

Investable Indices Quant/Structurer - Analyst/Associate

Quantitative Project - FX Carry Strategy

Rationale ⁽¹⁾ The strategy systematically sells low interest rate currencies and buys high interest rates currencies trying to capture the spread between the rates. Overall, in the academic literature, there is a consent that the foreign exchange carry trade anomaly works. For example, Acemoglu, Rogoff and Woodford in the Carry Trades and Currency Crashes says: "A "naive" investment strategy that chases high yields around the world works remarkably well in currency markets. This strategy is typically referred to as the carry trade in foreign exchange, and it has consistently been very profitable over the last 3 decades."

The academic theory says that according to the uncovered interest rate parity, carry trades should not yield a predictable profit because the difference in interest rates between two countries should be equal to the rate at which investors expect the low-interest-rate currency to rise against the high-interest-rate one. High interest rate currency often do not fall enough to offset carry trade yield difference between both currencies, because the inflation is lower than that which was expected in the high-interest-rate country. Additionally, the carry trades often weaken the currency that is borrowed and the reason is simple, investors sell the borrowed money by converting it to the other currencies. Capturing those gains is possible by a systematic portfolio rebalancing.

Moreover, the carry trade strategy exploits the "forward-rate bias" or the "forward premium puzzle", the fact, that the forward rate is not an unbiased estimate of future spot. Contrary to classical notions of efficient markets, carry trades have made money over time and proved themselves.

Objective: Design a FX Carry strategy using the data set provided.

Details:

- 1) Create a framework to backtest the FX Carry Strategy using the data set provided.
 - a) At each rebalance date, the strategy goes long the highest yielding currencies and short the lowest yielding ones by taking a position in the 1M forward on a monthly basis.
 - b) Each day, the index level can be constructed using the relation:

$$I_t = I_{t^*} * (1 + R_t)$$

Where R_t

$$R_t = \sum_i W_t^i * Carry_t^i$$

- i) W_t^i is the weight allocated to each pair;
- ii) I_{t^*} represents the value of the index at the last rebalance date t^* ;
- c) At each rebalance date, new portfolio weights W_t^i are determined by using any of the methods below:

(1) <https://quantpedia.com/Screener/Details/5>

- i. Rank the set of currencies by highest yielding carry values, go long the top m currencies with $W^i = 1/m$ and short the bottom m currencies with $W^i = -1/m$
 - ii. Rank the set of currencies by highest yielding carry values adjusted by the last 3 months of realised volatility, go long the top m currencies with $W^i = 1/m$ and short the bottom m currencies with $W^i = -1/m$
 - iii. Determine the optimal set of weights that minimise portfolio variance
 - iv. Determine the optimal set of weights that maximise carry subject to portfolio volatility of 10%.
- d) At each rebalance date, consider **Carry** to be:

$$Carry = \log(Spot_t / 1M Forward_{+1} Rate_t)$$

i.e the log of the ratio of the spot rate over the 1M forward rate to the next rebalance date.

- e) Consider realised volatility to be the standard deviation of spot log returns.
- 2) Provide the strategy backtesting
 - 3) Provide some quantitative metrics on the strategy, for example sharpe ratio, realised volatility, maximum drawdown, etc
 - 4) Compare different portfolio rebalancing methodologies (i, ii, iii, iv)
 - 5) Discuss the relationship between the backtested strategy and the VIX index.

Data/Content

data.zip. It contains all the time series required for the project.

In particular:

- **Spot** and **1M Forward points** time series for currencies: EUR, JPY, GBP, CHF, CAD, AUD, NZD, NOK, SEK, CZK, HUF, PLN, TRY, ZAR, SGD, MXN, BRL, KRW, TWD
- Each currency is quoted according the quotation style in the table below.
- The **1M FX Forward** rate can be computed from spot and forward points as:
- $1M Forward Rate = Spot + fxMult \times 1M Forward Points$, where the $fxMult$ is given in the table below
- We recommend to express all spot rates and forward rates as *American CCYUSD*. To convert an American quotation (CCYUSD) to European (USDCCY), it is sufficient to invert (1/x) the respective spot and forward rates and vice versa
- **VIX** : time series of the VIX Volatility index
- **Rebalance Dates**: time series of rebalance dates

Currency	Quotation Style	fxMult
EUR	American	0.0001
JPY	European	0.01

GBP	American	0.0001
CHF	European	0.0001
CAD	European	0.0001
AUD	American	0.0001
NZD	American	0.0001
NOK	European	0.0001
SEK	European	0.0001
CZK	European	0.001
HUF	European	0.01
PLN	European	0.0001
TRY	European	0.0001
ZAR	European	0.0001
SGD	European	0.0001
MXN	European	0.0001
BRL	European	0.0001
KRW	European	0.01
TWD	European	0.001

Comments:

- Please use only Python to solve the exercise, trying to leverage existing libraries as much as possible. Pandas dataframes are a good choice for this type of problem and they also provide .csv I/O functionalities
- There is no formal deadline on the exercise but try and finish this in 3 weeks time; please come back as soon as you have some reasonable results and you feel confident of your findings.
- If any point is unclear, please reach out with questions : on nwanjari@uss.co.uk