Commodity and Strategic Futures Index Methods: Adjusting to a New World Economy

October 2013
For Financial Professionals/Not for Public Distribution
What is an asset class?

There are no conclusive definitions of an asset class

- **Super Asset Classes**
  1. Capital assets
     - Stocks, bonds, real estate (infrastructure)
  2. Consumable/transformable assets
     - Commodities
  3. Store of value assets
     - Currency, fine-art

- **Beta (Market) Exposures**
  1. Exposures that produce a return NOT based on skill
     - Financial markets, interest rates, credit spreads, volatility

What makes COMMODITIES an asset class?

Commodities offer an inherent or natural return that is not conditional on skill. Coupled with the fact that commodities are the basic ingredients that build society, commodities are a unique asset class and should be treated as such.

Accessing commodities directly for asset class exposure

“We believe that this reflects a preference for the kind of risk profile provided by direct commodity returns, which is very different to that of commodity equities.”

Source: Barclays Capital, Commodities Research, Commodity Cross Currents Commodity investing to rebound, February 2012
Futures are the most practical way to get direct commodity exposure

Investors may choose to get commodity exposure by directly investing, using futures contracts or by using equities, but may not capture the asset class return

- **Direct investing**: buy the commodity and store it (Cash or Spot Market)
  - How would you store 40,000 pounds of live cattle or 1,000 barrels of oil?
  - Not practical for most investors

- **Equities of commodity producers**
  - Less direct commodity exposure (Ags (0.38), Gold (0.66), Oil&Gas (0.67))
    - Less diversification, inflation protection
    - Higher exposure to broad stock market movements
    - Influenced by management decisions
      - May hedge out commodity exposure
      - May provide exposure where futures markets are less tradable
        - Timber, Water, Steel

- **Futures contracts**
  - Most direct and practical solution
  - Exchange-traded contracts offer uniformity and are regulated
  - Provides the inherent asset class return

A special quality makes commodities tradable

- Commodities are fungible, raw materials used to produce the products consumers buy, from food to furniture to gasoline.
  - Some examples include crude oil, corn, cocoa, wheat, cattle, aluminum, copper, and gold.

- Where the raw materials trade for cash is called the “Spot Market”
Supply and demand drive commodity prices in the spot market

- Supply > Demand => Excess => Spot Price Declines
- Demand > Supply => Shortage => Spot Price Increases

Futures Contracts

• What is a futures contract?
  A standardized agreement between two parties.
  – The buyer agrees to buy and the seller agrees to deliver (sell) the underlying asset at a specified price on a set future date or expiration date.
  – Most positions are closed before expiration to avoid delivery.
  – The futures contracts in indices are exchange-traded and regulated.

• Futures prices are directly related to spot prices
Futures contract prices are directly linked to expected spot market prices.

For what risk does the index investor get paid?

The futures markets exist to facilitate hedging, not to forecast prices

- **Investors Earn An “Insurance Premium”**
  - Monetize this risk by owning commodity futures contracts
- **Producers need protection against price drops**
  - Excess short hedging
  - Keynes theory of “normal backwardation”
    - Sell production forward at a discount ⇒ downward price pressure
  - Hicks theory of “congenital weakness”
    - Producers are more vulnerable than consumers

Examples of a forward curve

- The collection of futures contracts with the same underlying commodity but different expiration dates make up a forward curve.
  - **Storage situations** drive the relationship between futures contracts with different expiration dates.

Backwardation is profitable and occurs when there is a shortage and no value to storage. Contango is losing and occurs when there is normal inventory and a value for storage.

