A Composite FX Strategy of Pairs and Carry Trading

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1 Introduction

Foreign exchange market is of high volatility, and involves economical situations of various regions around the world. After thorough research of G10 currencies, we develop two strategies to capture profit from co-integration and carry factor respectively.

2 Pairs Trade

The pairs trade is a statistical arbitrage and convergence trading strategy, which enables investors to profit from virtually any market conditions. Firstly we find highly correlated pairs of G10 currencies, then we take arbitrage profit with reference to difference between moving averages of selected pairs.

2.1 Pairs Filtration

Taking USD as the quote currency, the left 10 currencies to form pairs are EUR, GBP, JPY, AUD, NZD, CAD, CHF, NOK, SEK, DKK. As we can see from the heatmap (Figure 1) which visualizes the co-integration between these currencies, pairs varies a lot from each other. And we pick 17 mostly co-integrated pairs to trade.

2.2 Strategy Description

To illustrate our strategy, we take pair EUR-GBP as an exmaple. Pair ratio is defined as the ratio of EUR to GBP:

$$Ratio_t = EUR_t/GBP_t,$$

where EUR_t and GBP_t are the spot exchange rates at day t. And we take moving averages of pair ratio of two different periods (5 days and 60 days in our strategy) and rolling standard deviation of pair ratio:

$$\begin{aligned} MA1 &= \text{moving average}(Ratio, \text{period} = 5 \text{ days}),\\ MA2 &= \text{moving average}(Ratio, \text{period} = 60 \text{ days}),\\ STD &= \text{standard deviation}(Ratio, \text{period} = 60 \text{ days}). \end{aligned}$$

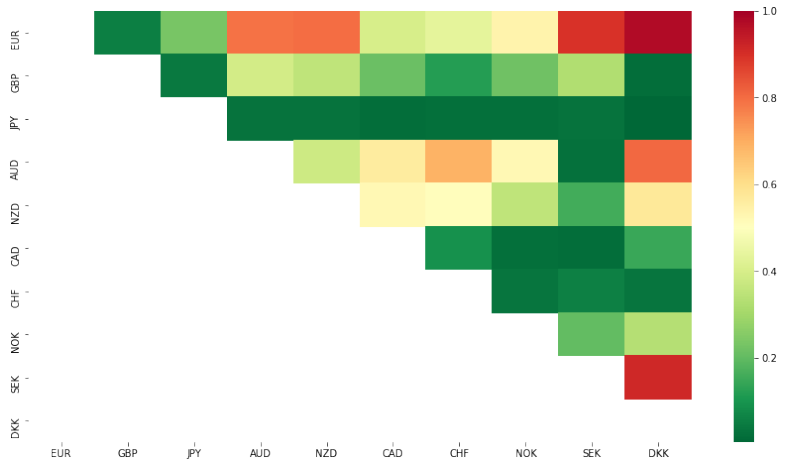

Figure 1: Heatmap

Then we compute the standardized difference between two periods of moving averages:

$$Zscore_t = (MA1_t - MA2_t)/STD_t$$

When $Zscore_t$ is above 1, we long 1 more position in EUR and short $Ratio_t$ more positions in GBP; when $Zscore_t$ is below -1, we long 1 more position in GBP and short $Ratio_t$ more positions in EUR. In this way, the cost of longing one currency can be covered by shorting another currency, and capital flow remains unchanged. We set maximum position as 5 to lower exposure to market fluctuations, and take transaction fee as 0.02% per trade. When $Ratio_t$ lies between -0.5 and 0.5, we close all opening positions and take profit.

Figure 2 shows the days when we add on positions.

2.3 Strategy Performance

Initializing with \$0, we find that most of 17 pairs achieve high sharpe ratio (Figure 3).

We finally construct our pair trade strategy by adding up 17 equally initialized pairs. As shown in Figure 4, this strategy performs well with Sharpe ratio 1.25.

3 Carry Trade

The carry trade is a currency investment strategy designed to exploit deviations from uncovered interest parity, involving borrowing in low-interest currencies and lending out high-interest currencies. On the basis of this fundamental strategy, we make an augmented strategy, adding two further conditions to determine whether and when to close out positions by using quantile regressions.

