LiNe CLEARING AND SECURITIES LENDING

ELECTRONIC TRADING PLATFORM (BTB)

LIMIT MONITORING

May 2022

1. INTRODUCTION

This Technical Note aims to present the methodology used by B3 to monitor the limits assigned by Full Trading Participants (PNPs) and Settlement Participants (PLs) to their investors' aggregate risk metrics in the pre-trade risk system on the LiNe Clearingplatform and in the Securities Lending Electronic Trading Platform (BTB). In BTB's platform, the aggregate risk metrics only apply to electronic trade of security lending contracts.

The limits assigned to the aggregate risk metrics enable control of the investors' access to the LiNe Clearing platform and, consequently, to the B3 Clearinghouse (Clearinghouse), which acts as a central counterparty. Therefore, these limits generate two risk types for PNPs/PLs: execution and settlement. Execution risk arises from the potential financial loss generated by reversal of execution error. Settlement risk arises from the investor's failure to comply with obligations to the Clearinghouse, either the required margin deposit or the multilateral net settlement payment.

The values of execution and settlement risks are set by the values of the assigned limits, given that these can be fully consumed. The settlement risk value is determined directly and simply by the limits assigned to the aggregate risk metrics, while the execution risk calculation uses the limits in a slightly more elaborate way.

The selection of the risk type that limits generate depends on the relationship between the investor to whom the limits were assigned and the participant who assigned them. If the investor settles its trades at the PNP/PL, it is a settlement risk. If the investor carries out its trades at a particular PNP and they are passed on to another participant, the risk to the investor is an execution risk. Selecting the risk type depends on the attributes of the account benefited by the limits. If the attributes of the account are not conclusive about the PNP/PL where the trade will be settled, the responsible participant assumes the settlement risk by hypothesis. The investor's pre-trade risk is the maximum point between its execution and settlement risks.

The investor's pre-trade risk is subtracted by the stressed economic capacity of its chain of responsibility – a fraction of the investor's own liquid funds (if this information is available) and the funds of participants responsible for the investor at the Clearinghouse under a stress situation – resulting in its residual risk. The investor’s residual risk can be reduced by depositing collateral with the Clearinghouse.

The PNP’s/PL’s residual risk is assessed from the perspective of two groups according to the type of account (definitive or transitory). This allows the assessment to be more accurate, differentiating between the consumption profile and the way limits are assigned. For both the

definitive and transitory accounts group, the participant's residual risk is the investor’s respective largest residual risk.

LiNe Clearing does not communicate with the Clearinghouse or the Central Depository, so open contracts, allocation, give-up and asset balances are not considered in the calculation of aggregate measures. The Clearinghouse will, therefore, assess cases of limits assigned to transitory accounts held by participants and, at its sole discretion, may compare these limits with their respective historical consumptions and not with the stressed economic capacity of the chain of responsibility.

This Technical Note is divided into five further sections and two annexes. The second section presents and defines the pre-trade risk. The third section relates risk types to account attributes. The fourth section determines the investor’s residual risk. The fifth describes B3’s monitoring of the assigned limits. Annex A provides several examples of how to calculate pre-trade risk. Annex B details the calculation of the economic capacity of participants who are granted access to the Clearinghouse.

2. PRE-TRADE RISK

In the context of LiNe Clearing, PNPs may act as a give-up destination and as a trading participant. PLs may only act as a give-up destination. For each of these roles (in this document identified by $\boldsymbol{D.Rep}$ and $\boldsymbol{PNP}$ respectively), PNPs/PLs must assign values to the limits of the three aggregate risk metrics for each investor on LiNe:

- Derivatives risk (RMKT): Derivatives risk represents the potential need to deposit collateral, or otherwise viewed, the potential loss arising from the close-out of derivatives positions of a defaulting investor;
- Loss incurred in day trades (SFD): Represents losses arising from day trades executed
- Potential debit balance (SDP): Represents financial debts related to the settlement of spot and option market trades. This is the principal value in spot market trades or the options premium due; and
- Potential short uncovered balance (SPVD): Represents the principal value related to delivery obligations due in the spot market or options exercises.

If limits are not assigned according to the liquid funds in the chain of responsibility, the following events may materialize due to such funds being insufficient:

(i) The investor and/or its give-up participant makes an execution error, the reversal of the market position generates financial losses and the associated value is not settled with the Clearinghouse in T+1 or T+2;

(ii) The investor creates derivatives positions and the margin required by the Clearinghouse is not covered in T+1;

(iii) The investor buys in the spot market and the principal amount is not settled with the Clearinghouse in T+1 or T+2, depending on the asset;

(iv) The investor suffers losses in day trades and the associated amount is not settled with the Clearinghouse in T+1 or T+2; and

(v) The investor sells in the spot market and the margin required by the Clearinghouse is not covered in T+1.

Monitoring limits helps mitigate the possibility of the above events materialize before the order sent by an investor or PNP responsible for it becomes a trade. When entering the order in the

book and its transformation into a trade, any default event generated from the execution of this order will financially impact the PNP responsible for it.

