S&P Dow Jones Indices

A Division of S&P Global

S&P Systematic Global Macro Index (S&P SGMI)

Methodology

January 2021

Table of Contents

Introduction

Index Objective and Overview

The S&P Systematic Global Macro Index (S&P SGMI) measures the performance of a strategy based on price trends of specific globally traded liquid future contracts by tracking long, short, or zero positions. The strategy is designed 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.

Highlights

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 trend signal generated by a regression of its historical prices, as outlined in *Appendix A: Rebalancing Procedures*.

The index is composed of 37 constituents determined every two years and grouped into six significant sectors traded in the global macro universe. Each sector is allocated an equal risk capital allowance with the underlying constituents within each sector evenly weighted as well. The resulting hypothetical 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. Sectors and constituents are rebalanced monthly.

The S&P SGMI was developed collaboratively by S&P Dow Jones Indices and Thayer Brook Partners, LLP. The index is calculated and managed independently by S&P Dow Jones Indices according to S&P Dow Jones Indices' standard policies and procedures, including the policies and procedures governing S&P Dow Jones Indices' independent Index Committee.

Index Family

S&P Dow Jones Indices also calculates two standalone sub-indices representing the components of the S&P SGMI. These are the S&P SGMI Commodity (reflecting the physical commodity futures components of the S&P SGMI) and the S&P SGMI Financial (reflecting the financial futures components of the S&P SGMI) Indices. Excess and Total Return sub-indices are calculated and published for each of these two market sectors. The S&P SGMI Commodity and S&P SGMI Financial indices are completely independent standalone indices that follow the S&P SGMI methodology.

Supporting Documents

This methodology is meant to be read in conjunction with supporting documents providing greater detail with respect to the policies, procedures and calculations described herein. References throughout the methodology direct the reader to the relevant supporting document for further information on a specific topic. The list of the main supplemental documents for this methodology and the hyperlinks to those documents is as follows:

Supporting Document	URL
S&P Dow Jones Indices' Commodities Indices Policies & Practices Methodology	Commodities Indices Policies & Practices
S&P Dow Jones Indices' Index Mathematics Methodology	Index Mathematics Methodology

This methodology was created by S&P Dow Jones Indices to achieve the aforementioned objective of measuring the underlying interest of each index governed by this methodology document. Any changes to or deviations from this methodology are made in the sole judgment and discretion of S&P Dow Jones Indices so that the index continues to achieve its objective.

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 Dow Jones 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.

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 certain situations, if a new Contract is identified, S&P Dow Jones Indices may determine its inclusion over a shorter time period if sufficient historical Daily Contract Reference Prices for the given Contract can 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, 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.

Availability of Volume Data. For a Contract to be eligible for inclusion in the S&P SGMI, volume data must be available 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 Dow Jones 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 Dow Jones Indices with at least the frequency required by S&P Dow Jones Indices to make the monthly determinations described under *Sources of Information* below.

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 Dow Jones Indices determines otherwise.

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	
	RBOB Gasoline	NYMEX	E	USD	
Commodities					
Commodity - Softs & Livestock	Sugar #11	ICE	C	USD	**Top 4**
	Live Cattle	CME	C	USD	
	Coffee "C"	ICE	C	USD	
	Cotton #2	ICE	C	USD	
Commodity - Grains	Soybeans	CBOT	C	USD	**Top 3**
	Corn	CBOT	C	USD	
	Wheat	CBOT	C	USD	
Commodity - Metals	NA Copper	COMEX	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	JPX	FI	JPY	
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	JPX	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	EUR	
STIR - Asia	3 Month Euroyen	TFX	STIR	JPY	

*STIR stands for Short Term Interest Rate

The S&P SGMI Select Sectors

The six S&P SGMI sectors are categorized into two subsets: the financial select sector and the commodities select sector. For each of these two select sectors, sub-indices are computed using the same methodology as the S&P SGMI. Exhibit 2 shows the various parameters for the S&P SGMI composite and select sectors indices.

EXHIBIT 2: COMPARISON

	SGMI Composite	SGMI Financials	SGMI Commodities
Number of Sectors	6	4	2
Number of Constituents	37	21	16
Target Index Volatility	17.5%	17.5%	17.5%
Leverage Constraint	3X	3X	3X

The four sectors included in the S&P SGMI Financials are Equity, Fixed Income, Foreign Exchange and Short Term Interest Rates (STIR). There are six constituents in each of the Equity, Fixed Income and Foreign Exchange sectors, and three constituents in STIR. The two sectors included in the S&P SGMI Commodities are Energy and Commodities. There are six constituents in the Energy sector, and ten constituents in the Commodities sector.

