Forecasting Exchange Rates

WS 2020/21
Chief Investment Office

Team Overview

Karl Just

Associate

- Team Leader
- Statistical analysis
- Back testing

BSc. Economics (WU)

Sebastian Fritsch

Associate

- Theoretical analysis

MSc. Finance and Accounting (WU) (last Semester)

Athanasios Gkiolmas

Associate

- Benchmark simulation

BSc. Economics (5th Semester)
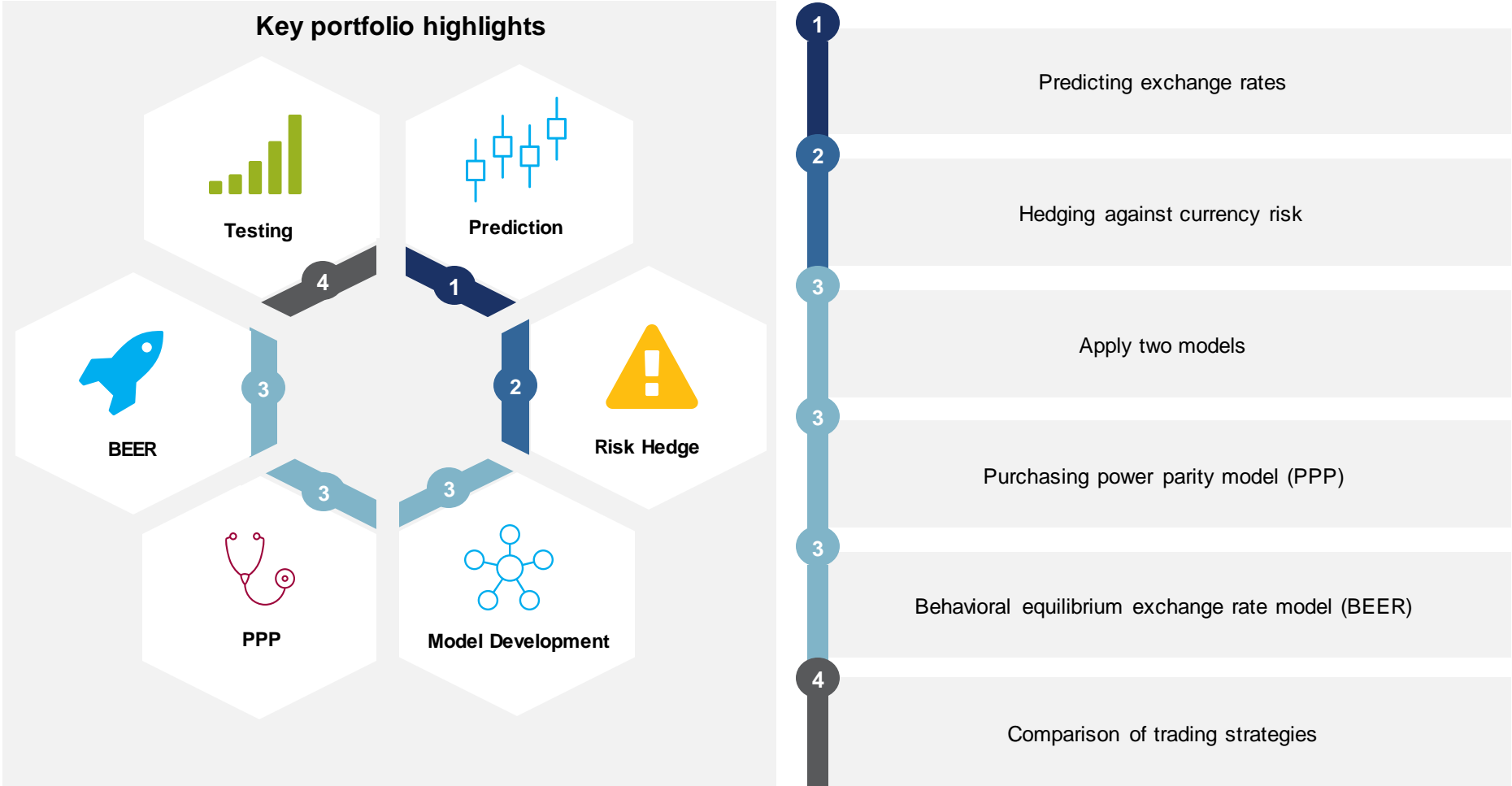
Alexander Lotz

Analyst

- Back testing
- Statistical analysis

MA. Treasury & Investments - FHWN (last Semester)

Forecasting Exchange Rates

Key portfolio highlights

- **Testing**
- **Prediction**
- **BEER**
- **Risk Hedge**
- **PPP**
- **Model Development**

1. Predicting exchange rates
2. Hedging against currency risk
3. Apply two models
3. Purchasing power parity model (PPP)
3. Behavioral equilibrium exchange rate model (BEER)
4. Comparison of trading strategies

Currency trends are important

For countries as well as for trading purposes

Why focus on currencies?

