What Is the GSCI?

- The design and construction of the Goldman Sachs Commodity Index (GSCI).

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The purpose of this paper is to provide an explanation of the design and implementation of the GSCI. *The GSCI Manual*, with its addenda, is the definitive source for the procedures for calculating the GSCI indices.

Executive Summary

The GSCI* is designed to provide investors with a reliable and publicly available benchmark for investment performance in the commodity markets comparable to the S&P 500 or FT equity indices. As such, the GSCI is a composite index of commodity sector returns, representing an unleveraged, long-only investment in commodity futures that is broadly diversified across the spectrum of commodities. The returns are calculated on a fully-collateralized basis with full reinvestment. The combination of these attributes provides investors with a representative and realistic picture of realizable passive returns attainable in the commodities markets.

Three GSCI indices are published: the excess return index, the total return index, and the spot index. The GSCI excess return index measures investor returns from an uncollateralized commodity futures investment, while the total return index, which is the index comparable to the S&P 500 (with dividend reinvestment), measures investor returns from a fully-collateralized commodity futures investment. The GSCI spot index measures commodity price levels, not investor returns.

This report describes the characteristics and design of the GSCI as an economic indicator and as a benchmark for investment performance. Further, the construction of the GSCI is illustrated with detailed calculations for sample one- and two-commodity indices. The construction then generalizes easily to the multi-commodity case of the actual GSCI. Replication of the excess return index through the use of the GSCI futures contracts is also covered.

In Summary, the GSCI is:

- A reliable and publicly available benchmark for commodity investment
- Comparable to the S&P 500 or FT equity indices (with dividend reinvestment)
- World-production weighted, the analogue to market capitalization weighting for equities
- Well-diversified, comprised of a broad range of liquid commodity futures
- Designed for easy and cost-efficient investment implementation and arbitrage

* Note that, in this report, GSCI refers to the GSCI total return index unless otherwise indicated.

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Goldman Sachs Commodity Index (GSCI)

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Individual components qualify for inclusion in the GSCI on the basis of liquidity and are weighted by their respective world production quantities. The principles behind the construction of the index are public and designed to allow easy and cost-efficient investment implementation. Possible means of implementation include the purchase of GSCI-related instruments, such as the GSCI futures contract traded on the Chicago Mercantile Exchange (CME) or over-the-counter derivatives, or the direct purchase of the underlying futures contracts.

Economic Weighting

The GSCI is world-production weighted; the quantity of each commodity in the index is determined by the average quantity of production in the last five years of available data. Such weighting provides the GSCI with significant advantages, both as an economic indicator and as a measure of investment performance.

For use as an economic indicator, the appropriate weight to assign each commodity is in proportion to the amount of that commodity flowing through the economy (i.e., the actual production or consumption of that commodity). For instance, the impact that doubling the price of corn has on inflation and on economic growth depends directly on how much corn is used (or produced) in the economy.

From the standpoint of measuring investment performance, production-weighting is not only appropriate but vital. The key to measuring investment performance in a representative fashion is to weight each asset by the amount of capital dedicated to holding that asset. In equity markets, this representative measurement of investment performance is accomplished through weighting indices by market capitalization.

For commodities, there is no direct counterpart to market capitalization. The problem is that commodities, and the related price risks, are held in a variety of ways – long futures positions, over-the-counter investments, long-term fixed-price purchasing contracts, physical inventory at the producer, etc. – making a complete accounting of capital dedicated to holding commodities from the time they are produced to the time they are consumed infeasible. A simple way to achieve a close analogue to true market capitalization, abstracting from differences in inventory patterns, is to note that the net long position of the economy is proportional to the quantity produced – hence, production weighting.

A Broad Spectrum of Commodities

The GSCI contains as many commodities as possible, with the rules excluding commodities only to retain liquidity and investability in the underlying futures markets. Currently, the GSCI contains 22 commodities from all commodity sectors: four energy products, nine metals, and nine agricultural products. This broad range of constituent commodities provides the GSCI with a high level of diversification both across subsectors and within each subsector. This diversity minimizes the effects of highly idiosyncratic events, which have large implications for the individual commodity markets, but are muted when aggregated to the level of the GSCI.

Together, the diversity of its constituent commodities and their economic weighting allow the GSCI to respond in a stable way to world economic growth, even as the composition of global growth changes through time. When world growth is dominated by industrialized economies, the metals sector of the GSCI generally responds more than the agricultural components. Similarly, when emerging markets dominate world growth, agricultural and petroleum-based commodities generally respond the most. Thus, for example, an index that significantly underweights agriculture would significantly underperform in a global

economy with weak OECD and strong emerging markets growth, much like a stock index that only contained industrials would provide a misleading picture of a service-led economy.

Liquidity Constraints and Return Calculations

Individual commodities are screened by liquidity for inclusion in the GSCI. The eligibility requirements are designed to promote cost-effective implementation and true investability. Underlying liquidity eases hedging of derivative products and investing in subsector or individual commodity overlays. Furthermore, liquidity in the underlying futures markets facilitates the discovery of true market prices for the components of the GSCI.

