S&P SGMI
Index Methodology

August 2011

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Introduction

Overview

The objective of the S&P Systematic Global Macro Index (S&P SGMI) is to measure statistically relevant price trends of certain globally traded liquid future contracts by systematically investing with long, short or no positions. The strategy is meant to represent the general level of volatility taken by managers in the global macro and managed futures/Commodity Trading Advisor (CTA) universe, while still being subject to leverage constraints.

The index follows a quantitative methodology to track the prices of a globally diversified portfolio of over three dozen commodity, foreign exchange and financial futures contracts. Each contract (also called a constituent) may be in a long, short, or no investment position depending upon a trending signal generated by a regression of its historical prices.

The constituents are grouped into six of the most significant sectors traded in the global macro universe. Since the index is unbiased towards any particular futures contract or sector, the weighting is based on the premise that each position has an equal probability of success. So, each sector is allocated an equal risk capital allowance with the underlying constituents within each sector evenly weighted as well. The resulting portfolio is, then, leveraged in such a way that the effects of diversification among the various constituents are taken into account. Finally, the weights are adjusted to fit within the leverage constraints.

The S&P SGMI is calculated and maintained by S&P Indices. It is designed as a leveraged index, comprised of tradable constituents, which can easily form the basis of futures products.

Highlights

The key characteristics of the S&P SGMI include:

- Currently 37 constituents (futures contracts) are grouped into six sectors.
- Risk capital allowances for the constituents are allocated evenly within their respective sectors.
- Risk capital allowances for the sectors are allocated evenly in the portfolio, with the total risk capital determined by the target volatility.
- Constituent position is determined by a regression of historical prices.
- Constituent selection is determined every two years.
- Sectors and constituents are rebalanced monthly.

The S&P SGMI Methodology

S&P Indices acquired the S&P SGMI from Thayer Brook Partners LLP (TBP). The index was developed by TBP exclusively for S&P Indices.

On any given S&P SGMI business day, the composition of the S&P SGMI and its value, as determined and published by S&P Indices, are dispositive. This document describes the methodology used by S&P Indices in determining such composition and calculating such value. Neither this methodology nor any set of procedures, however, are capable of anticipating all possible circumstances and events that may occur with respect to the S&P SGMI and the methodology for its composition, weighting and calculation. Accordingly, a number of subjective judgments are made in connection with the operation of the S&P SGMI that cannot be adequately reflected in this document. All questions of interpretation with respect to the application of the provisions of this methodology, including any determinations that need to be made in the event of a market emergency or other extraordinary circumstances, are resolved by S&P Indices in consultation with the Index Committee, or the Index Advisory Panel where appropriate.

S&P Indices is committed to maintaining the S&P SGMI as an index comprised of tradable constituents that serves as a principal measure for futures investing. We also recognize that the detailed rules-based approach contained in the methodology may not, at all times, reflect the underlying liquidity and condition of a specific market, particularly in periods of extraordinary market volatility or rapid technological change. Therefore, S&P Indices may determine that a given Contract that satisfies the eligibility criteria set forth in this methodology should, nevertheless, be excluded from the S&P SGMI if inclusion of such Contract is inconsistent with, or would undermine, the purposes of the S&P SGMI as a measure for futures market performance and an index comprised of tradable constituents.

Further, modifications to the methodology used to calculate the S&P SGMI may be necessary from time to time. S&P Indices reserves the right to make such changes or refinements to the methodology set forth in this document as it believes necessary in order to preserve and enhance the utility of the S&P SGMI as a measure for futures market performance and the tradability of the S&P SGMI constituents. S&P Indices also reserves the right to take any action with respect to the S&P SGMI, as it deems necessary or appropriate, in order to address market emergencies or other extraordinary market events or conditions. Wherever practicable, any such changes or actions are publicly announced prior to their effective date.

This methodology uses various terms and definitions similar to the S&P GSCI Index Methodology. Where not specifically noted otherwise in this document, the rules of the S&P GSCI Methodology will prevail. Where the terms in this document are also defined in the S&P GSCI Methodology, the definitions in this document prevail.

Index Constituents and Weightings

Overview of the Index Constituent Determination Process

The Contracts included in the S&P SGMI are determined every two years and must satisfy several eligibility criteria. First, S&P Indices identifies those contracts that meet the general criteria for eligibility. Second, the Contract liquidity requirements are applied. The list of Designated Contracts for the relevant S&P SGMI Years is, then, complete and the process moves to the determination of the constituents weights discussed below.

General Eligibility Requirements

These criteria are intended only to identify Contracts with characteristics that facilitate the calculation of the S&P SGMI and are consistent with the general purpose of the S&P SGMI as an index comprised of tradable constituents. This process generally produces a substantial list of Contracts eligible for inclusion; the list is narrowed through the application of the more specific criteria described below.

Physical Commodities, Financial, and Foreign Exchange Futures. To be eligible for inclusion in the S&P SGMI, a Contract must be on a physical commodity, financial instrument, currency, interest rate or an equity index. The Contracts need not require physical delivery by their terms in order for a commodity to be considered a physical commodity.

Certain Contract Characteristics. In order for a Contract to be eligible for inclusion in the S&P SGMI, the following criteria must be satisfied: (i) the Contract must have a specified expiration or term, or provide in some other manner for delivery or settlement at a specified time, or within a specified time period, in the future; (ii) the Contract must, at any given point in time, be available for trading at least five months prior to its expiration or such other date or time period specified for delivery or settlement; and (iii) the Trading Facility on which the Contract is traded must allow market participants to execute spread transactions between the pairs of Contract Expirations included in the S&P SGMI that, at any given point in time, are involved in the rolls effected during the next three Roll Periods.

The requirements set forth in this section reflect the fact that some of the products, from time to time, traded on or through Trading Facilities, in particular certain electronic platforms, may not display traditional characteristics of a futures contract, such as particular contract months. While it is not necessary for a Contract Expiration to be expressed as a calendar month, the S&P SGMI and its underlying methodology are premised upon the existence of specified dates or time periods for delivery or settlement. It is assumed that Contracts traded on contract markets, exempt electronic trading facilities, derivatives transaction execution facilities, exempt boards of trade and foreign boards of trade (as such terms are defined in the U.S. Commodity Exchange Act and the rules and regulations promulgated there under) will generally satisfy the above requirements, unless S&P Indices determines that any such Contract does not satisfy the foregoing criteria. The requirement that the specific Contract month be available for trading at least five months prior to its expiration is designed to ensure that a genuine trading market in the Contract exists prior to the time established for delivery or settlement, when trading conditions can be affected by the impending expiration of the Contract. The final requirement in this Section, regarding execution of spread transactions, is designed to allow market participants to effect the rolling of contracts included in the S&P SGMI more efficiently.

