



CCP Back Testing Applications and the Results

Takasbank Practice

Central Counterparty Department



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Introduction

- In risk management, back-testing which is usually employed to assess the measurement models' accuracy and performance, is used by CCPs to test the parameters in the collateral calculation models and haircuts applied to eligible collateral assets.
- It is compulsory for CCPs to back-test risk management models as per the CPMI-IOSCO principles and EU EMIR regulations. Similarly, in our country the Takasbank's obligation to check the authenticity and reliability of the risk models employed in CCP services through back-testing was introduced through the Central Counterparty Regulation, Article 45 .

Initial Margin Back-testing

- In the CCP-enabled markets the models employed in the calculation of initial margin and adequacy of confidence levels are analysed via back-tests executed on a daily basis by the Central Counterparty Division.
- In back-testing , it is controlled whether the initial margin required for the positions are large enough to meet the change in the value of the position during the holding period in light of the confidence level and holding period assumptions that are utilized in initial margin calculation. The observations where the initial margin does not cover the change in value is referred as breach. In the back-testing period, the number of breaches are anticipated to be less than the number implied by the confidence level.
- The back-testing results of the models employed in initial margin calculation and if there is any, suggested measures are presented to Takasbank Board of Directors at least 4 times a year in March, June, September and December by internal audit divisions. The back-testing results shall be submitted to the CCP Risk Advisory Committee in June and December.

Account Based Back-testing

- In Derivatives Market (VIOP) the back-tests are conducted on a daily basis on all accounts with open positions. At the end of each day, it is checked whether the initial margin amount required for the relevant account is large enough to meet the change in value of the position in the account during holding period. For this purpose the positions in the account are valued at market prices in the following days (during the holding period) and the change in the value of positions is calculated. If this value is larger than the initial margin, it is acknowledged that there is a breach in the account. The change in values of the positions in the Derivatives Market (VIOP) is based on the change in the profit/loss arising from futures contracts and short option positions' values.
- The conditions whereby the maximum change exceeds the initial margin is acknowledged as "breach". Back-testing is performed for all the positions taken in the market on a daily basis and the excess numbers' ratio to the total number of observations is anticipated to remain at the confidence level utilized in the initial margin calculation.

Product Based Back-testing

- As gross collateral basis is applied in Securities Lending Market (ÖPP) in back-testing an approach based on borrowed/ lent security is followed. For this purpose borrowing/ lending transactions are used on security basis. For a single day, the varied number of securities, which are subject of borrowing transactions, is the observation number for that day. The price changes in the borrowed/ lent securities during the holding period is acknowledged as breach if they exceed the initial margin requested for the related borrowing transaction. In Securities Lending Market, since initial margin and valuation process utilize weighted average price, in back-testing weighted average prices are used for borrowed/lent securities as well.
- Also, in Derivatives Market (VIOP) and Equity Market(PP) back-testing are performed. In this regard, it is tested through daily calculations whether the initial margin values requested for the contracts compensate for the price movements that they shall be exposed to in the course of the holding period.

Money Market Back-testing

- In the Money Market, one and three month maturity transactions are made. In this context, a different approach to Securities Lending Market (ÖPP) and Derivatives Market (VIOP) has been adopted in backtest analyzes. According to this, the interest rate implied by the level of initial margin on the contract basis is calculated daily and then it is observed whether there is an interest rate change exceeding the amount of change calculated in the market.

Haircut Back-testing

- Haircuts are back-tested on a monthly basis. Back-testing may be performed via indices, maturity and indicators that represent the collateral assets.
- In the event that breach is observed for more than two business days in average for the past one year period during the back-testing and this asset group's haircuts have not been previously calibrated via multiplication factors, the haircuts is calibrated by reduction subject to the framework of the multiplication factors table. If the need to recalibrate arises for a previously calibrated asset group , the haircuts are recalculated.

Haircut Back-testing

$$\text{Haircut (\%)} = 1 - (\% \text{ Reduction multiple} \times \text{Multiplication factor})$$

Number of Breach	Multiplication Factor
2 and less	1.00
3	1.20
4	1.35
5	1.5

In the event that breach is observed for more than 5 business days in the last year's valuation multiples , the utilized data set , confidence level and the model are reviewed.



Back-testing Results

Central Counterparty Department



Initial Margin Back-testing Results

Account based back-testing results (Derivatives Market (VIOP) 2018-1):

Total Number of Observations	518.832
Number of Breach	288
Breach (%)	0,05
The Limit Subject to the Confidence Level (%) (1-99.5%)	0,5
Acceptable Number of Breach	2.594

Test results show that the breach rate in this market stays within the confidence level (99.5%) range.

Initial Margin Back-testing Results

Product based Back-testing Results (SLM 2018-1):

Total Number of Observations	4,350
Number of Breach	20
Breach (%)	0.45
The Limit Subject to the Confidence Level (%) (1-99.5%)	0.5
Acceptable Number of Breach	22

Initial Margin Back-testing Results

Product Based Back-Test Results (Derivatives Market 2018-1)

Total Number of Observations	27,261
Number of Breach	34
Breach (%)	0.12
The Limit Subject to the Confidence Level (%) (1-99.5%)	0.50
Acceptable Number of Breach	136

In the back-test for the period concerned the open contracts in the derivatives market (VIOP) are taken into consideration. In the daily calculation, no breach has been observed on contract basis.

Initial Margin Back-testing Results

Product Based Back-Test Results (Equity Market 2018-1)

Total Number of Observations	27,328
Number of Breach	204
Breach (%)	0.75
The Limit Subject to the Confidence Level (%) (1-99.5%)	0.50
Acceptable Number of Breach	137

In the daily calculation, breach has been observed on contract basis for equity market.

Initial Margin Back-testing Results

Money Market Back-testing Results (2018-1):

Total Number of Observations	63
Number of Breach	0
Breach (%)	0
The Limit Subject to the Confidence Level (%) (1-99.5%)	0.50
Acceptable Number of Breach	1

The back test results for Money Market are given above. The interest rate change implied by the initial margin of 5% in the market is 61% for 1 month contract and 20% for 3 months contract. The test results show that there is no change in the market interest rate exceeding the declared rates.

Haircut Back-testing Results

Haircut Back-Test		Haircut	No of Breach
FX	USD	94%	0
	EUR	94%	0
DIBS (*)	Based on the 2 yrs benchmark interest rate.	91%	0
STOCK	BIST 30 Index	76%	0
	<i>The number of stocks in BIST 30 where breach was observed</i>		
	2	76%	4
	<i>The number of stocks in BIST 30/BIST100 where breach was observed</i>		
	8	70%	27
GOLD		86%	0
MUTUAL FUND	<i>The number of Equity Umbrella Fund where breach was observed</i>		
	0	82%	0
	<i>The number of Debt Instruments Umbrella Fund where breach was observed</i>		
	0	88%	0

(*) Government domestic borrowing security

The fact that the number of breach observed across asset groups such as FX, equity government domestic borrowing security (DIBS) and gold does not exceed two times for the past year indicates that there is no need for calibration.

In equities, three conditions are sought simultaneously, that number of breach shall not exceed 2 in BIST 30 Index, the number of breach for the stocks in BIST 30 shall not exceed 60 and the number of breach for the stocks in BIST 30/BIST100 shall not exceed 140.

In mutual funds, the fact that there are 74 equity umbrella funds, but the number of breach does not exceed 148 and that the number of breach does not exceed 92 for the 184 debt instruments umbrella funds indicates that there is no need for calibrating the valuation multiples for mutual funds.



Thank you



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