GSCI returns are calculated (as will be discussed in detail in the next section) based on the arithmetic average of stable long positions in futures contracts. This methodology, along with the liquidity in the underlying markets, allows easy implementation of the portfolio of futures contracts that the GSCI represents. These characteristics of the GSCI are designed to allow for efficient and relatively inexpensive arbitrage of publicly-traded GSCI-related instruments such as the CME futures contract.

GSCI Components and Weights

Currently, 22 commodities meet the eligibility requirement for the GSCI. A list of these components and their dollar weights in the GSCI as of January 5, 1996 (the day on which the 1996 production weights of the GSCI took effect), organized by subsector, is presented in Table 1.

Table 1: GSCI Components and Weights

(5-Jan-96)

Subsector Commodity	Dollar Weight (%)
Energy	**55.28**
Crude Oil	16.76
Unleaded Gas	10.79
Heating Oil	10.16
Natural Gas	17.58
Industrial Metals	**7.49**
Aluminum	3.28
Copper	2.52
Lead	0.34
Nickel	0.57
Tin	0.13
Zinc	0.64
Precious Metals	**2.64**
Gold	2.07
Platinum	0.34
Silver	0.23
Agriculture	**24.44**
Wheat	8.99
Corn	6.05
Soybeans	2.56
Cotton	2.90
Sugar	2.51
Coffee	1.17
Cocoa	0.26
Livestock	**10.16**
Live Cattle	6.81
Live Hogs	3.35

Construction of the GSCI

Three GSCI indices are published: excess return, total return, and spot. The excess return index measures the returns accrued from investing in uncollateralized nearby commodity futures, the total return index measures the returns accrued from investing in fully-collateralized nearby commodity futures, and the spot index measures the level of nearby commodity prices. Thus, the excess return and total return indices provide useful representations of returns available to investors from investing in the GSCI. In fact, the total return (i.e., the return on the GSCI total return index) is the measure of commodity returns that is completely comparable to returns from a regular investment in the S&P 500 (with dividend reinvestment) or a government bond, while the return on the excess return index is comparable to the return on the S&P 500 above cash.

The GSCI Excess Return Index

Passive Portfolios

By design, the GSCI reflects a passive portfolio of long positions in futures. However, unlike a passive equity portfolio, a passive futures portfolio requires regular transactions, for the simple reason that futures expire. Thus, the futures portfolio represented by the GSCI is, in this way, comparable to a bond portfolio of a specific duration.

In the GSCI's case, the maturity of choice is the nearby futures contract (i.e., the contract nearest to

expiration). Futures contracts near to expiration are rolled forward (i.e., exchanged for futures contracts with the next applicable expiration date) at the beginning of their expiration months.

Many commodities, like those in the energy and industrial metals sectors, have liquid futures contracts that expire every month. Therefore, these commodities are rolled forward every month. Other commodities, most notably agricultural and livestock products, only have a few contract months each year that trade with sufficient liquidity. Thus, these commodities, with futures that expire less frequently, roll forward less frequently than every month. Table 2 contains a listing of the expiration months included in the GSCI in 1996.

The Roll Period

The rolling forward of the underlying futures contracts in the excess return index portfolio occurs once each month on the 5th through 9th business days (the roll period)[1]. As explained above, some of the underlying commodity contracts expire in the next month and thus need to be rolled forward. The simplest way to think of the process is as rolling from one basket of nearby futures (the first nearby basket) to a basket of futures contracts that are further from expiration (the second nearby basket). The GSCI is calculated as though these rolls occur at the end of each day during the roll period at the daily settlement prices.

The portfolio is shifted from the first to the second nearby baskets at a rate of 20% per day for the five days of the roll period. Until just before the end of the 5th business day, the entire GSCI portfolio consists of the first nearby basket of commodity futures. At the end of the 5th business day, the portfolio is adjusted so that 20% of the contracts held are in the second nearby basket (i.e., a basket of future contracts that are farther from maturity), with 80% remaining the first nearby basket.

The roll process continues on the 6th, 7th, and 8th business days, with relative weights of first to second nearby baskets of 60%/40%, 40%/60%, and 20%/80%. At the end of the 9th business day, the last of the old first nearby basket is exchanged, completing the roll and leaving the entire portfolio in what we have been calling the second nearby basket. At this time, this former second nearby basket becomes the new first nearby basket, and a new second nearby basket is formed (with futures maturities further in the future) for use in the next month's roll.

Rolls and Holding Periods

All of the rolls occur at the end of the business day. Therefore, on the 1st through 4th business days and throughout the day (until the end of the day) on the 5th business day, the GSCI portfolio consists of a single basket, the first nearby basket. Therefore, even though the 5th business day is the first day of the roll, the portfolio return for the 5th business day is based on the portfolio construction of the evening before (i.e. the first nearby basket).