Denomination and Geographical Requirements. To be eligible for inclusion in the S&P SGMI, a Contract must be traded on or through a Trading Facility that has its principal place of business or operations in a country that is a member of the Organization for Economic Cooperation and Development (OECD) during the relevant Annual Calculation Period or Interim Calculation Period. This assures that the S&P SGMI is limited to those futures for which there are Trading Facilities in industrialized countries.

Availability of Daily Contract Reference Prices. For a Contract to be eligible for inclusion in the S&P SGMI, Daily Contract Reference Prices generally must have been available on a continuous basis for at least two years prior to the proposed date of inclusion. In appropriate circumstances, S&P Indices may determine that a shorter time period is sufficient or that historical Daily Contract Reference Prices for a given Contract may be derived from Daily Contract Reference Prices of a similar or related Contract.

At and after the time a particular Contract is included in the S&P SGMI, the price must generally be available to all members of, or participants in, such Facility (and S&P Indices) on the same Contract Business Day from the Trading Facility or through a recognized third-party data vendor. Such publication must include, at all times, Daily Contract Reference Prices for at least one Contract Expiration that is five months or more from the date the determination is made, as well as for all Contract Expirations during such five-month period.

The requirement that a Contract have a continuous price history of at least two years is intended to ensure the reliability and availability of the prices necessary to enable S&P Indices to calculate the S&P SGMI. In addition, in order to calculate the S&P SGMI on an ongoing basis, S&P Indices must be able to obtain Daily Contract Reference Prices for certain Contract Expirations with respect to each Designated Contract prior to the S&P SGMI Settlement Time on each Contract Business Day. This requirement is intended to assure that the value of the S&P SGMI can be reliably calculated on the basis of prices that are both announced and, in general, readily available to the members of, or participants in, the relevant Trading Facility (and S&P Indices).

Availability of Volume Data. For a Contract to be eligible for inclusion in the S&P SGMI, volume data with respect to such Contract must be available from sources satisfying the criteria specified under *Sources of Information* below, for at least two years immediately prior to the date on which the determination to include the contracts is made.

The S&P SGMI determination date is the same as the S&P GSCI for annual volume data, the 12-month periods from September through August.

Other Requirements with respect to the Trading Facility. The Trading Facility on or through which a Contract is traded must (i) make price quotations generally available to its members or participants (and to S&P Indices) in a manner and with a frequency that is sufficient to provide reasonably reliable indications of the level of the relevant market at any given point in time; (ii) make reliable trading volume information available to S&P Indices with at least the frequency required by S&P Indices to make the monthly determinations described under *Sources of Information* below; (iii) accept bids and offers from multiple participants or price providers (i.e., it must not be a single-dealer platform); and (iv) be accessible to a sufficiently broad range of participants. Such access may be provided either (a) by the Trading Facility making clearing services reasonably available, thereby eliminating counterparty credit considerations, or (b) by a network of brokers or dealers who are willing to intermediate transactions with third parties, thereby enabling such third parties to enter into transactions based on prices posted on such Facility.

These requirements are intended to establish certain minimum standards for Trading Facilities. If trading in certain futures is shifted to electronic platforms that are largely unregulated, or subject to different levels or types of regulation than traditional exchanges, these standards serve to ensure that the S&P SGMI includes only Contracts for which sufficient and reliable data and, in particular, price data developed in a competitive process, are available. It is assumed that contract markets and foreign boards of trade (as such terms are defined in the U.S. Commodity Exchange Act and the rules and regulations promulgated there under) will generally satisfy the above requirements, unless S&P Indices determines otherwise.

Contract Trading Hour Requirements. S&P Indices may exclude a Contract from the S&P SGMI that otherwise satisfies the criteria and conditions for inclusion if, in its reasonable judgment, such Contract's Overall Trading Window is insufficient to support the tradability of the S&P SGMI taken as a whole. This requirement is intended to support and enhance the tradability of the S&P SGMI constituents, by ensuring that all Designated Contracts are available for trading during at least a minimum period of time.

Liquidity Requirement

The S&P SGMI is limited to those Contracts that are actively traded in order to assure that the prices generated by the markets for such Contracts represent reliable, competitive prices. Liquidity is an indication both of the significance of a particular market and the ability to trade with minimal market impact. Liquidity is determined by the annual Total Dollar Value Traded (TDVT). The Contracts that satisfy the general eligibility requirements set forth in *General Eligibility Requirements* above must, therefore, also satisfy the liquidity requirements described below before being included in the S&P SGMI. Exhibit 1 on the following page displays the most liquid contracts from each sector that are included according to these criteria.

EXHIBIT 1: CONTRACT INCLUSION CRITERIA

Sector	Constituent	Exchange	Sector	Currency	Inclusion Criteria TDVT>$5B
Energy					
Energy	Natural Gas	NYMEX	E	USD	Top 6
	Heating Oil #2	NYMEX	E	USD	
	Gas Oil	ICE	E	USD	
	Crude Oil	NYMEX	E	USD	
	Brent Crude	ICE	E	USD	
	Gasoline	NYMEX	E	USD	
Commodities					
Commodity - Softs & Livestock	Sugar #11	NYBOT	C	USD	Top 4
	Live Cattle	CME	C	USD	
	Coffee "C"	NYBOT	C	USD	
	Cotton #2	NYBOT	C	USD	
Commodity - Grains	Soybeans	CBOT	C	USD	Top 3
	Corn	CBOT	C	USD	
	Wheat	CBOT	C	USD	
Commodity - Metals	Copper	NYMEX	C	USD	Top 3
	Gold (100 oz.)	COMEX	C	USD	
	Silver	COMEX	C	USD	
Fixed Income	**Top from the 3 regions Greater than 3yr maturity**				
Fixed Income - U.S.	T-Notes (10-year)	CBOT	FI	USD	Top 3
	T-Notes (5-year)	CBOT	FI	USD	
	T-Bonds (30-year)	CBOT	FI	USD	
Fixed Income - Europe	Euro-Bund	EUREX	FI	EUR	Top 2
	Euro-Bobl	EUREX	FI	EUR	
Fixed Income - Asia	JGB	TSE	FI	JPY	Top 2*
Foreign Exchange	**Top 6 OECD only US Exch Only**				
Foreign Exchange	Euro FX	CME	FX	USD	Top 6 US
	Japanese Yen	CME	FX	USD	
	British Pound	CME	FX	USD	
	Australian Dollar	CME	FX	USD	
	Canadian Dollar	CME	FX	USD	
	Swiss Franc	CME	FX	USD	
Equity	**Top 2 in each of 3 regions (Inst w/ mini are aggregated for Volume purposes)**				
Equity - U.S.	Nasdaq Complex	CME	SI	USD	Top 2
	S&P 500 Index Complex	CME	SI	USD	
Equity - Europe	Euro Stoxx 50	EUREX	SI	EUR	Top 2
	Dax	EUREX	SI	EUR	
Equity - Asia	Kospi 200	KE	SI	KRW	Top 2
	Nikkei 225 Futures	OSE	SI	JPY	
STIR	**4th Quarterly Contract in each region**				
STIR - U.S.	Eurodollars (3-month)	CME	STIR	USD	
STIR - Europe	3 Month Euribor	LIFFE	STIR	GBP	
STIR - Asia	3 Month Euroyen	TSE	STIR	JPY	
*Only 1 currently liquid in Fixed Income Asia					

*STIR stands for Short Tem Interest Rate

Position Direction

In order to reflect the measure of the global macro and managed futures/Commodity Trading Advisor (CTA) universe, the S&P SGMI must take directional positions that are long or short in order to represent the positions of the general market. If there is a positive trend, then the position will be long; conversely, if there is a negative trend, then the position will be short.

