Flow Margin Trading Working Paper

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1 Introduction

Flow Margin Trading protocol enable traders to **margin buy** and **short sell** any trading pair supported by the liquidity providers, including forex pairs such as EURUSD and USDJPY, at their chosen leverages up to 50 times of their own deposits.

2 Liquidity Pool

A liquidity provider can run his/her own liquidity pool after depositing USD stablecoins to be used as collateral to open margin positions, and set up their trading parameters such as spread and safe margin threshold, as well as which trading pairs they would like to trade against with the traders.

Flow protocol support co-existence of multiple liquidity pools, and traders are free to choose which liquidity pool to trade against with.

3 Model Setup

The following model is set up for margin buying and short selling trades.

- t - Time
- i - Trade $i = 1, 2, 3...$

- m - Midpoint of Market Exchange Rate in the form of XXX against USD, e.g. when market rate of EUDUSD equals to m, one USD is worth $1/m$ unit of EUR; and market rate of USDJPY equals to $1/m$ that one USD is worth m unit of JPY.
  m_0^i - Midpoint of Market Exchange Rate of trade i at its opening position
  m_t - Midpoint of Market Exchange Rate at time t

- θ - Market Fluctuation
  $m_t = m_0^i(1 + \theta_t^i)$ for any particular open position

- b and a - Bid or Ask spread between the Flow bid price $m_t(1 - b)$ or ask price $m_t(1 + a)$ to the market midpoint m_t set by the liquidity provider of a pool that

$$b_t = \frac{m_t - m_t(1 - b)}{m_t}$$

$$a_t = \frac{m_t(1 + a) - m_t}{m_t}$$

  Bid and ask spread b_t and a_t are chosen by the liquidity provider that can be changed anytime.

- l - Liquidation Fee, a fixed fee prepaid in equal amount of USD stablecoins by the trader and the liquidity provider at opening of a position, which will be fully refunded to both parties if the position is closed normally, or rewarded to the arbitrager if the position is liquidated. Liquidation fee is utilized in our Ethereum protocol as an incentive for arbitrager to monitor and close the positions at risk, as well as an incentive for traders and liquidity providers to close the positions to prevent losing these fees.

- v - Number of USD stablecoins deposited by trader at opening of a position, excluding the liquidation fee

- z - Leverage Ratio, $z \leq 50$

- α - Ratio of extra collateral that the liquidity provider is required to lock in to open an position, and currently $\alpha = 100\%$ of $\alpha v = v$ is required to be locked on top of v in a liquidity pool as collateral against market fluctuations.

- c - Collateral that belong to the liquidity provider at an open position, $c_0 = \alpha v = v$

- β - Safe Margin threshold, e.g. 20%

- γ - Liquidation threshold, e.g. 0%

4 Open Position

Suppose a trader is interested in opening a margin position with v USD stablecoins at leverage ratio z, he/she deposits unit of $v + l$ USD stablecoins into a liquidity pool. Since $\alpha = 100\%$, $v + l$ USD stablecoins from the liquidity provider are locked as collateral by Flow protocol to open the position with total collateral

$$\{ \quad v \quad + \quad v \quad \}$$

and $l + l$ are locked as liquidation fees.

4.1 Margin Buying

Suppose the trader opens a EURUSD margin buying position i with v USD stablecoins at leverage ratio z when market price is m_0^i,

$$\left\{ \quad \frac{z \cdot v^i}{m_0^i(1 + a_0^i)} \quad | \quad v^i \quad + \quad v^i \quad \right\}$$

that the trader holds an open margin position of $z \cdot v^i / [m_0^i(1 + a_0^i)]$ unit of EUR and a total collateral of $v^i + v^i$ are locked.

4.2 Short Selling

Suppose the trader opens a EURUSD margin buying position i with v^i USD stablecoins at leverage ratio z when market price is m_0^i,

$$\left\{ \quad \frac{z \cdot v^i}{m_0^i(1 - b_0^i)} \quad | \quad v^i \quad + \quad v^i \quad \right\}$$

that the trader holds an open margin position of $z \cdot v^i / [m_0^i(1 - b_0^i)]$ unit of EUR and a total collateral of $v^i + v^i$ are locked.

5 Unrealized Profit & Loss of an Open Position

5.1 Margin Buying Position

For a trader that opened a margin buying open position as

$$\left\{ \quad \frac{z \cdot v^i}{m_0^i(1 + a_0^i)} \quad | \quad v^i \quad + \quad v^i \quad \right\}$$

, when midpoint of market price reaches m_t, his unrealized profit or loss of the trade i

$$\pi_t^i = \frac{zv^i}{m_0^i(1+a_0^i)}\left[m_t(1-b_t) - m_0^i(1+a_0^i)\right] = zv^i\left[\frac{(1+\theta_t^i)(1-b_t)}{(1+a_0^i)} - 1\right]$$

and the open position is now

$$\left\{ \quad \frac{z \cdot v^i}{m_0^i(1+a_0^i)} \quad | \quad (v^i + \pi_t^i) \quad + \quad (v^i - \pi_t^i) \quad \right\}$$

i.e.

$$\left\{ \frac{z \cdot v^i}{m_0^i(1+a_0^i)} \quad | \quad zv^i\left[\frac{1}{z} - 1 + \frac{(1+\theta_t^i)(1-b_t)}{(1+a_0^i)}\right] \quad + \quad zv^i\left[\frac{1}{z} + 1 - \frac{(1+\theta_t^i)(1-b_t)}{(1+a_0^i)}\right] \right\}$$

where reminding collateral that belong to the liquidity provider

$$c_t^i = zv^i\left[\frac{1}{z} + 1 - \frac{(1+\theta_t^i)(1-b_t)}{(1+a_0^i)}\right]$$