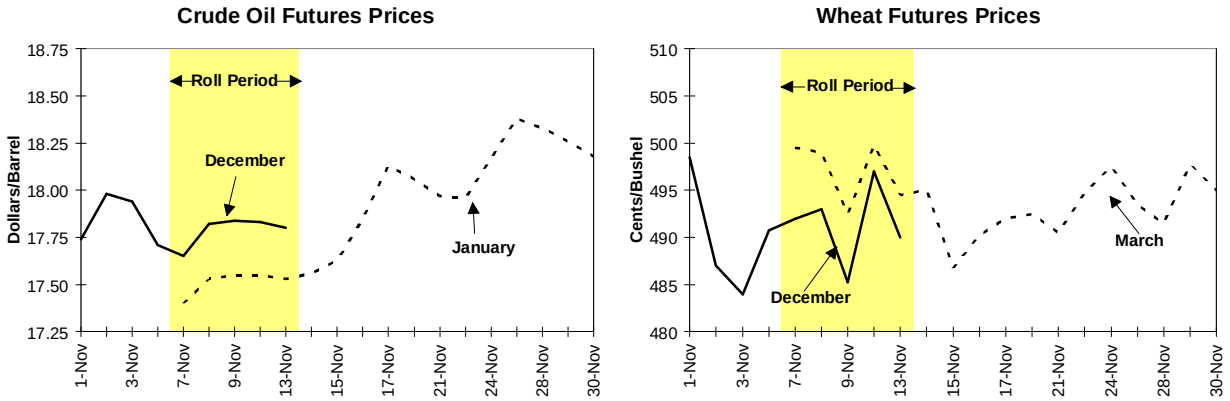
On the 6th business day, the returns are generated by the portfolio constructed at the end of the 5th business day (i.e., 80% first nearby basket and 20% second nearby basket). The roll continues, until on the 10th business day (the last roll occurring at the end of the 9th business day), the returns are generated by 100% of the new first nearby basket, which is held until the beginning of the next month's roll period. Note that from the end of the 5th business day to the end of the 9th business day is the only period during which the GSCI consists of a mixture of the two baskets and hence may contain more than one futures maturity per commodity.

Quantity versus Value Weights

The last key point to be made about the roll process is to specify exactly what the 80%/20% or other relative splits between nearby baskets mean. The roll percentages refer to contracts or quantities, not value. Taking the first day of the roll as an example, just before the roll takes place at the end of the day, the GSCI consists of the first nearby basket. That portfolio, constructed the night before and held throughout the 5th business day, has a dollar value. For the roll, that dollar value is distributed across the first and second nearby baskets such that the *number of contracts or the quantity* of the first nearby basket is 80% of the total and the *quantity* held of the second nearby basket is 20% of the total.

[1]Some events like limit moves and market disruptions may extend the roll period and require more complete treatment. See *The GSCI Manual: A Guide to the Goldman Sachs Commodity Index*, December 1995.

Figure 1: Crude Oil and Wheat Futures Prices



The dollar value held of each nearby basket can then be calculated from those quantity weights by multiplying them by the prices of the futures contracts contained in each basket. As the baskets contain futures with different maturities for some of the commodities, the prices are generally close but not exactly the same. Hence, the percentage of the portfolio value (i.e., dollar weight) held in each basket is generally close to, but not exactly equal to, the 80%/20% split specified for the quantities.

The world-production weighting of the GSCI is accomplished by keeping the quantity weights of the individual commodities within each basket proportional to world production weights, which are averages of historical production levels and are generally updated every year.

Recap

The GSCI excess return index captures the returns from a passive, world-production-weighted portfolio of uncollateralized long futures positions. The necessary rolling forward of the underlying futures contracts is accomplished every month over five days in a gradual process.

Two Detailed Examples of the Excess Return Index

To illustrate the construction of the GSCI excess return index, we have constructed two sample indices: one with only crude oil, the other with crude oil and wheat. Graphs of the relevant futures prices for these two commodities for November 1995 are shown in Figure 1, with the data behind these charts plus the 1995 world production weights shown in Table 3. The prices and weights are the only data we will need to construct our sample indices. The roll period is shaded in these graphs and in the following tables.

Table 3: Crude Oil and Wheat Futures Prices and World Production Weights

	Futures Prices (at end of day)			
	Crude Oil ($/barrel)		Wheat (cents/bushel)	
Date	December	January	December	March
1-Nov-95	17.74	-	498.50	-
2-Nov-95	17.98	-	487.00	-
3-Nov-95	17.94	-	484.00	-
6-Nov-95	17.71	-	490.75	-
7-Nov-95	17.65	17.40	492.00	499.50
8-Nov-95	17.82	17.53	493.00	499.00
9-Nov-95	17.84	17.55	485.25	492.50
10-Nov-95	17.83	17.55	497.00	499.75
13-Nov-95	17.80	17.53	490.00	494.50
14-Nov-95	-	17.56	-	495.00
15-Nov-95	-	17.63	-	486.75
16-Nov-95	-	17.85	-	490.25
17-Nov-95	-	18.13	-	492.00
20-Nov-95	-	18.06	-	492.50
21-Nov-95	-	17.97	-	490.50
22-Nov-95	-	17.96	-	494.75
24-Nov-95	-	-	-	497.50
27-Nov-95	-	18.38	-	493.50
28-Nov-95	-	18.33	-	491.50
29-Nov-95	-	18.26	-	497.75
30-Nov-95	-	18.18	-	495.00
1995 World Production Weights (a):				
	9004.4630 Million Barrels		198.3264 Hundred Million Bushels	

(a) Based on world production averages from 1987-1991, the most recent five-year period for which data was available.

For crude oil, the December contract is the nearby contract that is included in the GSCI for the first few days of November, then crude oil is rolled into the January contract. For wheat, the first contract is also December, but then wheat is rolled into the March contract since fewer wheat contract months are liquid enough to be included in the index. Crude oil futures are quoted in dollars per barrel, and wheat futures are quoted in cents per bushel.