Determining whether the trend is negative or positive for each constituent each month is dependent upon a series of steps that must be followed to develop a valid time-series regression model where the slope (positive/negative) acts as the position direction (long/short) indicator.

In order to establish whether a constituent is currently in an upward or downward trend we compute a linear regression of the constituent returns against time. This is an approach that is widely adopted by traditional technical analysts. If the regression line has a positive slope then the conclusion is that the market is currently trending upwards, and if the slope of the regression line is negative then the conclusion is that the market is trending downwards.

The first step in developing a constituent's valid time series regression is to collect its daily historical price data and calculate a cumulative return for each day. At least 256 data points must be available or else the weight cannot be calculated, so there would be no position. However, since a historical return is often dependent on the prior return, known as autocorrelation, the return data alone is not sufficient to produce a valid model with a constant mean and variance. For example, the mean and variance may be increasing over time in an unadjusted model, so that any predicted value will be too low. Because the time trend may vary through history, the analysis will use only the most recent period of time when the trend was stable. To determine this time period an initial assumption is made that the trend was stable over the most recent 22 days and then tests in five day increments until the longest stability period is discovered.

To check for stability the hypothesis that two variances are equal is tested. Equality indicates a stable trend and the longest period of stability ending with the current date is used for the position direction decision. The two variances are (1) the variance of the daily returns and (2) the variance of residuals of an Ordinary Least Squares (OLS) linear regression of the cumulative return (y) on time (t).

The statistical test that we use to test the validity of the linear regression model is the F-test (or variance ratio test), which tests whether the variance of the linear regression residuals (adjusted for autocorrelation) is the same as the variance of the first differences of cumulative returns series. This is the null hypothesis.

Equality of variances indicates that the linear regression model is a good fit for the data. If the variance of the residuals (adjusted for autocorrelation) is significantly larger than the variance of the first differences then this indicates that the linear model is not a good fit for the data which is likely to be due to non-linearity e.g. a change in the trend. If the test cannot reject the null hypothesis that the two variances are equal, the time period is increased by five days and the variances are recomputed and retested. If the null hypothesis is rejected, indicating the variances are not equal, then the sign of the slope coefficient in the regression is used to determine the position: positive = long, negative = short and 0 = no position.

Again, as the residuals are likely to be autocorrelated an uncorrected F-test is oversensitive. To correct for this oversensitivity, the variance of the residuals are adjusted by a factor of (1- ρ^2), where ρ is the autocorrelation lag at 1. Once F is too large, the regression is no longer as good at de-trending as the first differences, showing the residuals have more noise than the series itself. The autocorrelation of the residuals is computed as follows:

$$\rho = \frac{\frac{1}{(n-1)}\sum_{t=1}^{n-1}(y_t-\mu)(y_{t+1}-\mu)}{Var(y_t)} + (1/n)$$

where:

y_t = the residual at time *t*
μ = the mean of the residuals (*1.., n*), and
n = the number of days in the relevant period.
1/n is included to correct for a negative bias in the autocorrelation of a short time series. As the time series gets longer, this term becomes less relevant.

F is then defined as:

$$F = \frac{Var(residuals)*(1-\rho^2)}{Var(FD)}$$

where

FD = the first differences of the daily cumulative percentage return series used in the regression.
residuals= residuals of the OLS.

Finally, the iterative process based on the continuous cumulative component returns and a confidence interval of 95% is run to establish the direction based on the slope of the regression. This is referred to as the F-Inverse function (F_{inv}). The process starts at the present and works backwards until:

$$F > F_{inv}(95\%, n-3, n-2)$$

where *n* = the number of days looking back

note: the F-Inverse function is rounded to 2 decimal places to assure that the algorithm is easily repeatable.

More specifically, the algorithm starts by regressing the past 22 days, beginning with the rebalancing reference date. If $\mathrm{F} < \mathrm{F}_{\mathrm{inv}}(95\%,\ 19, 20)$, the process continues by adding five days of history with each iteration until $F > F_{inv}(95\%, n-3, n-2)$.

Once $F > F_{inv}(95\%, n-3, n-2)$, the sign of the slope determines the market position. If the slope is negative (downward sloping) then the market position for that component is short. Conversely, if the slope is positive (upward sloping) then the market position for that component is long.

For more information on position direction, please refer to the Appendix.

Weighting Scheme

The intention of the S&P SGMI weighting scheme is to create an index where each of the sectors is allocated the same risk capital allowance, with each of the constituents allocated the same risk capital allowance within its sector. The idea is that no single sector or constituent should drive the volatility of the index.

It is important to note that the goal of the weighting methodology is to allocate the risk capital allowance as evenly as possible. The S&P SGMI is a leveraged product and, as such, is not trying to minimize volatility for a given investment. It has been specifically designed to be mathematically valid without being overly dependent on the individual elements of the cross-correlation matrix. The S&P SGMI methodology creates a consistent and efficient portfolio by first producing a set of relative weights which creates the diversified portfolio. To take advantage of this diversification, leverage management then occurs by scaling the portfolio to the target volatility by using a factor which is solely dependent upon the overall average of the cross-correlation matrix and not the individual elements of that matrix. The overall portfolio average is more stable than the individual elements and, thus, ultimately facilitates the calculation of a portfolio that is leveraged to achieve a given target volatility.

In order to apply this concept to the S&P SGMI, the number of contracts needs to be determined for each constituent, so it is necessary to choose a dollar amount and target index volatility. The dollar amount or assets under management (AUM) is arbitrary but the target volatility level is currently set to 17.5%, and is meant to represent the average volatility of the global macro managed futures/Commodity Trading Advisor (CTA) universe.

From the AUM and target volatility, a US$ daily risk allowance is calculated for the entire index by multiplying the AUM by the daily target volatility.

$$\textit{US\$ Daily Risk Allowance}_{Index} = \ AUM_{US\$} * \frac{\textit{Target Volatility}}{\sqrt{256}}$$

It represents the total dollar risk the index is allowed to take in one day.

The next step is to determine the daily risk allowance for each constituent. Again, the idea is for each sector to have an equal dollar risk allowance where each constituent in the sector also has an equal dollar risk allowance.

$$\textit{US\$ Daily Risk Allowance}_{Constituent} = \textit{US\$ Daily Risk Allowance}_{Index} * (1/N) * (1/M) * CF$$

where:

N = number of sectors in the index

M = the number of constituents in its sector

CF = the correlation factor.

