Citi Grandmaster Index

Ticker: CITIMSTR

Citi Investment Strategies

“Like chess, investing requires one to think many moves ahead. But every Grandmaster knows that’s only part of the equation.”

Garry Kasparov
Chess Grandmaster and Former Chess World Champion

This brochure is a high level summary of the Index and is not intended to be the sole basis for an investment decision in any investment product linked to the Index. Additional information about the Index and its related risks is available at: https://investmentstrategies.citi.com/cis/us

Introducing the Citi Grandmaster Index

The Citi Grandmaster Index (the “Index”) is a rules-based multi-asset index comprised of thirteen components split into four asset classes – three equity futures indices, three government bond futures indices, three commodity futures indices, and four corporate credit default swap indices.

The Index has two key innovations

1. The Index plays out 1,000 future market simulations, and uses the outcomes of those simulations to identify the sequence of monthly asset allocation decisions over the next year which is expected to deliver the strongest returns compatible with a given level of risk (if those simulations were accurate predictors of future returns and risk).

2. The Index uses historical data from the prior year to build those simulations, and in times of elevated volatility also considers historical data from similar periods in history.

The key benefit of these features is that the Index attempts to use actual historical data to model simulations of future performance, and incorporate that information into the Index’s hypothetical asset allocation decisions.

With the goal of stabilizing global market uncertainties that may negatively affect the Index return, the Index also includes a daily volatility targeting mechanism which seeks to limit the overall volatility close to a pre-defined level of 5 %.

Index Attributes

Bloomberg Ticker	CITIMSTR Index
Currency	USD
Return Type	Excess Return
Live Date	20-April-21
Start Date	05-Oct-01
Rebalance Frequency	Monthly
Volatility Target	5 %
Index Fee	0.50 % per annum
Index Administrator	Citigroup Global Markets Ltd
Calculation Agent	Citigroup Global Markets Ltd

Summary of Selected Risks

- No guarantee that Index will make optimal asset-allocation decisions
- Simulations may not be accurate models of future returns or risk
- Index will not assign the weight determined to be optimal for the next month at each monthly rebalancing
- Relatively low volatility target likely to result in relatively low equity allocation, and therefore underperformance of equities in equity bull markets
- Likely to have significant exposure to government bond asset class, and therefore be subject to risk of decline in rising interest rate environment
- Performance of each Index constituent reduced by an implicit financing cost
- Volatility target may result in significant portion of Index being uninvested
- Index fee of 0.50 % per annum

For more information about important risks associated with the Index, see “Summary Risk Factors” below.

Step by Step Construction of Citi Grandmaster Index

The Index allocates between four asset classes, each comprising a number of constituent indices (each sponsored by Citi except in the commodity asset class). The allocation of the Index to each asset class is capped at predefined levels.

Index Universe

Core Asset	Constituent Exposure	Index Ticker	Weight within Asset Class
Equity	S&P 500 Futures	CIEQESUX	60 %
	Euro STOXX 50 Futures	CIEQVGES	30 %
	Nikkei 225 Futures	CIEQNIJS	10 %
Equity maximum asset class allocation is 100 %			
Government Bond	US Treasury Note, 10Yr Futures	CIIRBF1U	40 %
	Euro Bund Futures	CIIRBF1E	40 %
	Japan Gov't Bond 10Yr Futures	CIIRBF1J	20 %
Government Bond asset allocation is dependent on the Dynamic Bond Cap [1] with a maximum asset class allocation of 100 %			
Commodity	BBG Energy	BCOMEN	33 %
	BBG Precious Metals	BCOMPR	33 %
	BBG Industrial Metals	BCOMIN	33 %
Commodity maximum asset class allocation is 30 %			
Corporate Credit	Investment Grade US 5Y CDS	CICMCIG5	40 %
	Investment Grade Europe 5Y CDS	CICMCEB5	40 %
	High Yield US 5Y CDS	CICMCHY5	10 %
	High Yield Europe 5Y CDS	CICMCEX5	10 %
Corporate Credit maximum asset class allocation is 20 %			