Crude Oil-Only Excess Return Index

To illustrate the construction of a simple commodity excess return index, we have calculated an index for November 1995 that contains only one commodity – crude oil. We will now walk through the calculations in detail.

The overall index construction process begins with constructing first and second nearby baskets of crude oil futures to use in the index. Before and after the roll period, the portfolio represented by the excess return index consists of only the first nearby basket. During the roll period, when we roll the portfolio forward from the first nearby basket to the second, the portfolio represented by the index is a combination of the two baskets, with the relative weight of the first nearby basket decreasing throughout the roll period as more of the futures are rolled forward.

Once we have constructed the baskets of nearby futures, we calculate the return on those baskets, determine the weight of each basket in the index, calculate the return on the portfolio represented by the index, and calculate the index value from this return.

We set our index to 100 on the start date (November 1, 1995 for our sample index; January 2, 1970 for the GSCI). In early November, because crude oil is the only commodity in this sample index, the first nearby basket consists solely of December crude and the second nearby basket consists solely of January crude. (The world-production weighting of the commodities becomes relevant to the basket construction when there is more than one commodity in the index.)

Calculating the basket returns is simple when there is only one commodity in the index. The return on the first nearby basket is the return on the December crude futures contract and the return on the second nearby basket is the return on January crude.

For example, the daily return (Rtn) on the first nearby basket (B1) on November 2 is calculated as follows[2]:

$$\begin{aligned}
&\mathrm{Rtn}_{\mathrm{B1}}(\mathrm{Nov2}) \\
&= \mathrm{Rtn}_{\mathrm{DEC_Crude}}(\mathrm{Nov2}) \\
&= \frac{\mathrm{Price}_{\mathrm{DEC_Crude}}(\mathrm{Nov2})}{\mathrm{Price}_{\mathrm{DEC_Crude}}(\mathrm{Nov1})} - 1 \\
&= \frac{17.98}{17.74} - 1 \\
&= 0.0135 \text{ or } 1.35\ \%.
\end{aligned}$$

All other contract returns are calculated in the same manner and can be found, along with other information and interim results necessary for the construction of the crude oil-only excess return index, in Table 4.

Now that we have the returns for both baskets, we need to construct returns for the entire portfolio represented by the crude oil-only excess return index. Before and after the roll period, this calculation is trivial; the portfolio only contains the first nearby basket, so the portfolio return is the return on the first nearby basket.

Therefore, for November 2, (the first business day of November) the portfolio excess return is the 1.35% we calculated above, and for November 14, the 10th business day of the month, the portfolio excess return is 0.17%, the first nearby basket return for that day (from Table 4). Note that, in Table 4, the fact that the portfolio consists of only the first nearby basket is indicated by the 100% in the portfolio weight column for the first nearby basket.

[2] Note that this and all other calculations in this paper are for illustrative purposes only and may contain rounding error. For a description of the level of significant figures/rounding in the official GSCI calculations, see *The GSCI Manual: A Guide to the Goldman Sachs Commodity Index*, December 1995.

Table 4: Crude Oil-Only Excess Return Index

	Crude Oil												
	First Nearby Basket						Second Nearby Basket						
Date	Contract Month		Daily Rtn (%)	Total Value	Excess Rtn (%)	Portfolio Wt (%)	Contract Month		Daily Rtn (%)	Total Value	Excess Rtn (%)	Portfolio Wt (%)	Portfolio Excess Rtn (%)	Excess Return Index
	(during day)	(at end of day)	(since day before)	(at end of day)	(since day before)	(at end of day)	(during day)	(at end of day)	(since day before)	(at end of day)	(since day before)	(at end of day)	(since day before)	(at end of day)
1-Nov-95	Dec	Dec		159,739.1736		100.00	Jan	Jan				0.00		100.00
2-Nov-95	Dec	Dec	1.35	161,900.2447	1.35	100.00	Jan	Jan				0.00	1.35	101.35
3-Nov-95	Dec	Dec	-0.22	161,540.0662	-0.22	100.00	Jan	Jan				0.00	-0.22	101.13
6-Nov-95	Dec	Dec	-1.28	159,469.0397	-1.28	100.00	Jan	Jan				0.00	-1.28	99.83
7-Nov-95	Dec	Dec	-0.34	158,928.7720	-0.34	80.23	Jan	Jan		156,677.6562		19.77	-0.34	99.49
8-Nov-95	Dec	Dec	0.96	160,459.5307	0.96	60.39	Jan	Jan	0.75	157,848.2364	0.75	39.61	0.92	100.41
9-Nov-95	Dec	Dec	0.11	160,639.6199	0.11	40.39	Jan	Jan	0.11	158,028.3257	0.11	59.61	0.11	100.52
10-Nov-95	Dec	Dec	-0.06	160,549.5753	-0.06	20.25	Jan	Jan	0.00	158,028.3257	0.00	79.75	-0.02	100.50
13-Nov-95	Dec	Jan	-0.17	157,848.2364	-0.17	100.00	Jan	Feb	-0.11		-0.11	0.00	-0.12	100.37
14-Nov-95	Jan	Jan	0.17	158,118.3703	0.17	100.00	Feb	Feb				0.00	0.17	100.55
15-Nov-95	Jan	Jan	0.40	158,748.6827	0.40	100.00	Feb	Feb				0.00	0.40	100.95
16-Nov-95	Jan	Jan	1.25	160,729.6646	1.25	100.00	Feb	Feb				0.00	1.25	102.21
17-Nov-95	Jan	Jan	1.57	163,250.9142	1.57	100.00	Feb	Feb				0.00	1.57	103.81
20-Nov-95	Jan	Jan	-0.39	162,620.6018	-0.39	100.00	Feb	Feb				0.00	-0.39	103.41
21-Nov-95	Jan	Jan	-0.50	161,810.2001	-0.50	100.00	Feb	Feb				0.00	-0.50	102.89
22-Nov-95	Jan	Jan	-0.06	161,720.1555	-0.06	100.00	Feb	Feb				0.00	-0.06	102.84
24-Nov-95	Jan	Jan	0.00	161,720.1555	0.00	100.00	Feb	Feb				0.00	0.00	102.84
27-Nov-95	Jan	Jan	2.34	165,502.0299	2.34	100.00	Feb	Feb				0.00	2.34	105.24
28-Nov-95	Jan	Jan	-0.27	165,051.8068	-0.27	100.00	Feb	Feb				0.00	-0.27	104.95
29-Nov-95	Jan	Jan	-0.38	164,421.4944	-0.38	100.00	Feb	Feb				0.00	-0.38	104.55
30-Nov-95	Jan	Jan	-0.44	163,701.1373	-0.44	100.00	Feb	Feb				0.00	-0.44	104.10