The correlation factor needs to be taken into account in order to properly assess the risk allowance for each constituent. If the correlations were not considered or were just assumed to be 1, then the daily risk allowance would be too low to hit the chosen target volatility. In order to compute the correlation factor, a correlation matrix of daily returns of all constituents is run and the average of the lower left triangle is calculated (AC).

$$CF = \sqrt{\frac{Q}{(1+((Q-1)*AC))}}$$

which allows the index to allocate over the AUM (apply leverage) with the intention of reaching the target volatility.

where:

Q = the number of total constituents in the index

Once each constituent's US$ daily risk allowance is determined, the number of contracts needed to fill the position is calculated by dividing the daily risk allowance by the US$ dollar risk of one contract. For each constituent, the US$ dollar risk of one contract is measured by multiplying the standard deviation of the first differences of local prices by the local value of the contract tick and then by the exchange rate to the US$. So, all else being constant, higher volatility of a constituent will yield a higher US$ dollar risk of one contract so fewer contracts will be needed to fill the total risk allowance for the constituent. Conversely, if the volatility is too low, too many contracts would be required to fill the total risk allowance or it might not be possible at all.

The index solution for this problem is to set a threshold of 0.125% as a lower limit to a ratio that tests whether there is enough volatility for the contract size.

$$Ratio = \frac{US\$risk * m}{m * P * tick * FX}$$

where:

$US\$risk$ = US$ risk per constituent contract

m = number of contracts

P = last local contract price

$Tick$ = the local value of a contract tick

FX = exchange rate to the US$

Note: the denominator in the equation above measures the nominal value of the constituent in US$

If this ratio is less than 0.125%, then no position is taken so the weight of the constituent will be zero.

Again, since the correlation factor allows for an allocation greater than the AUM, also known as leverage, the index needs to adjust so that the leverage is never greater than 3x or 300% total nominal exposure. If the total nominal exposure of the index is greater than 300%, then 300% is divided by the total nominal exposure of the index to create a scale-back factor. This ratio will be applied to the number of contracts for each constituent to reduce the index to 300% of total nominal exposure.

Please see the formulas below that show the mathematical concept behind using the Correlation Factor (CF) in the weighting scheme. This illustration is for the simplified case where all individual constituents are allocated equally, which differs slightly from the adopted allocation scheme. Although the model is not exact, our studies show that the practical benefits derived from correlation stability far outweigh the mathematical rigor of a full scale model.

By definition, the variance of the portfolio returns is determined as the sum of the individual variances plus a cross-correlation factor. This is shown in the formula below:

$$\sum_{i=1}^{m} Var(x_i) + \sum_{1,i\neq j}^{m} \rho_{ij}\sigma_i\sigma_j$$

where,

ρ = correlation

σ = standard deviation

m = number of constituents

Since each risk unit, by design, has the same expected standard deviation, the equation can be rewritten as:

$$mVar(x) + Var(x)\sum_{1,i\neq j}^{m} \rho_{i,j}$$

The equation for the portfolio variance can now be restated as:

$$mVar(x)\left(1 + \frac{1}{m}\sum_{1,i\neq j}^{m} \rho_{i,j}\right)$$

The size, N, of the correlation matrix is:

$$N = (m^2 - m) = m(m-1)$$

Thus the average of the correlation matrix, $\overline{\rho}$, is given by the following identities,

$$\overline{\rho} = \frac{\sum_{i \neq j} \rho_{ij}}{N} = \frac{\sum_{i \neq j} \rho_{ij}}{m(m-1)}$$

And so it follows that:

$$\frac{1}{m} \sum_{i \neq j} \rho_{ij} = \overline{\rho}(m-1)$$

Substituting the above equation into the equation for the portfolio variance, we get:

$$mVar(x)\left(1 + \overline{\rho}(m-1)\right)$$

And it follows that the scaling factor is only proportional to the average of the cross-correlation matrix:

$$\frac{Var(portfolio)}{m^2 Var(x)} = (1 + (m-1)\overline{\rho}) / m$$

Therefore, the size of each risk unit can be computed directly from the target volatility:

$$Var(x) = \left(\frac{Var(portfolio)}{m^2} \right) \left(\frac{m}{1 + (m-1)\overline{\rho}} \right)$$

Or, taking the square root of this equation we arrive at:

$$\sigma_{per\ risk\ unit} = \frac{\sigma_{daily\ target}}{m} \sqrt{\frac{m}{1 + (m-1)\overline{\rho}}}$$

Thus, the size of each risk unit is equal to the risk capital allocated to the constituent multiplied by the Correlation Factor (CF).

The number of contracts which can be traded to create a single risk unit is:

$$\frac{\sigma_{per\ risk\ unit}}{\sigma_{per\ contract}}$$

At the end of each month, the USD standard deviation of each component is sampled over the past 60 trading days, to yield the $\sigma_{per\,contract}$ which is used with the preceding formula to determine the number of contracts in a risk unit for any given component.

According to the representative volatility of managers in the CTA universe as determined by TBP, the target S&P SGMI annualized volatility is set to 17.5%, before any restriction on exposure. If a component's USD standard deviation divided by its nominal size is less than 0.125%, then there is no position for that contract. If the gross exposure of the index is greater than 300%, each contract is scaled back proportionately such that the overall gross exposure is 300%.

Thus the number of contracts for any given component is computed using the formula:

$$C = \frac{\dfrac{\left(\dfrac{17.5\%}{\sqrt{256}}\right)}{m}\sqrt{\dfrac{m}{1+(m-1)\overline{\rho}}}}{\sigma_{per\,contract}}$$

For more information on the weighting scheme, please refer to the Appendix.

Rebalancing

Monthly Rebalancing for Component Weights. Components are rebalanced according to the signals generated by the algorithm run after the close of the last business day of each month. The rebalancing reference position implementation period is the second (2nd) through the sixth (6th) S&P SGMI business days of the month.

Bi-Annual Rebalancing for Component Weights. At the beginning of every other year, each of the constituents is evaluated for liquidity to ensure only the most liquid is included in the index as determined by the TDVT.

Sources of Information

The following are the sources of the information used to determine the eligibility of Contracts for inclusion in the S&P SGMI pursuant to the requirements set forth in *General Eligibility Requirements*. If any of the sources identified below is unavailable, with respect to the determination of the S&P SGMI for a particular S&P SGMI Year, S&P Indices will identify appropriate alternative sources and the composition of the S&P SGMI for such year will be based on such alternative sources. In addition, if S&P Indices, in its reasonable judgment, believes that one or more of the sources identified below contains a manifest error, it may use an alternative source to obtain the necessary information. Any such alternative sources used by S&P Indices will be publicly disclosed at the time that the composition of the S&P SGMI for the next S&P SGMI Year is announced.

