

INDEX GUIDELINE

RBC POLARIS MULTI-ASSET 5% INDEX

Version 1.0

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INTRODUCTION

This document (the "GUIDELINE") is to be used as a guideline with regard to the composition, calculation and maintenance of the RBC Polaris Multi-Asset 5% Index (the "INDEX"). Any amendments to the rules made to the GUIDELINE are approved by the OVERSIGHT COMMITTEE specified in Section 5.5. The INDEX is calculated, administered and published by Solactive AG ("SOLACTIVE") assuming the role as administrator (the "INDEX ADMINISTRATOR") under the Regulation (EU) 2016/1011 (the "BENCHMARK REGULATION" or "BMR"). The name "Solactive" is trademarked.

Royal Bank of Canada or any of its affiliates (the "INDEX IP OWNER") owns the copyright and all other intellectual property rights in the INDEX. Any use of these intellectual property rights may only be made with the prior written consent of the INDEX IP OWNER.

The INDEX IP OWNER is not responsible for the actions or inactions of the INDEX ADMINISTRATOR in accordance with the agreement on index administration and index calculation between the INDEX IP OWNER and the INDEX ADMINISTRATOR and any other separate agreements between the INDEX IP OWNER and the INDEX ADMINISTRATOR that have been or may be entered into from time to time (the "INDEX AGREEMENTS").

The INDEX IP OWNER owns the copyright and all other intellectual property rights in the INDEX. Any use of these intellectual property rights may only be made with the prior written consent of the INDEX IP OWNER.

The INDEX will be governed by the INDEX ADMINISTRATOR. The INDEX ADMINISTRATOR controls the creation and operation of the INDEX, including (but not limited to) all stages and processes involved in the production, calculation, maintenance, administration and dissemination of the INDEX. Notwithstanding that the INDEX relies on information from third party sources, the INDEX ADMINISTRATOR has primary responsibility for all aspects of the INDEX administration and determination process.

The GUIDELINE and the policies and methodology documents referenced herein contain the underlying principles and rules regarding the structure and operation of the INDEX. SOLACTIVE does not offer any explicit or tacit guarantee or assurance, neither pertaining to the results from the use of the INDEX nor the level of the INDEX at any certain point in time nor in any other respect. SOLACTIVE strives to the best of its ability to ensure the correctness of the calculation. There is no obligation for SOLACTIVE – irrespective of possible obligations to issuers – to advise third parties, including investors and/or financial intermediaries, of any errors in the INDEX. The publication of the INDEX by SOLACTIVE does not constitute a recommendation for capital investment and does not contain any assurance or opinion of SOLACTIVE regarding a possible investment in a financial instrument based on this INDEX.

The text uses defined terms which are formatted with "SMALL CAPS". Such Terms shall have the meaning assigned to them as specified in Section 5 (Definitions).





1. INDEX SPECIFICATIONS

1.1. SCOPE OF THE INDEX

Category	Description
Asset Class	Equity
Strategy	The INDEX is aimed at replicating the performance of a dynamic basket of ETFs with the volatility layer on top to achieve a level of volatility of 5%.
Rebalancing Frequency	Daily
Management Fee	0.5%

1.2. IDENTIFIERS AND PUBLICATION

The INDEX is published under the following identifiers:

Name	ISIN	Currency	Type	RIC	BBG ticker
RBC Polaris Multi-Asset 5% Index	DE000SLOGTP9	USD	Excess Return	.RBCPMA5U	RBCPMA5U Index

The INDEX is published on the website of the INDEX ADMINISTRATOR (www.solactive.com) and is, in addition, available via the price marketing services of Boerse Stuttgart GmbH and may be distributed to all of its affiliated vendors. Each vendor decides on an individual basis as to whether it will distribute or display the INDEX via its information systems.

Any publication in relation to the INDEX (e.g. notices, amendments to the GUIDELINE) will be available at the website of the INDEX ADMINISTRATOR: <https://www.solactive.com/news/announcements/>.

1.3. INITIAL LEVEL OF THE INDEX

The initial level of the INDEX on the 11/10/2007, the START DATE, is 1000. Historical values from the 26/10/2022, the LIVE DATE, will be recorded in accordance with Article 8 of the BMR. Levels of the INDEX published for a period prior to the LIVE DATE have been back-tested.