This is even true on November 7, the first day of the roll. At the end of the day on November 6, the excess return portfolio consists solely of the first nearby basket, which is then held throughout the day on November 7. Hence, the portfolio return for November 7 is the return for the first nearby basket, or -0.34%. Then, at the end of the day on November 7, the rolling begins, and the weight in the first nearby basket is reduced as the second nearby basket is added.

During the roll period, we need to determine the relative value weights of the first and second nearby baskets in order to weight the basket returns when calculating the entire portfolio return. The first day for which we need to do this is the end of November 7. As discussed in the previous section, on the first day of the roll, the portfolio is adjusted so that 80% of the quantity of contracts are in the first nearby basket and 20% are in the second nearby basket. We need to convert these quantity percentages into dollar weights.

The easiest way to do so is to first calculate the total dollar values of both baskets. We use world production weights based on a five-year average of world production quantities to determine how much crude oil is in each basket. These world production weights (WPWs) are quantities, so we multiply them by the futures prices to get the values of crude oil futures (and hence of the baskets themselves).

At the end of the day on November 7, the first nearby basket contains December crude, so the total value of the first nearby basket (TV1) is

$$\begin{aligned} &TV1(\text{Nov7}) \\ &= WPW_{\text{Crude}} * Price_{\text{DEC\_Crude}}(\text{Nov7}) \\ &= 9004.4630 * 17.65 \\ &= 158{,}928.7720. \end{aligned}$$

At the same time, the second nearby basket consists of January crude oil, so the total value of the second nearby basket (TV2) is

$$\begin{aligned} &TV2(\text{Nov7}) \\ &= WPW_{\text{Crude}} * Price_{\text{JAN\_Crude}}(\text{Nov7}) \\ &= 9004.4630 * 17.40 \\ &= 156{,}677.6562. \end{aligned}$$

The exact portfolio weight for the first nearby basket on November 7 is 80% of the total value of the first nearby basket as a fraction of the total value of the index - that is, 80% of the total value of the first nearby basket plus 20% of the total value of the second nearby basket. Because the total values of the first and second nearby baskets are very similar, the portfolio dollar weights are nearly 80%/20%.

The exact calculation for the portfolio weight of the first nearby basket (PW1) on November 7 (at the close of business) is

$$\begin{aligned} &PW1(\text{Nov7}) \\ &= \frac{80\% * TV1(\text{Nov7})}{80\% * TV1(\text{Nov7}) + 20\% * TV2(\text{Nov7})} \\ &= \frac{80\% * 158{,}928.7720}{80\% * 158{,}928.7720 + 20\% * 156{,}677.6562} \\ &= 80.23\,\%. \end{aligned}$$

Because there are only two baskets, the portfolio weight for the second nearby basket on November 7 can either be calculated from the first nearby basket portfolio weight or from the total values of the nearby baskets:

$$\begin{aligned} &PW2(\text{Nov7}) \\ &= 100\% - PW1(\text{Nov7}) \\ &= 100\% - 80.23\% \\ &= 19.77\,\%. \end{aligned}$$

$$PW2(\text{Nov7}) = \frac{20\% * TV2(\text{Nov7})}{80\% * TV1(\text{Nov7}) + 20\% * TV2(\text{Nov7})}$$

$$= \frac{20\% * 156{,}677.6562}{80\% * 158{,}928.7720 + 20\% * 156{,}677.6562}$$

$$= 19.77\ \%.$$

All of the portfolio weights for each of the baskets can be found in Table 4.

