MSCI WORLD BUSINESS CYCLE CLOCK FACTOR SELECT INDEX METHODOLOGY

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1 Introduction

The MSCI World Business Cycle Clock Factor Select Index aims to represent the performance of a rotational strategy that invests across 4 different MSCI sub-indices representing different business cycles. Each sub-index is allocated a weight based on the Chicago Fed National Activity Index as indicator.

2 Index Construction

The objective of this methodology is to create a 6% volatility targeted index that dynamically allocates monthly to different factor components based on a well-known macro signal: Chicago Fed National Activity Index (CFNAI)[1]. The CFNAI is a monthly index which is designed to gauge overall economic activity and related inflationary pressure.

The methodology defines different economic regimes such as expansion, contraction, recovery and slowdown based on the CFNAI signal outputs and allocates weights to one of the component factor mixes, monthly, on the basis of these values.

Each of the component factor mixes is risk controlled at a target volatility of 6% for the blended index to achieve the desired volatility level. In the risk control mechanism, the 'safe asset' is an investment in a risk controlled 5-year rolling bond futures index and the 'risky asset' is the respective factor component index. The process in detail is as follows:

2.1 CONSTRUCTING THE PARENT SUB-INDICES

2.1.1 EXPANSION PARENT SUB-INDEX

The Expansion parent sub-index is created by allocating 100% weight to MSCI WORLD Momentum Price Return Index.

2.1.2 SLOWDOWN PARENT SUB-INDEX

The slowdown parent sub-index is created by allocating 50% weight to MSCI WORLD Quality Price Return Index and 50% weight to MSCI WORLD Minimum Volatility Price Return Index. The Slowdown Parent Sub-Index rebalances monthly on third last trading day of the month.

2.1.3 RECOVERY PARENT SUB-INDEX

The recovery parent sub-index is created by allocating 50% weight to MSCI World Enhanced Value Price Return Index and 50% weight to MSCI World Equal Weight Price Return Index. The Recovery Parent Sub-Index rebalances monthly on third last trading day of the month.

[1] https://www.chicagofed.org/publications/cfnai/index

2.1.4 CONTRACTION PARENT SUB-INDEX

The contraction parent sub-index is created by allocating 100% weight to MSCI World Minimum Volatility Price Return Index.

2.2 CONSTRUCTING RISK CONTROLLED REGIME SUB-INDICES

2.2.1 VOLATILITY ESTIMATION

The returns of each parent sub-index are used for volatility estimation. The volatility estimation approach considers both the short-term and the long-term volatility trends of the respective parent sub-index. Volatility is calculated as the maximum of two volatility estimates: the short-term realized volatility estimate, calculated over a short horizon of 20 days, and the long-term realized volatility estimate, calculated over a long horizon of 60 days. The volatility estimation approach uses equally weighted daily price returns of the parent sub-index for both horizons. The volatility calculation formulas are described below:

$$Realized\ Volatility_t = \sqrt{\frac{252}{n} * Variance\,(t)}$$

$$Variance\,(t) = \frac{1}{N} * \sum_{t-N+1}^{t} [\ln(\frac{Parent\ SubIndex\,(i)}{Parent\ SubIndex\,(i-n)})]\text{^}2$$

n = Number of interval days used for return calculation; n=5 for weekly returns

N = Total number of historical trading days used for variance calculation and varies for short-term volatility estimate (N = 20) and long-term volatility estimate (N = 60)

$$Parent\ SubIndex\ Volatility\,(t) = Max(Short\ term\ Realized\ Volatility\,(t), Long\ term\ Realized\ Volatility(t))$$

2.2.2 INDEX LEVERAGE

The objective of the Risk Controlled Sub-Indices is to replicate the performance of a strategy that targets a specific level of risk by varying the weights of the parent sub-index and a cash component. The Index Leverage is calculated daily as the ratio of the specific risk level and the Parent Sub-Index Volatility subject to a maximum leverage of 100%. If the MSCI Parent Sub-Index Volatility is higher than 6% then the weight of the MSCI parent sub-index will be less than 100% while the weight of the cash component will be 100% minus the weight of the parent sub-index. The daily

return on the cash component is determined using the returns of SGX 5-Year Risk Controlled US Treasury Futures Index[2]. The Index Leverage applicable on an effective date is determined using the parent sub-index volatility estimated two trading days before the effective date.

2.2.3 EXCHANGE HOLIDAYS AND TRADING DAY

The Risk Controlled sub-indices are not rebalanced on a NYSE or CME exchange holiday. Any business day that is not a NYSE or CME exchange holiday is defined as Trading Day ("TD").