General Eligibility Requirements. The identification of those futures that satisfy the general eligibility requirements set forth in *General Eligibility Requirements* is based on

(1) the FIA (Futures Industry Association) Reports that are published at the time of the relevant Annual Calculation Period or Interim Calculation Period, and (2) the most recent version of the *Futures and Options Fact Book*, published by the Futures Industry Institute. The determination as to whether a particular Trading Facility has its principal place of business or operations in an OECD country is based on the most recent data published by the OECD.

Contract Volume and Liquidity Requirements. In order to determine whether a particular Contract satisfies the volume and liquidity requirements described above, S&P Indices may use any available sources that it believes to be reasonably reliable including, but not limited to, data contained in the FIA Reports. In the event of manifest error, S&P Indices may supplement, and make corrections to, any such data.

Index Maintenance

The S&P SGMI is a strategy of capturing futures contract price trends even though futures contracts have limited durations. Consequently, for the indicator to be calculated through time it must change (or roll) from tracking contracts that are approaching expiration to tracking new contracts. Each contract has its own “roll pattern” based on historical liquidity as determined by the Total Dollar Value Traded (TDVT) and open interest.

Exhibit 2 is a schedule of the active contracts used for price inputs of the Index.

EXHIBIT 2: SCHEDULE OF CONTRACT MONTHS

S&P SGMI Designated Contract Roll Schedule - Designated contract month the index rolls into at the beginning of each month.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Australian Dollar	H	H	M	M	M	U	U	U	Z	Z	Z	H
British Pound	H	H	M	M	M	U	U	U	Z	Z	Z	H
Canadian Dollar	H	H	M	M	M	U	U	U	Z	Z	Z	H
Euro	H	H	M	M	M	U	U	U	Z	Z	Z	H
Japanese Yen	H	H	M	M	M	U	U	U	Z	Z	Z	H
Swiss Franc	H	H	M	M	M	U	U	U	Z	Z	Z	H
10 Year Note	H	M	M	M	U	U	U	Z	Z	Z	H	H
Treasury Bond	H	M	M	M	U	U	U	Z	Z	Z	H	H
5 Year Note	H	M	M	M	U	U	U	Z	Z	Z	H	H
Coffee "C"	H	K	K	N	N	U	U	Z	Z	Z	H	H
Sugar #11	H	K	K	N	N	V	V	V	H	H	H	H
Cotton #2	H	K	K	N	N	Z	Z	Z	Z	Z	H	H
Crude Oil	H	J	K	M	N	Q	U	V	X	Z	F	G
Heating Oil	H	J	K	M	N	Q	U	V	X	Z	F	G
Unleaded Gasoline	H	J	K	M	N	Q	U	V	X	Z	F	G
Natural Gas	H	J	K	M	N	Q	U	V	X	Z	F	G
Corn	H	K	K	N	N	U	U	Z	Z	Z	H	H
Soybeans	H	K	K	N	N	X	X	X	X	F	F	H
Wheat (Chicago)	H	K	K	N	N	U	U	Z	Z	Z	H	H
Copper (COMEX)	H	K	K	N	N	U	U	Z	Z	Z	H	H
Live Cattle	J	J	M	M	Q	Q	V	V	Z	Z	G	G
Gold	J	J	M	M	Q	Q	Z	Z	Z	Z	G	G
Silver	H	K	K	N	N	U	U	Z	Z	Z	H	H
GasOil	H	J	K	M	N	Q	U	V	X	Z	F	G
Brent Crude	J	K	M	N	Q	U	V	X	Z	F	G	H
Euro-Bund	H	M	M	M	U	U	U	Z	Z	Z	H	H
Euro-Bobl	H	M	M	M	U	U	U	Z	Z	Z	H	H
JGB	H	M	M	M	U	U	U	Z	Z	Z	H	H
Nasdaq 100 Index	H	H	M	M	M	U	U	U	Z	Z	Z	H
S&P 500 Index	H	H	M	M	M	U	U	U	Z	Z	Z	H
Euro Stoxx 50	H	H	M	M	M	U	U	U	Z	Z	Z	H
Dax	H	H	M	M	M	U	U	U	Z	Z	Z	H
Kospi 200	H	M	M	M	U	U	U	Z	Z	Z	H	H
Nikkei 225	H	M	M	M	U	U	U	Z	Z	Z	H	H
Eurodollars (3-month)	H	H	M	M	M	U	U	U	Z	Z	Z	H
Euribor (3-month)	H	H	M	M	M	U	U	U	Z	Z	Z	H
Euroyen (3-month)	H	H	M	M	M	U	U	U	Z	Z	Z	H

EXHIBIT 3: MONTH LETTER CODES

LETTER	CONTRACT EXPIRATION
F	JAN
G	FEB
H	MAR
J	APR
K	MAY
M	JUN
N	JUL
Q	AUG
U	SEP
V	OCT
X	NOV
Z	DEC

The risk of aberrational liquidity or pricing of a commodity futures contract around the maturity date is greater than in the case of cash-settled futures contracts because (among other factors) a number of market participants take delivery of the underlying commodities. Spot markets in commodities occasionally have delivery problems related to, for example, weather conditions disrupting transportation of cattle to a delivery point. Such a delay could cause the spot market to move significantly, while latter-dated futures contracts are little changed. The strategy avoids delivery issues by owning contracts that are outside of nearby delivery.

Index Calculation

Please note, for all calculations below the formulae include the contract rolls that occur during the monthly rebalancings. During the remainder of each month, only one contract will be in effect, so the irrelevant portions of some equations will not apply.

Spot Calculation.

On a given S&P SGMI business day, *d*, the spot price (*SPOT)* of the index containing *i* number of Components (*c*) is calculated as follows:

$$\boxed{SPOT_d = \frac{\left(\sum_{c=1}^{i} TDW1 + SC1\right)}{NC_{old}} + \frac{\left(\sum_{c=1}^{i} TDW2 + SC2\right)}{NC_{new}}}$$

where

$\sum_{c=i}^{i} TDW1$ = The sum of the Total Dollar Weight (*TDW*) of each Component's (*c's*) Current Contract.

$\sum_{c=i}^{i} TDW2$ = The sum of the *TDW* of each Component (*c's)* next Contract

SC1 = The Short Component effective during the last month, expressed in the same terms as the Contract Weights, *CWs.*

SC2 = The Short Component effective in the current month, expressed in the same terms as the *CWs*.

NC_{old} = Normalizing Constant effective during the last month

NC_{new} = Normalizing Constant effective during this month

The Short Component *(SC)* is allocated to the amount of weight remaining in the Index after the weights of each component has been defined based on the long and short positions and their respective percentage weights. Adding the weight of the Short Component to the sum of the weights of the Components make the weight in the Index sum to 100%.

The Short Component is calculated as follows:

$$\boxed{SC = NumberofContracts * CRW_{c_d} * Position}$$

where

$CRWc_d$ = Contract Roll Weights for Future *c* on day *d*

Position is set as defined in the Appendix.