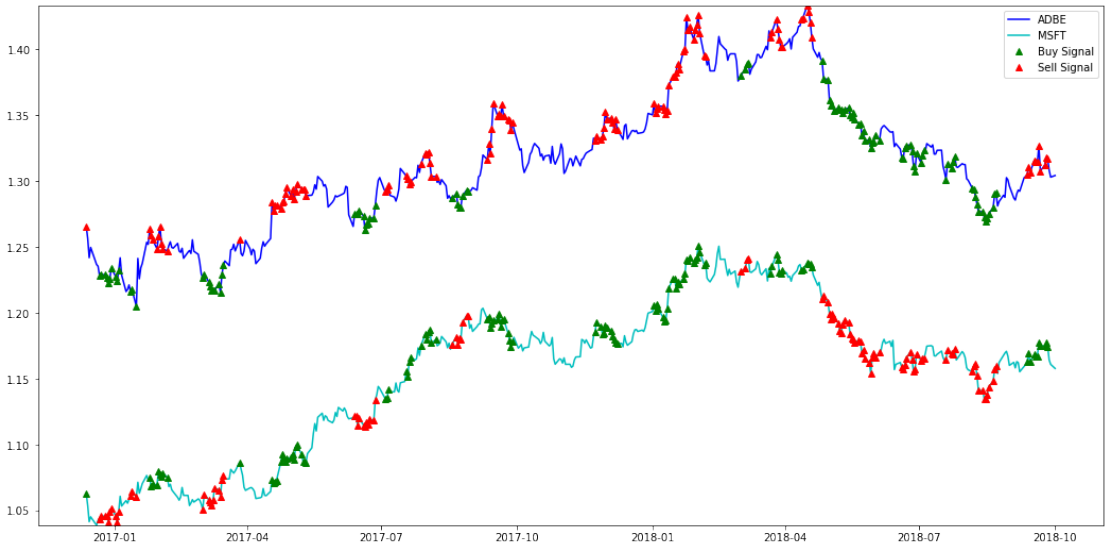

Figure 2: Signal

3.1 Two significant definitions

The excess return to this currency trading strategy for a one-month horizon is defined as

$$r_{j,t+1} = s_{j,t+1} - f_{j,t}, \quad j = 1, \ldots, N$$

where N is the number of exchange rates at month t, $s_{j,t+1}$ is the log of the nominal spot exchange rate, and $f_{j,t}$ is the log of the one-month forward exchange rate.

The monthly measure of FX market variance (MV) is estimated by daily excess return as follows:

$$MV_{t+1} = \sum_{d=1}^{D_t} r^2_{M,t+d/D_t} + 2\sum_{d=2}^{D_t} r_{M,t+d/D_t} r_{M,t+(d-1)/D_t}$$

where D_t is the number of trading days each month, and $r_{M,t+d/D_t}$ refers to the excess return to the FX market portfolio (equally wighted average).

3.2 Strategy Description

The standard strategy: We form portfolios by sorting at the beginning of each month all currencies according to the value of forward premium $f_{j,t} - s_{j,t}$. We then divide portfolios in quintiles. We long Portfolio 1, the portfolio with the highest forward premium currencies, whereas we short Portfolio 5, having the lowest forward premium currencies.

The augmented strategy: We add further two conditions on the standard strategy.