- Investigate the market's view on a country

- Big playground for central banks

- Reflection of capital flows and trade imbalances

Why trade currencies?

- Hedge one's portfolio against foreign exchange fluctuations

- Capitalize on fundamental mispricing's

- Speculative trading

- Hedging against huge drops is necessary

  (eg. GBP in 2008)

Foreign Currencies vs. USD

Legend: EUR, GBP, JPY, NZD

Purchasing Power Parity Model

Purchasing Power Parity Model

General

- Relative purchasing power of two different monetary units remains broadly unchanged over the long run

- Movements in price indices across nations, so that real exchange rates are mean reverting processes

- It is a Long-term concept, no evidence for fast mean reversion

- PPP deviations are explained by interest rate disparities or risk premia

Fundamental Assumptions

- Exchange rates are mean-reverting

- No trade barriers
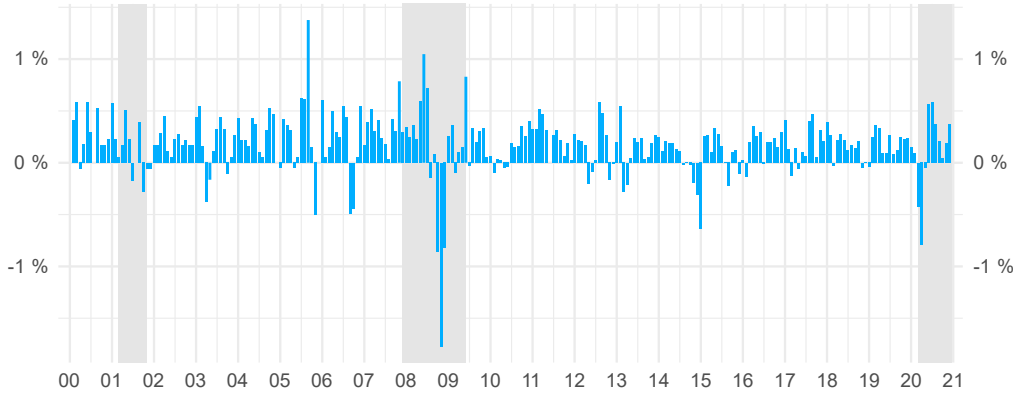
- No transaction costs