Please see the contract roll weights table on the next page for the CRW on day d.

Total Dollar Weight Calculation.

On a given S&P SGMI business day, *d*, the Total Dollar Weight (TDW) for Future *c* is the product of its Contract Weight, Contract Roll Weight, Daily Contract Reference Price and US$ exchange rate for the current and next contracts, respectively.

$$\boxed{TDWc_d = \sum_{c=1}^{i} TDWc_{d-1} * (CRWc_d / CRWc_{d-1}) + (CWc_d \quad * CRWc_d * \quad (DCRPc_d - DCRPc_{d-1}) * \quad FXc_d)}$$

On the roll start date for the contract rolling in and on the base date for the contract rolling out, the TDW is as follows:

$$\boxed{TDWc_d = \quad CWc_d \quad * CRWc_d * \quad DCRPc_d * \quad FXc_d}$$

After the completion of the roll, for the current contract, the TDW is as follows:

$$\boxed{TDWc_d = \sum_{c=1}^{i} TDWc_{d-1} + (CWc_d \quad * CRWc_d * \quad (DCRPc_d - DCRPc_{d-1}) * \quad FXc_d)}$$

where

$TDWc_d$ = Total Dollar Weight for Future *c* on day *d*.

$TDWc_{d-1}$ = Total Dollar Weight for Future *c* on the S&P SGMI business day prior to day *d*.

CWc_d = Contract Weight for Future *c* set on day d.

$CRWc_d$ = Contract Roll Weights for Future *c* on day *d*

$CRWc_{d-1}$ = Contract Roll Weights for Future *c* on the S&P SGMI business day prior to day *d*.

$DCRPc_d$ = Daily Contract Reference Price for Future *c* on day *d*

$DCRPc_{d-1}$ = Daily Contract Reference Price for Future *c* on the S&P SGMI business day prior to day *d*.

FXc_d = Foreign Exchange Rate for Future *c* on day *d*

Contract Weight

Contract Weights (*CWs*) are determined on the last S&P SGMI business day of each month. Effective for the following roll start date. The CW value is calculated as follows:

$$\boxed{CW = Multiplier * Number\ of\ Contracts * Position}$$

Multiplier = the value of a point

For determination of the Number of Contracts and Position please refer to the Appendix.

Contract Roll Weights Logic.

On a given non-roll day, *CRW1* = 1 and *CRW2* = 0

During the Roll Period the CRW value is computed as follows:

For the S&P SGMI the number of roll days is five (5).

$$CRW = \boxed{\frac{100\%}{number\ \ of\ \ roll\ \ days}} = 20\%$$

Since the number of roll days is five, 20% of its component will roll in and roll out daily, keeping the aggregate Component's weight total of 100%.

day d	CRW1	CRW2
1	0.8	0.2
2	0.6	0.4
3	0.4	0.6
4	0.2	0.8
5	0	1.0

Normalizing Constant

In order to assure continuity of the S&P SGMI and to allow comparisons of the value of the S&P SGMI to be made over time, it is necessary to make an adjustment to the calculation of the S&P SGMI each time the CWs are changed. The factor used to make this adjustment is the Normalizing Constant (NC) and is used in the same manner as similar factors applied to the calculation of other published financial market indices. The NC is determined each time the composition of the S&P SGMI is changed pursuant to the procedures set forth in this methodology.

$$\boxed{NC_{new} = NC_{old} \quad * \quad \frac{\sum\left(CW2 * DCRP1_d + \quad CW2 * DCRP2_d\right) \quad + SC1}{\sum\left(CW1 * DCRP1_d + \quad CW1 * DCRP2_d\right) \quad + SC2}}$$

where

$CW1$ = Last month's Contract Weight

$CW2$ = This month's Contract Weight

$SC1$ = Short Component effective during the last month, expressed in the same terms as Contract Weights, CWs

$SC2$ = Short Component effective in the current month, expressed in the same terms as *CWs*

$DCRP1_d$ = Current contract price on day *d*

$DCRP2_d$ = Next contract price on day *d*

NC_{old} = Normalizing Constant effective as of the last month

Excess Return Calculation.

On a given S&P SGMI business day, *d*, the S&P SGMI Excess Return (ER) index level is equal to the product of the S&P SGMI ER index level on the immediately preceding S&P SGMI business day multiplied by one plus the Contract Daily Return as of that day. The Index is calculated to a seven (7) digit precision.

$$\boxed{ER_d = \quad ER_{d-1} * \quad \left[1 + CDR_d\right]}$$

where

ER_d = Excess Return Value for S&P SGMI Business Day *d*.

ER_{d-1} = Excess Return Value as on the S&P SGMI business day prior to day *d*.

CDR_d = Contract Daily Return of the Index on the S&P SGMI business day prior to day *d*.

Contract Daily Return Calculation

The Contract Daily Return (CDR) on any S&P SGMI Business Day, *d*, is equal to the ratio obtained by dividing the Total Dollar Weight Obtained by the Total Dollar Weight Invested on the immediately preceding S&P SGMI Business Day, minus one.

$$\boxed{CDR_d = \frac{TDWO_d}{TDWI_d} - 1}$$

where

$TDWO_d$ = Total Dollar Weight Obtained for S&P SGMI Business Day *d*.

$TDWI_d$ = Total Dollar Weight Invested for S&P SGMI Business Day *d*.

Total Dollar Weight Obtained

On a given S&P SGMI business day, *d*, the Total Dollar Weight Obtained (TDWO) is the amount obtained from an investment on the immediately preceding day. The TDWO for a given day is calculated using the Component Weights and Contract Roll Weights in effect on the immediately preceding day, *d-1*, and the Daily Contract Reference Prices used to calculate the S&P SGMI Index on day *d.*

$$TDWO_d = \frac{NC_{new}}{NC_{old}} * (TDWI1_d + TDWO2_d)$$

$TDWO1_d =$

$$\sum_{c=1}^{i} TDW1_{d-1} + (CW1c_d * CRW1c_{d-1} * (DCRP1c_d - DCRP1c_{d-1}) * FXc_d) + SC1$$

$TDWO2_d =$

$$\sum_{c=1}^{i} TDW2_{d-1} + (CW2c_d * CRW2c_{d-1} * (DCRP2c_d - DCRP2c_{d-1}) * FXc_d) + SC2$$

where

$TDWO1_d$ = Total Dollar Weight Obtained of the current contract on day d

$TDWO2_d$ = Total Dollar Weight Obtained of the next contract on day d

$CW1_d$ = Contract Weight of the current contract on day *d*

$CW2_d$ = Contract Weight of the next contract on day *d*

$CRW1_{d-1}$ = The roll-out percentage of the Contract Roll Weight on the S&P SGMI business day prior to day *d*.

$CRW2_{d-1}$ = The roll-in percentage of the Contract Roll Weight on the S&P SGMI business day prior to day *d*.