By definition, an event (i) is associated with the execution risk, while the others are associated to settlement risks. The occurrence of an event (i) implies in the reversal (close-out) of any position generated from an execution error on the same day and will not occur simultaneously with settlement events. Thus, execution and settlement risks should not occur simultaneously for the same positions in the Clearinghouse. The pre-trade risk of an investor who is under the responsibility of a particular participant must, therefore, be the maximum point between the execution and settlement risks (risk being a positive value).

In the context of the limits of the BTB system, PNPs can act as a give-up destination and as a trading participant. PLs can only act as a give-up destination. For each of these roles (identified in this document by ***D.Rep*** and ***PNP***), the PNPs/PLs must assign, in the BTB system, values for the limits of two aggregate financial value metrics:

- The aggregate financial value of electronically traded non-certified lender positions (SPDA); and

- The aggregate financial value of electronically traded borrowing positions (SPTA).

The metrics above represent the sum, in financial terms, of the value of the Lending (SPDA) or Borrowing (SPTA) contracts of a given investor, contracted in the electronic trading modality. This aggregate value is calculated based on the contract assets' previous day average trading price and the number of shares implicit in the securities lending offers and trades on the calculation date.

If limits are not assigned according to the liquid funds in the chain of responsibility, the following events may materialize due to such funds being insufficient:

(i) The investor creates non-certified lender positions via electronic trading and the margin required by the Clearinghouse is not covered in T+0 or T+1;

(ii) The investor creates borrowing positions via electronic trading and the margin required by the Clearinghouse is not covered in T+0 or T+1;

Monitoring limits helps mitigate the possibility of the above events materialize before the order sent by an investor or PNP responsible for it becomes a trade. When entering the order in the book and its transformation into a trade, any default event generated from the execution of this order will financially impact the PNP responsible for it.

The two events above are associated with settlement risk.

The settlement risk generated by an investor to the participant may arise from both carrying accounts and accounts whose trades are executed and settled with the participant itself.

Let us assume a ***doc*** investor under the responsibility of a $\boldsymbol{P}$ PNP/PL. Its pre-trade risk is given by the following equation:

$$R_{P,doc} = \max\left(RL_{P,D.Rep,doc} + RL_{P,PNP,doc};\ RE_{P,doc}\right) \quad (1)$$

Where:

$RL_{P,D.Rep,doc}$ is the settlement risk of the $\boldsymbol{doc}$ investor under $\boldsymbol{P}$'s responsibility acting as a give-up destination;

$RL_{P,PNP,doc}$ is the settlement risk of the $\boldsymbol{doc}$ investor under $\boldsymbol{P}$'s responsibility acting as a trading participant; and

$RE_{P,doc}$ is the execution risk of the $\boldsymbol{doc}$ investor under $\boldsymbol{P}$'s responsibility.

The implicit severity in the materialization of LiNe Clearing's events (ii) to (v)and the BTB system's events (i) and (ii), in whole or in groups, is rather extreme. If these events materialize, the maximum default values to the Clearinghouse will be approximately the limit values assigned by the aggregate metrics.

In the event of payment failure generated by spot market purchases, the amount due may be offset against the sale of the assets purchased in the market on the day of the failure by the PNP/PL or by the Clearinghouse. However, the prices of such assets may have fallen between the buying and selling day. Therefore, assuming the availability of liquidity mechanisms, the loss to the PNP/PL or to the Clearinghouse is not the principal value of purchases but the market risk value. That is, this settlement risk is given by the market risk of the purchased asset portfolio multiplied by the assigned limit. By simplification, a single market risk value for spot and options trades will be used: 25%.

In the event that the client failure to honor the margin call due to spot markets sales, those assets may be delivered by purchasing the sold assets in the spot market on the day of the failure by the PNP/PL or by the Clearinghouse. However, the prices of such assets may have risen between the selling and buying day such that the settlement risk is given by the market risk of the sold

asset portfolio multiplied by the assigned limit. Similarly, the same single market risk value will be used for spot market trades: 25%.

In the event of improper execution of T+0 and T+1 modalities non-certified lender positions, the closeout strategy adopted by the Clearinghouse's risk model implies the acquisition of assets to comply with the delivery obligation and, subsequently, the sale of the assets received via securities lending agreement's early settlement. The interval between these operations is one day, with the Clearinghouse or the PNP/PL being exposed to a one-day asset's price variation. Thus, the margin requirement for these positions can be approximated by the average one-day risk of the shares. By simplification, a single value shares' one-day market risk will be used: 18%.

In the event of improper execution of T+0 and T+1 modalities borrowing positions, the expected margin requirement is equivalent to the market risk value of two days. By simplification, this value will be approximated for all shares by 25%.

As it is considered plausible that only one of the six events associated with the settlement risk will occur, such risk is given by the following equation:

$$RL_{P,Func,doc} = \max\left(LRMKT_{P,Func,doc};\ 0{,}25 \times LSDP_{P,Func,doc}; LSFD_{P,Func,doc};\ 0{,}18 \times LSPDA_{P,Func,doc};\ 0{,}25 \times LSPTA_{P,Func,doc};\ 0{,}25 \times LSPVD_{P,Func,doc}\right) \quad (2)$$

Where:

$LMA_{P,Func,doc}$ is the limit associated to the $\boldsymbol{doc}$ investor under the $\boldsymbol{P}$ PNP/PL responsibility acting under the $\boldsymbol{Func}$ ($\boldsymbol{D}.\boldsymbol{Rep}$ or $\boldsymbol{PNP}$) function for the aggregate risk metrics MA, where MA equals RMKT, SDP, SFD, SPDA, SPTA or SPVD.