Now that we have the portfolio weight and the excess return for each nearby basket, the excess return on the index portfolio is just the weighted average of the returns on the constituent baskets:

$$\text{Rtn}_{\text{Excess}}(\text{date}) = PW1(\text{daybefore}) * \text{Rtn}_{B1}(\text{date}) + PW2(\text{daybefore}) * \text{Rtn}_{B2}(\text{date}).$$

Note that the portfolio weights used are as of the end of the day before the date for which the return is being calculated. As explained above, the portfolio held throughout each business day is formed at the close of the prior business day.

Because November 7 is the fifth business day of the month and thus the first day of the roll period, the return calculations on November 7 and 8 merit special attention. At the end of the day on November 6, all of the index value resides in the first nearby basket of futures. Hence, all of the return for November 7 comes from the first nearby basket of futures. In our notation, that means that the portfolio weight of the first nearby basket (PW1) is 100% for November 6.

At the end of the day on November 7, about 20% of the index portfolio is shifted to the second nearby basket. Thus, the excess return for November 8 is a combination of the returns on the first and second nearby baskets of futures. That is, the portfolio weights for the first and second nearby baskets for November 7 are 80.23% and 19.77%, respectively.

The excess return calculations for these two days are:

$$\text{Rtn}_{\text{Excess}}(\text{Nov7}) = PW1(\text{Nov6}) * \text{Rtn}_{B1}(\text{Nov7}) + PW2(\text{Nov6}) * \text{Rtn}_{B2}(\text{Nov7})$$

$$= 100\% * -0.34\% + 0\% * \text{Rtn}_{B2}(\text{Nov7})$$

$$= -0.34\ \%.$$

$$\text{Rtn}_{\text{Excess}}(\text{Nov8}) = PW1(\text{Nov7}) * \text{Rtn}_{B1}(\text{Nov8}) + PW2(\text{Nov7}) * \text{Rtn}_{B2}(\text{Nov8})$$

$$= 80.23\% * 0.96\% + 19.77\% * 0.75\%$$

$$= 0.92\ \%.$$

The final step in the calculation process is creating an index from the excess returns we have calculated. The index value on any day is simply yesterday's value plus the return accrued over the day. Hence, the index value is calculated as follows:

$$\text{Index}_{\text{ER}}(\text{date}) = \text{Index}_{\text{ER}}(\text{daybefore}) * (1 + \text{Rtn}_{\text{Excess}}(\text{date})).$$

For example, on November 2, the excess return index is

$$\text{Index}_{\text{ER}}(\text{Nov2}) = \text{Index}_{\text{ER}}(\text{Nov1}) * (1 + \text{Rtn}_{\text{Excess}}(\text{Nov2}))$$

$$= 100 * (1 + 0.0135)$$

$$= 101.35.$$

The crude oil excess return index values for the rest of the days are calculated in exactly the same way. Table 4 contains all of the weights, returns, and index values for the month of November for the crude oil-only excess return index.

Crude Oil and Wheat Excess Return Index

To illustrate the construction of a two-commodity excess return index, we have calculated a crude oil and wheat index for November 1995. The construction process for two commodities differs from the process for one commodity only because of some additional complexity in the construction of the first and second nearby baskets. After that, the excess return index is calculated from the first and second nearby basket returns and rolled forward in the same way described for the crude oil-only index above.

Each nearby basket contains one expiration date each of crude oil and wheat. In early November, December crude is in the first nearby basket and January crude is in the second nearby basket. For wheat, December wheat is in the first nearby basket and March wheat is in the second nearby basket.

Thus, the first nearby basket of futures contains December crude oil and December wheat. The quantity weight for each commodity in the sample index, as well as in the GSCI, is the commodity's world production weight (WPW).

To calculate the excess return on the basket as a whole, we need to know the relative dollar weights of the crude and wheat contracts within the first nearby basket (denoted BW1 for basket weight 1) the day before (at settlement). Therefore, we multiply the world-production (quantity) weights by the futures prices to get the values of crude and wheat within the basket. To get the basket (dollar) weight for each commodity, we divide its value by the total value of the basket, which is just the sum of the values of all of the commodities in the basket.

At the end of the day on November 1, the total value of the first nearby basket (TV1) is calculated as follows:

$$\begin{aligned} &TV1(\text{Nov1}) \\ &= WPW_{\text{Crude}} * Price_{\text{DEC\_Crude}}(\text{Nov1}) \\ &\quad + WPW_{\text{Wheat}} * Price_{\text{DEC\_Wheat}}(\text{Nov1}) \\ &= 9004.4630 * 17.74 + 198.3264 * 498.50 \\ &= 258{,}694.8840. \end{aligned}$$

The weight of crude oil within the first nearby basket ($BW1_{\text{Crude}}$) is the value of crude divided by the total basket value:

$$\begin{aligned} &BW1_{\text{Crude}}(\text{Nov1}) \\ &= \frac{WPW_{\text{Crude}} * Price_{\text{DEC\_Crude}}(\text{Nov1})}{TV1(\text{Nov1})} \\ &= \frac{9004.4630 * 17.74}{258{,}604.8840} \\ &= 61.77\,\%. \end{aligned}$$