$DCRP1_d$ = Current contract price on day *d*

$DCRP2_d$ = Next contract price on day *d*

$SC1$ = Short Component effective last month

$SC2$ = Short Component effective in the current month.

NC_{old} = Normalizing Constant effective as of the last month

NC_{new} = Normalizing Constant effective during this month

Total Dollar Weight Invested

On a given S&P SGMI business day, *d*, the Total Dollar Weight Invested (TDWI) is equal to the Total Dollar Weight of the immediate preceding S&P SGMI business day *d-1* and is calculated as follows:

$$TDWI_d = \frac{NC_{new}}{NC_{old}} * (TDWI1_d + TDWO2_d)$$

$$TDWI1_d = \sum_{c=1}^{i} TDW1_{d-1} + SC1$$

$$TDWI2_d = \sum_{c=1}^{i} TDW2_{d-1} + SC2$$

where

$TDWI1_d$= Total Dollar Weight Invested of the current contract on day d

$TDWI2_d$= Total Dollar Weight Invested of the next contract on day d

$TDW1_{d-1}$ = Total Dollar Weight of the of the current contract on the S&P SGMI business day prior to day *d*.

$TDW2_{d-1}$ = Total Dollar Weight of the next contract on the S&P SGMI business day prior to day *d*.

$SC1$ = Short Component effective last month

$SC2$ = Short Component effective in the current month.

NC_{old} = Normalizing Constant effective as of the last month

NC_{new} = Normalizing Constant effective during this month

Total Return Calculation

On any given calendar day, *d*, the Treasury Bill Return (*TBR*) is equal to an amount determined in accordance with the following formula:

$$TBR_d = \left[\frac{1}{1 - \frac{91}{360} * TBAR_{d-1}} \right]^{1/91} - 1$$

where:

$TBAR_{d-1}$ = The 3 month T-Bill Rate available on the S&P SGMI business day prior to day *d*.

.

On a given S&P SGMI business day, *d*, the value of the S&P SGMI Total Return (TR) Index is equal to the product of (i) the value of the S&P SGMI TR on the immediately preceding S&P SGMI Business Day, (ii) one plus the sum of the Contract Daily Return and the Treasury Bill Return on the day on which the calculation is made, and (iii) one plus the Treasury Bill Return for each non S&P SGMI Business Day since the immediately preceding S&P SGMI Business Day. The result of the foregoing calculation is, then, rounded to seven (7) digits of precision. The calculation of the S&P SGMI TR for any S&P SGMI Business Day, *d,* is obtained by rounding the expression below to seven digits of precision.

$$SPSGMITR_d = SPSGMITR_{d-1} * (1 + CDR_d + TBR_d) * (1 + TBR_d)^{days}$$

where

$SPSGMITR_{d-1}$ = S&P SGMI TR Index value on the S&P SGMI business day prior to day *d*.

CDR_d = The Contract Daily Return on day *d*.

TBR_d = Treasury Bill Return on day *d*.

Days = Number of non S&P SGMI business days since the last immediate preceding S&P SGMI Business Day.

Glossary

Term	Description
CDR	Contract Daily Return
CRW	Contract Roll Weight
CW	Contract Weight
DCRP	Daily Contract Reference Price
Active Contract	A liquid, actively traded Contract with respect to a Designated Contract, as defined or identified by the relevant Trading Facility or, if no such definition or identification is provided by the Trading Facility, as defined by standard custom and practice in the industry.
Contract Expiration	A date or term specified by the Trading Facility on or through which a Contract is traded as the date or term on, during or after which such Contract will expire, or delivery or settlement will occur. The contract expiration may, but is not required to, be a particular contract month.
NC	Normalizing Constant
Roll Period	With respect to any Designated Contract, the period of five S&P SGMI Business Days beginning on the 2nd S&P SGMI Business Day of each calendar month and ending on the 6th S&P SGMI Business Day of such month.
ER Index	Excess Return Index, which is the accretion of the Contract Daily Return indexed to a normalized value
Spot Index	The index that reflects the price levels of the Designated Contracts and the CPW of each such Contract.
TR Index	The Total Return Index incorporates the returns of the ER Index and the Treasury Bill Return.
Treasury Bill Rate	Treasury Bill Rate ($TBAR_{d-1}$). On any S&P SGMI Business Day, *d*, the 91-day discount rate for U.S. Treasury Bills, as reported by the U.S. Department of the Treasury's Treasury Direct service at http://www.treasurydirect.gov/RI/OFBills on the most recent of the weekly auction dates prior to such S&P SGMI Business Day, *d*.
TDW	Total Dollar Weight
TDWO	Total Dollar Weight Obtained
TDWI	Total Dollar Weight Invested
TBR	Treasury Bill Rate

Index Data

In order to reflect the performance of a total return investment in futures, three separate but related indices have been developed based on the S&P SGMI.

1. The S&P SGMI Spot Index, which is based on price levels of the contracts included in the S&P SGMI.
2. The S&P SGMI Excess Return Index (S&P SGMI ER), which incorporates the returns of the S&P SGMI Spot Index as well as the discount or premium obtained by "rolling" hypothetical positions in such contracts forward as they approach delivery.
3. The S&P SGMI Total Return Index (S&P SGMI TR), which incorporates the returns of the S&P SGMI ER and interest earned on hypothetical fully collateralized contract positions on the futures included in the S&P SGMI.

Index Governance

Index Committee

The S&P SGMI will be overseen by the S&P Commodities Index Committee, which is responsible for all analytical methodologies and calculation of the indices. The Index Committee may revise index policy covering rules for selecting futures, or other matters. The Index Committee consists solely of full-time employees of S&P Indices.

S&P Indices considers information about changes to its indices and related matters to be potentially market moving and material. Therefore, all Index Committee discussions are confidential.

Index Business Committee

S&P Indices has established a Business Committee to assist with the operation of the S&P SGMI. The Business Committee meets on an annual basis and at other times, if needed. The principal purpose of the Business Committee is to review the performance of the S&P SGMI against the business plan for the immediately preceding financial year, approve the business plan for the SGMI business for the next financial year, and to discuss product and competitor strategy and general business development. The Business Committee may discuss such other matters as S&P Indices in its sole discretion will decide. The Business Committee is comprised of four members, with three members appointed by S&P and one member appointed by TBP. One of the S&P members serves as the Chairman of the Business Committee. The Business Committee shall not have any formal decision making power and no confidential or material non-public information is provided to the Business Committee. As the Business Committee is advisory, formal votes are not taken.

The Business Committee acts solely in an advisory and consultative capacity; the Index Committee makes all decisions with respect to the composition, calculation and operation of the S&P SGMI.

Index Policy

Holiday Schedule

The S&P SGMI is calculated daily based on the same holiday schedule as the S&P GSCI which follows the official NYSE holiday schedule.   The Index is calculated when the majority of the S&P SGMI futures contracts are open for official trading and official settlement prices are provided, excluding holidays and weekends.