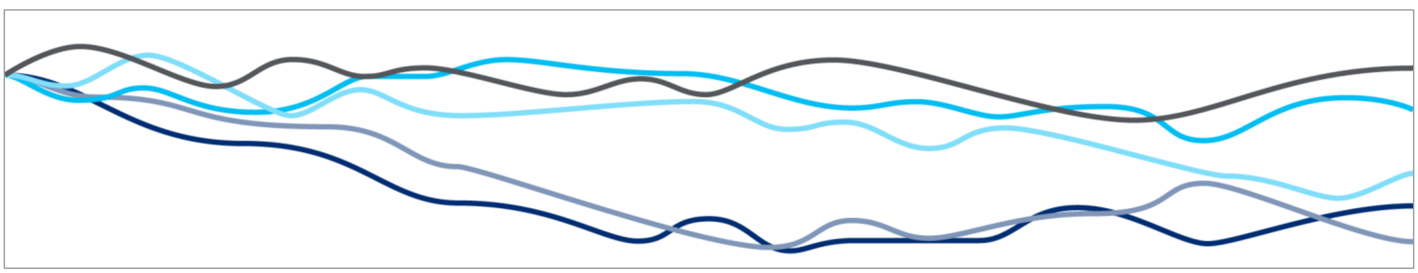
1 Definition of Dynamic Bond Cap: The maximum allocation to Government Bonds is determined each month. If (a) the slope of the U.S. yield curve (specifically the normalized difference between 10yr and 2yr U.S. swap rates) has steepened beyond a specified threshold over the prior year and (b) US breakeven inflation rates have risen beyond a specified threshold from their lowest level over the prior year, then the maximum permitted allocation to Government Bonds will be reduced by as much as 50 %, depending on the degree to which US breakeven inflation rates have risen. Please see additional information, available at: https://investmentstrategies.citi.com/cis/us and https://investmentstrategies.citi.com/citicis/cis-doc/html/app.html?u1A-H3ij-7tvWSHGJV5iOg==

Step by Step Construction of Citi Grandmaster Index

Step 1 | Step 2 | Step 3 | Step 4

Each month, to allocate between asset classes, the Index builds **1,000 hypothetical scenarios** for each asset class to simulate the next 12 monthly returns. These scenarios are generated by randomly sampling daily returns [2] over the past year and, in relatively more volatile times, daily returns from historical periods (as far back as 2001) with similar level of market stress.

1,000 Hypothetical Scenarios

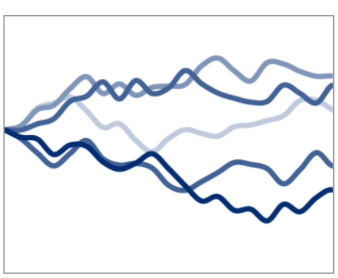


12 monthly returns

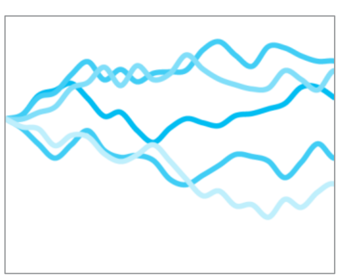
- Created by randomly sampling daily returns over the last year

- Daily returns at times in history with similar levels of equity volatility [3]
(if the current VIX level is elevated [4])

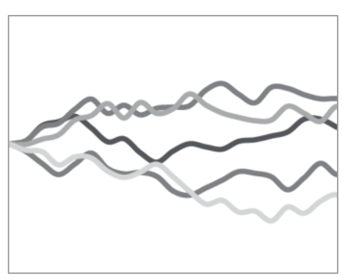
Equity



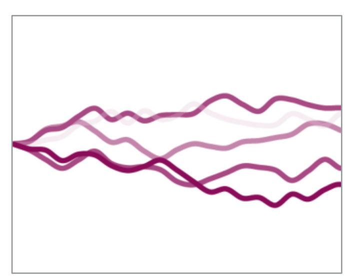
Commodity



Corporate Credit



Government Bonds



2 Historical daily return data for the constituents of the index is derived from publically available price data as described in the index methodologies for each constituent available at the link at page 4 above.
3 Defined with reference to a VIX band. For example, if the VIX today is 15 %, the Index will sample returns from historic time periods when VIX in a +/−20 % range (e.g. between 12 % (= 15 % × 0.8) and 18 % (= 15 % × 1.2)).
4 We define ‘elevated’ to mean times when the current level of VIX is greater than its median value over the previous 12 months.