1.4. PRICES AND CALCULATION FREQUENCY

A closing level of the INDEX is calculated for each CALCULATION DAY. This closing level is based on the CLOSING PRICES for the INDEX COMPONENTS.

1.5. LICENSING

Licenses to use the INDEX as the underlying value for financial instruments, investment funds and financial contracts may be issued to stock exchanges, banks, financial services providers and investment houses by Royal Bank of Canada or any of its affiliates.

2. INDEX SELECTION

2.1. INDEX COMPONENTS

Name	Currency	RIC	BBG ticker
iShares MSCI USA Quality Factor ETF	USD	QUAL.P	QUAL UP Equity
Vanguard Value ETF	USD	VTV.P	VTV UP Equity
Vanguard Growth ETF	USD	VUG.P	VUG UP Equity
iShares IBOXX High Yield Corp	USD	HYG.P	HYG UP Equity
SPDR Gold Shares	USD	GLD.P	GLD UP Equity
iShares US Real Estate ETF	USD	IYR.P	IYR UP Equity
Invesco DB Commodity Index Tracking Fund	USD	DBC.P	DBC UP Equity
iShares 20+ Year Treasury Bond ETF	USD	TLT.OQ	TLT UQ Equity
Invesco DB US Dollar Index Bullish Fund	USD	UUP.P	UUP UP Equity

The INDEX invests in the components detailed above as follows:



Each CALCULATION DAY, target weights are calculated as described in Section 3.2

Target weights are translated to index weights by taking into account certain constraints regarding the maximum move of the index weights per day, which is described in Section 3.4.

Index weights are translated into index units as described in detail in Section 3.5.

3. CALCULATION OF THE INDEX

3.1. INDEX FORMULA

The INDEX is calculated as an excess return Index.

The Index level I_t on each CALCULATION DAY t is calculated in accordance with the following formula:

If t is the START DATE:

$$I_t = 1000$$

Else:

$$IL_t = \max \left(0, IL_{t-1} + \left[\sum_{i=1}^N U_{i,t-1} \times (P_{i,t} + Div_{i,t} - P_{i,t-1}) \right] - FC_t - TC_{t-1} - DMF_t \right)$$

Where:

IL_{t-1}	The level of the INDEX as of the CALCULATION DAY immediately preceding t.
$P_{i,t}$	The CLOSING LEVEL of INDEX COMPONENTS i as of CALCULATION DAY t
$P_{i,t-1}$	The CLOSING LEVEL of INDEX COMPONENTS i as of CALCULATION DAY t-1
$Div_{i,t}$	The dividend amount INDEX COMPONENTS i with ex-date equal to CALCULATION DAY t
FC_t	The funding cost as of CALCULATION DAY t
TC_{t-1}	The transaction costs as of CALCULATION DAY t-1
DMF_t	The daily management fee CALCULATION DAY t
$U_{i,t-1}$	The index units of INDEX COMPONENTS i as of CALCULATION DAY t-1
N	The number of INDEX COMPONENTS

Funding costs are calculated according to:



$$FC_t = Exposure_{t-1} \times \frac{FCR_{t-1}}{100} \times DCF_{t-1,t}$$

Where:

$DCF_{t-1,t}$ The day count fraction, which equals the number of calendar days between CALCULATION DAY t (including) and CALCULATION DAY t-1 (excluding), divided by 360.

FCR_{t-1} the funding cost as of CALCULATION DAY t-1

$Exposure_{t-1}$ the total dollar exposure as of CALCULATION DAY t-1

The daily management fee is calculated according to :

$$DMF_t = IL_{t-1} \times MF \times DCF_{t-1,t}$$

With:

MF the management fee of 0.5%

The transaction costs are calculated as:

$$TC_t = \left[\sum_{i=1}^N P_{i,t} \times abs(U_{i,t} - U_{i,t-1}) \times TCR_i \right]$$

Where:

TCR_i The transaction cost rate of INDEX COMPONENT i (equal to 0.02% for each INDEX COMPONENT)

If the level of the INDEX will reach 0, it will stay at 0 thereafter.



3.2. TARGET WEIGHT DETERMINATION

On each CALCULATION DAY, the following calculations are performed to calculate the target weights for each INDEX COMPONENT:

A maximization problem is solved with the objective to maximize historical portfolio return, while constraining the portfolio volatility to 5% and setting caps on individual INDEX COMPONENT weights and the sum of weights of INDEX COMPONENT from the same group (as defined below).