Source: Greer, Robert J., Editor. The Handbook of Inflation hedging Investments, Enhance Performance and Protect Your Portfolio from Inflation Risk. Greer, Robert J. Author, Chapter 5: Commodity Indexes for Real Return. Published by McGraw Hill, January 2006. **Sample for illustrative purposes only.**
Fundamental sources that drive the commodity asset class returns

**Components of**

- **T-Bill Rate**
- **Risk Premium**
- **Rebalancing**
- **Convenience Yield**
- **Expectational Variance**

**Causes of**

- Expected Inflation (plus real rate of return)
- Price Uncertainty (producers vs. processors)
- Uncorrelated Volatility (mean reversion)
- Low Inventory Relative to Demand
- Unexpected General Inflation (plus... Individual market “surprises”)

Commodity indexing captures the asset class return

In order to obtain the market return or beta from commodities, index investments should measure returns from a process that:

- Constructs and calculates with a passive, specified method
- Considers only exchange-traded futures contracts on physical commodities
- Assumes only long positions
- Collateralizes each position fully
S&P GSCI®

- Weighting Scheme
  - World production-weighted

- Constituents (24)
  - Must meet eligibility criteria on an annual basis
  - Futures contracts on physical commodities
  - Total Dollar Value Traded (TDVT) minimums
  - Reference Percentage Dollar Weight minimums
  - Denominated in USD and Trading Facility Organization for Economic Cooperation and Development (OECD)
  - Pricing and volume availability

- Sectors (5 groups)
  - Agriculture, Energy, Livestock, Precious Metals, Industrial Metals

- Rebalance
  - Annual rebalance, Monthly review

- Roll
  - 20% each day of the 5th through 9th S&P GSCI Business Days of each month
  - Next nearby most liquid contract

Source: S&P Dow Jones Indices. Data is as of December 31, 2012
Dow Jones UBS Commodity Index

Similar to the S&P GSCI with one MAJOR difference. The **weights have limits** where no:

- Commodity can be greater than 15%
- Commodities derived from each other like soybeans, soybean meal, and soybean oil can be greater than 25% (also crude oil, heating oil, and gasoline)
- Group can be more than 33%

Grains and Softs are two distinct groups rather than the one sector, Agriculture, in the S&P GSCI

Approximate Weighting Results:

- DJ-UBSCI = 1/3 energy, 1/3 metals, 1/3 agriculture & livestock
- S&P GSCI = 70% energy, 15% agriculture, 5% each livestock, precious metals and industrial metals

Other slight differences are only 22 commodities and 6-10th business day rolls.
- DJ-UBSCI CI only - soybean oil, soybean meal
- S&P GSCI only – feeder cattle, cocoa, gasoil, lead

Source: S&P Dow Jones Indices. Data is as of December 31, 2012
Main reasons for using commodities as an asset class

- **Diversification**
  - Low correlations to stocks and bonds

- **Inflation Protection**
  - Positive correlation to inflation AND changes in the rate of inflation

- **Risk/Return Profile**
  - Equity-like risk and return

Survey responses in: What is the main reason you invest in commodities?

Barclays European Commodity Investor Survey results

March 2009-2012
What are the long-term historical benefits that has driven investments in commodities as an asset class?

- **Diversification**
  - Low correlations *using monthly data from 1/76-12/12
    - BarCap US Agg = -0.02
    - S&P 500 = 0.18
  - In only 4 years from 1970 through 2012 did both the S&P 500® and the S&P GSCI drop in value.
  - Low correlations between commodity sectors has reduced annualized volatility of the S&P GSCI to 2/3 of oil alone. *using monthly data from 2/87-12/12
    - S&P GSCI = 21%
    - S&P GSCI Crude Oil = 34%
    - Correlation = 0.89

- **Inflation Protection**
  - Positive correlation to inflation
  - One dollar of commodity index investment may hedge more than one dollar of inflation

- **Potential equity-like risk and return**
  - Equities = 7.44% return, 15.16% risk
  - Commodities = 7.15% return, 19.24% risk

Source: S&P Dow Jones Indices. S&P 500, BarCap US Agg, and S&P GSCI represent Stocks, Bonds, and Commodities, respectively. Monthly data from 1/76 - 12/12. Charts and graphs are provided for illustrative purposes only. Indices are unmanaged statistical composites and their returns do not include payment of any sales charges or fees an investor would pay to purchase the securities the index represents. Such costs would lower performance. It is not possible to invest directly in an index. Past performance is not an indication of future results. The inception date for the S&P GSCI and S&P GSCI Crude Oil was May 1, 1991, at the market close. All information presented prior to the index inception date is back-tested. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.
Commodities have provided diversification from equities and from nominal bonds