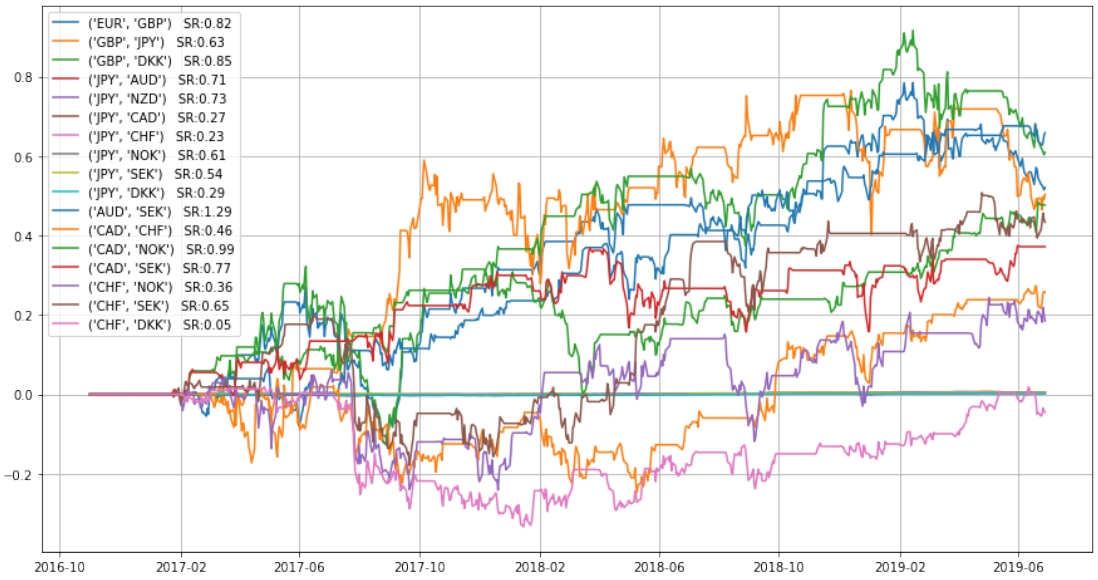

Figure 3: 17 Pairs

For the carry trade returns that are lower than the 50−quantile of the empirical distribution at first 12 months, if the MV of current month is higher than its median value calculated to the current month, we close the carry trade positions; otherwise we execute the standard carry trade.

3.3 Trading Example

In this subsection, We will show you exactly how we traded the G10 FX currencies from March 2017 to March 2018. The trade numbers ($) are shown in the table below.

date	EUR	GBP	JPY	AUD	NZD	CAD	CHF	NOK	SEK	DKK
2017-03-01	0	0	0	0.00386398	-0.00653742	0	0.0039625	0	0.0748	0
2017-04-03	0	0	0	-0.00304063	-0.00648599	0	-0.0018625	0	-2.2623	1.74275
2017-05-01	0	0	0	-0.00345067	-0.00552165	0	-0.0013	0	0	-0.037075
2017-06-01	0	0	0	-0.00684725	0.00784399	0	-0.006175	0	2.17163	-1.70568
2017-07-03	0	0	0	0.0127009	0.0113602	0	-0.002025	0	-0.049575	0
2017-08-01	0	0	0	0.0125928	0.00794098	0	0.00055	0	-0.09465	0
2017-09-01	0	0	0	-0.00001969	0.0145507	0	-0.00025	0	-0.02945	0
2017-10-02	0	0	0	-0.00565216	0.00194195	0	0.002475	0	-1.99795	1.58595
2017-11-01	0	0	0	-0.00628328	-0.015693	0	0.007175	0	0	0.015325
2017-12-01	0	0	0	-0.00284623	0.00005273	0	-0.0066875	0	2.08992	-1.60128
2018-01-01	0	0	0	0.0082292	0.0112154	0	-0.0005125	0	-2.08992	1.55043
2018-02-01	0	0	0	0.00932354	0.013911	0	-0.01205	0	0	-0.062875
2018-03-01	0	0	0	0.310984	0.337929	0	-0.231575	0	0	-1.48755

Specifically, on Apr 3, 2017, we find CHF/USD and DKK/USD have the highest forward premium over March, while AUD/USD and NZD/USD have the lowest forward premium.

Figure 4: Pairs Trade

Then we would long $\frac{1}{4}$ position of CHF/USD (equal to long $\$\frac{1}{4s}$CHF/USD, where s refers to the spot exchange rate of CHF/USD) and DKK/USD respectively, short $\frac{1}{4}$ position of AUD/USD and NZD/USD as well. Next we notice the indicators of trade return and monthly market variance take effect on SEK/USD, then we close out the position of SEK/USD by shorting.

