非現金担保を考慮に入れた派生証券評価モデル
A Numerical Example of Derivatives Price with Non-Cash Collateralization[*]

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1   Introduction

In this study, we propose a derivatives pricing method when non-cash assets are posted as a collateral. In order to mitigate the counterparty risk[1], the collateralization has been applied in derivatives transactions. That is, the participant with a negative exposure in the derivatives contract posts collateral to her/his counterparty with a positive exposure at predetermined dates in the life of the derivatives contract. Clearinghouses or the security exchanges all over the world provides an opportunity to the participants using both cash and the non-cash assets as collaterals. For example, the participant is permitted to post the U.S. government bond as a collateral. We exogenously provide the proportion of the posted cash amount and the non-cash assets amount.

While the collateral receiver can invest the posted cash collateral to the risk-free asset with a collateral cost (namely collateral rate), she/he can manage the posted non-cash collateral by funding through repo market with a repo cost (namely repo rate). Therefore, we face a couple of rates in derivatives pricing, that is, "muti-curve" framework and implement the pricing rule under the multi-curve setting. The derivatives pricing models including some different rates have been proposed up to now (Johannes and Sundaresan 2007, Fujii and Takahashi 2013, 2016, Lou 2017, Brigo et al. 2017). Our study closely relates to Lou (2017) among these. Lou (2017) constructed a replication strategy for derivatives and suggested a pricing approach when cash and the non-cash assets are posted as collateral, and showed that the discount factor includes the haircut in the repo market. However, it has never been verified how each variable influence the derivatives price itself. On the other hand, Brigo et al. (2017) examined the effects of a funding rate and a repo rate on an option price under the case of constant rates. From Brigo et al. (2017), the repo rate increases the option price and the funding rate decreases it. Brigo et al. (2017) suppose that the investor is allowed to arbitrarily select how the underlying asset is resourced from the repo market. This

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[1]*Counterparty risk* means a sort of credit risk in the derivatives contract.