<table>
<thead>
<tr>
<th>Correlation on Monthly Returns from 1/03-12/12</th>
</tr>
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<tbody>
<tr>
<td></td>
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<tr>
<td>S&amp;P 500       BarCap US Agg   S&amp;P GSCI   DJ-UBS CI</td>
</tr>
<tr>
<td>S&amp;P 500</td>
</tr>
<tr>
<td>BarCap US Agg</td>
</tr>
<tr>
<td>S&amp;P GSCI</td>
</tr>
<tr>
<td>DJ-UBS CI</td>
</tr>
</tbody>
</table>

Source: S&P Dow Jones Indices and Bloomberg. S&P 500, BarCap US Agg, and both S&P GSCI and DJ-UBS CI represent Stocks, Bonds, and Commodities, respectively.
There have also been low correlations between sectors which has benefited well-diversified indices.

In only 5 years since 1984 did all of the sectors move in the same direction – and in 4 of those years that direction was positive.

Commodities have provided diversification during historical crises

- Commodities provided diversification during a political crisis
  - Persian Gulf War

- Commodities provided diversification during a financial crisis
  - Black Monday

Source: S&P Dow Jones Indices and Bloomberg. S&P 500 and S&P GSCI represent Stocks and Commodities, respectively. Charts and graphs are provided for illustrative purposes only. Indices are unmanaged statistical composites and their returns do not include payment of any sales charges or fees an investor would pay to purchase the securities the index represents. Such costs would lower performance. It is not possible to invest directly in an index. Past performance is not an indication of future results.
This pattern has led to increased portfolio efficiency and capital preservation

<table>
<thead>
<tr>
<th>Historical Performance for Hypothetical Portfolios from 1/76-12/12</th>
</tr>
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<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>S&amp;P 500</td>
</tr>
<tr>
<td>BarCap US Agg</td>
</tr>
<tr>
<td>S&amp;P GSCI</td>
</tr>
<tr>
<td>Annualized Return</td>
</tr>
<tr>
<td>Annualized Risk</td>
</tr>
<tr>
<td>Sharpe Ratio</td>
</tr>
</tbody>
</table>

Source: S&P Dow Jones Indices and Bloomberg. S&P 500, BarCap US Agg, and S&P GSCI represent Stocks, Bonds, and Commodities, respectively. Monthly data from 1/76 - 12/12. Charts and graphs are provided for illustrative purposes only. Indices are unmanaged statistical composites and their returns do not include payment of any sales charges or fees an investor would pay to purchase the securities the index represents. Such costs would lower performance. It is not possible to invest directly in an index. Past performance is not an indication of future results. The inception date for the S&P GSCI was May 1, 1991, at the market close. The inception date for the BarCap US Agg was January 1, 1986. All information presented prior to the index inception date is back-tested. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.
A hypothetical, historical allocation to DJ-UBS CI from S&P 500 may reduce portfolio volatility

**Efficient Frontier with Mix of S&P 500 and DJ-UBS CI**

*Using Monthly Data from 1/2003-12/2012*

- **100% S&P 500**
  - 14.51%, 7.02%
  - 14.77%, 7.10%

- **14.30%, 6.94%**

- **14.13%, 6.84%**

- **14.01%, 6.74%**

- **13.95%, 6.63%**

- **13.94%, 6.51%**

**70% S&P 500 / 30% DJ-UBS CI**

Source: S&P Dow Jones Indices Uses 10 years monthly return data from 1/2003-12/2012 from Bloomberg. Every point represents a 5% allocation shift from S&P 500 to DJ-UBS CI. Charts and graphs are provided for illustrative purposes only. Indices are unmanaged statistical composites and their returns do not include payment of any sales charges or fees an investor would pay to purchase the securities the index represents. Such costs would lower performance. It is not possible to invest directly in an index. Past performance is not an indication of future results. The inception date for the S&P GSCI was May 1, 1991, at the market close. The inception date for the DJ-UBS CI was July 14, 1998, at the market close. All information presented prior to the index inception date is back-tested. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.
In a Barclays Capital commodity investing survey of over 100 institutional investors….