Within each of the sub-indices, the risk capital allocations are carried out evenly first at the sector level, then again evenly within the individual constituents, in accordance with the S&P SGMI methodology.

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 positive or negative 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 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 auto-correlated 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.

$$\text{US\$ Daily Risk Allowance}_{Index} = AUM_{US\$} * \frac{TargetVolatility}{\sqrt{256}}$$

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.

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

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 considered 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:

$$\sigma_{per\,riskunit} = \frac{\sigma_{dailytarget}}{m}\sqrt{\frac{m}{1+(m-1)\overline{\rho}}}$$

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:

$$\frac{\sigma_{per\,riskunit}}{\sigma_{per\,contract}}$$

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 Dow Jones 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 Dow Jones 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 Dow Jones 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 Dow Jones 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 Dow Jones 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 3 is a schedule of the active contracts used for price inputs of the Index.

EXHIBIT 3: 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
RBOB 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
NA 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)	Z	Z	H	H	H	M	M	M	U	U	U	Z
Euribor (3-month)	Z	Z	H	H	H	M	M	M	U	U	U	Z
Euroyen (3-month)	Z	Z	H	H	H	M	M	M	U	U	U	Z

EXHIBIT 4: 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.

Currency of Calculation and Additional Index Return Series

The S&P SGMI is calculated in U.S. dollars. The prices of the underlying futures contracts are collected in their local currencies. Using WM/Refinitiv's spot exchange rates, these local prices are converted to U.S. dollars.

Real-time Forex rates, as supplied by WM/Refinitiv, are used for ongoing index calculation. The index's final closing values convert all underlying contracts prices used in the index calculation at the spot exchange rates provided by WM/Refinitiv at 04:00 PM London Time.

In addition to the indices detailed in this methodology, additional return series versions of the indices may be available, including, but not limited to: currency, currency hedged, decrement, fair value, inverse, leveraged, and risk control versions. For a list of available indices, please refer to *S&P DJI's All Indices by Methodology Report*.

For information on index calculation, please refer to S&P Dow Jones Indices' Index Mathematics Methodology.

For the inputs necessary to calculate certain types of indices, including decrement, dynamic hedged, fair value, and risk control indices, please refer to the Parameters documents available at www.spdji.com.

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:

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

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 makes the weight in the Index sum to 100%.

The Short Component is calculated as follows:

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

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.

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

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:

$$TDWc_d = CWc_d * CRWc_d * DCRPc_d * FXc_d$$

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

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

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:

$$CW = Multiplier * Number\ of\ Contracts * Position$$

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.

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

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.

$$ER_d = ER_{d-1} * [1 + CDR_d]$$

where

ERd	=	Excess Return Value for S&P SGMI Business Day *d*.
ERd-1	=	Excess Return Value as on the S&P SGMI business day prior to day *d*.
CDRd	=	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.

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

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 (TBARd-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 Governance

Index Committee

The S&P SGMI is overseen by S&P Dow Jones Indices' 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 Dow Jones Indices.

S&P Dow Jones 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.

S&P Dow Jones Indices' Index Committees reserve the right to make exceptions, when applying the methodology if the need arises. In any scenario where the treatment differs from the general rules stated in this document or supplemental documents, clients will receive sufficient notice, whenever possible.

In addition to the daily governance of indices and maintenance of index methodologies, at least once within any 12-month period, the Index Committee reviews the methodology to ensure the indices continue to achieve the stated objectives, and that the data and methodology remain effective. In certain instances, S&P Dow Jones Indices may publish a consultation inviting comments from external parties.

For information on Quality Assurance and Internal Reviews of Methodology, please refer to S&P Dow Jones Indices' Commodities Indices Policies & Practices Methodology.

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.

For information on Calculations and Pricing Disruptions, Expert Judgment, Data Hierarchy and Unexpected Exchange Closures, please refer to S&P Dow Jones Indices' Commodities Indices Policies & Practices Methodology.

Contact Information

For questions regarding an index, please contact: *index_services@spglobal.com.*

Index Dissemination

Index levels are available through S&P Dow Jones Indices' Web site at www.spdji.com, major quote vendors (see codes below), numerous investment-oriented Web sites, and various print and electronic media.