The magnitude of the loss associated to the execution risk is determined by the size of the position that needs to be reversed and its market risk. The hypothesis is that the position may be reversed within two hours.

Market risk associated with the reversal of an execution error in derivatives contracts is controlled by the limit assigned to the RMKT metrics. RMKT is a market risk measure with two risk horizons: five days for financial options and two days for other derivatives contracts. The RMKT can be approximated to measure a two-hour risk horizon by multiplying it by 35%[1].

[1] By simplification, we use the hypothesis that the RMKT risk horizon is two days for all risk factors. It is assumed that risk factor returns contain certain features that allow using the "root rule". This rule changes the two-day risk (16 hours) into the two-hour risk by maintaining the same severity using the following formula: $R_{16\ hours} = \sqrt{16/2}\, R_{2\ hours}$.

Market risk associated with the reversal of a spot purchase trade is controlled by the limit assigned to the SDP metrics. The settlement risk of a spot market position measured by the SDP metrics was approximated to 25% of the principal purchase value. The 25% risk is measured by taking into account a two-day horizon and can be changed to a two-hour risk by following the same procedure applied to RMKT.

Market risk associated with the reversal of a spot sale trade is controlled by the limit assigned to the SPVD metrics. The settlement risk of a spot market position measured by the SPVD was approximated to 25% of the principal sale value. The 25% risk is measured by taking into account a two-day horizon and can be changed to a two-hour risk by following the same procedure applied to RMKT or SDP.

SFD is not a risk measure. It is a realized loss. Therefore, the previous adjustments do not apply to SFD. It can also be interpreted as loss of execution error reversals.

Another hypothesis used in the calculation of an execution risk is that execution errors do not occur simultaneously in different accounts of the same investor under the responsibility of the same participant.

Therefore, the execution risk is given by the following equation:

$$RE_{P,doc} = \max_{ct}\big(0{,}35 \times \max\big(LRMKT_{P,doc,ct};\ 0{,}25 \times LSDP_{P,doc,ct};\ 0{,}25 \times LSPVD_{P,doc,ct}\big); LSFD_{P,doc,ct}\big) \quad (3)$$

Where:

$LMA_{P,doc,ct}$ is the limit associated to the $\boldsymbol{ct}$ account of the $\boldsymbol{doc}$ investor under the $\boldsymbol{P}$ PNP responsibility acting as a trading participant for the aggregate risk metrics MA, where MA equals RMKT, SDP, SPVD or SFD.

Annex A provides nine examples of calculation of execution and settlement risks for various combinations of account types and the manner in which limits are assigned to the investor's accounts or to the investor.

3. RISK ACCOUNTS AND TYPES

The monitoring of limit assignment aims to identify in which participant the trade will be settled before the originating order enters the order book.

Identification of the settlement participant can be made by account type and its links. An order sent via a regular definitive account without give-up link will be executed and the trade will be settled by the give-up participant. An order sent via a regular definitive account with give-up link will be executed and the trade will be settled by different participants. If the account attributes do not show the identification of the settlement PNP/PL, the hypothesis that the resulting trade will be settled by the give-up PNP will be used. This is the case of capture accounts. Table 1 shows the risk associated with each account type under the perspective of the responsible PNP/PL.

Table 1: Account types and attributes and derived risks

Account	Settlement risk	Execution risk
Definitive accounts: • Regular without give-up link; • Regular give-up destination; and • Error and operational error.	X	
Definitive account: Regular give-up origin.		X
Transitory accounts: • Master without give-up link with, at least, one linked definitive account without give-up link; • Admincon; • Fintermo; • Market maker; • Intermediary; • Capture; and • Brokerage give-up origin.	X	
Transitory accounts: • Master give-up origin; • Master without give-up link whose linked definitive accounts are all give-up origin; and • Brokerage give-up origin.		X

4. INVESTOR'S RESIDUAL RISK

Limit monitoring is based on the adequacy of the values assigned to the stressed economic capacity of its CEE_{Cadeia} chain of responsibility. The CEE_{Cadeia} of an investor composed of different participants is given by the following equation:

$$CEE_{Cadeia} = min\left(0{,}3 \times CEE_{PN} + 0{,}3 \times CEE_{PNP/PL} + 0{,}3 \times CEE_{MC},\ L1\right) + min\left(F \times CEE_{doc},\ L2\right) \quad (4)$$

Where:

CEE_P is the PNP/PL stressed economic capacity;

CEE_{MC} is the clearing member (MC) stressed economic capacity;

CEE_{PN} is the trading participant (PN) stressed economic capacity;

CEE_{doc} is the stressed economic capacity of the $\boldsymbol{doc}$ investor account holder;

F is the positive factor less than 1 as defined by B3 according to Table 2 below;

L1 is the limit assigned by B3 to the sum of the PN, PNP/PL and MC stressed economic capacity; and

L2 is the limit assigned by B3 to the stressed economic capacity of the ***doc*** investor account holder.

If the same participant plays different roles in the chain of responsibility, its stressed economic capacity contributes to the chain's economic capacity only once.