“For more than 70% of the survey the appropriate long-term average weighting for commodities in a portfolio is over 6%, a long way above current norms. “

Source: Barclays Capital, Commodities Research, Commodity Cross Currents Commodity investing to rebound, February 2012
Commodities have provided protection from inflation

10-year correlation to CPI yoy Index based on monthly data 1/03-12/12:
S&P GSCI yoy% = 0.74
DJ-UBS CI yoy% = 0.64

Commodity index investments may provide a levered response to inflation

One dollar of commodities may hedge more than one dollar of the portfolio from inflation

<table>
<thead>
<tr>
<th>Dates</th>
<th>Inflation Beta</th>
<th>R-squared</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S&amp;P GSCI</td>
<td>DJ-UBS CI</td>
</tr>
<tr>
<td>1971-2012</td>
<td>2.8</td>
<td>0.12</td>
</tr>
<tr>
<td>1987-2012</td>
<td>13.2</td>
<td>0.48</td>
</tr>
<tr>
<td>1992-2012</td>
<td>16.0</td>
<td>10.2</td>
</tr>
<tr>
<td>2003-2012</td>
<td>14.1</td>
<td>8.9</td>
</tr>
<tr>
<td>2008-2012</td>
<td>15.5</td>
<td>9.6</td>
</tr>
</tbody>
</table>

SOURCE: S&P Dow Jones Indices (rolling 12-month calculations)

Inflation beta data are measured by CPI-U as listed on the website: ftp://ftp.bls.gov/pub/special.requests/cpi/cpiai.txt

R-squared signifies the percentage that inflation explains of the variability in commodity index returns

Inflation beta can be interpreted as: (using DJ-UBS CI 1992-2012 as an example) A 1% increase in inflation results in 10.2% increase in return of the DJ-UBS CI during the period from 1992-2012

Time periods shown reflect first full year of returns for the S&P GSCI (1971), first year crude oil was included in the S&P GSCI (1987), first full year of returns for the DJ-UBS CI (1992), 2003 and 2008 are 5-years and 10-years.

The inception date for the S&P GSCI was May 1, 1991, at the market close. The inception date for the DJ-UBS CI was July 14, 1998, at the market close. All information presented prior to the index inception date is back-tested. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.

S&P acquired the GSCI from Goldman Sachs on February 2, 2007 and it was subsequently renamed the S&P GSCI. Goldman Sachs first began publishing the GSCI related indices in 1991 but has calculated the historical value of the GSCI beginning January 2, 1970 based on actual prices from that date forward and the selection criteria, methodology and procedures in effect during the applicable periods of calculation (or, in the case of all calculations periods prior to 1991, based on the selection criteria, methodology and procedures adopted in 1991. The GSCI has been normalized to a value of 100 on January 2, 1970, in order to permit comparisons of the value of the GSCI to be made over time.
Shifting World Economy?

A possible change in the world economy from one driven by expansion of supply to expansion of demand may be causing the following:

- More persistence of backwardation
- Greater instability of term structure
- Lower correlation between commodities

Source: Societe Generale 2011
Backwardation is Returning

Shortages caused backwardation more frequently since 2011, which may be a result in the shifting economy.

- From 2005-2011, commodities were in contango 93% of months
- In 2012, 5 of 7 months were in backwardation
- Positive roll yield in the S&P GSCI every month since May 2013.

### Exhibit 2: The Environment Characterized By Term Structure

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Months</th>
<th>Contango</th>
<th>Backwardation</th>
<th>Contango (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>11</td>
<td>6</td>
<td>5</td>
<td>55</td>
</tr>
<tr>
<td>1996</td>
<td>12</td>
<td>2</td>
<td>10</td>
<td>17</td>
</tr>
<tr>
<td>1997</td>
<td>12</td>
<td>8</td>
<td>4</td>
<td>67</td>
</tr>
<tr>
<td>1998</td>
<td>12</td>
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<td>100</td>
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<td>1999</td>
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<td>67</td>
</tr>
<tr>
<td>2003</td>
<td>12</td>
<td>3</td>
<td>9</td>
<td>25</td>
</tr>
<tr>
<td>2004</td>
<td>12</td>
<td>5</td>
<td>7</td>
<td>42</td>
</tr>
<tr>
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<td>100</td>
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<tr>
<td>2011</td>
<td>12</td>
<td>9</td>
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<td>75</td>
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<tr>
<td>2012</td>
<td>12</td>
<td>7</td>
<td>5</td>
<td>58</td>
</tr>
</tbody>
</table>

Total 215 148 67 69

Minimal Stocks Lead to Price Sensitivity

Supply shocks become driving forces to commodity returns when inventories are low, as opposed to periods of high stocks relative to consumption.