Step by Step Construction of Citi Grandmaster Index

Step 1 | **Step 2** | Step 3 | Step 4

Calibrate

In Step 1, the Index created 1,000 hypothetical simulations of the performance of each asset class over the next 12 months, each referred to as an “iteration”.

In Step 2, using these 1,000 hypothetical simulations, the Index seeks to determine an estimate of the relative “investment utility” that would result from increasing or decreasing the investment exposure to each asset class on a given date at the beginning of each of the next 12 months.

Investment utility represents a quantification of the relationship between the reward and the risk of making an investment in an asset class of a particular notional amount for a particular given period. Therefore, investment utility is not simply a measure of the expected return of an asset class, but also takes into account a measure of the expected risk of that asset class. The Index seeks a 5 % target volatility and discounts the investment utility of higher-volatility asset classes accordingly. As a result, the Index is likely to have greater exposure to lower-volatility asset classes (such as government bonds and corporate credit) and lower exposure to higher-volatility asset classes (such as equities).

The Index makes an estimate of investment utility through a calibration procedure that starts by estimating investment utility in respect of one iteration and then fine-tunes that estimate through each of 999 succeeding iterations.

At the end of the calibration process, the Index has an estimate of the investment utility of increasing or decreasing exposure to each asset class for each of the next 12 months.

Optimize

For each of the next 12 months, the Index determines the weight of each asset class that would maximize the expected investment utility of the Index’s portfolio of constituent indices for that month (the “optimized weight”), subject to the asset class caps.

Average

At each monthly rebalancing, the Index assigns a weight to each asset class equal to the average of the optimized weights determined for that asset class for each of the next 12 months.

Because of this averaging step, the weight assigned to each asset class at a monthly rebalancing is different from the optimized weight determined for the upcoming month.

Step by Step Construction of Citi Grandmaster Index

Step 1 | Step 2 | **Step 3** | Step 4

To mitigate the risk return, the Index relies on a Enhanced Risk Control mechanism which adjusts the Index exposure to the underlying constituents on a daily basis based on the risk of the Index Portfolio calculated in Step 2:

1. In a high volatility environment, generally associated with asset selloffs, the Index exposure is reduced.
2. In a low volatility environment, the Index exposure is increased, subject to an exposure cap of 150 %.

The Risk of the Index Portfolio is calculated as the maximum between:

Past (Realized Vol)
The backward-looking realized volatility of the current Allocation.

Present (Stress Test)
Whenever the volatility of the core index exceeds 7.25 %, we introduce a ‘stress’ factor which further decreases the exposure temporarily. The rationale is that when market volatility is elevated and the core index is realizing at elevated levels of volatility, it’s likely that markets are stressed and the strategy should attempt to be more cautious.

Future (VIX estimated)
The forward-looking implied future volatility of the Equity Allocation (VIX scaled down by the Equity Weight).

Step 1 | Step 2 | Step 3 | **Step 4**

Index performance is reduced by an index fee of 0.50 % per annum, deducted daily.

