

# Flow Integrated Money Market Working Paper

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## 1 Before Trading

To start trading, traders and liquidity providers make deposits in USD stablecoins, and iUSD tokens of equivalent value will be issued and deposited into the liquidity pools by the Flow protocols.

After receiving  $w$  USD stablecoins at time  $t$ , Flow protocols invest a proportion  $d_t w$  of the deposit into a chosen cryptocurrency lending platforms (e.g. Compound) to generate additional return from the external money market, while holding the rest  $(1 - d_t)w$  as cash reserve for liquidity, where

$$d \in (0, 100\%) \quad \forall t$$

This is because not all investment made into the cryptocurrency lending platforms can be cashed out immediately at all time, depending on the Total Supply ( $TS$ ) and Total Borrow ( $TB$ ) on the platforms prior to the deposit  $d_t w$  that

$$\epsilon_t = \frac{(TS_t + d_t w) - TB_t}{TS_t + d_t w}$$

Thus, for every 1 USD stablecoin deposit received, Flow protocol makes sure  $s$  unit of the USD stablecoins can be withdrawn at all time with full liquidity, i.e. maintaining a minimum liquidity level  $s \in (0, 100\%)$  of for all deposits we receive from liquidity providers and traders, that

$$s = \epsilon_t d_t + (1 - d_t) \quad \forall t$$

that

$$d_t = \frac{(1 - s)TS_t}{TB_t - (1 - s)w}$$

for all

$$w \leq \frac{TB_t - (1-s)TS_t}{1-s}$$

Once there are two or more deposits invested into the lending platforms, re-balance (with adjustment  $k_t$  if needed) is performed at each time when a new deposit (or withdrawal, i.e.  $w < 0$ ) is made, to make sure the minimum liquidity level is maintained.

Before making the  $n_{th}$  deposit into the lending platforms at time  $t$ , we compute the amount to be deposited (including re-balance adjustment  $k$ ) to satisfy the condition that the sum of the current balance of our USD stablecoins investment that can be withdrawn with full liquidity, total USD stablecoins kept in hands, the fully liquidity part of new  $n_{th}$  deposit, and remaining fund from  $w^n$  to be kept in hand, is equal to the total fund we have received from liquidity providers and traders and those we have earned from investment multiplying by the minimum liquidity level  $s$ .

For

$$W^n = \sum_{i=1}^n w^i \quad \text{and} \quad D^i = d^i w^i$$

where  $D_t^i$  grow in USD stablecoins as receiving returns from lending platforms

Solve

$$\begin{aligned} \epsilon_t^n \sum_{i=1}^{n-1} (D_t^i + k_t^i) + \sum_{i=1}^{n-1} [(1-d^i)w^i - k^i] + \epsilon_t^n (D^n + k_t^n) + [(1-d_t^n)w^n - k_t^n] \\ = s \left[ W^n + \sum_{i=1}^{n-1} (D_t^i + k_t^i) - \sum_{i=1}^{n-1} d^i w^i \right] \end{aligned}$$

where

$$\epsilon_t^n = \frac{(TS_t + D^n + k_t^n) - TB_t}{TS_t + D^n + k_t^n}$$

for  $k_t^n$ , where  $k^1 = 0$  and any  $k_t^i > 0$  also grow in USD stablecoins as receiving returns from lending platforms.

- If  $k_t^n = 0$ , no additional adjustment will be performed and only  $d^n w^n$  will be invested into the lending platform.

- If  $k_t^n > 0$ , an additional deposit of  $k_t^{n+1}$  on top of  $d^n w^n$  will be invested into the lending platform.
- If  $k_t^n < 0$ ,  $d^n w^n$  minus adjustment of  $|k_t^n|$  will be invested into the lending platform.

In realization of the model, since we have direct access to our current balance in the leading platforms  $B$ , total returns of USD stablecoins earned in the leading platforms so far  $R$ , total fund held in hand  $C$  that we do not have to calculate all terms cumulatively that instead we solve the simplified condition

$$\epsilon_t^n B_t^{n-1} + C^{n-1} + \epsilon_t^n \Delta B_t + \Delta C_t = s(W^n + R_t^{n-1})$$

where

$$\begin{aligned} B_t^{n-1} &= \sum_{i=1}^{n-1} (D_t^i + k_t^i) \\ C^{n-1} &= \sum_{i=1}^{n-1} [(1 - d^i)w^i - k^i] \\ R^{n-1} &= \sum_{i=1}^{n-1} (D_t^i + k_t^i) - \sum_{i=1}^{n-1} d^i w^i \end{aligned}$$

$$\epsilon_t^n = \frac{TS_t + \Delta B_t - TB_t}{TS_t + \Delta B_t} \quad \text{and} \quad \Delta C_t = w^n - \Delta B_t$$

that the amount to deposit at  $t$

$$\Delta B_t = \frac{TS_t [s(W^n + R_t^{n-1}) - C^{n-1} - w^n] - (TS_t - TB_t)B_t^{n-1}}{B_t^{n-1} - TB_t - s(W^n + R_t^{n-1}) + C^{n-1} + w^n}$$

## 2 Return of fEUR

If a trader wants to purchase fEUR tokens, he needs to deposit the required amount of USD stablecoins firstly. After iUSD tokens of equivalent value are issued and deposited into the liquidity pool by the protocols, fEUR tokens will be minted according to the exchange rate and transferred to the trader.

Now the trader may use the fEUR tokens to his will, that he can either keep them in his wallet, spend them as a medium of payment, sell them in external exchanges, or he can choose to deposit the fEUR tokens back to the protocol to earn return.