Stressed economic capacity (CEE) is an indicator of the amount of own liquid funds the participant has during stress moments. The access prerequisites enable the Clearinghouse to hold monthly accounting information that allows the creation of an indicator for CEEs of participants whose access to the Clearinghouse is authorized by it (PNs, PNPs, PLs and MCs). This methodology is described in Annex B.

The Clearinghouse does not have the necessary information to calculate the CEE according to the methodology described in Annex B for a non-participating investor whose access to the Clearinghouse is authorized by it. The Clearinghouse, however, may have access to an indicator

of the investor's economic capacity, such as the equity value of a company or fund. In these cases, factor F will play the role of reducing the economic capacity for stress situations.

The Clearinghouse will determine the factor F value according to the accuracy of the investor's economic capacity indicator and the level of legal certainty if the PNP/PL responsible for the investor or the Clearinghouse attempts to access its funds following their default. The F value for Brazilian funds must be greater than that of international funds. The F value for international companies and funds depends on the quality of their accounting information. Table 2 shows indicative values for the F factor according to the investor's nature and the quality of their accounting information. The Clearinghouse, at its sole discretion, may at any time decide on individual values for certain investors.

Table 2: Indicative values of the F factor by investor type

Investor Type	F Factor
Banks and brokerage houses with access authorized by B3	30%
Brazilian funds with daily equity value	20%
Investment clubs (information from RCL-B3)	20%
Individuals	20%
Brazilian companies with quarterly accounting information reviewed by a special auditor	15%
Brazilian banks and brokerage houses without access authorized by B3	15%
Other investors	10%

The Clearinghouse will systematically use the funds' equity value disclosed by the Securities & Exchange Commission of Brazil (CVM) and the CEE of PNPs, PNs, PLs and MCs to calculate the CEE of the investor's chain of responsibility. The PNP or PL may request the use of the economic capacity from other investor types to calculate the CEE of their chains of responsibility through documents that prove those values. These documents must be sent to Credit Risk at dc-grc@b3.com.br.

If the Clearinghouse's estimate for the CEE of the investor's chain of responsibility is overestimated, its PNP/PL will be responsible for informing its best estimate for that CEE to the Clearinghouse immediately.

The residual risk of a $\boldsymbol{doc}$ document under the responsibility of a $\boldsymbol{P}$ PNP / PL is given by the following equation:

$$RR_{P,doc} = \max\left(R_{P,doc} - CEE_{Cadeia} - G_{Pre-Neg}; 0\right) \quad (5)$$

Where:

$\boldsymbol{G_{Pré-neg}}$ is the collateral amount deposited with the Clearinghouse for pre-trade risk.

5. LIMIT MONITORING

Monitoring LiNe limits at the PNP/PL level allows a top-down assessment of the limits assigned to investors and/or accounts by account type. Therefore, two groups are defined:

Group 1: Definitive accounts; and

Group 2: Transitory accounts.

Residual risks of ***P*** participants are defined as the largest residual risks per document and account types, namely:

$$RR_{P,Grupo\ n} = \max_{doc}\left(RR_{P,doc,Grupo\ n}\right) \qquad \text{for } n = 1 \text{ and } 2 \qquad (6)$$

Where:

$RR_{P,doc,Grupo\ n}$ is the residual risk calculated according to equation (5), considering only Group n accounts.

Limits are considered adequate if all the participant's residual risks are smaller than a maximum value defined by B3.

The PNP/PL may request a justified permission to increase the $LSPVD_{P,doc,ct}$ limit to values that generate a residual risk above the allowed as per this Technical Note for selling in the spot market to Risk Management by calling (5511) 2565-5031. The justifications for such transactions should mitigate the risk of short selling. Examples of justifications include: (i) the existence of an asset balance at the Central Depository, (ii) settlement of equity forward positions, and (iii) settlement of options exercise positions. The Clearinghouse may request evidence to support the justification after the transaction has been carried out.

Given that there is no communication between LiNe Clearing and the Clearinghouse, allocations and give-ups carried out throughout the day are not considered in the calculation of aggregate measures on LiNe Clearing. In practice, this limitation leads participants to adopt high limits for some of their transitory accounts. Therefore, for some participant-held transitory accounts selected by the Clearinghouse, the adequacy of their limits for aggregate metrics will be assessed against the historical consumption.

ANNEX A: EXAMPLES OF PRE-TRADE RISK CALCULATION

Example 1

The $\boldsymbol{doc}$ investor has two regular definitive accounts ($\boldsymbol{Ct_1}$ and $\boldsymbol{Ct_2}$) without give-up link under the responsibility of the $\boldsymbol{P}$ participant. The following limits are assigned to the document limit-entity (there are no limits assigned in the BTB system):

- $LRMKT_{P,doc} = 200$
- $LSDP_{P,doc} = 500$
- $LSPVD_{P,doc} = 500$
- $LSFD_{P,doc} = 60$

Since the accounts have no give-up link to another participant, the assigned limits generate settlement risk for the $\boldsymbol{P}$ participant. Settlement risk considers the accounts together and as the limit-entity used was a document, the settlement risk calculation is directly given by equation (2): $RL_{P,doc} = 200$.