Formula

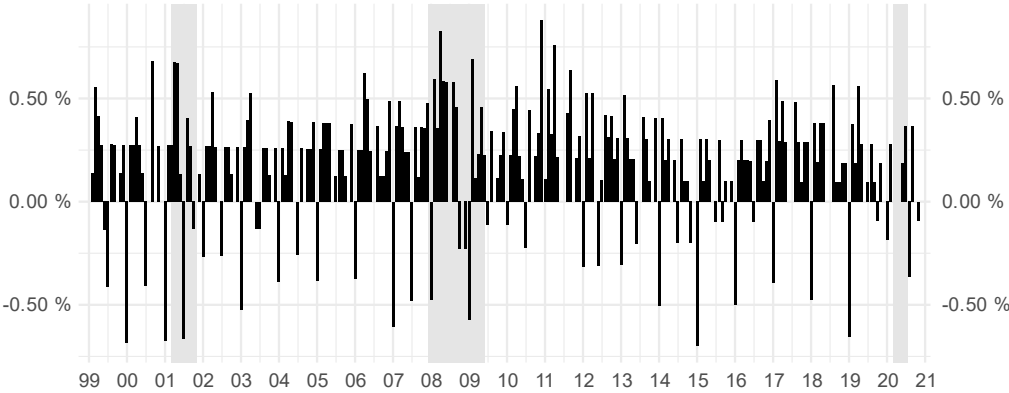$$rer_{i,t}^{PPP} = \overline{rer_i}$$

Purchasing Power Parity Model
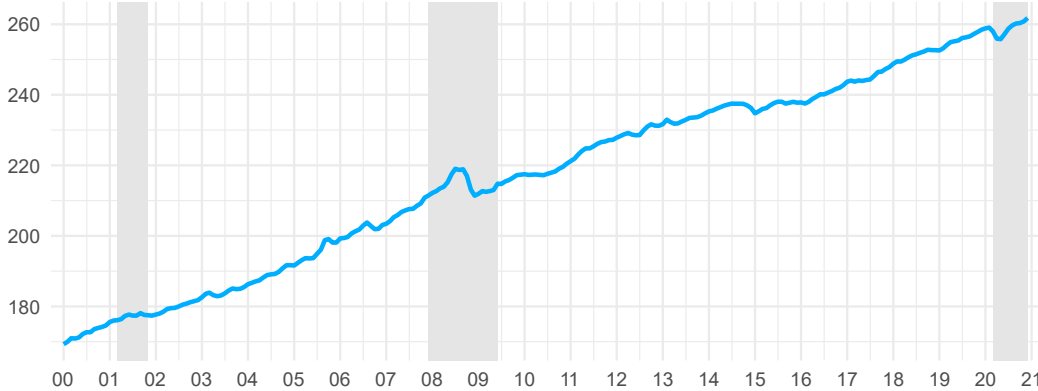
UK had far weaker inflation over the long-term
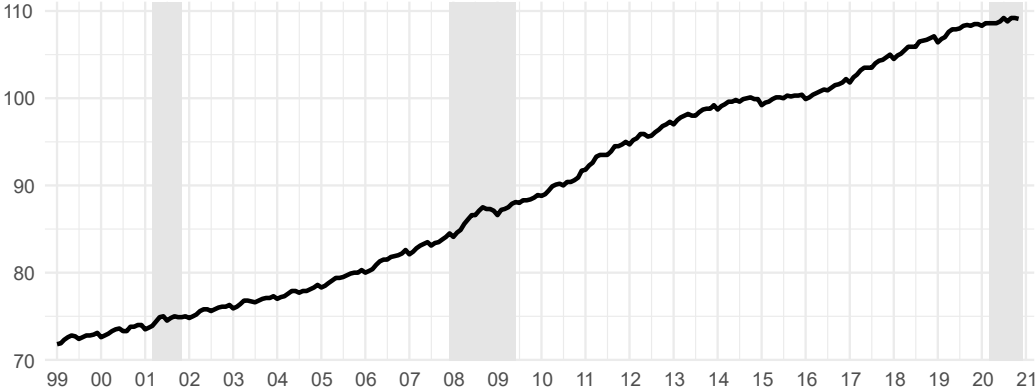
US Month on Month Change