Formally, weights will fulfil:

$$\arg \max_{TW} \sum_{i=1}^N TW_{i,t} \times ER_{i,t}$$

Subject to:

The sum of target weights is between 0% and 100%

$$0\% \leq \sum_{i=1}^N TW_{i,t} \leq 100\%$$

The portfolio volatility is less than or equal to the volatility target:

$$\sigma_t^{ST} \leq VT$$

σ_t^{ST} is defined in Section 3.3.

Target weight for each INDEX COMPONENT is higher than its floor but lower than its cap:

$$Floor_i \leq TW_{i,t} \leq Cap_i$$

The sum of target weights for INDEX COMPONENTS from the same group J , for each group J , is between the group's floor and cap.

$$Floor_j \leq \sum_{i \in J} TW_{i,t} \leq Cap_j$$



RIC	Floor	Cap	Group	Delta Cap	Group Floor	Group Cap
QUAL.P	0%	30%	Risk	30.0%	0%	100%
VTV.P	0%	30%	Risk	30.0%		
VUG.P	0%	30%	Risk	30.0%		
HYG.P	0%	30%	Risk	30.0%		
GLD.P	0%	20%	Diversifying	20.0%	0%	30%
IYR.P	0%	10%	Diversifying	5.0%		
DBC.P	0%	10%	Diversifying	2.5%		
TLT.OQ	0%	50%	Defensive	50.0%	0%	50%
UUP.P	0%	10%	Defensive	2.5%		

Where:

$ER_{i,t}$ The excess return of INDEX COMPONENT *i* as of CALCULATION DAY *t*

$TW_{i,t}$ The target weight of INDEX COMPONENT *i* as of CALCULATION DAY *t*

σ_t^{ST} The short-term portfolio volatility (calculated using $TW_{i,t}$)

VT The level of target volatility of 5%

$Floor_i$ The target weight floor of INDEX COMPONENT *i*

Cap_i The target weight cap of INDEX COMPONENT *i*

$Floor_j$ The weights floor of group *J*

Cap_j The weight cap of group *J*

The excess return of INDEX COMPONENT *i* as of CALCULATION DAY *t* is calculated as:

$$ER_{i,t} = \ln\left(\frac{AP_{i,t}}{AP_{i,t-126}}\right) - \ln\left(\frac{CIL_t}{CIL_{t-126}}\right)$$

$AP_{i,t}$ The adjusted price of INDEX COMPONENT *i* as of CALCULATION DAY *t*



$AP_{i,t-126}$ The adjusted price of INDEX COMPONENT as of CALCULATION DAY t-126

CIL_t The cash level as of CALCULATION DAY t

CIL_{t-126} The cash level as of CALCULATION DAY t-126

The adjusted price of INDEX COMPONENT as of CALCULATION DAY t is calculated as:

$$AP_{i,t} = AP_{i,t-1} \times \left(\frac{P_{i,t} + Div_{i,t}}{P_{i,t-1}} \right)$$

The adjusted price of each INDEX COMPONENT is incepted at 100 as of 20/02/2007..

The cash level is calculated according to the following formula:

For each CASH BUSINESS DAY t:

$$CIL_t = CIL_{t-1} * (1 + FCR_{t-1} * DCF_{t-1,t})$$

Where:

FCR_{t-1} If CASH BUSINESS DAY t-1 is prior to the RATE SWITCH DAY, the ICE Libor USD 3 Month (RIC: USD3MFSR=). If CASH BUSINESS DAY t-1 is equal to or after the RATE SWITCH DAY, the Secured Overnight Funding Rate (RIC: USDSOFR=) plus a spread of 0.25%

On the START DATE, the cash level is: 1482.62061015657

If any given CALCULATION DAY is not a CASH BUSINESS DAY, previous day Cash levels will be filled forward.

3.3. VOLATILITY CALCULATION

Two different volatility measures are calculated based on different decay factors.

