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

**Trading Proposal**

**Team Profile**

|  |  |
| --- | --- |
| Team Name: | AlphaBoom |
| University: | The Hong Kong University of Science and Technology |
| Team Member(s): | LIU, Dingdong |
| FENG, Xinyu |
| ZHOU, Shixu |
| FENG, Jinglong |

**Executive Summary**

Trading idea:

We plan to use the Tick Tape trading idea in the High-frequency trading. Since in actual trading, much information happens to be unwittingly embedded in market data, such as quotes and volumes. By observing a flow of quotes, computers are capable of extracting information that has not yet crossed the news screens. Using this strategy, we will construct a model to monitor the price of EUR and USD and make appropriate trading operations accordingly.

We will use certain level of leverage to maximize the profit under appropriate risk, which is mitigated by the opposite position in the interest rate market. Besides these, our team also consider a position in the commodity market to hedge the downside risk of our prediction. The short position with leverage requires certain level of cash as well.

Trading Hypothesis and Philosophy:

Hypothesis:

We can get adequate first-hand information and feed it into our model.

We can use our constructed and trained model to predict the future price of EUR and USD. The risk can be controlled by setting some constraint on the parameters of the model during training and using a certain level of leverage as stated above. Thus, it can be guaranteed that the trading strategy can earn profit.

The foreign exchange rate largely depends on the base rate determined by the central banks (CB). So it will largely hedge the risk of our portfolio by entering the interest rate futures markets. Since an upward shift in the interest rate of currency indicates depreciation, we can enter an opposite position in the two markets respectively.

Which market:

Forex (Foreign Exchange) rate exchange market.

Interest Rate Futures

Commodity (minor)

Data Input:

Dollar index, federal funds rate, CPI, exchange rate between EUR and USD, oil price and S&P500 etc. Such data that represents USD price changes or other factors that may cause changes in USD price.

According to the data given on the website, in the actual training process, we will use those kinds of data like precious metal prices, currency exchange rate, commodity prices like oil price that will influence USD price.

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**

The trading logic follows the idea of ticker tape trading. Which is to first predict the exchange rate, for example, between EUR and USD (EUR/USD) in the near future, then buy in USD when the rate is low and sell USD when the rate is high. A threshold for forex will be set as a hyperparameter to tigger trading. When the rising or falling of forex exceeds the threshold, a trade will be triggered automatically. Although the threshold hasn't been set, we will use 0.001 as an initial value and tune this hyperparameter in the machine learning algorithm with a metric set as profit earned.

The entire trading model can be modularized into three parts, namely information collection, forex prediction and trade trigger. During the information collection part, the most relevant information to forex will be selected. We read about research on forex and found some top factors such as the difference in income growth rates, difference in GDP growth rates and difference in interest rates. We will further examine the covariance between other factors and forex to select more. In the forex prediction part, a LSTM model on the selected variable will be trained to dig out hidden information and predict the future exchange rate. The trade trigger will receive output of the LSTM model (future foreign exchange rate) and then trigger trades.

The general idea behind prediction is to extract hidden information behind the quotas and columns. The LSTM model helps to dig out the unreported information, such as increased future demand, and the trade trigger performs trades based on this information. Ideally, we can witness the patterns in market change and predict future trends of the forex market and react to it. For example, if we witnessed an increase in crude oil market and deduced an increase of demand in USD, we can buy in some USD and then sell them after the purchase of crude oil happened, where it is expected to witness a rise in USD.

The theories we used are financial theories and statistical theories.

The assumption we made is that the liquidity of forex remains active. And we can get adequate first-hand information and feed it into our model.

Besides, the position in the interest rate future market will be closed as described on the agreement. Considering the International Fisher Effect & International interest rate parity, our team will keep a close eye on the impact of policy side like FOMC meetings on the spot market to mitigate our risk and when, for instance, the spot market goes beyond our expectation by more than 10%, we will close our position in the future market at a prior stage.

