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18/02/2024

**Quantitative Analyst project TMC**

**MEAN REVERSION MODEL**

Goal of this exercise is to backest the proposed trading strategy and to check wheter it is possible to improve it by modifying some of its parameters.

I start backtesting the proposed strategy as descripted, then I will perform some parameters’ tuning to check if it is possible to improve it.

The Mean Reversion Entry signal is the intersection of two signals S1 and S2. When they are both triggered the trading system enters a Long or Short position in the asset.

S1\_long is triggered when the price of an instrument is simultaneously below:

* the 5% percentile calculated on the last 10 trading days (as convention for 2 weeks)
* the 15% percentile calculated on the last 21 trading days (as convention for 1 month)
* the 25% percentile calculated on the last 63 trading days

S1\_short is triggered when the price of an instrument is simultaneously above:

* the 95% percentile calculated on the last 10 trading days
* the 85% percentile calculated on the last 21 trading days
* the 75% percentile calculated on the last 63 trading days

S2 is an ON/OFF condition that is ON when the 20d and 60d moving averages are not breached, I interpreted this condition as a reinforcement of S1

Hence, S2\_long is triggered when the price of an instrument is below both the 20d and the 60d moving average (thus indicating a possible reversion towards the faser or the slower mean), S2\_short is triggered when the price of an instrument is above both the 20d and the 60d moving average.

Once a trade is open, Take Profit (TP) and Stop Loss (SL) returns are calculated using monthly returns. Starting from prices, the monthly return is defined as and , .

TP are defined as supportive 30th percentile move, so for long position , and for short position , where is the ith percentile.

SL are defined as supportive 20th percentile move, so for long position , and for short position , where is the ith percentile.

If neither TP nor SL are hitted the trade is automatically closed after 21 trading days.

TP / SL rule diagram

* according to direction of the trade consider or
* use an expanding window to compute monthly returns distribution (the window is expanding daily, so to have more observation when estimating TP/SL)
* if direction=1 (buy):
  + take + Monthly rets, calc 30th pctl 🡪 TP
  + take - Monthly rets, calc 20th pctl 🡪 SL (SL more conservative than TP, let profits run)
* if direction=-1 (sell):
  + take - Monthly rets, calc 30th pctl 🡪 TP
  + take + Monthly rets, calc 20th pctl 🡪 SL (SL more conservative than TP, let profits run)
* if no TP/SL hitted, exit after 21 days

In terms of trades sizing, since I want all trades to lose the same maximum amount of money, and being :

If :

If :

Rewriting, given the SL Price: , the optimal quantity for each trade is:

Assuming for simplicity that a short position return is equal to:

The Return formula employed in the project is:

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