

Trading threshold equation

This document describes an equation to determine the appropriate trading threshold that should be used for executing profitable trades.

Assume that we trade V_S volume of spot assets at price P_S for 1 unit of the asset. In a similar notion, assume we trade V_F lots of futures perpetual assets, at price P_F for 1 unit of the asset. 1 lot size of perpetual asset represents R_F units of the asset.

Also, assume that for each trade, a taker fee of T_S is levied on spot assets, and T_F on perpetuals.

If we want to make the choice for going long spot, short futures, our profit is

$$\begin{aligned} Profit &= V_F R_F P_F - V_S P_S - T_S V_S P_S - T_F V_F R_F P_F \\ &= (1 - T_F) V_F R_F P_F - (1 + T_S) V_S P_S \end{aligned}$$

If we want to generate positive returns from the trade, then profit must be at least 0.

$$(1 - T_F) V_F R_F P_F - (1 + T_S) V_S P_S \geq 0$$

$$\frac{P_F}{P_S} \geq \frac{(1+T_S)V_S}{(1-T_F)V_F R_F} - (1) \quad (1)$$

Likewise, if we go short spot, long futures, we obtain the equation

$$\frac{P_S}{P_F} \geq \frac{(1+T_F)V_F R_F}{(1-T_S)V_S} - (2) \quad (2)$$

In all, since we do not know if the bot will go long / short on either assets, we determine that the best threshold T^* to execute the trade should be the maximal of (1) or (2).

$$T^* = \max \left(\frac{(1+T_S)V_S}{(1-T_F)V_F R_F}, \frac{(1+T_F)V_F R_F}{(1-T_S)V_S} \right) - \quad (3)$$

A special case happens when $V_S = V_F R_F$, implying that we are executing equal units of trade for the given asset. In this case, we can simplify equation (3) to:

$$T^* = \max \left(\frac{1+T_S}{1-T_F}, \frac{1+T_F}{1-T_S} \right)$$