Unscheduled Market Closures

In the event of unscheduled market closures for a majority of future contracts the S&P SGMI will not be published. In the event of unscheduled market closures for individual future contracts the S&P SGMI will be published using the prior day's settlement values.

Index Dissemination

Complete data for index replication (including tickers and data on index levels and returns) are available through S&P Indices' index data group for subscription via FTP.

Tickers

Index	Bloomberg	Reuters
S&P Systematic Global Macro Index Excess Return	SPSGMIP	.SPSGMIP
S&P Systematic Global Macro Index Total Return	SPSGMITR	.SPSGMITR

Appendix

Index values and divisors are calculated every S&P SGMI business day. Along with the daily index calculations, the position determination and number of contracts (weights) calculations are made once a month on the Rebalancing Reference day.

Position Determination

Position refers to either a long, a short or no position for each futures contract. The position will be used for calculating each component's daily Total Dollar Weight.

Position Value	Position Type
1	Long
-1	Short
0	No Position

For performing position determination S&P Indices requires at least 256 days of historic closing price data.

Steps for Position determination:

1. Beginning with the latest day, calculate the return for the contract for that date. The return is calculated by taking the current day's (*t*) contract closing price and calculating the return for it using the previous day's (*t-1*) closing price. During roll periods, contracts used in return calculations will change. For example, assuming we are rolling from a March to a June contract:

   On the Roll start date:

   $$Price\ Return_t = \frac{Price\ of\ March\ Contract_t - Price\ of\ March\ Contract_{t-1}}{Price\ of\ March\ Contract_t}$$

   On the day after the Roll:

   $$Price\ Return_t = \frac{Price\ of\ June\ Contract_t - Price\ of\ June\ Contract_{t-1}}{Price\ of\ June\ Contract_t}$$

2. Calculate the cumulative returns for each day using the formulae above.
3. Create a time-series of daily cumulative returns.
4. Take the last 22 cumulative returns and calculate the residuals from an Ordinary Least Square (OLS) regression curve.
5. Compute the autocorrelation adjusted variance of the residuals (AAVR).

$$AAVR = Variance\ of\ Residuals * \left[1 - \left(\left(\frac{Covariance\ of\ Residuals}{Variance\ of\ Residuals}\right) + \frac{1}{n}\right)^2\right]$$

This ratio is ρ, the autocorrelation lag at 1.

6. Calculate the daily differences for the cumulative returns.
7. Calculate the variance of the differences calculated in step 6 for the 22 days over which the OLS was calculated.
8. Calculate the Variance Ratio using the *AAVR* and variance of differences calculated in steps 5 and 7.

   Variance Ratio =AAVR/Variance of differences
9. Calculate the F-Inverse function (*FINV*) using a probability = .05 (a 95% confidence internal), Degree of Freedom1 = *n-3* and Degree of Freedom2 = *n-2,* where *n=22*.
10. If $Variance\ Ratio \leq FINV$ then increase the sample size by going back 5 more days and repeating steps 4 through 9
11. Once *Variance Ratio > FINV*, then the breakpoint has been reached. The slope is calculated based on the cumulative returns from the breakpoint to the rebalancing reference day. The position value of a futures contract is, then, calculated using the Slope
    - **If slope > 0, then Position Value=1 (Long)**
    - **If slope < 0, then Position Value=-1 (Short)**
    - **If slope = 0, then Position Value=0**
12. If all historic contract prices are used and *Variance Ratio* is still less than *FINV* then the contract start date become the breakpoint. The slope and positions are calculated as mentioned in Step 11.

Number of Contracts

The following calculation is done once every month to determine the number of contracts for each index component.

1. The following parameters are used for the calculation of the number of contracts

   i. Assets Under Management (AUM). This is a constant (US$ 10 billion) used to calculate the number of contracts. For example a different number of contracts would be purchased in the index for US$ 10 million versus if there were US$ 100m. The weights will be the same but the number of contracts will be different.
   ii. Target Volatility (17.5%)
   iii. Local Currency Per Unit for all futures contracts present in the index
   iv. Threshold Floor (0.125%)
   v. Threshold Ceiling (300%)

2. The following calculations are done to arrive at the number of contracts

   i. $Volatility\ Per\ Day = \dfrac{Target\ Volatility}{\sqrt{256}}$

   *ii. Daily Risk Allowance = Volatility Per Day * AUM*

   iii. Compute the average correlation factor using the last 256 daily returns of each instrument

   iv. Calculate the standard deviation of the price differences for each instrument for the last 60 days

   v. For each instrument,

      *US Dollar Risk = Local Currency Per Unit * Std Deviation of Price Differences * Fx Rate*

   vi. For each Instrument,

      *Risk Allowance = Sector Weight * Instrument Weight * Daily Risk Allowance*

      where

      $$Sector\ Weight = \frac{100\%}{Number\ of\ Sectors}$$

      $$Instrument\ Weight = \frac{Sector Weight}{\text{Number of Instruments in the Sector}}$$

   vii. For each instrument,

      *Final Risk Allowance = Risk Allowance * Correlation Factor (rounded to 1 decimal)*

   viii. $Contract\ Size = \dfrac{Final\ Risk\ Allowance}{US\ Dollar\ Risk}$; (rounded to 0 decimals)

   ix. *Nominal Value in Dollars = Local Currency Per Unit * FX Rate * Contract Size * Instrument's Last Closing Price*

   x. $\dfrac{Volatility}{Nominal}\ Ratio = \dfrac{US\ Dollar\ Risk * Contract\ Size}{Nominal\ Value\ in\ Dollars}$

   xi. If the $\dfrac{Volatility}{Nominal}\ Ratio$ is less than the *Threshold Floor* then the Contract Size is 0, otherwise it is as calculated in step viii

   xii. Nominal Value as a Percent of AUM =

      $$\frac{Nominal\ Value\ in\ Dollars}{AUM}$$

xiii. *Total Nominal Exposure*= $\sum$*(Nominal Value as a Percent of AUM) for all futures in the index*

xiv. If *Total Nominal Exposure > Threshold Ceiling* then ,

- $\textit{Scale Back} = \dfrac{\textit{Threshold Ceiling}}{\textit{Total Nominal Value}}$, else
- Scale Back = 1
- *Number Of Contracts = Scale Back * Contract Size*; rounded to 0 decimals

Cash Weight Calculation

$$\textit{Cash Weight} = \textit{AUM} - \textit{Total Dollar Weight}_{\textit{(Open of the Rebalancing Reference Day)}}$$

The Rebalancing Reference Day is the close of business of the last trading day of each month. The Rebalancing Day is the second trading day of each following month (this is also the contract Roll Start date).

Precisions for Calculation

The following are the precisions used for calculations

- OLS – 15 Decimals
- FINV – 2 Decimals
- Variance Ratio – 2 Decimals
- Correlation Factor – 1 Decimal
- Standard Deviation – 14 Decimals
- Contract Size (Instrument Weight) – Rounded to Nearest Whole Number
- Cash Weight – 14 Decimals

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