Hypothetical Back-Tested and Historical Index Monthly Performance[5]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
2005			0.2 %	-0.3 %	2.0 %	1.0 %	0.0 %	0.8 %	1.6 %	-1.2 %	2.3 %	1.0 %	**7.4 %**
2006	0.8 %	-0.6 %	1.2 %	2.3 %	-0.6 %	0.0 %	0.1 %	0.0 %	0.3 %	1.0 %	0.7 %	-0.2 %	**5.0 %**
2007	0.2 %	-0.6 %	-0.1 %	1.0 %	0.7 %	-0.7 %	2.0 %	1.0 %	1.5 %	0.9 %	1.7 %	-0.5 %	**7.2 %**
2008	2.6 %	3.0 %	-0.1 %	-0.7 %	-0.6 %	0.6 %	-0.5 %	-0.5 %	-1.1 %	-0.7 %	2.6 %	1.2 %	**5.9 %**
2009	-0.6 %	0.1 %	1.3 %	-0.5 %	-0.3 %	-0.6 %	-0.1 %	0.7 %	1.0 %	-0.2 %	1.4 %	-0.3 %	**1.9 %**
2010	-0.6 %	0.7 %	1.8 %	0.2 %	-0.8 %	0.7 %	1.3 %	0.7 %	1.8 %	0.4 %	-0.5 %	0.5 %	**6.2 %**
2011	-0.4 %	0.6 %	0.3 %	2.5 %	-1.3 %	-0.2 %	0.8 %	-1.3 %	1.6 %	-0.2 %	-0.1 %	1.1 %	**3.3 %**
2012	0.8 %	-0.1 %	-0.3 %	1.4 %	2.2 %	-1.4 %	1.7 %	0.5 %	0.2 %	-0.6 %	1.1 %	0.6 %	**6.3 %**
2013	0.8 %	1.0 %	1.7 %	1.5 %	-0.3 %	-2.1 %	0.7 %	-0.6 %	1.7 %	1.7 %	1.0 %	0.3 %	**7.5 %**
2014	-0.8 %	1.6 %	0.4 %	0.3 %	1.6 %	0.8 %	-0.7 %	2.0 %	-0.3 %	0.5 %	1.9 %	-0.5 %	**7.1 %**
2015	2.3 %	-0.6 %	0.0 %	-0.6 %	-0.8 %	-1.0 %	1.0 %	-2.9 %	0.6 %	0.1 %	-0.8 %	-0.6 %	**-3.3 %**
2016	1.9 %	1.5 %	-0.2 %	-0.7 %	0.9 %	3.4 %	0.7 %	-0.7 %	-0.2 %	-1.4 %	-0.3 %	1.7 %	**6.5 %**
2017	0.4 %	1.8 %	0.3 %	0.1 %	0.7 %	-0.6 %	0.5 %	0.1 %	1.0 %	1.5 %	0.1 %	0.2 %	**6.1 %**
2018	2.2 %	-1.3 %	1.5 %	-1.0 %	0.4 %	-0.2 %	0.7 %	0.1 %	0.3 %	-2.2 %	2.3 %	2.1 %	**4.9 %**
2019	1.5 %	0.5 %	3.0 %	-0.7 %	1.6 %	2.8 %	0.7 %	2.6 %	-1.1 %	0.3 %	0.1 %	-0.2 %	**11.5 %**
2020	-0.8 %	4.0 %	-0.3 %	0.2 %	0.0 %	0.2 %	0.5 %	-0.7 %	-0.7 %	0.2 %	1.3 %	0.9 %	**4.7 %**
2021	-0.4 %	0.5 %	-0.1 %	1.6 %	0.8 %	0.2 %	0.4 %	0.2 %	-0.2%	0.7%	-0.9%	0.4%	**3.3 %**
2022	-1.4 %	1.4%	1.8%	-0.9%	-0.3%	-1.4%	1.0%	-0.9%	-1.4%	0.2%	0.8%	-0.7%	**-1.8%**
2023	0.5%	-0.07%	0.05%	0.27%	-0.2%	1.34%	0.1%	-1.1%	-2.2%	-0.7%			**-2.2%**