Because there are only two commodities in this sample index, the basket weight of wheat can be calculated in two ways. First, in a direct parallel to the calculation above for crude, the basket weight of wheat can be calculated from wheat's WPW and price:

$$\begin{aligned} &BW1_{\text{Wheat}}(\text{Nov1}) \\ &= \frac{WPW_{\text{Wheat}} * Price_{\text{DEC\_Wheat}}(\text{Nov1})}{TV1(\text{Nov1})} \\ &= \frac{198.3264 * 498.50}{258{,}694.8840} \\ &= 38.23\,\%. \end{aligned}$$

Or, the basket weight of wheat can be calculated from the basket weight of crude:

$$\begin{aligned} &BW1_{\text{Wheat}}(\text{Nov1}) \\ &= 100\,\% - BW1_{\text{Crude}}(\text{Nov1}) \\ &= 100\,\% - 61.77\,\% \\ &= 38.23\,\%. \end{aligned}$$

Now, we use the November 1st basket weights to calculate the return for the first nearby basket on November 2:

$$\begin{aligned}
&\text{Rtn}_{B1}(\text{Nov2}) \\
&= \text{BW1}_{\text{Crude}}(\text{Nov1}) * \text{Rtn}_{\text{DEC_Crude}}(\text{Nov2}) \\
&\quad + \text{BW1}_{\text{Wheat}}(\text{Nov1}) * \text{Rtn}_{\text{DEC_Wheat}}(\text{Nov2}) \\
&= 61.77\% * 0.0135 + 38.23\% * -0.0231 \\
&= -0.0005 \text{ or } -0.05\%.
\end{aligned}$$

This slight additional complexity in determining the dollar weights of the commodities within the nearby baskets and calculating the return for the portfolio represented by each nearby basket is the only impact that adding more commodities has on the index construction process. The next steps are to weight the baskets within the index portfolio, calculate the return on the index portfolio, and construct the excess return index value in the same manner as shown for the crude oil-only index. All of the interim results, as well as the final crude oil and wheat excess return index values, can be found in Table 5.

Recap and Generalization

The GSCI is currently composed of 22 commodities. The nearby basket constructions can easily be generalized from the two commodity examples here to the 22 commodities in the GSCI. Once the first and second nearby baskets are constructed, all of the calculations proceed exactly as they did in the example above.

The construction process stays the same regardless of the number of commodities included in the index:

1. Construct first and second nearby baskets of commodity futures.
2. Calculate the excess return on each futures contract.
3. Cumulate the individual contract excess returns into excess returns for the first and second nearby baskets.
4. Calculate the weights of the two baskets in the index portfolio (always 100% in the first nearby basket except during the roll).
5. Cumulate the basket excess returns into the excess return for the entire index portfolio.
6. Calculate the index level from yesterday's value and the portfolio excess return.

Table 5: Crude Oil and Wheat Excess Return Index

First Nearby Basket

Date	Crude Oil				Wheat				Total Value	Basket Excess Rtn (%)	Portfolio Wt (%)
	Contract Month		Basket Wt (%)	Excess Rtn (%)	Contract Month		Basket Wt (%)	Excess Rtn (%)			
	(during day)	(at end of day)	(at end of day)	(since day before)	(during day)	(at end of day)	(at end of day)	(since day before)	(at end of day)	(since day before)	(at end of day)
1-Nov-95	Dec	Dec	61.77		Dec	Dec	38.23		258,604.8840		100.00
2-Nov-95	Dec	Dec	62.63	1.35	Dec	Dec	37.37	-2.31	258,485.2015	-0.05	100.00
3-Nov-95	Dec	Dec	62.73	-0.22	Dec	Dec	37.27	-0.62	257,530.0438	-0.37	100.00
6-Nov-95	Dec	Dec	62.10	-1.28	Dec	Dec	37.90	1.39	256,797.7205	-0.28	100.00
7-Nov-95	Dec	Dec	61.96	-0.34	Dec	Dec	38.04	0.25	256,505.3608	-0.11	80.05
8-Nov-95	Dec	Dec	62.14	0.96	Dec	Dec	37.86	0.20	258,234.4459	0.67	60.13
9-Nov-95	Dec	Dec	62.54	0.11	Dec	Dec	37.46	-1.57	256,877.5055	-0.53	40.11
10-Nov-95	Dec	Dec	61.96	-0.06	Dec	Dec	38.04	2.42	259,117.7961	0.87	20.12
13-Nov-95	Dec	Jan	61.68	-0.17	Dec	Mar	38.32	-1.41	255,920.6412	-0.64	100.00
14-Nov-95	Jan	Jan	61.70	0.17	Mar	Mar	38.30	0.10	256,289.9383	0.14	100.00
15-Nov-95	Jan	Jan	62.19	0.40	Mar	Mar	37.81	-1.67	255,284.0579	-0.39	100.00
16-Nov-95	Jan	Jan	62.31	1.25	Mar	Mar	37.69	0.72	257,959.1822	1.05	100.00
17-Nov-95	Jan	Jan	62.59	1.57	Mar	Mar	37.41	0.36	260,827.5030	1.11	100.00
20-Nov-95	Jan	Jan	62.48	-0.39	Mar	Mar	37.52	0.10	260,296.3538	-0.20	100.00
21-Nov-95	Jan	Jan	62.45	-0.50	Mar	Mar	37.55	-0.41	259,089.2993	-0.46	100.00
22-Nov-95	Jan	Jan	62.24	-0.06	Mar	Mar	37.76	0.87	259,842.1419	0.29	100.00
24-Nov-95	Jan	Jan	62.11	0.00	Mar	Mar	37.89	0.56	260,387.5395	0.21	100.00
27-Nov-95	Jan	Jan	62.84	2.34	Mar	Mar	37.16	-0.80	263,376.1083	1.15	100.00
28-Nov-95	Jan	Jan	62.87	-0.27	Mar	Mar	37.13	-0.41	262,529.2324	-0.32	100.00
29-Nov-95	Jan	Jan	62.48	-0.38	Mar	Mar	37.52	1.27	263,138.4600	0.23	100.00
30-Nov-95	Jan	Jan	62.51	-0.44	Mar	Mar	37.49	-0.55	261,872.7053	-0.48	100.00

