**Joint-University Algo Trading Challenge 2020/21**

**Trading Proposal**

**Team Profile**

| Team Name: | JUSTRY |
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**Executive Summary**

The team’s main aim is to develop a robust trading algorithm which targets instruments that have a tendency for its value to fluctuate about certain points. The algorithm uses the Relative Strength Index (RSI) as a proxy determine the ‘acceleration’ of the fluctuation, and by proxy, predict the inflection point at which the price will likely begin a change in the opposite direction. The higher the RSI, the larger the acceleration and the higher the confidence that the fluctuation will reverse direction back towards the baseline. An example of an instrument whose value fluctuates about a fixed point is the exchange rate of currencies (generally different currency values take turns to do better than one another at different points in time depending on the economic cycle and news about the country but overall, the exchange rate remains relatively constant because the net value of the country does not experience sudden surges in true value). Hence any changes in value are expected to be temporary in the short run (in the long run, it is indeed possible for a country to grow in value far beyond another country). This means that in the short run (approximately 1 month) it is possible to ride the small fluctuations about the true exchange rate. However, due to the relatively small degree of fluctuations in exchange rates, the gains proportional to capital are minute – unless a high leverage is used. As an added layer of complexity, the larger the RSI value, the greater the confidence that the fluctuation will be reversed, and the bigger the investment made towards that prediction by the algorithm. Additionally, to catch fluctuations in both directions (both an expected increase and drop in exchange rate value), the short selling option is required. Lastly, to balance the quantity and quality of orders, the RSI threshold is relatively strict, but the algorithm monitors multiple instruments and invests its capital in instruments that meet this threshold.

In conclusion, the strategy relies on the confidence that fluctuations in the instrument’s value will be reversed towards a baseline when a currency is overbought/oversold, high leverage and high frequency to make its orders. The order size scales with the degree of confidence, and short selling is used to enable action when the exchange rate is expected to move in either direction. Multiple instruments are considered simultaneously increasing flexibility and expected gains from the investment of the capital. Complementary strategies using RSI and Moving Average Convergence Divergence (MACD), a trend-following momentum indicator, are also employed to predict uptrends and downtrends, which is explained in the later section.

eg. High level description of your trading idea. Any trading philosophy/hypothesis behind your strategy? What financial market/ instruments your strategy apply to? What kind of data/ inputs your strategy use?

**Implementation Details**

Trades are triggered by two mechanisms: (i) RSI values determined by the price history and (ii) the crossing of the MACD line with its signal line, where the MACD line is determined by subtracting the 26-period exponential moving average (EMA) from the 12-period EMA of the instrument’s prices, while its signal line is the 9-period EMA of the calculated MACD values.

For the RSI mechanism, there are two RSI thresholds – one for long trades and one for short selling beyond which an order will be triggered. Every 24 hours, a group of instruments which meet the requirements are monitored and the RSI values calculated for each of them, when the RSI of an instrument meets the threshold, an order is made proportional to the RSI’s difference from the threshold.

Graphical user interface, application, email

Description automatically generated

The logic behind the trading model is that for instruments whose value are expected to fluctuate about a fixed point, when there is an exceedingly high or low RSI, it is a signal that the instrument has been overbought/oversold and will likely return towards the baseline value. Based on this assumption, if the price is expected to increase, a long order will be made, while in the case where the price is expected to decrease, a short sell order will be made.

The RSI threshold logic is complemented with uptrend and downtrend prediction strategies. Firstly, there is the strategy that triggers with a different threshold of RSI that makes small orders to hedge against the main RSI logic while the prices are trending. When the RSI is larger than 60 but still below our specified overbought threshold, it indicates that the instrument has upwards momentum but is not yet overbought, hence prices are expected to continue rising and a buy order can be opened to take a small profit from the upwards trend. Similarly, if RSI is lower than 40 but above the specified oversold threshold, there is momentum on the downtrend, and sell orders can be opened to take profit when the price is expected to drop further. Once the orders are made, they will be closed when it has achieved a specific level of profit.

A second trend prediction strategy that complements the main strategy involves the MACD indicator, where the crossing of the MACD line from below to above its signal line while above 0 is used as a buy signal, while conversely, the crossing of the MACD line from above to below its signal line while below 0 is used as a sell signal. This signal will be considered in conjunction with the 200-period EMA to provide further confirmation on the market’s trend. When the above-mentioned MACD buy signal is seen while the 200-period EMA is below the market price, the market is predicted to follow an uptrend, hence a buy order will be placed. If the MACD sell signal is observed while the 200-period EMA is above the market price, the market is predicted to follow a downtrend, hence a sell order will be placed.

eg. What is the exact trading logics? What conditions will trigger trades? How do you derive the trading model/ logic? What theories/ methodologies you applied? Any assumptions made?

**Risk Management**

The selection of an instrument that does not have values which generally fluctuate about a certain point is the worst-case scenario for the portion of the algorithm which relies on trend reversal to make a profit. In the worst-case it is possible that the instrument continuously increases or drops in value – in short spurts, triggering longs/shorts as the value continues to decrease/increase. This will lead to a large loss of capital which is compounded by the fact that all orders are leveraged. A hard limit on the amount of capital invested per order is set to limit the amount of loss each order can make, and the capital invested for each order is controlled based on the remaining capital available. Additionally, a complementary system is in place to hedge against the failure of this segment of the model.

