MSCI CURRENCY FACTOR INDEXES

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1 INTRODUCTION

MSCI Currency Factor Indexes (herein, the "Index") aim to reflect the risk premia associated with currencies. MSCI Currency Factor Indexes focus on three prominent style factors associated with the currency asset class i.e. Carry, Value and Momentum.

2 INDEX CONSTRUCTION

2.1 OVERVIEW

MSCI Currency Factor Indexes are designed to reflect the risk premia associated with the currency factors. The currency weights are derived from their exposure to the given factor. The excess return reflects the currency appreciation/depreciation of the currencies included in the MSCI Currency Factor Index relative to the home currency.

The index aims to represent the performance of an investment process that uses a combination of monthly trades of currency Forwards against the home currency.

MSCI currently offers the following currency factor indexes:

- MSCI Currency Value Factor Index.
- MSCI Currency Carry Factor Index.
- MSCI Currency Momentum Factor Index.
- MSCI Currency Factor Mix Index.

The methodology described in this guide is a generic methodology that could be applied to create other currency indexes from sets of currencies against a home currency.

2.2 CONSTRUCTING THE MSCI CURRENCY FACTOR INDEXES

Constructing the MSCI Currency Factor Indexes involves the following steps:

- Defining the home currency.
- Identifying the currencies to be included in the index.
- Identifying the weight for each currency in the index.

Each of these steps is described in detail below.

2.2.1 DEFINING THE HOME CURRENCY

Investors investing in foreign exchange would typically measure the performance of their holdings relative to their home currency. For construction of MSCI Currency Factor Indexes, the default home currency is the US Dollar.

2.2.2 IDENTIFYING THE CURRENCIES TO BE INCLUDED IN THE INDEX

The ten currencies identified as G-10 currencies[1] are eligible currencies for inclusion in the Index. The Currency Factor Indexes are constructed against US Dollar as a home currency.

2.2.3 SELECTION OF CURRENCIES IN THE INDEX

In each of the MSCI Currency Factor Indexes, the currencies are included based on the currencies' characteristics (factor score) pertaining to the corresponding factor. In each MSCI Currency Factor Index, the eligible currencies are sorted in the descending order of their factor score. The top four currencies by factor score are assigned to the "Long" basket (i.e. buying foreign currency and selling home currency) while the bottom four currencies are assigned to the "Short" basket (i.e. selling foreign currency and buying home currency) of currencies. The currencies ranked fifth and sixth are not included in the Index.

2.2.4 WEIGHTING OF CURRENCIES IN THE INDEX

The weights in each basket are assigned based on the rank of the currency within each basket and are derived as follows:

Positive and negative weights are assigned to each currency in the Long and Short basket respectively based on their relative ranking within each basket. The weights in each basket are arrived at based on the corresponding ranks. The formula producing the weights (Rank Sum Weighting) is the following:

$$w_j\ (RS) = \frac{n - r_j + 1}{\sum_{k=1}^{n} n - r_k + 1} = \frac{2(n + 1 - r_j)}{n(n+1)}$$

Where, r_j is the rank of the currency in the basket and n is the number of currencies in each basket. The weights in Long and Short baskets are capped at 30% and -30% respectively to avoid concentration.

Factor score for different factors are computed as described in Appendix I.

[1] Please refer to Appendix II for the list of G-10 currencies

2.3 MAINTAINING THE MSCI CURRENCY FACTOR INDEXES

The MSCI Currency Factor Indexes are maintained with an objective of reflecting the change in currency characteristics pertaining to each factor. In particular, index maintenance involves:

- Resetting the weights of the currencies in the index
- Rolling the Forward contracts over to the next month

The MSCI Currency Factor Indexes are rebalanced monthly on the last trading day of the month, when the index will take into account the effect of rolling into new 1-month Forward contracts based on the newly determined weights of currency to be sold for the next month's index calculation. The currency weights are determined as of the close of two weekdays before the first calendar day of following month and remain constant intra month. This means that no changes in the weights are made during the month to account for changes in the indexes.

2.3.1 RESETTING THE WEIGHTS OF CURRENCIES IN THE INDEX

The currency weights are determined two weekdays before the first calendar day of the following month and reset after the close of the last trading day of the month. They remain constant intra month, i.e. no changes in the weights are made during the month to account for changes in the indexes.