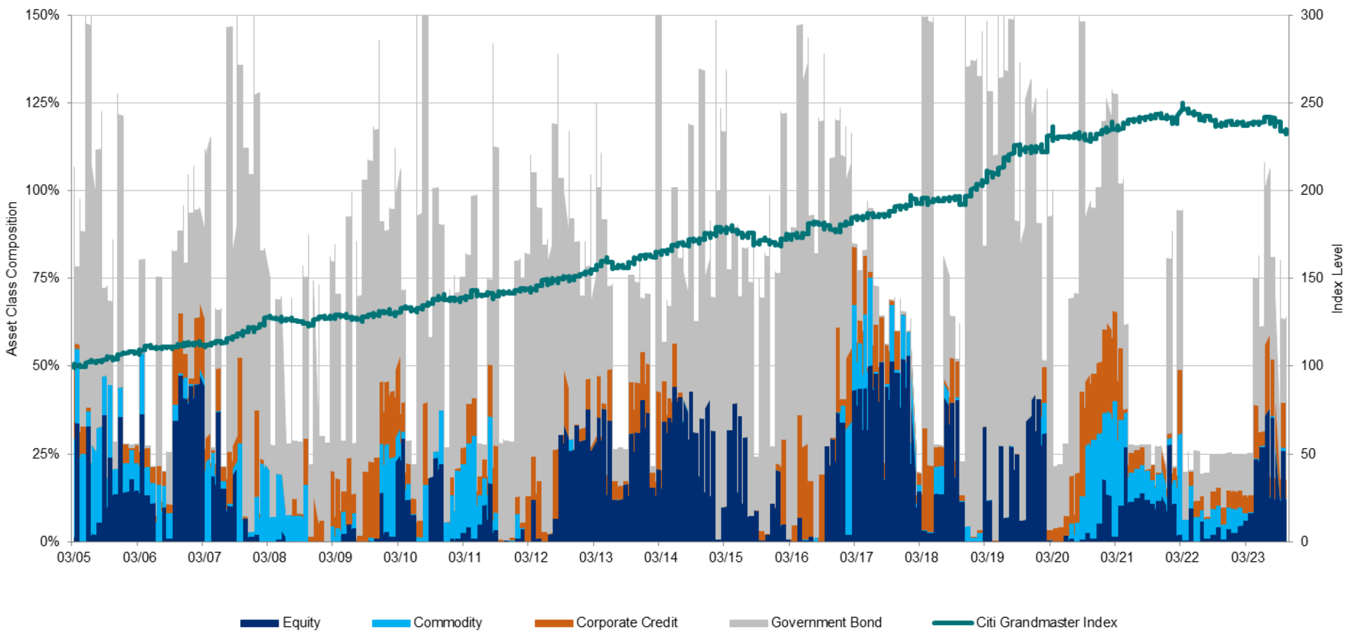
Live Date
April 20,
2021

See next page for Important Information about Hypothetical Back-Tested Index Performance Data.

5 Data as of 31-Oct-2023. Data source for all charts, graphs and tables: Citi, Bloomberg.

Hypothetical Back-Tested and Historical Index Monthly Performance

Asset Class	Average Allocation (Since 1-Mar-05)	Average Allocation (Prior 12 Months)
Equity	16.5%	18.1%
Commodity	5.8%	2.1%
Corporate Credit	7.1%	9.7%
Government Bond	43.7%	21.5%
Uninvested	32.0%	48.9%



Data as of 31-Oct-2023. Data source for all charts, graphs and tables: Citi, Bloomberg.

Important Information about Hypothetical Back-Tested Index Performance Data
All Index performance data prior to April 20, 2021 is hypothetical and back-tested, as the Index did not exist prior to that date. Hypothetical back-tested Index performance data is subject to significant limitations. The Index Administrator developed the rules of the Index with the benefit of hindsight – that is, with the benefit of being able to evaluate how the Index rules would have caused the Index to perform had it existed during the hypothetical back-tested period. The fact that the Index generally appreciated over the hypothetical back-tested period may not therefore be an accurate or reliable indication of any fundamental aspect of the Index methodology. Furthermore, the hypothetical back-tested performance of the Index might look different if it covered a different historical period. The market conditions that existed during the hypothetical back-tested period may not be representative of market conditions that will exist in the future. Moreover, the hypothetical back-tested performance of the Index was based on a particular random distribution of historical returns to construct each hypothetical market simulation, using a different random number generator than the Index currently uses. Each random distribution of returns is different, and so the hypothetical back-tested performance is different from the performance that would have resulted if the Index had actually existed during the back-tested period.

It is impossible to predict whether the Index will rise or fall. In providing the hypothetical back-tested and historical Index performance data above, no representation is made that the Index is likely to achieve gains or losses similar to those shown. In fact, there are frequently sharp differences between hypothetical performance results and the actual results subsequently achieved by any particular investment. One of the limitations of hypothetical performance information is that it did not involve financial risk and cannot account for all factors that would affect actual performance. The actual future performance of the Index may bear no relation to the hypothetical back-tested or historical performance of the Index.

Summary Risk Factors

Allocation procedure

The Index methodology determines the percentage weight to be allocated to each asset class within the Index on a monthly basis by following a procedure that attempts to identify the optimum weight of each asset class at specified dates at the beginning of each of the next 12 months. This procedure calibrates a measure of expected investment utility of each asset class based on 1,000 hypothetical market simulations over the next 12 months. There is no guarantee that this procedure will find the combination of percentage weights which results in the optimal investment outcome, and no guarantee that the actual evolution of the relevant markets will be similar to the market environments that are simulated by the Index methodology.