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**

Mainly the risk of prediction is caused by the uncatchable loss of USD, which is related with natural disaster, global trade, policy change, environmental factors and etc.These factors can not be predicted before occurrence and have impact on the global economic environment as well as the financial exchange market. To be more specific, we have done research on the current COVID-19 issue, where USD-EUR exchange rate is closely related with the burst of the virus. Accordingly, exchange rate fluctuates when workers go on strike, flood occurs affecting factory operations, and more importantly, government control of the monetary policy. But even having these unpredictable issues, we still could apply historical data to further train the model. Take natural disaster as an example, in the year 2005 and 2018, tsunami occurred in the US, and the recovery policy shared great similarities in these two years. Therefore, we set the occurrence of unpredictable events as categorical data and refer back to previous exchange rate fluctuation trend after similar events. Our model could react when these issues are identified and predict exchange rate under related conditions. However, this causes a technical issue that there would be a reaction delay between occurrence and identification. And this is what we would adjust and optimize during the second stage of our model.

And this model needs improvement when little or none similar cases are identified, where the training set lacks a point of reference. The worst scenario is when unpredictable issues outweigh predictable issues. According to research, USD-EUR exchange rate vibrated significantly when the UK announced Brexit and when the US increased export tax for goods. So when dealing with policy problems, we apply the concept of economic strength, which basically shows a trend rather than numerical exchange rate. And we could digitize the relative economic strength and train the dataset with this variable. As exchange rate is a relative concept, we could improve prediction accuracy when understanding the relative economic strength between the US and EU.

To reduce risk, we preserve for interest risk futures, which is a financial derivative that allows exposure to changes in interest rates. The foreign exchange rate largely depends on the base rate determined by the central banks (CB). So it will largely hedge the risk of our portfolio by entering the interest rate futures markets. Since an upward shift in the interest rate of currency indicates depreciation, we can enter an opposite position in the two markets respectively.

Another risk factor comes from the potential margin call considering we are using leverage to increase the return. Our team will invest into debt markets like the US Treasury, which is highly liquid, to keep as cash & equivalent and prevent us from a forced position close.

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

**Capital Management**

Our portfolio will implement a structure which is similar to the classic investment portfolio. More specifically, we will invest 40% of our total capital into the forex market with both long and short positions. Out of the 40%, we will divide it based on the exchange rate basis. The pair theory in forex trading indicates an opposite position in the two currencies in the spot market. For instance, when the factors in the model indicate an upward in the USD and downward in the GBP, assuming their overall exchange rate to be USD1.1 / GBP1, we will inject 18% in a short position in pound and the other 22% in USD.

Also leverage will be taken into account in calculating the distribution of the capital. Let’s assume a leverage ratio of 2:1. Assume the short position requires a margin of 15%, then 15% \* 18% \* 2 amounts of liquid assets will be held in the portfolio. Also in order to prevent a margin call, we will divide 15% of capital to US Treasury bonds as a liquid asset.

Another 30% of capital will be distributed to the interest rate futures. This structure of investment in the futures and forex can net out a considerable level of the downside risk. A less investment in futures also reduces the agency cost required by the agreement.

The final 15% will be invested into the commodity market to further reduce our risk, considering that the commodity market is less correlated with the forex market.

This structure is scalable as a whole. As for an investment on a large scale, the margin call will pose a greater risk to our portfolio and thus we might need to reduce the leverage ratio to 1.5:1.

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**

The most unfavorable situation is that the forex market is frequently influenced by unpredictable factors such as policy changes that never happen before. The effects of these factors are unable to predict by the algorithm we proposed. Ideally, our strategy works automagically, but requires human interference under unprecedented situations such as mentioned above. Humans need to adjust a parameter by hand.

The frequency of trading is highly dependent on the threshold we set. Under default settings, it is expected that the trading triggers every few hours.

The ideal investment size is 1,000,000 USD at the beginning

Potential issues may include network issues. If we face high latency in acquiring the data, we may fail to respond in time and trigger corresponding trades accordingly.

The interest rate future market is an OTC market, which eliminates the involvement of human capital. Same case for the forex market. Ideally we adjust the investment in the forex market in minutes but this won’t work for futures.

Potencial technical problems will sort of stop our investment vehicle from adjusting itself to the optimal stage.

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?