



## Basel's value-at-risk capital requirement regulation: An efficiency analysis <sup>☆</sup>

Guy Kaplanski <sup>a</sup>, Haim Levy <sup>b,\*</sup>

<sup>a</sup> School of Business Administration, Bar-Ilan University, Israel

<sup>b</sup> Jerusalem School of Business Administration, The Hebrew University of Jerusalem, 91905, Israel

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### Abstract

We analyze the optimal portfolio policies of expected utility maximizing agents under VaR Capital Requirement (VaR-CR) regulation in comparison to the optimal policy under exogenously-imposed VaR Limit (VaR-L) and Limited-Expected-Loss (LEL) regulations. With VaR-CR regulation the agent strategy consists of *simultaneous* decisions on both the portfolio VaR and on the implied amount of required eligible capital. As a result, the performance of VaR-CR regulation depends on its design (the parameter  $n$ ) and the agent preferences. We show that an optimal VaR-CR regulation allows the regulator on the one hand, to completely eliminate the exposure to the largest losses, which may jeopardize the existence of the institution, and on the other hand, to restrain the portfolio exposure to all other losses. These results rationalize the current Basel regulations. However, the analysis shows also that there is an optimal level of required eligible capital from the regulator standpoint. Counter-intuitively, any requirement above this optimal level is *inefficient* as it leads to a smaller amount of actually maintained eligible capital and thereby to a larger exposure to the most adverse states of the world. Unfortunately, the current Basel's range of required levels ( $n = 3-4$ ) is within this *inefficient* range. Moreover, with an inefficient regulation the agent might employ an inefficient reporting and disclosure procedure.

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\* Corresponding author. Tel.: +972 2 58831011; fax: +972 2 5881341.

E-mail addresses: [guykap@netvision.net.il](mailto:guykap@netvision.net.il) (G. Kaplanski), [mshlevy@mscc.huji.ac.il](mailto:mshlevy@mscc.huji.ac.il) (H. Levy).

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## 1. Introduction

Value-at-risk (VaR) has become the standard measure for risk management and regulation.<sup>1</sup> The theoretical analysis of VaR regulations can be divided roughly into two main categories. The first and the primarily analyzed category is the regulation which imposes a limit on the maximal allowed VaR of the portfolio. Several recent papers analyze this case. [Vorst \(2001\)](#), for example, shows that maximizing expected return under exogenously-imposed limit on the portfolio VaR (VaR-L) might lead to a larger exposure to *extreme* losses. [Basak and Shapiro \(2001\)](#) comprehensively analyze this case and explore optimal portfolio policies of expected utility maximizing agents under exogenously-imposed limit on their portfolio VaR. They, find that “VaR risk managers often optimally choose a larger exposure to risky assets than non-risk managers and consequently incur larger losses when losses occur”. Consequently, [Basak and Shapiro \(2001\)](#) suggest an alternative risk measure to VaR, the Limited-Expected-Loss (LEL) regulation. According to their pioneer analysis, a regulation that imposes a limit on the maximal allowed *expected* loss overcomes the VaR-L shortcoming. The current Basel Committee on Banking Supervision regulations introduces conceptually a different regulation. This regulation imposes a minimal level of *eligible capital* that the agents must maintain at all times as a function of the portfolio VaR. Of course, this regulation, like any imposed constraint, may be costly. This case is very important because it obligates financial institutions in all developed countries to maintain eligible capital as a function of their bi-weekly market-risk VaR.

Inspired by the study of [Basak and Shapiro \(2001\)](#), who analyze the VaR-L and the LEL limit regulations and using the techniques they employed, this paper analyzes the VaR Capital Requirement (VaR-CR) regulation. More precisely, this paper explores the agent's optimal investment strategy under VaR-CR regulation. We would like to stress at the outset that the agent strategy under VaR-CR regulation differs substantially from the strategy in the case of VaR-L and LEL regulations. This is because in the VaR-CR regulation the exogenously-imposed parameter is the level of the required eligible capital rather than the maximal allowed VaR and the expected loss in VaR-L and LEL regulations, respectively. Consequently, in the VaR-CR case through deciding on the portfolio VaR the agent determines also the amount of the Actually Maintained Eligible Capital (hereafter AMEC), which at the same time affects the portfolio VaR. This is because this required reserved eligible capital is part of the regulated portfolio and thus influences directly the portfolio VaR.<sup>2</sup> In other words, in the case of VaR-CR regulation the agent

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<sup>1</sup> An introduction and overview of VaR can be found in [Duffie and Pan \(1997\)](#) and in the excellent book by [Jorion \(2000\)](#).

<sup>2</sup> While we focus on the optimal strategy under VaR-CR regulation, [Cuoco and Liu \(2002\)](#) who also analyze aspects of the VaR-CR regulation, focus on the optimal reporting and disclosure strategy of a VaR-CR regulated agent. Therefore they focus on the current [Basel Committee on Banking Supervision \(1996\)](#) Amendment VaR-CR regulation reporting and Back-Testing sanction mechanism, showing that this specific procedure may lead the agent to curb the risk of the traded portfolio and to report the true VaR.

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