- **The Index does not assign the weights that the calibration procedure identifies as the optimum weights for the next monthly period.** Instead, at each monthly rebalancing, the Index gives each asset class a weight equal to the average of the optimized weight determined for each of the next 12 months. This approach is designed to reduce the size of monthly changes in allocations among the asset classes but is a departure from the optimum weight determined by the calibration procedure for the next month.

- **There is no guarantee that the optimization process will identify the overall optimal set of asset class weights.** The optimization process attempts to find the particular combination of asset class weights which results in the investment outcome which has the highest value (that is, maximizes the expected investment utility). The optimization process searches only a finite number of combinations of asset class weights and the set of weights identified by the process may not be the so-called “global” (overall) maxima.

- **Other implementations of the allocation procedure process may result in different results.** The optimization procedure relies upon various assumptions and initial conditions. There is no single way to implement the optimization procedure and the techniques employed by the Index may not be as successful as other approaches.

- **The allocation procedure is sensitive to initial conditions.** The optimal asset class weights are determined through a systematic step-by-step process, and not a single equation with a single calculated result. The procedure operates through a substantial number of iterations, and the result of each iteration (other than the final iteration) provides the numerical inputs to the operation of the next following iteration. Therefore, small variations in the initial conditions provided to the initial iteration may result in wider divergences in the results obtained.

- **Notional costs will affect the determination of the optimum weights.** In determining the optimum weight of each asset class, the Index takes into account different notional costs associated with transactions in the relevant asset class. These costs will have an effect on the Index’s determination of the optimum weights and may cause the Index to assign weights that differ from the weights that would apply in the absence of those costs.

Market simulations

- **The allocation procedure relies on simulations of relevant markets based upon historical daily returns which may be a poor indicator of future returns and risk.** The allocation procedure uses historical daily returns to construct simulations of the evolution of relevant markets. The actual evolution of the relevant markets may nonetheless be substantially different from the simulated evolution of the relevant markets. The past cannot be considered a guide to the future.

- **The particular way the Index constructs market simulations has limitations.** The Index determines which set of historical daily returns to use to construct simulations of the relevant markets based on the level of the CBOE Volatility Index (the VIX). The VIX only reflects options written the S&P 500 (an index which contains shares listed on US exchanges); the VIX does not represent other equity markets, or the other asset classes represented by the Index. Therefore the VIX level may not be an accurate representation of market behavior, and if the VIX level is an inaccurate representation, then the historical daily returns sampled by the Index in constructing its hypothetical market simulations may not be representative of the future returns of the various asset classes in the Index.

- **The market simulations are constructed based on a particular randomized distribution of historical daily returns and are sensitive to the particular random distribution of returns that results.** Different random number generators (operating with different inputs) that are run on different computers will product different results.

Summary Risk Factors

- **Caps are applied to weights.** The weight in respect of each asset class is subject to a cap. The cap operates as a constraint that may cause the weight assigned to each asset class to be less optimal than if no cap applied.

- **Rebalancing frequency.** The Index is scheduled to be rebalanced monthly. Monthly rebalancing may result in less favorable Index performance than might have been achieved with some other rebalancing frequency.

- **The Index methodology will tilt the Index toward lower-volatility asset classes, which may also have lower returns.** The Index uses a risk aversion parameter, which emphasizes the contribution of the volatility of an asset class (relative to its return) to its expected investment utility. As a result, the Index will tend to have greater allocations to lower-volatility asset classes, such as government bonds and corporate credit, and lower allocations to higher-volatility asset classes, such as equities. The Index will therefore tend to underperform equities in bull markets for equities. In addition, at times when the Index has significant exposure to the government bond and corporate credit asset classes, it will have significant exposure to the risks of those asset classes. In general, those asset classes are likely to perform poorly when interest rates rise.

- **The performance of each Index constituent is expected to be reduced by an implicit financing cost, and any increase in this cost will adversely affect the performance of the Index.** Each of the constituents that make up the Index tracks the performance of a hypothetical rolling position in a futures contract or a credit default swap contract referencing an underlying index or asset. Futures and credit default swap contracts (and in turn, the constituents) are expected to reflect not only the performance of their corresponding reference underlying indexes or assets, but also the implicit cost of a financed position in that reference underlying. This implicit financing cost will adversely affect the level of each constituent and, therefore, the Index.