Source: Till (2013)
Commodity Correlations have Fallen

- A return to pre-crisis levels of correlations:

  **Between individual commodities**


  ![Graph showing correlation between commodities](image1)

  **... and to other asset classes**

  Average of absolute 12-month correlations between DJUBS and hedge funds (HFRX), S&P Global 1500, the US Dollar (DXY), 7 Year US treasuries, Case-Schiller 20 City House Prices and the VIX. As of October 1st 2013. Source: S&P Dow Jones 2013, HFR.

  ![Graph showing correlation with other asset classes](image2)
Recent Impacts on Index Performance

First generation indices are outperforming deferred strategies but **flexible strategies** have performed best.

<table>
<thead>
<tr>
<th>Year</th>
<th>S&amp;P GSCI TR (%)</th>
<th>S&amp;P GSCI 3-Month Forward TR (%)</th>
<th>S&amp;P GSCI Enhanced TR (%)</th>
<th>S&amp;P GSCI Dynamic Roll TR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1995</td>
<td>23.4</td>
<td>17.4</td>
<td>21.1</td>
<td>15.2</td>
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<td>1996</td>
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<tr>
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<td>-2.1</td>
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<td>2007</td>
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<td>2008</td>
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<td>-39.2</td>
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<tr>
<td>2009</td>
<td>13.5</td>
<td>20.8</td>
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<td>2010</td>
<td>9.1</td>
<td>12.1</td>
<td>12.1</td>
<td>9.5</td>
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<tr>
<td>2011</td>
<td>-1.2</td>
<td>0.4</td>
<td>0.5</td>
<td>-0.4</td>
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<tr>
<td>2012</td>
<td>0.1</td>
<td>-1.4</td>
<td>-0.1</td>
<td>3.0</td>
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</tbody>
</table>

Total 127.0 558.7 609.9 814.0

Source: S&P Dow Jones Indices. Data from 1995 to 2012. Past performance is not an indication of future results. This chart reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with back-tested performance.
Commodity indices with flexible signals have outperformed

Source: S&P Dow Jones Indices. Data from Dec 2011 to Oct 18, 2013. Past performance is not an indication of future results. This chart reflects hypothetical historical performance. Please see the Performance Disclosure at the end of this document for more information regarding the inherent limitations associated with backtested performance.
DJ-UBS Roll Select Commodity Index

For each commodity the index selects futures which indicate the highest implied roll yield, aiming to potentially capture the highest risk premium.

- The underlying principle behind Roll Select is to determine the point of greatest backwardation, or least contango, in each commodity’s futures curve and invest in the relevant futures contract representing that point.
- For all the underlying commodities in the DJ-UBS Commodity Index, Roll Select calculates the basis or curve slope for each eligible contract. This observation is performed on the fourth business day of each month and only those contracts that fall within the 9 month tenor limit are included in this process.
- Pairs of contracts are ranked in order of their annualized basis, with the pair with the greatest basis ranking first. The index invests in the longer dated contract of the top ranked pair. If two or more pairs have the same basis, then the longer dated contract of the shorter maturity pair is selected.