UK Month on Month Change

US CPI

UK CPI
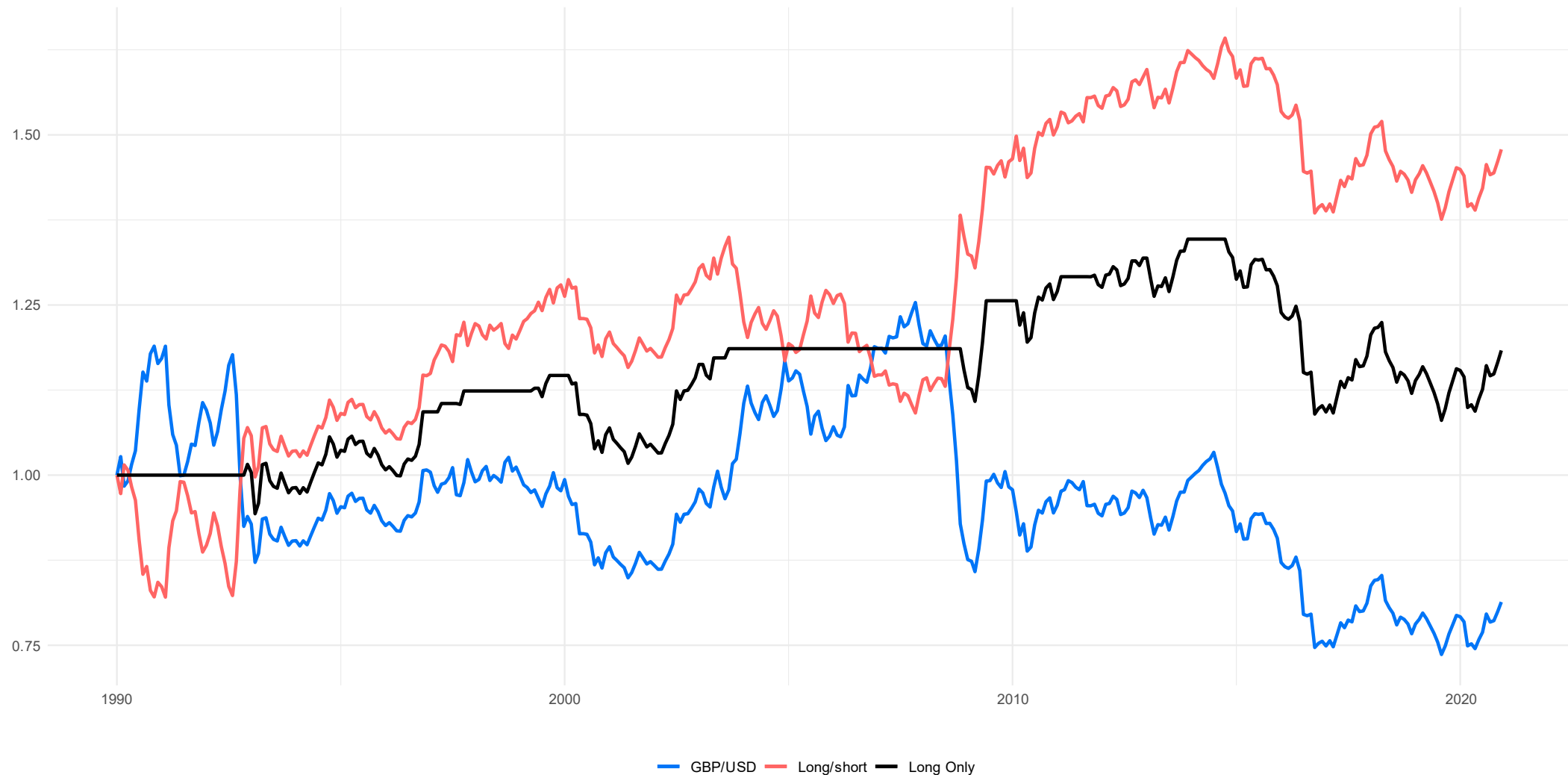
Purchasing Power Parity Model

Short-run model from 1990 to date

WUTIS

Purchasing Power Parity Model – Trading Strategy

Legend: GBP/USD — Long/short — Long Only

Behavioral Equilibrium Exchange Rate Model

Behavioral Equilibrium Exchange Rate

BEER model

General

- Examining to what extent the equilibrium exchange rate is consistent with a country's economic fundamentals

- There can only exist one price for a certain basket of goods

- If assumption is violated – arbitrage possible

- Accuracy distortion
  - Transaction costs
  - Non-tradable good
  - Closed economies

Sample mean of the real exchange rate (rer)

- Good proxy of the PPP-implied equilibrium real exchange rate (rer^{PPP})

i = currency
t = time

Demand perspective

- Increase in relative wealth leads to stronger demand for domestic non-traded goods

- Increase in their relative price

Supply perspective (Balassa-Samuelson effect)

- Tendency for consumer prices to be systematically higher in developed countries than in less developed countries

- Greater variation in productivity in the traded goods' sectors

- Affects wages and prices in the non-tradable goods sectors

Net foreign assets (nfa)

- A Rise improves interest income on the current account

- Hence counterbalanced by a deterioration in the trade balance

Current Account (tot)

- Deficits depreciates the currency due to funding necessities

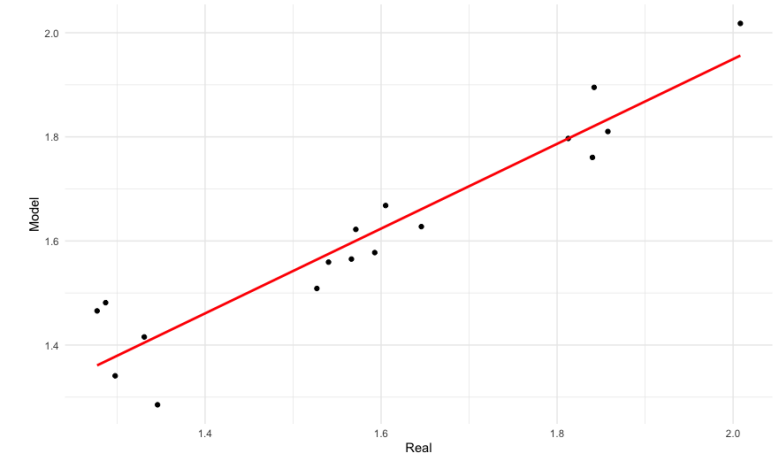- Surplus result in appreciation because the country earns more than it spends

$$rer_{i,t}^{BEER} = \beta_0 + \alpha_1 GDP_{i,t} + \alpha_2 nfa_{i,t} + \alpha_3 tot_{i,t}$$

