Bollinger Bands Mean Reversion Grid

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Disclaimer

The strategy described in this document and its related program are intended for educational purposes only. Nothing in this document should be consider investment advice. Moreover, the program created to test the strategy should not be used to trade real money. Trading entails risks, and you could lose all your stake. Consult with a professional to assess your risk profile before trading or investing any money.

Contents

1 Abstract

The main goal of the strategy is to trade the price's reversion to a moving average when it surpasses one of the outer bands of the Bollinger Bands indicator. To do that a set of positions is entered, and they are closed on the price reaching an intermediate level between the outer band and the moving average.

The strategy is intended to trade FX pairs constituted by currencies from countries/economies that are are tightly related to each other or that are driven by the same or very similar factors and risk drivers. Some examples are the Euro and the Swiss Franc, the Australian Dollar and the New Zealand Dollar or the Euro and the British Pound.

2 Limitations

Before starting the development of a cTrader robot to test the strategy, we already acknowledge the limitations of the strategy. We know that prices are not normally distributed, and that returns distributions have fat tails. This reduces the effectiveness of betting on mean reversion based on the difference between the current price and its moving average with respect to standard deviations.

We also recognise the limitation of not being able to trade the moving average. In an ideal environment, we would enter a position for the moving average in the opposite direction to the position entered for the current price. Those 2 position would then be closed on convergence between the current price and its moving average. Because we cannot trade the moving average, it is possible that mean reversion occur only because the moving average moves to close the gap between it and the current price. In that case, our position would close flat or even in a loss, although the price converged to its moving average.

These two facts have to be taken into account when optimising the strategy. Moreover, this strategy will work best when prices move laterally and the moving average stays relatively flat. This optimal market regime is the one we would like to deploy this strategy at. For trending markets, especially the ones with high one-sided volatility, this strategy should be put to rest.

3 Alpha Model

On an entry signal, a set of positions (grid) is entered, such that the distance between the current price and the moving average is divided into equal parts. For each price level between the current price and the moving average a positions is entered with that price level as take-profit.

A long grid is entered when,

- the current price crosses below the lower Bollinger Band, and the parameter *Enter Positions after Confirmation* is deactivated.

- the current candle closes below the lower Bollinger Band, and the parameter *Enter Positions after Confirmation* is activated.

A short grid is entered when,

- the current price crosses above the upper Bollinger Band, and the parameter *Enter Positions after Confirmation* is deactivated.

- the current candle closes above the upper Bollinger Band, and the parameter *Enter Positions after Confirmation* is activated.

All positions are entered with a fixed initial stop-loss set in pips.
Positions are closed when the price reach their stop-loss or take-profit level.

4   Risk Management

To control risk, several features have been included.

4.1   Transaction Costs

When entering a grid, only the positions with take-profit levels that would result in a net profit when reached are entered. Here the fixed round lot commissions and the current spread are considered. The current spread is used as best approximation for the spread at the moment of closing, so as to simplify the technical implementation of the position closing on the price reaching the take-profit level.

Moreover, a parameter (*Min. Net Initial TP in Pips*) has been implemented, so that only positions with a take-profit level that implies a net profit greater than the value of the parameter are entered. This is to avoid entering positions that do not correspond to the risk/reward profile of the investor. For example, to avoid entering positions with a net initial take-profit in pips lower than the initial stop-loss in pips.

4.2   Position Sizing

The position size is estimated using Kelly's formula separately for each level. The Kelly ratio for grid position level i is given by the following

$$K_i := \min \left\{ W_i - \frac{(1 - W_i)}{R_i}, K_{max} \right\}$$

$$\text{where } W_i := \frac{\text{Number of level } i \text{ closed trades with a net win}}{\text{Number of level } i \text{ trades closed with a net loss}}$$

$$R_i := \frac{\text{Total net profit of level } i \text{ closed trades with a net win}}{|\text{Total net profit of level } i \text{ closed trades with a net loss}|}$$

Positions closed with net profit equal 0 are considered as trades closed with a net loss.