2.4 INDEX CALCULATION[2]

The MSCI Currency Factor Index aims to measure the performance of the corresponding currency factor which is calculated as given by:

$$CFI(t) = CFI(M-1) \times \left[1 + \sum_{i=1}^{n} \left\{ Weight_{i,M} \times FXRate_{i,M-1} \times \left(\frac{1}{FFRate_{i,M-1}} - \frac{1}{FFRate_{i,odd-days_t}} \right) \right\} \right]$$

Where:

t	= Index calculation date
M	= First calendar day of the month
$CFI(t)$	= Currency Factor index in the home currency at time t
$CFI(M-1)$	= Currency Factor index on the last day of the previous calendar month in the home currency

[2] Please refer to Appendix IV for details on input data for index calculation

$Weight_{i,M-1}$ = Weight of the currency i in the Index calculated on last weekday before the start of the current calendar month,

$FXRate_{i,M-1}$ = Spot rate of the currency i on the last weekday before the start of the current calendar month.

$FFRate_{i,M-1}$ = 1-month Forward for the currency i one weekday before the start of the current calendar month (or last weekday of the previous calendar month)

$FFRate_{i,odd-days_t}$ = Interpolated odd-days forward rate of the currency i on day t. This term is used to mark to market the currency position intra month and is equal to the Spot rate of currency i on the last day of the month. Its calculation is described in Section 2.4.2

2.4.1 CALCULATION OF DAILY RETURNS

Marking to market the Forward contracts on a daily basis

The daily calculation of MSCI Currency Factor Indexes marks to market the one-month Forward contracts on a daily basis by using an equal and offsetting Forward position. For instance, after 8 days, the Forward would be marked to market using a 22-days offsetting Forward in the case of a month when the last weekday of the month is the 30th (i.e. 30 – 8 = 22).

Pricing the Offsetting Forward

Typically, only a limited number of standard duration of Forwards is available in the market. These rates are called "tenors", and represent one day, one week, one month, etc. This means that other durations for Forwards (called odd-days Forwards) are generally not available, but must be calculated. When calculating MSCI Currency Factor Indexes, MSCI uses a linear interpolation based both on the 1-month Forwards to estimate the value of odd-days Forwards every day during the whole month. Odd-days Forwards are computed as the Spot rate plus the premium or discount between the Spot and the 1-month forward, pro-rated for the number of days until the last weekday of the month.

2.4.2 CALCULATION OF ODD-DAYS FORWARDS USING A LINEAR INTERPOLATION

MSCI uses a linear interpolation formula to compute odd-days Forwards. The general formula is as follows:

$$FFRate_{odd-days_t} = FXRate_t + \left(\left(FFRate_{1-month_t} - FXRate_t \right) \times \frac{Odd - days_t}{TotNbOfCalDaysDuringMonth} \right)$$

Where

$FXRate_t$ = Spot rate at time t

$FFRate_{1-month_t}$ = 1-Month Forward rate at time t

$Odd - days_t$ = Number of days until the last weekday of the current month (not counting t)

2.4.3 CALCULATION EXAMPLE

To compute a linear interpolation, the following process is used, using as an example data as of February 12, 2002:

a) Obtain the date of the last weekday of the month, in our example February 28, 2002.

b) Check if today is the last weekday of the month, in which case, the Spot exchange rate is used and there is no need to compute a linear interpolation.

c) Obtain the 1-month Forward rate as of today, i.e. February 12, 2002, for example 1.5915 CAD / USD. This forward settles in one month.

d) Compute the price difference between the Spot and the 1-month forward, as of today, February 12, 2002, called the premium (or discount). In this example, the Spot is at 1.5912, so the premium is 0.0003.

e) Using a linear interpolation, compute the value, as of today, February 12, 2002, of a Forward with a duration equal to the number of days until the last weekday of the month. In our example, the last weekday of the month is the 28th, so the duration of the Forward is 28-12 = 16 days.

The value of a 16 day Forward is estimated as the Spot rate plus the premium pro-rated for the period. The total number of days taken into account is the number of days in the month, in our example 28, as there are 28 days in February 2002.

Interpolated value of a Forward for 16 days

= 1.5912 + 0.0003*(16 / 28)

= 1.5912 + 0.00017

= 1.59137

APPENDIX I: CURRENCY FACTOR DESCRIPTORS

Value Factor

Mean reversion is the underlying basis of the Value factor. As such, if a currency has depreciated over time relative to Purchasing Power Parity (PPP)[3] between foreign and base currencies, the exchange-rate could mean-revert and therefore strengthen in the future. The economic rationale is that over the long-term prices of goods should equalize to an equilibrium level adjusting for those exchange rates.