Entities	LRMKT	LSDP	LSPVD	LSFD	LSPTA	LSPDA	*RL*
Account 1	-	-	-	-	-	-	
Account2	-	-	-	-	-	-	
Document	200	500	500	60	-	-	***200***
Final Risk							***200***

Example 2

The $\boldsymbol{doc}$ investor has two regular definitive accounts ($\boldsymbol{Ct_1}$ and $\boldsymbol{Ct_2}$) without give-up link under the responsibility of the $\boldsymbol{P}$ participant. The following limits are assigned to the accounts limit-entity:

- $LRMKT_{Ct_1} = 50$ $\qquad$ $LRMKT_{Ct_2} = 120$

The following limits were assigned to the document limit-entity:

- $LSDP_{P,doc} = 500$
- $LSPVD_{P,doc} = 400$
- $LSFD_{P,doc} = 80$

The following limit has been assigned in the BTB system:

- $LSPDA_{P,doc} = 480$
- $LSPTA_{P,doc} = 100$

Since the accounts have no give-up link to another participant, the assigned limits generate settlement risk for the $\boldsymbol{P}$ participant. Settlement risk considers the accounts together and as the RMKT limits were assigned to accounts, the $\boldsymbol{doc}$ investor limits need to be consolidated:

- $LRMKT_{P,doc,def} = LRMKT_{Ct_1} + LRMKT_{Ct_2} = 170$

When the above limits are applied to equation (2), we have the following: $RL_{P,doc} = 170$.

Entities	LRMKT	LSDP	LSPVD	LSFD	LSPTA	LSPDA	*RL*
Account 1	50	-	-	-	-	-	
Account 2	120	-	-	-	-	-	
Document	170	500	400	80	100	480	***170***
Final Risk							***170***

Example 3

The $\boldsymbol{doc}$ investor has two regular definitive accounts ($\boldsymbol{Ct_1}$ and $\boldsymbol{Ct_2}$) without give-up link under the responsibility of the $\boldsymbol{P}$ participant. Limits are assigned to both the document and the accounts. The following limits were assigned to the document limit-entity:

- $LSDP_{P,doc} = 300$
- $LSPVD_{P,doc} = 400$
- $LSFD_{P,doc} = 60$

The following limits are assigned to the accounts limit-entities:

- $LRMKT_{Ct_1} = 50$ $\quad$ $LRMKT_{Ct_2} = 120$
- $LSFD_{Ct_1} = 40$ $\quad$ $LSFD_{Ct_2} = 40$

The following limit has been assigned in the BTB system:

- $LSPDA_{P,doc} = 1000$
- $LSPTA_{P,doc} = 300$

Since the accounts have no give-up link to another participant, the assigned limits generate settlement risk for the $\boldsymbol{P}$ participant. Settlement risk considers the accounts together.

Given that the RMKT limits were assigned to accounts, the ***doc*** investor limits need to be consolidated:

- $LRMKT_{P,doc} = LRMKT_{Ct_1} + LRMKT_{Ct_2} = 170$

When the above limits are applied to equation (2), we have the following: $RL_{P,doc} = 180$.

Entities	LRMKT	LSDP	LSPVD	LSFD	LSPTA	LSPDA	*RL*
Account 1	50	-	-	40	-	-	
Account 2	120	-	-	40	-	-	
Document	170	300	400	60	300	1000	***180***
Final Risk							***180***

Example 4

The ***doc*** investor has two regular definitive accounts (***Ct_1*** and ***Ct_2***), which are give-up origin accounts under the responsibility of the ***P*** participant. The following limits are assigned to the document limit-entity:

- $LRMKT_{P,doc} = 200$
- $LSDP_{P,doc} = 500$
- $LSPVD_{P,doc} = 400$
- $LSFD_{P,doc} = 60$
- $LSPDA_{P,doc} = 600$
- $LSPTA_{P,doc} = 300$

Since the accounts have a give-up link to another participant, the assigned limits generate settlement risk for the ***P*** participant. Execution risk considers the accounts separately. As the limits assigned to the document limit-entity document can be totally consumed by each of the accounts at different times, the calculation mechanics considers as if the accounts limit-entity received the same limits as the document limit-entity and the consumption were verified together. Furthermore, the limits of the BTB system are not considered in the execution risk calculation.

- $LRMKT_{Ct_1} = LRMKT_{Ct_2} = LRMKT_{P,doc} = 200$
- $LSDP_{Ct_1} = LSDP_{Ct_2} = LSDP_{P,doc} = 500$
- $LSPVD_{Ct_1} = LSPVD_{Ct_2} = LSPVD_{P,doc} = 400$

- $LSFD_{Ct_1} = LSFD_{Ct_2} = LSFD_{P,doc} = 60$

When the above limits are applied to equation (3), we have the following: $\boldsymbol{RE_{P,doc,def} = 70}$.