For the other half of the strategy which complements the first, the RSI is used as an indicator of momentum for growth/loss when it is not in beyond the threshold. This means that in the worst-case scenario for the first half of the strategy, the orders made in this second half of the strategy will secure profits to offset the losses from the orders made by the first half of the model.

As mentioned before, the model’s success is strongly dependent on the selection of the correct instruments, if the instrument does not have a baseline around which it fluctuates, it is possible that large losses are made in the long run if the instrument experiences continuous spurts of growth or losses and never returns to its original value. This means that the instrument selection process can also be used to mitigate risk. The instruments chosen for our mode to perform on have been back tested against the historical data given to confirm that the model can perform well with these instruments in general. Additionally, the historical price action is studied to determine that the prices do indeed generally fluctuate about a certain point on a one-month horizon (see Figure 1.)

Graphical user interface

Description automatically generated with medium confidence

*Figure 1. Price action of USDJPY on the one-month horizon shows a generally fluctuation about ¥108.*

To manage risks for the complementary trend-following strategies, in the complementing MACD strategy, a stop loss is placed for each opened order at the price level of the 200-period EMA, which is the pullback of the trend. The order will be closed at either the stop loss or at a profit of 1.5 times the risk (where the risk is the price difference between the price at which the order was opened and the stop loss price). This will help reduce losses and maintain a healthy risk-reward ratio in the complementing strategies.

eg. What are the risk factors? What is the worst scenario? How do you manage the risks?

**Capital Management**

The strategy is extremely capital friendly in the sense that it makes purchases proportional to the amount of capital available, distributing the risk of each order across any amount of capital. This capital management strategy allows the amount to be invested in the daily orders to increase along with the available capital balance, naturally scaling the profits accordingly while retaining the same amount of risk. Also, in the case where the available capital pool is decreased due to losses, the amount invested per order will also be scaled down accordingly to prevent the algorithm from making large orders that can potentially bankrupt the account.

For example, with $100,000 of capital, there will be a maximum investment amount for each strategy (e.g. RSI reversal strategy, MACD trend-following strategy) limited to where k is the percentage multiplier to be specified at the start of the algorithm. If *k=1*, the maximum amount invested per strategy will be $1,000. With 10 times the capital ($1,000,000), the maximum amount invested per strategy will be 10 times larger ($10,000), potentially increasing the gains by that same amount while keeping the percentage risk of each order constant across all capital sizes. The amount of capital to be invested in the main RSI trend reversal strategy is also weighted in proportion to |RSI - 50|, where the more overbought or oversold the instrument is, the more likely a reversal will occur, hence more capital is invested proportionately in comparison to orders on other instruments. Similarly, Average DIrectional Index (ADX) is a trend strength indicator used to weigh the investment amounts of the complementary MACD trend-following strategy.

Additionally, the larger the capital, the impact of fixed transaction costs and minimum orders is proportionally smaller on the execution of the trading algorithm. If the starting capital is small to the point where high frequency trades inhibit the profits due to transaction costs, or where orders cannot be made because they do not meet the minimum volume requirements, then this strategy should not be implemented until enough investment capital is secured.

Funding liquidity is ensured by controlling the order sizes that decrease together with the amount of capital available thus always ensuring a degree of liquidity. Additionally, there is a portion of the orders that are made for long term growth or losses which can be sold before the desired profits are required if funds are suddenly required.

eg. Does your strategy utilize the investment capital? How do you manage the funding liquidity? Is your strategy scalable? What is the minimum capital required to execute your strategy? Can your strategy still work if the investment size become very large?

**Expectations for real-life implementation**

This strategy has one specifically unfavorable situation which is that when RSI values are **constantly** beyond the overbought/oversold thresholds – which is not expected but can happen, the model no longer mitigates the losses because the instrument is considered overbought/oversold and the second half of the model which is based on general buy/sell momentum will not be triggered. As discussed earlier, the key method to mitigate this risk is the careful selection of instruments.

However, that said, human/stop-loss intervention in the event of freak incidents can prevent substantially losses from being made. For example, if the RSI for a specific instrument is beyond the threshold for 2 weeks in a row, which is substantial part of the 1-month horizon, perhaps the model can trigger a red flag to temporarily stop making trades using the said instrument. A mix of human intervention in the event news that clearly greatly affects any instrument used by the model is released, and automated pausing of orders made with a specific instrument if its RSI is behaving unexpectedly is desirable.

Aside from this nightmare scenario, the model does not have a specifically unfavorable situation considering it is a model with two parts that complement each other. However, in the event that RSI values do not cross into the overbought/oversold regions, it means that first half of the model remains inactive, while the second half of the model which acts when there is general growth/losses continues making orders. Conversely, when RSI values are constantly high, the second half of the model does not act.

The first half of the model trades seeks to capitalize on spikes in price action that results in overbought/oversold instruments.

A good investment size is $1,000,000 USD which is generally large enough to execute decent sized orders without consuming too large a fraction of the capital – while maintaining order sizes that make fixed transaction costs insignificant.

eg. What market situation(s) would be (un)favorable to you? Can your strategy fully automate, or need human interference? How frequent your strategy trades? What is an ideal investment size to execute your strategy? Any potential issues for real trading?