Beer Model for UK's Pound against US-Dollar

Fair Value and monthly exchange rate

Correlation between Model and Exchange Rate

Remaining Issues

- Data quality and frequency issues (Only annual data available)

- Each variable was significant (p-value below 0.05)

Beer Model for GBP/USD

```
Call:
lm(formula = data7$GBP_USD ~ ., data = data7)

Residuals:
     Min        1Q    Median        3Q       Max
-0.062971 -0.027017  0.008111  0.018213  0.079695

Coefficients:
                    Estimate Std. Error t value Pr(>|t|)
(Intercept)        4.954e-01  1.875e-01   2.642 0.029644 *
GDP.per.capita     3.323e-05  4.704e-06   7.064 0.000106 ***
Current.account    5.763e-02  1.780e-02   3.238 0.011918 *
Net.foreign.assets -7.270e-13  1.361e-13  -5.343 0.000692 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.04945 on 8 degrees of freedom
Multiple R-squared:  0.9315,    Adjusted R-squared:  0.9059
F-statistic: 36.28 on 3 and 8 DF,  p-value: 5.259e-05
```

Statistical observations

- Each varable is significant (p-value < 0.05)

- GDP per capita and Current Account proves the theory to be true

- Net foreign assets have a reversed sign, indicating a negative impact of it on currency valuation

- Adjusted R-squared is 0.91, which means variations in explenatory variables can explain 90% of GBP/USD fluctuation

