data, were employed in the measurement of operational risks in the commercial banks[7,8,9].

The study of CVaR abroad started from the end of 20<sup>th</sup> centuries. CVaR risk measurement approach was firstly advanced by the Americans Rockafellar and Uryasev(1999), who described a new investment portfolio optimum method, called Conditional Value-Risk (CVaR), and firstly illustrated the definition of CVaR[10]. Later, some scholars studied mean-CVaR. Pflug(2000) discussed the optimum issues of CVaR[11]. Fredrik Anderson, Helmut Mausser, Dan Rosen and Stanislav Uryasev(2001) successfully introduced CVaR in the measurement of credit risks, in which random values were generated by Monte Carlo method to stimulate return distribution of bonds, then the measurement of credit risks was transformed to linear programming to get the weights in portfolios so as to get the minimum CVaR[12]. Till now, CVaR is a method to measure not only market risks but also all kinds of risks, whose frame has been further expended. Based on the traits of operational risks, VaR model can be introduced to the management of operational risks. But due to the innate limitations, VaR model failed to get a scientific, reasonable, and relatively precise calculation on operational risks. However, CVaR makes up the faculties of the loss of information on the tails, and can be used as a satisfied instrument on the calculation of operational risks.

In China the study of CVaR has just started. A small number of papers focus on the definition of CVaR, optimum method and assessment method. HU Jie, GUO Xiaohui and QIU Yaguang(2005) compared the application of VaR and CVaR in commercial banks' risk measurement[13].TANG Xiangjin, TONG Shikuan(2005) suggested the conditions and methods of risk capital deployment under CVaR limitations[14].

Therefore, the traits of operational risks make its measurement difficult. A reasonable and precise model and technique to measure operational risks is incumbent in the face of rampant operational cases in China. Operational risk management mainly includes the assessment and disposal of risk loss. Based on the scientific and reasonable calculation of operational risks, the strategies such as the provision for risk reserves, the allocation of economic capital, insurance and outsourcing should be employed.

## 2. The Definition and Application of CVaR

### 2.1. The Application and Limitation of VaR

G-30 report published in July, 1993 defined Value at Risk (VaR) as “ at a certain confidence interval and a certain target range, the maximum expected loss”. In 1994, J.P. Morgan firstly promoted a risk measurement system based on VaR-Risk Metrics. It indicated VaR has formally become a tool for risk measurement and management. Since then, the obvious merits of VaR obtained the wide acceptance of global finance industry. But VaR initially measures market risks under certain premises. There are at least two issues in the usage:

- It only measures the percentages of loss distribution, but ignores the loss over a certain level. As a result, the loss on the tail is often neglected.
- For it is not a coincidence indicator, VaR cannot be added. But Conditional-Value-at-Risk, as a measurement of financial risks, preserves even better virtues that VaR. Although it has not yet been the criterion of financial industry, CVaR has been widely adopted in insurance and credit risk measurement.

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