Entities	LRMKT	LSDP	LSPVD	LSFD	LSPTA	LSPDA	*RE*
Account 1	200	500	400	60	-	-	*70*
Account 2	200	500	400	60	-	-	*70*
Document	200	500	400	60	300	600	
Final Risk							*70*

Example 5

The $\boldsymbol{doc}$ investor has two regular definitive accounts ($\boldsymbol{Ct_1}$ and $\boldsymbol{Ct_2}$), which are give-up origin accounts under the responsibility of the $\boldsymbol{P}$ participant. The following limits are assigned to the accounts limit-entity:

- $LRMKT_{Ct_1} = 50$ $LRMKT_{Ct_2} = 120$
- $LSDP_{Ct_1} = 200$ $LSDP_{Ct_1} = 300$
- $LSPVD_{Ct_1} = 300$ $LSPVD_{Ct_1} = 300$
- $LSFD_{Ct_1} = 40$ $LSFD_{Ct_2} = 40$

And the following limits are assigned to the document limit-entity:

- $LSDP_{P,doc} = 500$
- $LSPVD_{P,doc} = 600$
- $LSFD_{P,doc} = 80$
- $LSPDA_{P,doc} = 500$
- $LSPTA_{P,doc} = 125$

Since the accounts have a give-up link to another participant, the assigned limits generate execution risk for the $\boldsymbol{P}$ participant. Execution risk considers the accounts separately. When the above limits are applied to equation (3), we have the following: $RE_{P,doc} = 42$.

Entities	LRMKT	LSDP	LSPVD	LSFD	LSPTA	LSPDA	*RE*
Account 1	50	200	300	40	-	-	***40***
Account 2	120	300	300	40	-	-	***42***
Document	-	500	600	80	125	500	
Final Risk							***42***

Example 6

The $\boldsymbol{doc}$ investor has two regular definitive accounts ($\boldsymbol{Ct_1}$ and $\boldsymbol{Ct_2}$), which are give-up origin accounts under the responsibility of the $\boldsymbol{P}$ participant. Limits are assigned to both the document and the accounts. The following limits were assigned to the document:

- $LSDP_{P,doc} = 300$
- $LSPVD_{P,doc} = 200$
- $LSFD_{P,doc} = 60$
- $LSPDA_{P,doc} = 500$
- $LSPTA_{P,doc} = 200$

The following limits are assigned to accounts:

- $LRMKT_{Ct_1} = 50$ $\quad$ $LRMKT_{Ct_2} = 120$
- $LSFD_{Ct_1} = 40$ $\quad$ $LSFD_{Ct_2} = 40$

Since the accounts have a give-up link to another participant, the assigned limits generate execution risk for the $\boldsymbol{P}$ participant. Just like settlement risk, execution risk considers the accounts together.

As the limit for the SDP is assigned the document limit-entity, it can be totally consumed by each of the accounts at different times. Therefore, the calculation mechanics considers as if the accounts limit-entity received the same limits as the document limit-entity and the consumption were verified together.

- $LSDP_{Ct_1} = LSDP_{Ct_2} = LSDP_{P,doc} = 300$
- $LSPVD_{Ct_1} = LSPVD_{Ct_2} = LSPVD_{P,doc} = 200$

When the above limits are applied to equation (3), we have the following: $RE_{P,doc} = 42$.

Entities	LRMKT	LSDP	LSPVD	LSFD	LSPTA	LSPDA	*RE*
Account 1	50	300	200	40	-	-	***40***
Account 2	120	300	200	40	-	-	***42***
Document	-	300	200	60	200	500	
Final Risk							***42***

Example 7

The $\boldsymbol{doc}$ investor has one definitive account ($\boldsymbol{Ct_1}$), which is a give-up destination account, i.e., the $\boldsymbol{P}$ participant acts a give-up destination; and one definitive account ($\boldsymbol{Ct_2}$) without give-up link, i.e., the $\boldsymbol{P}$ participant acts a trading participant. Limits were assigned to the document limit-entity for the participant's two figures:

- $LRMKT_{P,D.Rep,doc} = 50$
- $LRMKT_{P,PNP,doc} = 15$
- $LSDP_{P,D.Rep,doc} = 300$
- $LSDP_{P,PNP,doc} = 100$
- $LSPVD_{P,D.Rep,doc} = 200$
- $LSPVD_{P,PNP,doc} = 100$
- $LSFD_{P,D.Rep,doc} = 60$
- $LSFD_{P,PNP,doc} = 20$
- $LSPDA_{P,D.Rep,doc} = 200$
- $LSPDA_{P,PNP,doc} = 300$
- $LSPTA_{P,D.Rep,doc} = 0$
- $LSPTA_{P,PNP,doc} = 100$

In this case, limits assigned to the $\boldsymbol{P}$ participant's two figures generate settlement risks, which must be added. Therefore, when the limits are applied to equation (2), we have the following: $R_{P,D.Rep,doc} = 75$ and $R_{P,PNP,doc} = 54$. When these results are applied to equation (1) we obtain the value $R_{P,doc} = 129$ for the $\boldsymbol{doc}$ risk under the $\boldsymbol{P}$ participant.