Generally, portfolio volatility is calculated as:

$$Sigma_t = \sqrt{W'.CoV.W} \times \sqrt{252}$$

Where:

W a Nx1 vector of weights

CoV a NxN matrix, with generic element (i,j), which has the covariance between INDEX COMPONENT i and j



The generic element (i,j) is calculated according to:

$$CoVar_{i,j} = \frac{CV_t + (1 - \alpha) \times CV_{t-1} + (1 - \alpha)^2 \times CV_{t-2} \dots \dots + (1 - \alpha)^{125} \times CV_{t-125}}{1 + (1 - \alpha) + (1 - \alpha)^2 \dots \dots + (1 - \alpha)^{125}}$$

Where:

α the inverse weighting factor calculated as 1 – decay factor

CV_d daily cross return between INDEX COMPONENT i and j

With:

$$CV_d = Ret_{A,d} \times Ret_{B,d}$$

And

$$Ret_{i,d} = \ln \left(\frac{AP_{i,d}}{AP_{i,d-1}} \right)$$

The short decay factor is equal to $\lambda = 0.94$, the long decay factor is equal to $\lambda = 0.97$

σ_t^{ST} is equal to $Sigma_t$ using a decay factor of 0.94 and the respective target weights as of CALCULATION DAY t

σ_t^{LT} is equal to $Sigma_t$ using a decay factor of 0.97 and the respective target weights as of CALCULATION DAY t

3.4. INDEX WEIGHT CALCULATION

The weight of INDEX COMPONENT i as of CALCULATION DAY t is determined as follows:

If t is equal to the INDEX START DATE:

$$W_{i,t} = Lev_t \times TW_{i,t}$$

Where:

Lev_t The leverage as of CALCULATION DAY t

If t falls strictly after INDEX START DATE:

$$W_{i,t} = W_{i,t-1} + \left[sign(Lev_t \times TW_{i,t} - W_{i,t-1}) \times min \left(DeltaCap_i, abs(Lev_t \times TW_{i,t} - W_{i,t-1}) \right) \right]$$



Where:

DeltaCap_i The maximal daily move in weights of INDEX COMPONENT i

sign(x) The sign function, which return 1 if $x > 0$ and -1 if $x < 0$

The leverage is calculated based on the short-term and long-term volatility:

$$Lev_t = \min\left(1.5, \frac{VT}{\sigma_t}\right)$$

Where:

$$\sigma_t = \max(\sigma_t^{ST}, \sigma_t^{LT})$$

If $\sigma_t = 0$, we will set $Lev_t = 1.5$

3.5. INDEX UNITS CALCULATION

Given the index weights as determined in Section 3.4, the index units are derived from these according to:

If t is equal to the INDEX START DATE:

$$U_{i,t} = W_{i,t} \times \frac{IL_t}{P_{i,t}}$$

If t falls strictly after INDEX START DATE:

$$U_{i,t} = W_{i,t-1} \times \frac{IL_{t-1}}{P_{i,t-1}}$$

Based on the index units, the total dollar exposure is calculated.

$$Exposure_t = \sum_{i=1}^N U_{i,t} \times P_{i,t}$$



3.6. ACCURACY

The level of the INDEX will be rounded to 2 decimal places for publication purposes.

3.7. RECALCULATION

SOLACTIVE makes the greatest possible efforts to accurately calculate and maintain its indices. However, errors in the determination process may occur from time to time for variety reasons (internal or external) and therefore, cannot be completely ruled out. SOLACTIVE endeavors to correct all errors that have been identified within a reasonable period of time. The understanding of "a reasonable period of time" as well as the general measures to be taken are generally depending on the underlying and is specified in the Solactive Correction Policy, which is incorporated by reference and available on the SOLACTIVE website: <https://www.solactive.com/documents/correction-policy/>.

3.8. MARKET DISRUPTION

In periods of market stress SOLACTIVE calculates its indices following predefined and exhaustive arrangements as described in the Solactive Disruption Policy, which is incorporated by reference and available on the SOLACTIVE website: <https://www.solactive.com/documents/disruption-policy/>. Such market stress can arise due to a variety of reasons, but generally results in inaccurate or delayed prices for one or more INDEX COMPONENTS. The determination of the INDEX may be limited or impaired at times of illiquid or fragmented markets and market stress.



4. MISCELLANEOUS

4.1. DISCRETION

Any discretion which may need to be exercised in relation to the determination of the INDEX (for example the determination of the INDEX UNIVERSE (if applicable), the selection of the INDEX COMPONENTS (if applicable) or any other relevant decisions in relation to the INDEX) shall be made in accordance with strict rules regarding the exercise of discretion or expert judgement.