3.4 Strategy Performance

Trading G10 FX currencies with the augmented strategy from 2016-11-01 to 2019-06-28 monthly. We can get the daily position and daily P&L, and then we figure out the Sharpe ratio is equal to 0.5863. The line chart (Figure 5) shows the daily P&L and monthly P&L. These results imply that this strategy is profitable and also with a relative low volatility.

4 Combined Strategy & Conclusion

With two strategies suggested, we consider to combine them to get a better performance. Combination is straightforward, we change the positions of currencies depending on both strategies.

Firstly, if we find there is a abnormal spread between a pair of currencies with high correlation, then we long under-performing currency and short over-performing currency as we describe in section 2. Secondly, at the beginning of each month, we need to review

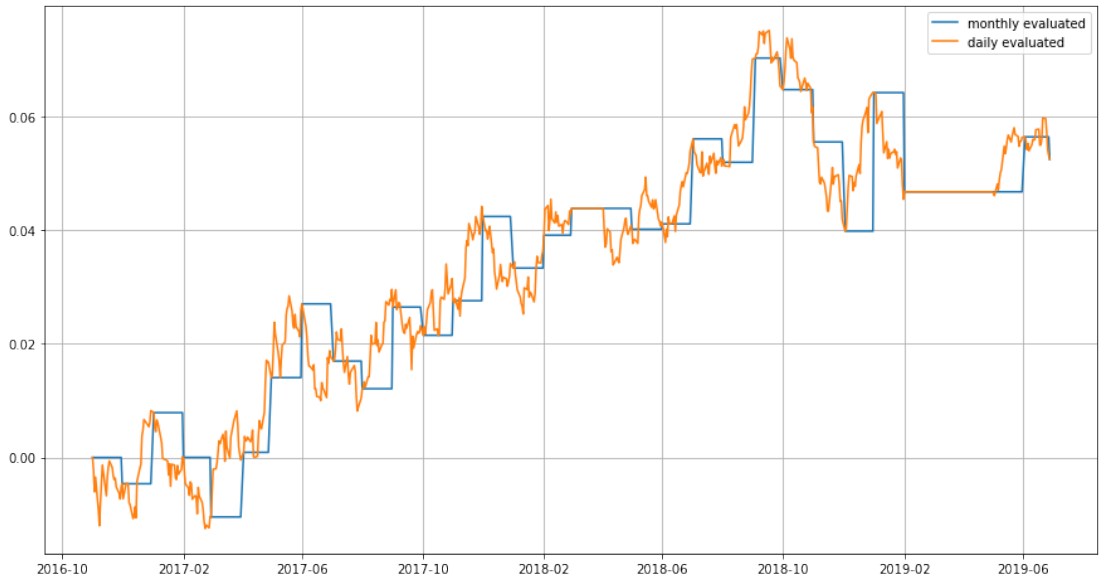

Figure 5: Carry Trade

the forward premium of all the currencies in the last month, then long currencies with highest forward premium, short currencies with lowest forward premium, and close out the position of currency which meets criteria of low return or high market variance.

Trading as the combined strategy during the period of March 1, 2016 to June 28, 2019, we set the transaction fee as 0.02% and assume there is no margin, then we get the return of 4.0605 with the initial fund \$0 and the Sharpe ratio of 1.2394. It can be compared that the return of combined strategy is higher than that of just utilizing one strategy, and the Sharpe ratio also shows a great profitability of combined strategy. The figure confirms the better performance clearly, where the cumulative P&L of combined strategy is above all the other strategies.

Strategy	Returns(units)	Sharpe ratio
Pairs Trade	3.9954	1.2485
Carry Trade	0.0504	0.5863
Combined Strategy	4.0605	1.2394