In case the Kelly ratio cannot be computed or is less or equal to 0, K_i is set to $K_{default}$.

To avoid using K_i values that are too extreme for some investors, the K_i is capped by a maximum value K_{max}. Positions at level i are then entered with position size vol_i defined as

$$vol_i := \max\{K_i * AFM, vol_{min}\}$$

where AFM is the current account free margin and vol_{min} the minimum volume in units that can be traded for the instrument.

4.3   Dynamic Stop-loss

A variable stop-loss setting feature is introduced to update the stop-loss of the still opened positions in a grid when positions at lower levels are closed after reaching their take-profit level.

When the first position of a grid is closed, the stop-loss of the remaining positions in the grid is updated to net break-even, such that the fixed round lot commission and spread are taken into consideration. Here the current spread at the closing of the first positions is used as best approximation for the future spread so as to simplify the implementation.

After the first position of a grid is closed, the stop-loss of the remaining positions in the grid is updated on closing of the subsequent positions at their take-profit level. The new stop-loss for the remaining positions is, in this case, set to the take-profit level of the positions closed before the last closed one.

4.4   Dynamic Take-profit

Because the moving average can move against the direction of the grids entered using this strategy, a dynamic take-profit feature is implemented. This allows to close positions on updated price levels based on the current moving average and outer band levels.

On every value change of the moving average or outer bands, the take-profit levels are computed again as described in section 3.

5 Parameters

The default parameters are not set to any economically reasoned values. The default values for the indicator are set to the default values provided by the cTrader platform when adding the Bollinger Bands indicator to a chart. The other default values are set to random values, which however allow the bot to work correctly. For example, the *Risk Management - Max. Account Risk % per Grid* parameter is set to a value greater or equal the *Risk Management - Initial Account Risk %* parameter value.

5.1 Robot Id

This parameter is used for the bot to identify the positions it has created, and that it has to manage. The value of this parameter must be unique for each instance of the bot to avoid interference between different bots.

5.2 Bollinger Bands - Source

This parameters allows the user to choose what price time-series to use for the Bollinger Bands computation.

5.3 Bollinger Bands - Periods

This parameter sets the number of look-back periods (candles) used for the Bollinger Bands computation.

5.4 Bollinger Bands - Standard Deviations

This parameter sets the standard deviations multiplier used for the Bollinger Bands outer bands computation.

5.5 Bollinger Bands - MA Type

This parameter sets the moving average type to use for the Bollinger Bands computation.

5.6 Bollinger Bands - Shift

This parameter allows to use shifted Bollinger Bands values for trading. When set to 0, the latest Bollinger Bands values are used to find entry signals. When set to a value $x > 0$, the Bollinger Bands values computed x bars ago are used to find entry signals in the current bar.

5.7 Grid - Level Count

This parameter sets the amount of levels that each grid should contain. When an entry signal is given, grids are entered with so many positions as specified by this parameter (assuming that their corresponding take-profit levels can result in a net profit. See subsection 4.1)

5.8 Risk Management - Round Lot Commission

This parameter is used to consider the fixed transactions costs per lot.

5.9 Risk Management - Initial Account Risk %

This parameter sets $K_{default}$ in subsection 4.2.

5.10 Risk Management - Max. Account Risk % per Grid

This parameter divided by the number of grid levels sets K_{max} in subsection 4.2.

5.11 Risk Management - Initial SL in Pips

This parameter sets the initial stop-loss level in pips distance from the current price for positions on their execution.

5.12 Risk Management - Min. Net Initial TP in Pips

This parameter sets the minimum potential net profit in pips for entering a positions. See subsection 4.1.

5.13 Risk Management - Enter Positions after Confirmation

This parameter limits the bot to enter grids when a bar closes outside the outer bands of the Bollinger Bands. See section 3.

5.14 Risk Management - Activate Dynamic SL

This parameter activates the variable stop-loss feature described in subsection 4.3.

5.15 Risk Management - Activate Dynamic TP

This parameter activates the variable take-profit feature described in subsection 4.4.

6 Optimisation

WORK IN PROGRESS

7 Further Development

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