Interest Accrual Mechanics

Each time *borrow* or *repay* happens, a checkpoint of the *borrowerIndex* is updated and saved into the smart contract storage. The index defines how much interest has accrued, starting with the block when the last time interest was applied, until the current block. For every newly deployed Borrowing Pool, the initial *borrowerIndex* is `1`. The rate at which it accumulates interest every block is the *InterestRate* (i.e. 10%) divided by the number of blocks per year. Blocks delta ($\Delta blocks$) is the current block number subtracted by the block number saved in the checkpoint $\Delta blocks = blockNumber_n - blockNumber_{n-1}$.

$$borrowerIndex_n = \left(\frac{InterestRate}{blocksPerYear} \times \Delta blocks \times borrowerIndex_{n-1} \right) + borrowerIndex_{n-1}$$

Or, another representation

$$borrowerIndex_n = \left(\frac{InterestRate}{blocksPerYear} \times \Delta blocks + 1 \right) \times borrowerIndex_{n-1}$$

A borrower's balance, including accrued interest, is calculated by dividing the current *borrowerIndex* to the index when the user's balance was last checkpointed and multiplying it by the *principal*.

$$borrowerBalance_n = \frac{borrowerIndex_n}{borrowerIndex_{n-1}} \times principal$$

Borrowing Pool Dynamics

$$utilizationRatio_b = \frac{borrowerBalance_b}{poolSize_b}$$

where

$$poolSize_b = Cash_b + borrowerBalance_b - \left(reserveBalance_b + insuranceBalance_b + interestOutstanding_b \right)$$

where *Cash* is the total amount of underlying liquidity that has not been borrowed, meaning the amount of base currency tokens (i.e on the balance of the Borrowing Pool.

Lenders APR in the *b* Borrowing pool is $APR_b = InterestRate \times utilizationRatio_b$

Insurance and Reserve Balances

Both reserve and insurance balances (reserves) are calculated the same way. The only difference between them is the *factor* which represents the percentage of the *interestAccrued* per block

$$reserveBalance_n = reserveBalance_{n-1} + borrowerBalance_{n-1} \times \frac{factor_{reserve} \times InterestRate}{blocksPerYear} \times \Delta blocks$$

$$insuranceBalance_n = reserveBalance_{n-1} + borrowerBalance_{n-1} \times \frac{factor_{insurance} \times InterestRate}{blocksPerYear} \times \Delta blocks$$

Liquidity Available

$$liquidityAvailableBorrower_b = poolSize_b - borrowerBalance$$

$$interestOutstanding_b = borrowerBalance_b - totalPrincipal_b$$

$$liquidityAvailableLenders_b = poolSize_b - borrowerBalance + interestOutstanding_b$$