Note: Basis calculated for each commodity as (F1/F2 - 1) * 365/(D2 – D1), where F1 is the nearest futures contract and F2 is the next nearest futures contract, and D1 and D2 are the number of days until expiration of the respective contracts. Source: Bloomberg, UBS
S&P GSCI Dynamic Roll

Minimizing Rolling Costs

• Rank Order
  – Applied *before* the Dynamic Roll Algorithm
  – Determines the number of contracts in the optimal set
    • 1, 2, 3 or 4 contracts
  – Based on performance of contracts with highest implied roll yields*

• For example, a commodity with a rank order of 3 means the top three contracts ranked on the implied roll yields will be considered when determining the new contract month

* Rank Order is based on the performance results of models using data from 1995 through 2010.
S&P GSCI Dynamic Roll

Optimizing Roll Yield

• Dynamic Roll Algorithm
  – Run monthly to determine new contract
  – Eligible contracts
    • Dollar Value of Open Interest
    • 11 contracts or less
    • 48 months or less
  – Stage 1
    • Determines the optimal set
      – Based on rank order and implied roll yield*
  – Stage 2
    • Test whether index is currently holding a contract in the optimal set
      – If yes, continue to hold
      – If no, contract will be selected based on implied roll yield

*Please see Appendix B for implied roll yield calculation
Example - The Contract Selection
Forward Curve Crude Oil

Implied Roll Yield Calculation

- The Implied Roll Yield between two adjacent contracts, \( S_{i-1} \) and \( S_i \), in the Roll Matrix for a given month is calculated as follows:
- \( \text{IRY}(S_i) = \frac{\left( \frac{P_{i-1}}{P_i} - 1 \right)}{d} \),
- Where \( d \) is the number of months apart between \( S_{i-1} \) and \( S_i \), for \( i=1 \) to \( m \), and \( P_{i-1} \) and \( P_i \) are the contract prices for \( S_{i-1} \) and \( S_i \).

Example:

<table>
<thead>
<tr>
<th>Contract</th>
<th>Price</th>
<th>Contract 2</th>
<th>Contract 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>( S_1 )</td>
<td>( P_1 = 100 )</td>
<td>D</td>
<td>D</td>
</tr>
<tr>
<td>( S_2 )</td>
<td>( P_2 = 110 )</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>( S_3 )</td>
<td>( P_3 = 120 )</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\[
\text{IRY}(S_2) = -9.1\% \quad \text{IRY}(S_3) = -8.3\%
\]
Weight Modifications Have Been in High Demand

In order to preserve more liquidity while managing risk both from volatility and rolling, new strategies that focus on modifying weights are at the forefront.

- Forward curves states tend to be persistent when measured by the realized roll yields
- Relative steepness has also been persistent

The possible reason for the persistence in realized roll yield may be, as discussed in Till and Eagleeye (2005), “if there are inadequate inventories for a commodity, only its price can respond to equilibrate supply and demand, given that in the short run, new supplies of physical commodities cannot be mined, grown, and/or drilled. When there is a supply/usage imbalance in a commodity market, its price trend may be persistent….”

**Given the logic behind the persistence of term structures of commodity futures, the change in realized roll yield is a reasonable choice as an indicator to determine weight. It is an extension of implied roll yield, the signal for contract selection in the S&P GSCI Dynamic Roll.**

**Another indexing innovation afforded by the change in realized roll yield is that for the first time, a term structure measurement can be made on a broad basket or sector rather than only a single commodity.**
S&P GSCI Roll Weight Select
Change in Realized Roll Yield: An Illustration

The difference between the interpolated front and 1-month forward realized roll yield represents a measure of the curvature of the forward curve at the front end.

The highest gradient indicates greater contango
Many active managers use more than just commodities

A Commodity Trading Advisor (CTA) is an individual or organization which, for compensation or profit, advises others as to the value of or the advisability of buying or selling futures contracts, options on futures, or retail off-exchange forex contracts.¹

What does this mean?

A CTA registers with the National Futures Association (NFA) so that it is regulated by the U.S. Commodity Futures Trading Commission.

WHY IS THIS SO CONFUSING?!

The word “commodity” in CTA doesn’t reflect what the strategies are trading! The CTA’s are trading any futures contracts including ones on stocks, currencies, interest rates, fixed income, and commodities.