Tickers

The table below lists headline indices covered by this document. All versions of the below indices that may exist are also covered by this document. Please refer to *S&P DJI's All Indices by Methodology Report* for a complete list of indices covered by this document.

Index	Bloomberg	RIC	Base Date	Launch Date
S&P Systematic Global Macro Index ER	SPSGMIP	.SPSGMIP	11/28/2003	08/09/2011
S&P Systematic Global Macro Index TR	SPSGMITR	.SPSGMITR	11/28/2003	08/09/2011
S&P Systematic Global Macro Commodities Index ER	SPSGMICP	.SPSGMICP	11/28/2003	02/24/2012
S&P Systematic Global Macro Commodities Index TR	SPSGMICT	.SPSGMICT	11/28/2003	02/24/2012
S&P Systematic Global Macro Financials Index ER	SPSGMIFP	.SPSGMIFP	11/28/2003	02/24/2012
S&P Systematic Global Macro Financials Index TR	SPSGMIFT	.SPSGMIFT	11/28/2003	02/24/2012
S&P SGMI Australian Dollar Long ER	SSGMALP	.SSGMALP	11/28/2003	04/05/2016
S&P SGMI Australian Dollar Long TR	SSGMALT	.SSGMALT	11/28/2003	04/05/2016
S&P SGMI United Kingdom Pound Long ER	SSGMBLP	.SSGMBLP	11/28/2003	04/05/2016
S&P SGMI United Kingdom Pound Long TR	SSGMBLT	.SSGMBLT	11/28/2003	04/05/2016
S&P SGMI Canadian Dollar Long ER	SSGMCLP	.SSGMCLP	11/28/2003	04/05/2016
S&P SGMI Canadian Dollar Long TR	SSGMCLT	.SSGMCLT	11/28/2003	04/05/2016
S&P SGMI Euro Long ER	SSGMELP	.SSGMELP	11/28/2003	04/05/2016
S&P SGMI Euro Long TR	SSGMELT	.SSGMELT	11/28/2003	04/05/2016
S&P SGMI Japanese Yen Long ER	SSGMJLP	.SSGMJLP	11/28/2003	04/05/2016
S&P SGMI Japanese Yen Long TR	SSGMJLT	.SSGMJLT	11/28/2003	04/05/2016
S&P SGMI Switzerland Francs Long ER	SSGMSLP	.SSGMSLP	11/28/2003	04/05/2016
S&P SGMI Switzerland Francs Long TR	SSGMSLT	.SSGMSLT	11/28/2003	04/05/2016
S&P SGMI Australian Dollar Long Short ER	SSGMALSP	.SSGMALSP	11/28/2003	04/05/2016
S&P SGMI Australian Dollar Long Short TR	SSGMALST	.SSGMALST	11/28/2003	04/05/2016
S&P SGMI United Kingdom Pound Long Short ER	SSGMBLSP	.SSGMBLSP	11/28/2003	04/05/2016
S&P SGMI United Kingdom Pound Long Short TR	SSGMBLST	.SSGMBLST	11/28/2003	04/05/2016
S&P SGMI Canadian Dollar Long Short ER	SSGMCLSP	.SSGMCLSP	11/28/2003	04/05/2016
S&P SGMI Canadian Dollar Long Short TR	SSGMCLST	.SSGMCLST	11/28/2003	04/05/2016
S&P SGMI Euro Long Short ER	SSGMELSP	.SSGMELSP	11/28/2003	04/05/2016
S&P SGMI Euro Long Short TR	SSGMELST	.SSGMELST	11/28/2003	04/05/2016
S&P SGMI Japanese Yen Long Short ER	SSGMJLSP	.SSGMJLSP	11/28/2003	04/05/2016
S&P SGMI Japanese Yen Long Short TR	SSGMJLST	.SSGMJLST	11/28/2003	04/05/2016
S&P SGMI Switzerland Francs Long Short ER	SSGMSLSP	.SSGMSLSP	11/28/2003	04/05/2016
S&P SGMI Switzerland Francs Long Short TR	SSGMSLST	.SSGMSLST	11/28/2003	04/05/2016

Index Data

Daily index levels and index data are available via subscription.

For product information, please contact S&P Dow Jones Indices, www.spdji.com/contact-us.

Web site

For further information, please refer to S&P Dow Jones Indices' Web site at *www.spdji.com*.