Entities	LRMKT	LSDP	LSPVD	LSFD	LSPTA	LSPDA	*RL*
Account 1	-	-	-	-	-	-	
Account 2	-	-	-	-	-	-	
Document (PNP)	15	100	100	20	100	300	***54***
Document (D. Rep)	50	300	200	60	0	200	***75***
Final Risk							***129***

Example 8

The $\boldsymbol{doc}$ investor has one definitive account ($\boldsymbol{Ct_1}$), which is a give-up destination account, i.e., the $\boldsymbol{P}$ participant acts a give-up destination; and one definitive account ($\boldsymbol{Ct_2}$) without give-up link, i.e., the $\boldsymbol{P}$ participant acts a trading participant. Limits were assigned to the document limit-entity for the participant's two figures:

- $LRMKT_{P,D.Rep,doc} = 50$
- $LRMKT_{P,PNP,doc} = 15$
- $LSDP_{P,D.Rep,doc} = 300$
- $LSDP_{P,PNP,doc} = 100$
- $LSPVD_{P,D.Rep,doc} = 400$
- $LSPVD_{P,PNP,doc} = 200$
- $LSFD_{P,D.Rep,doc} = 60$
- $LSFD_{P,PNP,doc} = 20$
- $LSPDA_{P,D.Rep,doc} = 200$
- $LSPDA_{P,PNP,doc} = 300$
- $LSPTA_{P,D.Rep,doc} = 0$
- $LSPTA_{P,PNP,doc} = 100$

In this case, limits assigned to the $\boldsymbol{P}$ participant's two figures generate settlement risks, which must be added. Therefore, when the limits are applied to equation (2), we have the following: $R_{P,D.Rep,doc} = 100$ and $R_{P,PNP,doc} = 54$. When these results are applied to equation (1) we obtain the value $R_{P,doc} = 129$ for the $\boldsymbol{doc}$ risk under the $\boldsymbol{P}$ participant.

Entities	LRMKT	LSDP	LSPVD	LSFD	LSPTA	LSPDA	*RL*
Account 1	-	-	-	-	-	-	
Account 2	-	-	-	-	-	-	
Document (PNP)	15	100	200	20	100	300	***54***
Document (D. Rep)	50	300	400	60	0	200	***100***
Final Risk							***154***

Example 9

The $\boldsymbol{doc}$ investor has one definitive give-up destination account ($\boldsymbol{Ct_1}$) under the responsibility of the $\boldsymbol{P}$ participant. Besides using the account as give-up destination, the investor executes trades

in this account through the $\boldsymbol{P}$ participant itself. There are no limits assigned in the BTB system. The following limits were assigned to the document limit-entity:

- $LSDP_{P,D.Rep,doc} = 500$ $\quad$ $LSDP_{P,PNP,doc} = 100$
- $LSPVD_{P,D.Rep,doc} = 450$ $\quad$ $LSPVD_{P,PNP,doc} = 150$
- $LSFD_{P,D.Rep,doc} = 60$ $\quad$ $LSFD_{P,PNP,doc} = 10$

The following limit was assigned to the account limit-entity:

- $LRMKT_{Ct_1} = 50$

It should be noted that, even if $\boldsymbol{Ct_1}$ does not have a give-up link registration, for the purpose of pre-trade risk evaluation it is considered that trades executed through $\boldsymbol{P}$ are given up to $\boldsymbol{Ct_1}$. This means that for pre-trade risk evaluation purposes, the give-up origin account is considered. Therefore, the execution risk is calculated by applying the limits assigned to the document, with $\boldsymbol{P}$ in the trading participant figure, in equation (3) given by $RE_{P,doc} = 17.5$.

Additionally, the settlement risk is calculated by applying the limits assigned to the document, with $\boldsymbol{P}$ in the give-up destination figure, in equation (2) given by $R_{P,D.Rep,doc} = 125$. Finally, the results are applied in equation (1), resulting in $R_{P,doc} = 125$ for the $\boldsymbol{doc}$ risk under the $\boldsymbol{P}$ participant.

Entities	LRMKT	LSDP	LSPVD	LSFD	*RE*	*RL*
Account 1	50	100	150	10	*17,5*	
Document (PNP)	-	100	150	10		
Document (D. Rep)	50	500	450	60		*125*
Final Risk						*125*

ANNEX B: STRESSED ECONOMIC CAPACITY

The participant's economic capacity must reflect its ability to fulfill its obligations to the Clearinghouse. Given that the manner and timeframe of compliance with these obligations under B3 regulations requires cash or assets with immediate liquidity in Brazilian Reals, the participant's capacity must measure its liquid financial assets that are not dependent on third party financing.

The following methodology is applied to a participant whose access to the Clearinghouse is authorized by it.

Since the economic capacity (CE) fluctuates over time, it is important to include the deterioration risk arising therefrom. Therefore, the participant's credit risk will be measured from a future potential shortfall of its CE. Once the credit risk is applied to its capacity, the stressed economic capacity (CEE) is achieved. Current and stressed economic capacities are defined below.

ECONOMIC CAPACITY

As the CE cannot be defined unequivocally from balance sheet data, the minimum indicator between the Adjusted Net Equity Value (PLA) and Liquid Financial Assets in T0 ($AFLD0$) will be used as given by the equation below:

$$CE = \min(AFLD0, PLA) \qquad \text{(B1)}$$

The $AFLD0$ and PLA values will be obtained from the participant's monthly financial statement level 8. B3 may, at its sole discretion, use the balance sheet of the participant's prudential conglomerate.

$AFLD0$ is the balance between financial assets with immediate liquidity and short-term financial liabilities. It was built from Free Liquid Assets (AFD), as defined in the BM&FBOVESPA Access Manual. It should be noted that in the institution's balance sheet there is no separation between assets and liabilities by availability/expiration date. Therefore, the choice of accounts that will make up the $AFLD0$ involves some degree of discretion.