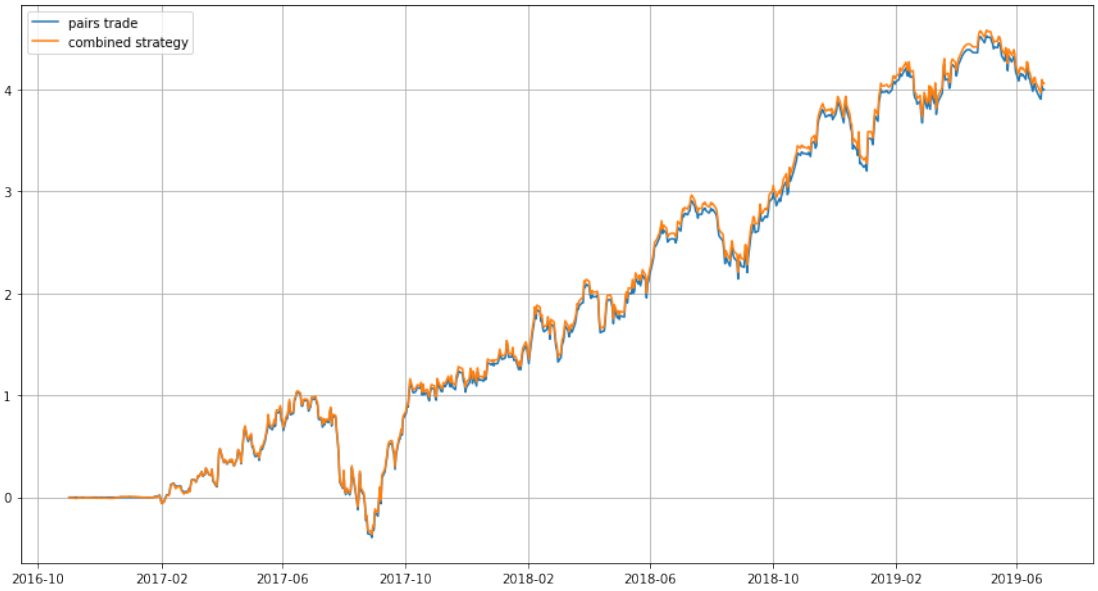

Figure 6: Combined Strategy

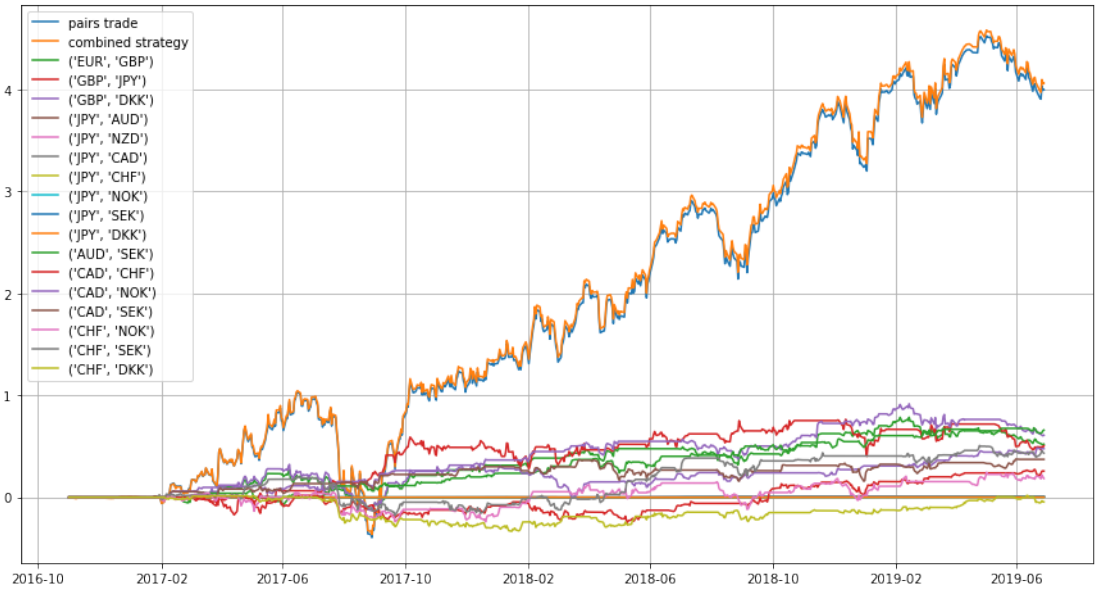

Figure 7: P&L of all Strategies