¹ Source: http://www.nfa.futures.org/nfa-registration/cta/index.html
General characteristics of active versus passive strategies

<table>
<thead>
<tr>
<th></th>
<th>Commodity Indices</th>
<th>Active Commodities</th>
<th>CTA’s</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Return Type</strong></td>
<td>Passive</td>
<td>Passive + Active or Active only</td>
<td>Passive + Active or Active only</td>
</tr>
<tr>
<td><strong>Direction</strong></td>
<td>Long-only</td>
<td>Long or Short</td>
<td>Long or Short</td>
</tr>
<tr>
<td><strong>Constituents</strong></td>
<td>Commodity Futures Contracts</td>
<td>Commodity Futures, Swaps, Spreads, or Private Deals</td>
<td>Futures only of all types including stocks, bonds, currencies, interest rates, and commodities</td>
</tr>
<tr>
<td><strong>Strategy</strong></td>
<td>Rules-based</td>
<td>Numerous</td>
<td>Systematic or Discretionary</td>
</tr>
<tr>
<td><strong>Leverage</strong></td>
<td>None</td>
<td>Maybe</td>
<td>Maybe</td>
</tr>
<tr>
<td><strong>Liquidity</strong></td>
<td>Higher</td>
<td>Variable</td>
<td>Variable</td>
</tr>
<tr>
<td><strong>Transparency</strong></td>
<td>Higher</td>
<td>Lower</td>
<td>Lower</td>
</tr>
<tr>
<td><strong>Fees</strong></td>
<td>Lower</td>
<td>Higher</td>
<td>Higher</td>
</tr>
</tbody>
</table>
The S&P SGMI intends to reflect price trends of the global futures markets by going long or short in each constituent monthly based on the direction of the constituent’s historical price trend.

• Time-series regression run on each component to find historical price trend
  – Iterative process to find the most current, statistically relevant trend
    • Begin with the most recent 22 days of data and add 5 more historical days progressively until trend is detected
  – The trend is set when the F-test shows variance of the historical prices are different from the variance of the residuals of the OLS

• Monthly signals based on slope of the regression
  – Positive slope generates long signal
  – Negative slope generates short signal
  – Flat if slope is exactly equal to zero*

*This has never happened in the back-tested results using slope up to 15 decimals
S&P SGMI: Position direction example

Linear regression of constituent returns against time

The cumulative return daily is calculated, but autocorrelation may be present so return data alone is not sufficient to produce a valid model with a constant mean and variance.

To check for stability, the hypothesis that two variances are equal is tested by an F-test.

1. the variance of the daily returns
2. the variance of residuals of an OLS linear regression of the cumulative return on time.

Equality of variances indicates that the linear regression model is a good fit for the data.

- To correct for oversensitivity, the variance of the residuals are adjusted by a factor of \((1-\rho^2)\), where \(\rho\) is the autocorrelation lag at 1.
- The autocorrelation of residuals is calculated as follows:

\[
\rho = \frac{1}{(n-1)} \sum_{t=1}^{n-1} \frac{(y_t - \mu)(y_{t+1} - \mu)}{\text{Var}(y_t)} + \frac{1}{n}
\]

\[
F = \frac{\text{Var(residuals)} \cdot (1-\rho^2)}{\text{Var(FD)}}
\]

where:
- \(y_t\) = the residual at time \(t\)
- \(\mu\) = 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.

\(FD\) = the first differences of the daily cumulative percentage return series used in the regression.

\(residuals\) = residuals of the OLS.
S&P SGMI: Position direction example

The iterative process is as follows:
Based on a 95% confidence interval and continuous cumulative component returns, the iterative testing process is run to establish a slope.

The F-Inverse function \((F_{\text{inv}})\) starts at the present and works backwards until:

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

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.

Once \(F > F_{\text{inv}}(95\%, n-3, n-2)\), 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.
S&P SGMI: An illustration

**Iteration 1 - 22 Days Historical Data**
Shows Negative Trend

**Iteration 2 - 27 Days Historical Data**
Still Shows Negative Trend

**Iteration 3 - 32 Days Historical Data**
Shows Positive Trend

**Result** – Use Iteration 3 of 32 Days Historical Data
Longest Stable Trend is Positive

**Iteration 4 - 37 Days Historical Data**
Trend is Unstable – 2 lines describe the trend better than 1 line
S&P SGMI: Position direction example