2.2.4 INTEREST RATE DEDUCTION

From each of the Risk Controlled sub-indices calculated above, a blended 2-month Libor and 3-month Libor interest rate calculated as below is deducted daily:

$$IR_{t-1} = (Days_{t-1,t} * IR3M_{t-1} - \left(IR3M_{t-1} - IR3M_{t-2} - Days_{t-1,t} * (IR3M_{t-1} - IR2M_{t-1}) * \left(\frac{1}{30}\right)\right) * 90)/360$$

Where:

$Days_{t-1,t}$ = Number of calendar days between t-1 and t

$IR3M_{t-1}$ = 3-month Libor rate on date t-1

$IR2M_{t-1}$ = 2-month Libor rate on date t-1

2.3 MOMENTUM LEVERAGE

To each of the above calculated risk controlled regime sub-indices, a momentum leverage overlay is applied to get the following final regime sub-indices:

IndexExpansion
IndexRecovery
IndexSlowdown
IndexContraction

Calculation

For each risk-controlled regime sub-index, a momentum signal is calculated as:

$$ETO(t) = \frac{Average(RC\ IL(t):\mathrm{RCIL(t-19d)})}{Average(RC\ IL(t-12\mathrm{m}):\mathrm{RCIL(t-12m-19d)})}$$

[2] Appendix 1

Where:
$Average(RC\ IL(t): \mathrm{RCIL(t-19d)})$: Average if respective Risk Controlled regime sub-index levels over 20 trading days
$Average(RC\ IL(t-12\mathrm{m}): \mathrm{RCIL(t-12m-19d)})$: Average if respective Risk Controlled regime sub-index levels from 12 months back over 20 trading days

A corresponding momentum overlay weight is assigned to the respective risk-controlled regime sub-indices to get final regime sub-indices. The weight is assigned as

If ETO(t-2TD) >1, LeverageWeight(t) = 130% else LeverageWeight(t) = 30%> This weight is applied by smoothing over 5 trading days.

The momentum Leverage weight applicable on an effective date is determined based on the average LeverageWeight over 5 previous trading days starting one trading day before effective date.

2.4 CFNAI SIGNAL

A Chicago Fed National Activity Index derived signal is used for allocating weights between different final regime sub-indices. We calculate 2 derivations of the CFNAI Index:

$$CFNAI_{Change} = CFNAI(t) - CFNAI(t-3)$$

Where:

$CFNAI(t)$ = The latest available CFNAI Index value as of t

$CFNAI(t-3)$ = The latest available 3-month prior CFNAI Index value as of t

$$CFNAI_{Average} = 0.6 * CFNAI(t) + 0.3 * CFNAI(t-1) + 0.1 * CFNAI(t-2)$$

Where:

$CFNAI(t)$ = The latest available CFNAI Index value as of t

$CFNAI(t-1)$ = The latest available 1-month prior CFNAI Index value as of t

$CFNAI(t-2)$ = The latest available 2-month prior CFNAI Index value as of t

$CFNAI(t-3)$ = The latest available 3-month prior CFNAI Index value as of t

1.4 WEIGHT CALCULATION

At each monthly index rebalance date, 100% weight is allocated to any of the Regime Momentum Leveraged Sub Index based on the following rule:

- If $CFNAI_{Change}(t)$ >= 0 and $CFNAI_{Average}(t)$ >=0 Then IndexExpansion = 100%
- If $CFNAI_{Change}(t)$ >= 0 and $CFNAI_{Average}(t)$ < 0 Then IndexRecovery = 100%
- If $CFNAI_{Change}(t)$ < 0 and $CFNAI_{Average}(t)$ >= 0 Then IndexSlowdown = 100%
- If $CFNAI_{Change}(t)$ < 0 and $CFNAI_{Average}(t)$ < 0 Then

  If $CFNAI_{Change}(t-1)$ >= 0 and $CFNAI_{Average}(t-1)$ < 0 Then IndexRecovery = 100%

  Otherwise, IndexContraction = 100%

3 Maintenance of the Index

3.1 MONTHLY INDEX REVIEWS

The MSCI World Business Cycle Clock Factor Select Index is reviewed on a monthly basis.

3.1.1 STAGGERED REBALANCE

The monthly Index rebalance is staggered over a period of 3 days starting on the last trading day of each month. Three versions of the Index are calculated, based on the steps described above, each having their rebalancing dates as last but one trading day of the month, last trading day of the month and 1st trading day of subsequent month with their respective effective dates as the Last trading day of the month, 1st trading day of subsequent month and to 2nd trading day of subsequent month. These indexes are then equal weighted to arrive at the final index, which rebalances to equal weights.