5.2 Short Selling Position

For a trader that opened a short selling buying open position as

$$\left\{ \quad \frac{z \cdot v^i}{m_0^i(1-b_0^i)} \quad | \quad v^i \quad + \quad v^i \quad \right\}$$

, when midpoint of market price reaches m_t, his unrealized profit or loss of the trade i

$$\pi_t^i = \frac{zv^i}{m_0^i(1-b_0^i)}\left[m_0^i(1-b_0^i) - m_t(1+a_t)\right] = zv^i\left[1 - \frac{(1+\theta_t^i)(1+a_t)}{(1-b_0^i)}\right]$$

and the open position is now

$$\left\{ \quad \frac{z \cdot v^i}{m_0^i(1+a_0^i)} \quad | \quad (v^i + \pi_t^i) \quad + \quad (v^i - \pi_t^i) \quad \right\}$$

i.e.

$$\left\{ \frac{z \cdot v^i}{m_0^i(1-b_0^i)} \quad | \quad zv^i \left[\frac{1}{z} + 1 - \frac{(1+\theta_t^i)(1+a_t)}{(1-b_0^i)} \right] \quad + \quad zv^i \left[\frac{1}{z} - 1 + \frac{(1+\theta_t^i)(1+a_t)}{(1-b_0^i)} \right] \right\}$$

where reminding collateral that belong to the liquidity provider

$$c_t^i = zv^i \left[\frac{1}{z} - 1 + \frac{(1+\theta_t^i)(1+a_t)}{(1-b_0^i)} \right]$$

6 Close Position

The protocol caps the profit and loss at collateralized margin of each position to ultimately protect participating parties, that the maximum that a trader and a liquidity provider could gain or lose in any open position is sum of the original collateral locked at opening and the liquidation fee.

6.1 Liquidation of an Open Position

An open position is considered to be completely liquidated, when the proportion of either the trader's or the liquidity provider's remaining collateral against their original collateral at opening reach the liquidation threshold (currently set up as $\gamma = 0\%$),

- either when absolute value of unrealized loss of a trader is equal to his original collateral locked at opening

$$\pi_t^i = -v^i$$

  - for a Margin Buying Position

$$\frac{(1+\theta_t^i)(1-b_t)}{(1+a_0^i)} = 1 - \frac{1}{z}$$

  - for a Short Selling Position

$$\frac{(1+\theta_t^i)(1+a_t)}{(1-b_0^i)} = 1 + \frac{1}{z}$$

- or when the remaining collateral that belong to the liquidity provider reach zero

$$c_t^i = 0$$

– for a Margin Buying Position

$$\frac{(1+\theta_t^i)(1-b_t)}{(1+a_0^i)} = 1 + \frac{1}{z}$$

– for a Short Selling Position

$$\frac{(1+\theta_t^i)(1+a_t)}{(1-b_0^i)} = 1 - \frac{1}{z}$$

then any arbitrager may step in to close the position and receive a reward of $2l$ USD stablecoins, the Liquidation Fees paid by both parties at opening of the position.

6.2 Unsafe Open Positions

An open position is considered ***unsafe*** if the proportion of liquidity provider's remaining collateral against their original collateral at opening reach the safe margin threshold,

$$c_t^i \leq \beta v^i$$

that is, when

- for a Margin Buying Position

$$1 + z\left[1 - \frac{(1+\theta_t^i)(1-b_t)}{(1+a_0^i)}\right] \leq \beta$$

- for a Short Selling Position

$$1 + z\left[\frac{(1+\theta_t^i)(1+a_t)}{(1-b_0^i)} - 1\right] \leq \beta$$

and the liquidity provider may choose to close the open position to stop their loss.

6.3 Safe Open Positions

An open position is considered ***safe*** if it is not unsafe, and only the trader who opened the safe position is allowed to close it. Trader may close a safe open position anytime t to receive his current unrealized profit or loss together with his original collateral $v^i + \pi_t^i$ and have the prepaid liquidation fee l refunded.

6.4 Numerical Examples

The following two tables demonstrate how different leverage ratios and market fluctuations affect open positions in Margin Buying and Short Selling trades.

Margin Buying - Numerical Examples of trading EURUSD pair $m_0 = 1.2000$, $a_0 = 0.01$, $b_t = 0.01$, $\beta = 20\%$ $v = 1,212$ USD stablecoins, opening margin long position of EUR				
		Market Fluctuation θ_t that make		
Leverage	EUR Position	Liquidation I $\pi_t = -v$	Liquidation II $c_t = 0$	Safe Margin $c_t = \beta v$
5x	5,000	-18.38%	22.42%	18.34%
10x	10,000	-8.18%	12.22%	10.18%
20x	20,000	-3.08%	7.12%	6.10%
50x	50,000	-0.02%	4.06%	3.65%

Short Selling - Numerical Examples of trading EURUSD pair $m_0 = 1.2000$, $a_0 = 0.01$, $b_t = 0.01$, $\beta = 20\%$ $v = 1,188$ USD stablecoins, opening short selling position of EUR				
		Market Fluctuation θ_t that make		
Leverage	EUR Position	Liquidation I $\pi_t = -v$	Liquidation II $c_t = 0$	Safe Margin $c_t = \beta v$
5x	5,000	17.62%	-21.58%	-17.66%
10x	10,000	7.82%	-11.78%	-9.82%
20x	20,000	2.92%	-6.88%	-5.90%
50x	50,000	-0.02%	-3.94%	-3.55%

7 Tokenized Margin Positions

Besides individual margin positions, we aim to provide tokenized margin positions in the next stage, where fungible tokens will be minted at opening position. Such tokens can be traded in external exchanges more conveniently, while the opening position associated with each token can also be closed within the Flow protocol by the token holder.