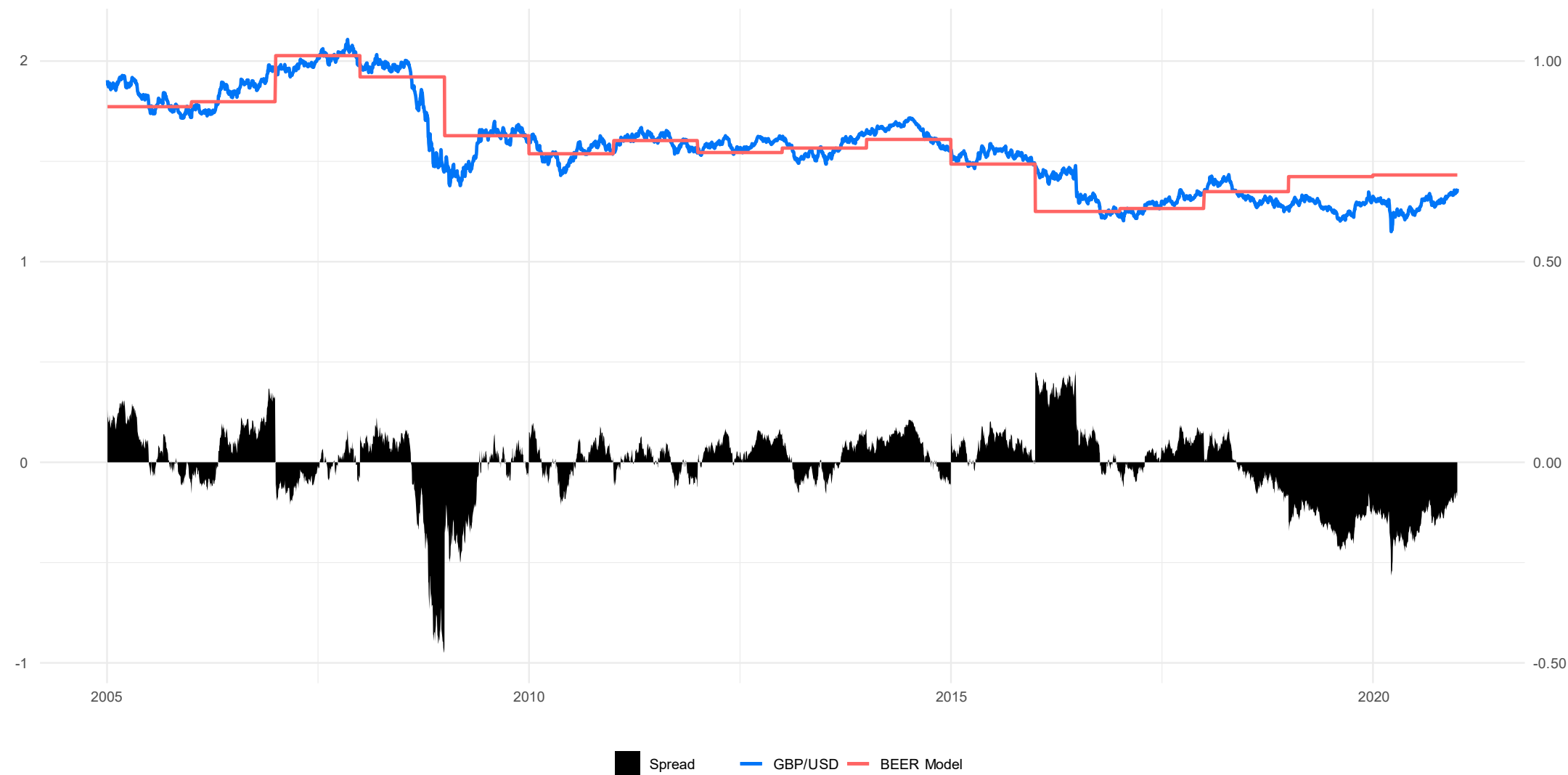- The whole model is highly significant (p-value = 0.00005259)
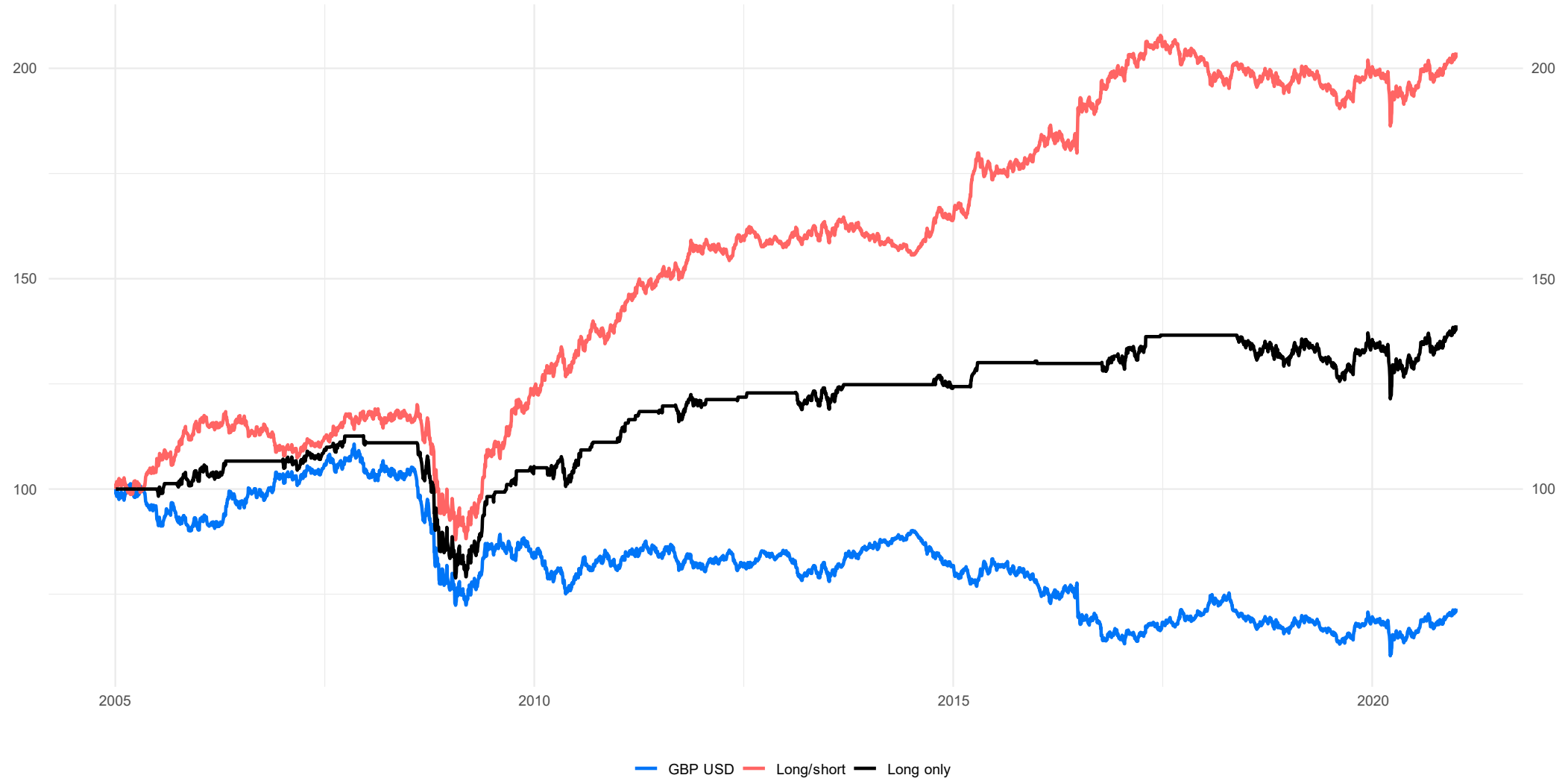
Trading Strategy

