Currency Total Return Indices

The P&L of an FX Trade comes from movements in the exchange rate of the pair you are trading and the interest differential between the currencies in that pair.

In this notebook we create "total return indexes" which represents the total return you would receive if any interest received or paid is compounded at every periodic observation.

Charts are displayed which show the cumulative total return for a number of currencies, quoted in USD. We also show the cumulative returns from the spot movements and interest.

Important - Set DATA_FOLDER to your FXBootcamp resilio location

```
DATA_FOLDER <- '/Users/damian.fanaro/ResilioSync/FXBootcamp'
```

Setup

Load the RW data utilities.

```
source(paste0(DATA_FOLDER,'/Code/tools/r-tools/data-utils.R'))
```

Set AssetList to pull all USD denominated pairs, and set up the environment to point at our boot camp data folder.

```
ASSET_LIST <- 'AssetsDWX-FX-USD'
```

Pull and convert data

We convert all our pairs to the USD quote currency to make comparisions easier.

```
asset_list <- get_asset_list(ASSET_LIST)
prices_df <- get_daily_OHLC(asset_list$Name)
usd_prices_df <- convert_common_quote_currency(prices_df, quote_currency = 'USD')
```

Get policy interest rates for each currency

Pull short term interest rates for each currency. (Note SGD currently missing)

```
currencies <- get_unique_currencies(usd_prices_df)
policy_rates_df <- get_policy_rates(currencies)
```

Now we call the append_interest_rate_differential() function, which does the following:

- split the ticker into Base and Quote currencies
- look up the Base_Rate and Quote_Rate interest rates for each currency, carrying missing observations forward
- calculate Rate_Diff, the differential between the BASE and QUOTE rates
- calculate Daycount_Fraction for accruing interest. This is the number of days since the last price observation divided by 365
- calculate Interest_Returns as Daycount_Fraction x Rate_Diff
- calculate Interest_Accrual_on_Spot, the interest that accrues since the last observation on a single unit of currency, expressed in the quote currency at the last exchange rate - This is Daycount_Fraction x Rate_Diff

- calculate Spot_Returns from closing prices
- calculate Spot Returns from the closing prices

It constructs total return indexes by Ticker which assume all p&l from interest is compounded into the position on every price observation

- Spot_Return_Indexes is the cumulative product of 1 + Spot_Returns
- Interest_Return_Indexes is the cumulative product of 1 + Interest_Returns
- Total_Return_Indexes is the cumulative product of 1 + Spot_Returns + Interest_Returns

You can use these total return indexes like price series in your analysis.

```
usd_extended_prices_df <- append_interest_rate_differential(usd_prices_df, policy_rates_df)
```

```
## Warning: `chr_along()` is deprecated as of rlang 0.2.0.
## This warning is displayed once per session.
```

```
head(usd_extended_prices_df)
```

```
## # A tibble: 6 x 19
## # Groups:   Ticker [1]
##    Ticker Date        Open  High   Low Close Volume Base  Quote Base_Rate
##    <chr>  <date>     <dbl> <dbl> <dbl> <dbl>  <int> <chr> <chr>     <dbl>
## 1 AUDUSD 1999-01-04 0.614 0.623 0.614 0.622      0 AUD   USD      0.0475
## 2 AUDUSD 1999-01-05 0.612 0.623 0.612 0.622      0 AUD   USD      0.0475
## 3 AUDUSD 1999-01-06 0.622 0.626 0.621 0.622      0 AUD   USD      0.0475
## 4 AUDUSD 1999-01-07 0.622 0.630 0.619 0.629      0 AUD   USD      0.0475
## 5 AUDUSD 1999-01-08 0.629 0.638 0.628 0.635      0 AUD   USD      0.0475
## 6 AUDUSD 1999-01-11 0.634 0.642 0.632 0.639      0 AUD   USD      0.0475
## # ... with 9 more variables: Quote_Rate <dbl>, Rate_Diff <dbl>,
## #   Daycount_Fraction <dbl>, Interest_Returns <dbl>,
## #   Interest_Accrual_on_Spot <dbl>, Spot_Returns <dbl>,
## #   Spot_Return_Index <dbl>, Interest_Return_Index <dbl>,
## #   Total_Return_Index <dbl>
```

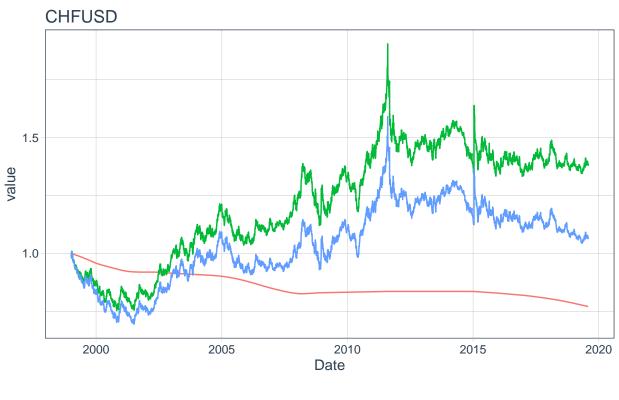## Total Return Charts (USD-quote pair convention)