Appendix A: Rebalancing Procedures

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 Dow Jones 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:

$$\text{Price Return}_t = \frac{\text{Price of March Contract}_t - \text{Price of March Contract}_{t-1}}{\text{Price of March Contract}_t}$$

   On the day after the Roll:

$$\text{Price Return}_t = \frac{\text{Price of June Contract}_t - \text{Price of June Contract}_{t-1}}{\text{Price of June Contract}_t}$$

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).

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

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 & 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* ≤ *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* = $\frac{TargetVolatility}{\sqrt{256}}$

    *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* = $\frac{Final\ Risk\ Allowance}{US\ Dollar\ Risk}$; (rounded to 0 decimals)

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

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

xi. If the $\frac{Volatility}{Nominal} Ratio$ 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= ∑(Nominal Value as a Percent of AUM) for all futures in the index*

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

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

Cash Weight Calculation

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

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

Appendix B: Long and Long Short Indices of Currency Futures Contracts

For each futures contract in the foreign exchange sector of the S&P SGMI, S&P Dow Jones Indices calculates two indices. One tracks the performance of holding the contract with a long only position, and the other with a long or short position – with the position determined on a monthly basis.

These indices are available for six currency futures that are included in the S&P SGMI's foreign exchange sector: Australian Dollar (AUD), Canadian Dollar (CAD), Euro (EUR), Japanese Yen (JPY), Swiss Franc (CHF), and British Pound (GBP). The indices follow the same position determination and roll period as S&P SGMI.

Disclaimer

 This document does not constitute an offer of services in jurisdictions where S&P Dow Jones Indices LLC, S&P, S&P Trucost Limited, SAM (part of S&P Global), Dow Jones or their respective affiliates (collectively "S&P Dow Jones Indices") do not have the necessary licenses. Except for certain custom index calculation services, all information provided by S&P Dow Jones Indices is impersonal and not tailored to the needs of any person, entity or group of persons. S&P Dow Jones Indices receives compensation in connection with licensing its indices to third parties and providing custom calculation services. Past performance of an index is not an indication or guarantee of future results.

It is not possible to invest directly in an index. Exposure to an asset class represented by an index may be available through investable instruments based on that index. S&P Dow Jones Indices does not sponsor, endorse, sell, promote or manage any investment fund or other investment vehicle that is offered by third parties and that seeks to provide an investment return based on the performance of any index. S&P Dow Jones Indices makes no assurance that investment products based on the index will accurately track index performance or provide positive investment returns. S&P Dow Jones Indices LLC is not an investment advisor, and S&P Dow Jones Indices makes no representation regarding the advisability of investing in any such investment fund or other investment vehicle. A decision to invest in any such investment fund or other investment vehicle should not be made in reliance on any of the statements set forth in this document. Prospective investors are advised to make an investment in any such fund or other vehicle only after carefully considering the risks associated with investing in such funds, as detailed in an offering memorandum or similar document that is prepared by or on behalf of the issuer of the investment fund or other investment product or vehicle. S&P Dow Jones Indices LLC is not a tax advisor. A tax advisor should be consulted to evaluate the impact of any tax-exempt securities on portfolios and the tax consequences of making any particular investment decision. Inclusion of a security within an index is not a recommendation by S&P Dow Jones Indices to buy, sell, or hold such security, nor is it considered to be investment advice.

These materials have been prepared solely for informational purposes based upon information generally available to the public and from sources believed to be reliable. No content contained in these materials (including index data, ratings, credit-related analyses and data, research, valuations, model, software or other application or output therefrom) or any part thereof ("Content") may be modified, reverse-engineered, reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without the prior written permission of S&P Dow Jones Indices. The Content shall not be used for any unlawful or unauthorized purposes. S&P Dow Jones Indices and its third-party data providers and licensors (collectively "S&P Dow Jones Indices Parties") do not guarantee the accuracy, completeness, timeliness or availability of the Content. S&P Dow Jones Indices Parties are not responsible for any errors or omissions, regardless of the cause, for the results obtained from the use of the Content. THE CONTENT IS PROVIDED ON AN "AS IS" BASIS. S&P DOW JONES INDICES PARTIES DISCLAIM ANY AND ALL EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR USE, FREEDOM FROM BUGS, SOFTWARE ERRORS OR DEFECTS, THAT THE CONTENT'S FUNCTIONING WILL BE UNINTERRUPTED OR THAT THE CONTENT WILL OPERATE WITH ANY SOFTWARE OR HARDWARE CONFIGURATION. In no event shall S&P Dow Jones Indices Parties be