4.2. METHODOLOGY REVIEW

The methodology of the INDEX is subject to regular review, at least annually. In case a need of a change of the methodology has been identified within such review (e.g. if the underlying market or economic reality has changed since the launch of the INDEX, i.e. if the present methodology is based on obsolete assumptions and factors and no longer reflects the reality as accurately, reliably and appropriately as before), such change will be made in accordance with the Solactive Methodology Policy, which is incorporated by reference and available on the SOLACTIVE website: <https://www.solactive.com/documents/methodology-policy/>.

Such change in the methodology will be announced on the SOLACTIVE website under the Section "[Announcement](https://www.solactive.com/news/announcements/)", which is available at <https://www.solactive.com/news/announcements/>. The date of the last amendment of this INDEX is contained in this GUIDELINE.

4.3. CHANGES IN CALCULATION METHOD

The application by the INDEX ADMINISTRATOR of the method described in this document is final and binding. The INDEX ADMINISTRATOR shall apply the method described above for the composition and calculation of the INDEX. However, it cannot be excluded that the market environment, supervisory, legal and financial or tax reasons may require changes to be made to this method. The INDEX ADMINISTRATOR may also make changes to the terms and conditions of the INDEX and the method applied to calculate the INDEX that it deems to be necessary and desirable in order to prevent obvious or demonstrable error or to remedy, correct or supplement incorrect terms and conditions. The INDEX ADMINISTRATOR is not obliged to provide information on any such modifications or changes. Despite the modifications and changes, the INDEX ADMINISTRATOR will take the appropriate steps to ensure a calculation method is applied that is consistent with the method described above.



4.4. TERMINATION

SOLACTIVE makes the greatest possible efforts to ensure the resilience and continued integrity of its indices over time. Where necessary, SOLACTIVE follows a clearly defined and transparent procedure to adapt Index methodologies to changing underlying markets (see Section 5.2 "Methodology Review") in order to maintain continued reliability and comparability of the indices. Nevertheless, if no other options are available the orderly cessation of the INDEX may be indicated. This is usually the case when the underlying market or economic reality, which an index is set to measure or to reflect, changes substantially and in a way not foreseeable at the time of inception of the index, the index rules, and particularly the selection criteria, can no longer be applied coherently or the index is no longer used as the underlying value for financial instruments, investment funds and financial contracts.

SOLACTIVE has established and maintains clear guidelines on how to identify situations in which the cessation of an index is unavoidable, how stakeholders are to be informed and consulted and the procedures to be followed for a termination or the transition to an alternative index. Details are specified in the Solactive Termination Policy, which is incorporated by reference and available on the SOLACTIVE website: <https://www.solactive.com/documents/termination-policy/>.

4.5. OVERSIGHT

An oversight committee composed of staff from SOLACTIVE and its subsidiaries (the "OVERSIGHT COMMITTEE") is responsible for decisions regarding any amendments to the rules of the INDEX. Any such amendment, which may result in an amendment of the GUIDELINE, must be submitted to the OVERSIGHT COMMITTEE for prior approval and will be made in compliance with the Methodology Policy, which is available on the SOLACTIVE website: <https://www.solactive.com/documents/methodology-policy/>.



5. DEFINITIONS

"BENCHMARK REGULATION" shall have the meaning as defined in Section "Introduction".

"BMR" shall have the meaning as defined in Section "Introduction".

"CALCULATION DAY" is every weekday where the New York Stock Exchange (MIC: XNYS) and Nasdaq (MIC: XNAS) are open for general business

"CASH BUSINESS DAY" is every day on which commercial banks are open in New York.

"CLOSING PRICE" means, in respect of a CALCULATION DAY and each INDEX COMPONENT, the official closing price of such INDEX COMPONENT on such CALCULATION DAY as published by the Primary Exchange

"GUIDELINE" shall have the meaning as defined in Section "Introduction".

An "INDEX COMPONENT" is any security in the list in section 2.1

"INDEX" shall have the meaning as defined in Section "Introduction".

"INDEX ADMINISTRATOR" shall have the meaning as defined in Section "Introduction".

"INDEX CURRENCY" is the currency specified in the column "Currency" in the table in Section 1.2.

"INDEX IP OWNER" is Royal Bank of Canada

"LIVE DATE" shall have the meaning as defined in Section 1.3.

"OVERSIGHT COMMITTEE" shall have the meaning as defined in Section 4.2.

"RATE SWITCH DAY" is 3rd January 2022

"SOLACTIVE" shall have the meaning as defined in Section "Introduction".

"START DATE" shall have the meaning as defined in Section 1.3.

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