- **The Index is subject to foreign currency exchange rate risk in addition to risks associated with the equity, commodity, corporate credit and government bond asset classes.** The Index is calculated in U.S. dollars, but certain constituents are denominated in a foreign currency. The Index will be subject to foreign currency exchange rate risk with respect to these constituents. If the U.S. dollar appreciates against the relevant foreign currencies, the level of the Index will be adversely affected for that reason alone.

- **The performance of the Index will be adversely affected by the deduction of an Index Fee.** An Index Fee of 0.50 % per annum is deducted in the calculation of the Index.

- **The Index may fail to maintain a 5 % volatility**. There is a time lag associated with the Index's volatility targeting mechanism. As a result, it may be some period of time before a recent increase in the volatility of the performance of the Index's portfolio of constituent indices is sufficiently reflected in the calculation to cause a compensating adjustment in the Index's exposure. During the intervening period, if the increased volatility is associated with a significant decline in the value of the portfolio of constituent indices, the Index may in turn experience a significant decline without any mitigating reduction in exposure.

- **The Index's volatility-targeting feature may adversely affect Index performance.** The volatility targeting methodology of the Index may result in the exposure of the Index to its portfolio of constituent indices being considerably less than 100 %. The remainder would be hypothetically uninvested and accrue no return.

- **The Index uses fixed parameters and may underperform alternative strategies using different parameters.** The Index's fixed parameters include (i) the monthly frequency of optimization and rebalancing, (ii) the fixed weight to each constituent index within each asset class, (iii) the number of iterations used in each market simulation and (iv) the cap applied to each asset class. The Index might have performed better if different parameters were used.

- **The Index will be calculated pursuant to a set of fixed rules and will not be actively managed.** If the Index performs poorly, the Index Administrator will not change the rules in an attempt to improve performance.

- **The Index has limited historical information.** The Index launched on April 20, 2021. Accordingly, the Index has limited historical data, and that historical data may not be representative of the Index's potential performance under other market conditions.

- **The Index is notional.** The Index is purely notional and reflects the performance of notional positions in its constituents. There is no actual portfolio of assets to which any person has any ownership interest. The Index is not a substitute for any actual asset or combination of assets.

Summary Risk Factors

- **The index is exposed to market risk.** The Index is subject to the risks which arise in the markets for the assets whose performance it reflects, including the risk of market disruption.

- **Performance risk.** The Index level may go down as well as up and may not be correlated with the value of any or all of its constituents. The Index may be adversely affected by any change in the correlation between its constituents and by fluctuations in any currency exchange rate used to determine its level. The Index has limited performance history and there can be no assurance that it will meet any investment objective or achieve any particular performance. The Index is not directly comparable with any benchmark and may underperform a benchmark.

- **Limitation in the design of the Index.** In common with all algorithmic strategies, the Index uses a rules-based methodology with fixed processes and parameters that are assumed to be reasonable. However, an alternative index using other processes and parameters may outperform the Index.

- **Governance and operation of the Index.** Citigroup Global Markets Limited acts as administrator of the Index (the “Index Administrator”). Citigroup Global Markets Limited also acts as calculation agent for the Index (the “Index Calculation Agent”). Although the Index is rules-based, the Index Calculation Agent (using expert judgement) may make certain determinations or suspend publication of the Index on the occurrence of certain events (including market disrupttions), and the Index Administrator (using expert judgement) may modify the Index to resolve any error, ambiguity or omission. The Index Administrator may also cancel and discontinue the Index.

- **Conflicts of interest and no Duty.** The Index Calculation Agent and the Index Administrator, and their affiliates, (1) may engage in other activity (including trading the assets represented in the Index) which may give rise to conflicts of interest and which may adversely affect the Index level; and (2) do not act as adviser to, or owe any duty to, any person, including any investor in any transaction or instrument linked to the Index. The Index Administrator may enter into hedging transactions in connection with any investment product linked to the Index. The Index Administrator may profit from such hedging transactions and, in the event that it is required to exercise judgment in connection with the Index, may have a conflict of interest with any investor in any such investment product.

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