The value factor is calculated by the following ratio: the average spot rate[4] at the end of month over the last three months divided by the latest available PPP (Purchasing Power Parity) exchange rate.

$$VALUE = \frac{P_S}{PPP}$$

Where,

$$P_s = Averagte\ of\ spot\ rate\ at\ the\ end\ of\ month\ over\ last\ 3\ months$$

$$PPP = Latest\ available\ PPP\ value$$

Momentum Factor

The Momentum factor is based on the economic hypothesis that currencies that have appreciated in the recent past will continue to appreciate reflecting persistent trends in macro-economic momentum, for example.

The momentum factor is defined as the average trailing return over a 12-month period lagged by one month:

$$MOM = \frac{1}{12}\sum_{t=-13M}^{-1M} r_t$$

Where $\boldsymbol{r_t}$ is the total return at time t, with t spanning from 13 months to 1 month prior to the rebalancing date.

[3] PPPs are the rates of currency conversion that equalize the purchasing power of different currencies by eliminating the differences in price levels between countries. PPPs are used to remove the effects of the different levels of prices within a group of countries at a point in time. Exchange rates are used to convert GDP in different currencies to a common currency. Data is sourced from OECD and World Bank and is updated annually.

[4] The spot rates used for computation of value factor should be quoted as the number of units of home currency which can be purchased by a unit of the foreign currency

Carry Factor

The Carry factor is based on the carry trade strategy of buying higher-yielding currencies with the funding provided by the low yielding currencies. The strategy historically outperformed when the adjustment implied by the difference in local interest rates has been relatively slow to occur.

The carry factor is calculated between spot exchange rate P_s and the 1-month forward rate P_f as:

$$CARRY = (P_f - P_s)/P_s$$

Where,

$$P_f = 1 - month\ Forward\ rate$$

$$P_s = Spot\ rate$$

APPENDIX II: LIST OF G-10 CURRENCIES

The default opportunity set will be G-10 Currency basket for constructing the MSCI Currency Factor indexes. The G-10 Currency basket is listed below:

No.	G-10 Currencies
1	Australian Dollar (AUD)
2	Canadian Dollar (CAD)
3	Euro (EUR)
4	Japanese Yen (JPY)
5	New Zealand Dollar (NZD)
6	Norwegian Kroner (NOK)
7	Pound Sterling (GBP)
8	Swedish Kroner (SEK)
9	Swiss Franc (CHF)
10	United States Dollar (USD)

APPENDIX III: MSCI CURRENCY FACTOR MIX INDEX

The MSCI Currency Factor Mix Index is a combination of individual Currency Factor Indexes. It is created by taking average of each currency's weight across three single factor indexes. Currency weights in MSCI Currency Factor Mix Index on any index review date are calculated as follows:

$$W_{fm,i} = \frac{W_{v,i} + W_{c,i} + W_{m,i}}{3}$$

Where,

$W_{fm,i}$ = Weight of ith currency in the MSCI Currency Factor Mix index
$W_{v,i}$ = Weight of ith currency in the MSCI Currency Value Factor index
$W_{c,i}$ = Weight of ith currency in the MSCI Currency Carry Factor index
$W_{m,i}$ = Weight of ith currency in the MSCI Currency Momentum Factor index

The weights in MSCI Currency Factor Mix index are computed at each index review coinciding with the index review dates for underlying single factor indexes and they remain constant between two index reviews. Index calculation for this index is done as described in Section 3.

APPENDIX IV: DATA TREATMENT IN MSCI CURRENCY FACTOR INDEXES

Currency Data

Closing Spot Rates

MSCI uses the WM/Reuters closing Spot rates (the mid-point of closing bid and ask rates to five decimal places), taken at 4 p.m. UK time in the daily index calculation and also in the determination of the notional amount of currencies to be sold forward on the roll date.

The WM/Reuters closing Spot rates are provided by Thomson Reuters. MSCI may elect to use alternative sources of exchange rates if the WM/Reuters rates are not available, or if MSCI determines that the WM/Reuters rates may not reflect market conditions.

Closing Forward Rates

MSCI uses the mid values of the 1-month, 1-week and TN (tomorrow next) WM/Reuters closing Forward rates published by Thomson Reuters at 4 p.m. UK time.

Currency Crisis

Disruptions in the currency Spot and/or Forward market may potentially result in a currency being excluded from the MSCI Currency Factor Indexes. In this case, the currency weights determined at the time of previous index review will continue till the next index review.

METHODOLOGY BOOK TRACKED CHANGES

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