These charts show:

- the total cumulative return from being long these pairs, assuming periodic (nearly daily) compounding of all interest paid or receive (blue)
- the cumulative return from spot exchange rate movements (green)
- the cumulative return from interest paid or received.
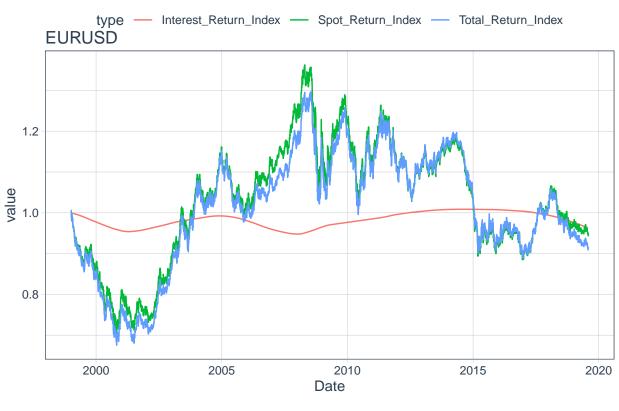
```
tickers <- distinct(usd_extended_prices_df, Ticker)[[1]]
for (i in tickers) {
  print(usd_extended_prices_df %>%
      filter(Ticker == i) %>%
      select(Ticker, Date, Spot_Return_Index, Interest_Return_Index, Total_Return_Index) %>%
      gather('Spot_Return_Index','Interest_Return_Index','Total_Return_Index', key = 'type', value = 'va
      ggplot(aes(x = Date, y = value, colour = type)) +
      geom_line() +
      labs(title = i) +
      theme_tq())
}
```

AUDUSD

type — Interest_Return_Index — Spot_Return_Index — Total_Return_Index

CADUSD

type — Interest_Return_Index — Spot_Return_Index — Total_Return_Index

CHFUSD

EURUSD

GBPUSD

type — Interest_Return_Index — Spot_Return_Index — Total_Return_Index

JPYUSD

type — Interest_Return_Index — Spot_Return_Index — Total_Return_Index

MXNUSD

type —— Interest_Return_Index —— Spot_Return_Index —— Total_Return_Index

NOKUSD

type —— Interest_Return_Index —— Spot_Return_Index —— Total_Return_Index
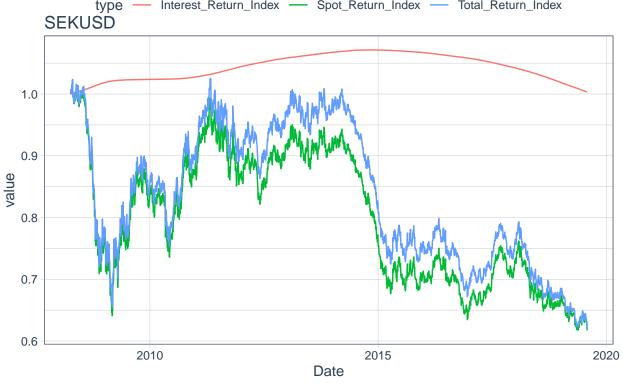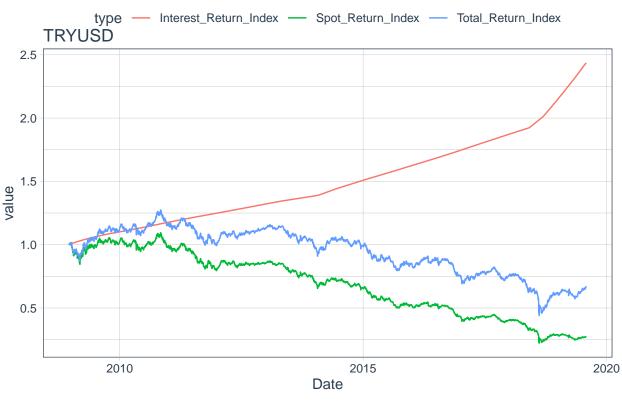
6

NZDUSD

type — Interest_Return_Index — Spot_Return_Index — Total_Return_Index

SEKUSD

type — Interest_Return_Index — Spot_Return_Index — Total_Return_Index

SGDUSD

| type | Interest_Return_Index | Spot_Return_Index | Total_Return_Index |

TRYUSD

| type | Interest_Return_Index | Spot_Return_Index | Total_Return_Index |