AFD is calculated based on the following accounts set forth in the Chart of Accounts of the National Financial System Institutions (Cosif):

- **a.** Cash and cash equivalents (1.1.0.00.00-6);
- **b.** Liquid interbank investments (1.2.0.00.00-5);

c. Securities and financial derivatives instruments (1.3.0.00.00-4);

d. Financial derivatives instruments (1.3.3.00.00-3);

e. Linked to collateral posting (1.3.6.00.00-2); and

f. Repo obligations (4.2.0.00.00-6).

AFD is given by the equation:

$$AFD = (a + b + c) - (d + e + f) \quad \text{(B2)}$$

$AFLD0$ is the AFD adjusted to immediate liquidity, i.e., it can be obtained on the same day (T0). For this, the following Cosif accounts should be added to the analysis:

g. Intermediate fixed income securities (1.3.1.05.00-2)

h. Illiquid fixed income securities = fixed income securities (i) – liquid fixed income securities (ii)

i. Fixed income securities (1.3.1.10.00-4)

ii. Illiquid fixed income securities = the sum total of the following accounts:

- Federal Treasury Bills (1.3.1.10.03-5)
- National Treasury Bills (1.3.1.10.05-9)
- National Treasury Notes (1.3.1.10.07-3)
- National Treasury Obligations (1.3.1.10.10-7)
- National Treasury Bonds (1.3.1.10.12-1)
- Central Bank Bills (1.3.1.10.15-2)
- Central Bank Notes (1.3.1.10.16-9)
- Central Bank Bonds (1.3.1.10.18-3)

i. Investment in structured transactions certificates (1.3.1.13.00-1)

j. Investment fund shares (1.3.1.15.00-9)

k. Equity securities (1.3.1.20.00-1)

l. Economic development bonds (1.3.1.50.00-2)

m. Commodities investment (1.3.1.60.00-9)

n. Securities investment abroad (1.3.1.85.00-8)

o. Special regime companies securities (1.3.1.90.00-0)

p. Central Bank bonds (1.3.4.00.00-6)

q. Securities linked to the acquisition of state-owned companies stocks (1.3.5.00.00-9)

r. Repurchase agreement obligations with own issue securities (4.2.1.10.80-0)

The assets referred to in items (g) to (q) are considered illiquid. $AFLD0$ is given by the equation:

$$AFLD0 = AFD - (g + h + \cdots + q) - r \quad \text{(B3)}$$

PLA is the Net Equity Value (PL) adjusted by the monthly net result. The Cosif accounts involved are as follows:

a. Net equity value (6.0.0.00.00-2);
b. Credit statement accounts (7.0.0.00.00-9); and
c. Debit statement accounts (8.0.0.00.00-6).

The PLA is given by the following equation:

$$PLA = PL + (b - c) \quad \text{(B4)}$$

STRESSED ECONOMIC CAPACITY

As the Stressed Capacity (CE) is calculated based on accounting information with a lag of at least one month, the risk of its monthly variation needs to be considered. The Stressed Economic Capacity (CEE) is defined as the CE reduced by its future potential shortfall, according to the equation below:

$$CEE_{P,T} = CE_{P,T-1}(1 + Credit\ Risk_P) \quad \text{(B5)}$$

Since risks arising from monthly variations in $AFLD0$ and PLA differ, they need to be differentiated them in the analysis by rewriting the previous equation.

$$CEE_{P,T} = \min\left(AFLD0_{P,T-1}(1 + risk\ AFLD0_P),\ PLA_{P,T-1}(1 + risk\ PLA_P)\right) \quad \text{(B6)}$$

Both risks are defined as the Expected Shortfall (ES) of their respective variables with a 90% confidence level. This means that the risk is the average of future shortfalls equal to or greater than the 10th percentile. Whether *K* is equal to $AFLD0$ or equal to PLA, its risk is given by equation (B7):

$$Risk(K) = ES[monthly\ variation\ of\ K]^{10\%} = ES[VM(K)]^{10\%} \quad \text{(B7)}$$

The ES was selected as the risk measure to bring stability to the CEE while also considering the shortfalls. The definition of both risks is prospective and, whenever possible, supported by historical data following the same treatment given to market risk factors. The beginning of the sample for historical data taken from balance sheets is January 2012. The following equation presents the CEE in its most detailed form:

$$CEE_{P,T} = \min\Big(AFLD0_{P,T-1}(1 + ES[VM(AFLD0_P)]^{10\%}),\ PLA_{P,T-1}(1 + ES[VM(PLA_P)]^{10\%})\Big) \quad \text{(B8)}$$

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Responsible	Area
Drafting	Risk Modeling
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Version	Item Changed	Reason	Date
01	Original Version	N/A	N/A
02	Inclusion of SPDA and SPTA risk metrics in the residual risk calculation	Update of the methodology for monitoring including the limits assigned in the Securities Lending Electronic Trading system (BTB Tela)	10/29/2020
03	Change of settlement risk calculation formula	Change of assumption and settlement risk considered for the event of improper execution of borrowing positions	07/26/2021
04	Inclusion of SPVD risk metrics in the residual risk calculation and exclusion of sales control in the spot market	Update of the methodology for monitoring including the new limit assigned in the Potential Short Uncovered Balance	05/16/2022