Trading strategy

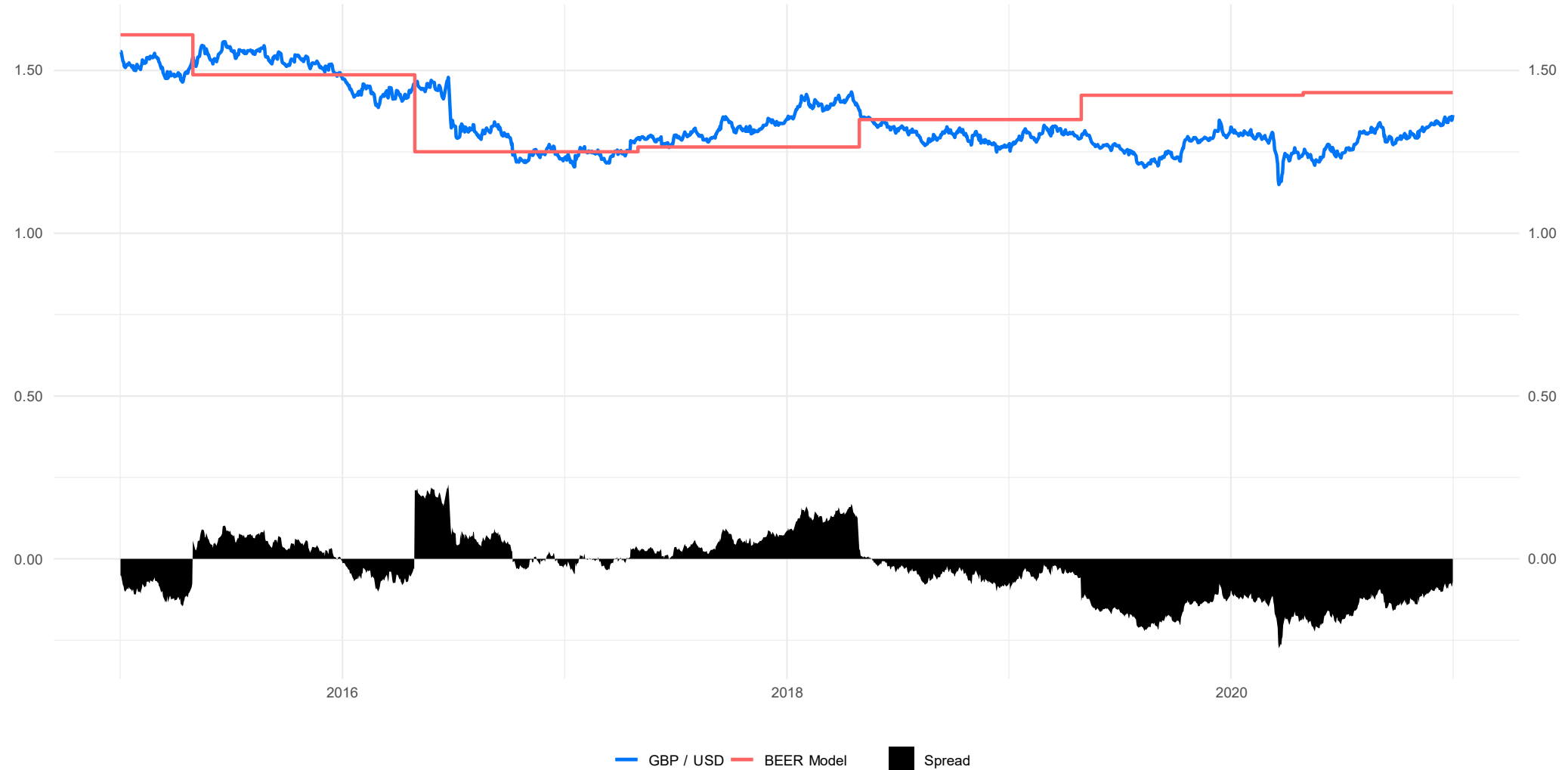Long if considered undervalued, short if considered overvalued