- Average number of days ranges from 158 (Corn) – 350 (S&P 500)
- Maximum number of days ranges from 432 (Corn) – 2287 (Gold)
- Minimum number of days ranges from 22 (Nikkei 225) – 62 (AD, CD, CO, SP)
Active strategies have many choices of fund structures and implementation options

- **Long-only products**
  - utilize curve strategies
  - under/overweights to commodity sectors and individual commodities

- **Long-neutral products**
  - tactically allocate to cash

- **Long-biased products**
  - allow limited shorting

- **Long-short products**
  - benchmark-agnostic and seek absolute returns
  - use spread trades and outright long or short directional bets

- **Specialist managers**
  - limit investments to specific sectors

- **Thematic strategies**
  - employ long-term macro views on commodity sectors

Source: Russell Investments // Active Commodity Investing. Russell Research by Lee Keyser, Research Analyst
Risk factors to consider in active commodity investing

- **Liquidity**
  - Large position sizes
  - Over-the-counter derivatives

- **Collateral management**
  - Invest collateral opportunistically
  - May use leverage

- **Credit/counterparty risk**
  - May use custom derivatives

- **Speculative limits**
  - Size and implementation strategies may be disrupted

- **Delivery risk**
  - Non-commercial players may get “squeezed” during delivery

- **Model/analytics risk**
  - Many risk systems only handle stocks and bonds appropriately

Source: Russell Investments // Active Commodity Investing. Russell Research by Lee Keyser, Research Analyst
Thank You

Contact Us

Jodie M. Gunzberg, CFA
Head of Commodity Indices
Performance Disclosure

It is not possible to invest directly in an S&P index. Past performance of an index is not an indication of future results.

S&P acquired the GSCI from Goldman Sachs on February 2, 2007 and it was subsequently renamed the S&P GSCI. Goldman Sachs began first publishing the GSCI related indices in 1991 but has calculated the historical value of the GSCI beginning January 2, 1970 based on actual prices from that date forward and the selection criteria, methodology and procedures in effect during the applicable periods of calculation (or, in the case of all calculation periods prior to 1991, based on the selection criteria, methodology and procedures adopted in 1991). The GSCI has been normalized to a value of 100 on January 2, 1970, in order to permit comparisons of the value of the GSCI to be made over time.

The inception dates for the S&P GSCI is May 1, 1991 at the market close.
The inception date for the S&P GSCI Enhanced Index is March 28, 2007 at the market close.
The inception date for the S&P GSCI 3-Month Forward Index is February 3, 2008 at the market close.
The inception date for the S&P GSCI Equal Weight Select Index is September 9, 2010 at the market close.
The inception date for the S&P GSCI Covered Call Select Index is October 7, 2010 at the market close.
The inception date for the S&P Dynamic Futures Index (DFI) is February 19, 2010 at the market close.
The inception date for the S&P/BGCantor 7-10 Years U.S. Treasury Bond Index is February 7, 2009 at the market close.
The inception date for the S&P World Commodity Index (WCI) is May 5, 2010 at the market close.
The inception date for the S&P GSCI Dynamic Roll Index is January 27, 2011 at the market close.
The inception date for the S&P Systematic Global Macro Index (SGMI) is August 9, 2011 at the market close.

The indices were not in existence prior to that date and all data presented prior to that date are back-tested. The back-test calculations are based on the same methodology that was in effect when the indices were officially launched. Complete index methodology details are available at www.indices.standardandpoors.com.

Prospective application of the methodology used to construct the S&P GSCI, S&P GSCI Enhanced Index, S&P GSCI 3-Month Forward Index, S&P Dynamic Futures Index (DFI), S&P Commodity Trading Strategy Index (CTSI), S&P/BGCantor 7-10 Years U.S. Treasury Bond Index, and S&P World Commodity Index (WCI) may not result in performance commensurate with the back-test returns shown. The back-test period does not necessarily correspond to the entire available history of the indices. Please refer to the methodology paper for the indices, available at www.standardandpoors.com for more details about the indices, including the manner in which they are rebalanced, and the timing of such rebalancing, criteria for additions and deletions and index calculation. The indices are rules based, although the Index Committee reserves the right to exercise discretion, when necessary.

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