3.2 ONGOING EVENT RELATED CHANGES

The following section briefly describes the treatment of common corporate events within each of the component indices of the MSCI World Business Cycle Clock Factor Select Index:

MSCI World Quality Index
MSCI World Equal Weight Index
MSCI World Enhanced Value Index
MSCI World Minimum Volatility Index

No new securities will be added (except where noted below) to the Index between Index Reviews. For cases where additions are noted below, securities will be added to the index only if added to the parent index. Parent Index deletions will be reflected simultaneously.

EVENT TYPE	EVENT DETAILS
New additions to the Parent Index	A new security added to the Parent Index (such as IPO and other early inclusions) will not be added to the index.

Spin-Offs	All securities created as a result of the spin-off of an existing Index constituent will be added to the Index at the time of event implementation. Reevaluation for continued inclusion in the Index will occur at the subsequent Index Review.
Merger/Acquisition	For Mergers and Acquisitions, the acquirer's post event weight will account for the proportionate amount of shares involved in deal consideration, while cash proceeds will be invested across the Index. If an existing Index constituent is acquired by a non-Index constituent, the existing constituent will be deleted from the Index and the acquiring non-constituent will not be added to the Index.
Changes in Security Characteristics	A security will continue to be an Index constituent if there are changes in characteristics (country, sector, size segment, etc.) Reevaluation for continued inclusion in the Index will occur at the subsequent Index Review.

Further detail and illustration regarding specific treatment of corporate events relevant to this Index can be found in the MSCI Corporate Events Methodology book under the sections detailing the treatment of events in Capped Weighted and Non-Market Capitalization Weighted indexes.

The MSCI Corporate Events methodology book is available at:
https://www.msci.com/index-methodology

Appendix I: Methodology for Component Indexes

SGX 5-Year Risk Controlled US Treasury Futures Index

The SGX 5-Year Risk Controlled US Treasury Futures Index is calculated in USD and utilized for the calculation of Risk Controlled Sub-Indices.

The returns of SGX 5-Year US Treasury Futures Index (Parent Index) are used for volatility estimation. The volatility estimation approach considers both the short-term and the long-term volatility trends of the parent index. Volatility is calculated as the maximum of two volatility estimates: the short-term realized volatility estimate, calculated over a short horizon of 20 days, and the long-term realized volatility estimate, calculated over a long horizon of 60 days. The volatility estimation approach uses equally weighted daily price returns of the parent sub-index for both horizons. The volatility calculation formulas are described below:

$$Realized\ Volatility_t = \sqrt{\frac{252}{n} * Variance\,(t)}$$

$$Variance\,(t) = \frac{1}{N} * \sum_{t-N+1}^{t} [\ln(\frac{Parent\ SubIndex\,(i)}{Parent\ SubIndex\,(i-n)})]\text{^}2$$

n = Number of interval days used for return calculation; n=5 for weekly returns

N = Total number of historical trading days used for variance calculation and varies for short-term volatility estimate (N = 20) and long-term volatility estimate (N = 60)

$$Parent\ Index\ Volatility(t) = Max(Short\ term\ Realized\ Volatility\,(t), Long\ term\ Realized\ Volatility(t))$$

3.2.1 INDEX LEVERAGE

The objective of the Risk Control is to replicate the performance of a strategy that targets a specific level of risk by varying the weights of the parent sub-index and a cash component. The Index Leverage is calculated daily as the ratio of the specific risk level and the Parent Index Volatility subject to a maximum leverage of 100%. If the SGX Parent Index Volatility is higher than 6% then the weight of the SGX Parent Index will be less than 100% while the weight of the cash component will be 100% minus the weight of the parent sub-index. The daily return on the cash component is determined using 3-month Libor. The Index Leverage applicable on an effective date

is determined using the parent index volatility estimated two trading days before the effective date.

The index methodology of SGX 5-Year US Treasury Futures Index as of 29th August 2019 has been published at:

https://api2.sgx.com/sites/default/files/2019-08/5-Year%20US%20Treasury%20Futures%20Index%20-%20Index%20Methodology.pdf

Contact us

clientservice@msci.com

AMERICAS

Americas	1 888 588 4567 *
Atlanta	+ 1 404 551 3212
Boston	+ 1 617 532 0920
Chicago	+ 1 312 675 0545
Monterrey	+ 52 81 1253 4020
New York	+ 1 212 804 3901
San Francisco	+ 1 415 836 8800
São Paulo	+ 55 11 3706 1360
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Cape Town	+ 27 21 673 0100
Frankfurt	+ 49 69 133 859 00
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China North	10800 852 1032 *
China South	10800 152 1032 *
Hong Kong	+ 852 2844 9333
Mumbai	+ 91 22 6784 9160
Seoul	00798 8521 3392 *
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Taipei	008 0112 7513 *
Thailand	0018 0015 6207 7181 *
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