Spread — GBP/USD — BEER Model

Trading strategies to benefit from undervalued currencies
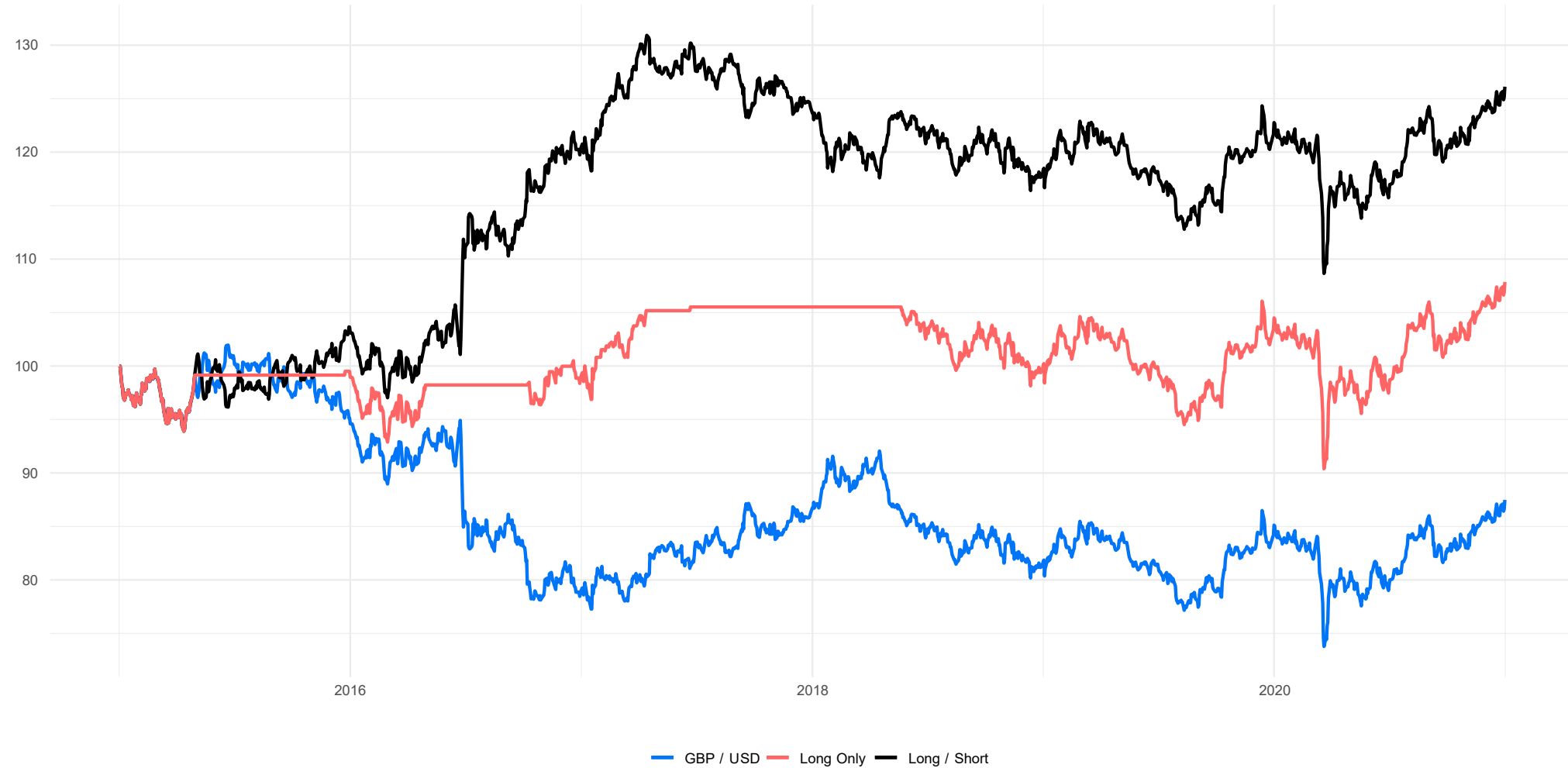
Long if below BEER, short if above

Legend: GBP USD — Long/short — Long only

Trading strategies to benefit from undervalued currencies

Adjusted Period, Beer Model + Lag of 5 months

GBP / USD —— BEER Model ■ Spread

Trading strategies to benefit from undervalued currencies

Adjusted Period, Beer Model + Lag of 5 months, less profitable, still confirming our results

Conclusion

Performance since strategy inception 2015 - 2020