Trailing Stops

Trailing stops are used in different industries and depend on the objective. For this homework, trailing stops are used to minimize the risk of significant losses on FX trading.

Homework environment:

From the previous homework, for 10 currency pairs and 10 consecutive hours (a total of 100 data points $T_1, T_2, \dots, T_{100}$ for each currency pair), you have computed 5 features every 6 minutes:

1. The Mean Price (P),
2. The maximum price (MAX),
3. The minimum price (MIN),
4. The Volatility (VOL = MAX–MIN), and
5. The Fractal Dimension (FD).

Now, you will add a new feature: the return r defined as $r_i = (P_i - P_{i-1})/P_{i-1}$. (The first 6-minutes ($T_1$) doesn't have a return because of the absence of prior information.). So, after adding the returns, you will end up with a total of 6 features every 6 minutes (except for the first bucket).

Logic:

1. Choose randomly 5 currency pairs to go LONG (Buy) and 5 currency pairs to go SHORT (Sell).
2. Buy (or sell) 100 currency units (USD, CHF, GBP, etc.) at T_1 for each currency pair.
3. First layer:
    a. At T_{10} (1 hour after you entered the initial trade) check if the position is doing well, i.e., if your loss **IS NOT** larger than **0.250%**. Consider that, if you are LONG, a profitable trade has a positive return; if you are SHORT, a profitable trade has a negative return.
    b. Use the following approximation: $r_{10} = \sum_{i=2}^{10} r_i$.
    c. If your loss is larger than 0.250%, then immediately close the trade at T_{10} and compute the loss – you are done with this trade.
    d. If your loss is NOT larger than 0.250%, compute the profit (or small loss) and invest an extra 100 currency units (USD, CHF, GBP, etc.). Then, you will have a total of 200 currency units, plus the profit (or small loss) from T_1 to T_{10}.
4. Second layer:
    a. At T_{20} (2 hours after you entered the initial trade) check if the position is doing well, i.e., if your loss **IS NOT** larger than **0.150%** since T_{10}.
    b. Use the following approximation: $r_{20} = \sum_{i=11}^{20} r_i$.
    c. If your loss is larger than 0.150%, then immediately close the trade at T_{20} and compute the total profit or loss, and you are done with this trade.
    d. If your loss is NOT larger than 0.150%, compute the profit (or small loss) and invest an extra 100 currency units. Then, you will have a total of 300 currency units, plus the profit (or small loss) from T_1 to T_{10}, plus the profit (or small loss) from T_{11} to T_{20}.

5. Third layer:
    a. Same logic as the first and second layer at T_{30} (3 hours after you entered the initial trade). However, the loss tolerance is reduced to 0.100% since T_{20}. If your loss is NOT larger than 0.100%, compute the profit or loss and invest an extra 100 currency units to 400 currency units, plus the profit (or small loss) from T_1 to T_{10}, plus the profit (or small loss) from T_{11} to T_{20}, plus the profit (or small loss) from T_{21} to T_{30}.
6. Forth layer:
    a. Same logic 4 hours after you entered the initial trade. However, the loss tolerance is reduced to 0.050% since T_{30}.
7. After the fourth layer, there is no new investment, and the loss tolerance remains 0.050% I.e., if at T_{50} the loss reaches 0.050% since T_{40}, then we close the trade; if at T_{60} the loss reaches 0.050% since T_{50}, then we close the trade; and so on. Otherwise, we keep the position open until you close it after 10 hours.

Output:

1. You should generate a *.csv file with the numerical value of the 6 features (P, MAX, MIN, VOL, FD, and r) – a total of 100 data vectors (with 6 components) for each currency pair (the first data vector doesn't have r).
2. You should generate *.csv file with the balance for all currency pairs at T_{10}, T_{20}, …, T_{100}, and the profit (or loss) at the end of the time window (10 hours).

Final comment: I will be in person at NYU on Wednesday (11/23/2022) from 6 to 7 pm to answer all questions regarding HWK 3.