Second Nearby Basket

Date	Crude Oil				Wheat				Total Value	Basket Excess Rtn (%)	Portfolio Wt (%)	Portfolio Excess Rtn (%)	Excess Return Index
	Contract Month		Basket Wt (%)	Excess Rtn (%)	Contract Month		Basket Wt (%)	Excess Rtn (%)					
	(during day)	(at end of day)	(at end of day)	(since day before)	(during day)	(at end of day)	(at end of day)	(since day before)	(at end of day)	(since day before)	(at end of day)	(since day before)	(at end of day)
1-Nov-95	Jan	Jan			Mar	Mar					0.00		100.00
2-Nov-95	Jan	Jan			Mar	Mar					0.00	-0.05	99.95
3-Nov-95	Jan	Jan			Mar	Mar					0.00	-0.37	99.58
6-Nov-95	Jan	Jan			Mar	Mar					0.00	-0.28	99.30
7-Nov-95	Jan	Jan	61.26		Mar	Mar	38.74		255,741.6930		19.95	-0.11	99.19
8-Nov-95	Jan	Jan	61.46	0.75	Mar	Mar	38.54	-0.10	256,813.1100	0.42	39.87	0.62	99.81
9-Nov-95	Jan	Jan	61.80	0.11	Mar	Mar	38.20	-1.30	255,704.0777	-0.43	59.89	-0.49	99.32
10-Nov-95	Jan	Jan	61.46	0.00	Mar	Mar	38.54	1.47	257,141.9441	0.56	79.88	0.69	100.00
13-Nov-95	Jan	Feb		-0.11	Mar	Mar		-1.05		-0.47	0.00	-0.51	99.49
14-Nov-95	Feb	Feb			Mar	Mar					0.00	0.14	99.64
15-Nov-95	Feb	Feb			Mar	Mar					0.00	-0.39	99.25
16-Nov-95	Feb	Feb			Mar	Mar					0.00	1.05	100.29
17-Nov-95	Feb	Feb			Mar	Mar					0.00	1.11	101.40
20-Nov-95	Feb	Feb			Mar	Mar					0.00	-0.20	101.19
21-Nov-95	Feb	Feb			Mar	Mar					0.00	-0.46	100.72
22-Nov-95	Feb	Feb			Mar	Mar					0.00	0.29	101.02
24-Nov-95	Feb	Feb			Mar	Mar					0.00	0.21	101.23
27-Nov-95	Feb	Feb			Mar	Mar					0.00	1.15	102.39
28-Nov-95	Feb	Feb			Mar	Mar					0.00	-0.32	102.06
29-Nov-95	Feb	Feb			Mar	Mar					0.00	0.23	102.30
30-Nov-95	Feb	Feb			Mar	Mar					0.00	-0.48	101.81

Replicating the GSCI Excess Return Index with GSCI Futures Contracts

A particularly simple and useful application of the index calculations is the replication of the GSCI excess return index through the use of the GSCI futures contracts, publicly traded baskets for which prices are known.

The GSCI futures contracts, listed on the CME on a monthly basis starting with June 1996[3], are designed to mirror the first and second nearby baskets of futures we have been discussing and using to construct the excess return portfolio and index. Each GSCI futures contract regularly expires on the 11th business day of the month and represents the basket of futures that is rolled out of during its expiration month.

Thus, the November GSCI futures contract is the first nearby basket during the early part of November, while the December GSCI futures contract is the second nearby basket. After the roll period in November, the December contract becomes the first nearby basket, and the January contract becomes the second nearby basket.

Replicating the GSCI excess return index with the GSCI futures contracts reduces to the crude oil case examined above. During the roll, the number of GSCI futures contracts held in first to second nearby baskets move from 80%/20% at the end of the 5th business day, through 60%/40%, 40%/60% to 20%/80% at the end of the 8th business day. As before, at the end of the 9th business day, the roll ends, and all of the value of the excess return portfolio is held in one nearby basket (the one just rolled into).

Returns are calculated using the fair value of the baskets in place of the price of crude oil, following the calculations above. For the first few days of November 1996, the GSCI excess return portfolio consists solely of the November 1996 GSCI futures contract, and the GSCI excess return is the same as the return on the fair value of the futures contract.

[3] Note that GSCI futures have been trading on the CME since July 1992, but they have recently been listed on a monthly basis to account for increased investor interest and to allow easy replication of the GSCI indices.

At the end of the day on November 7 (the 5th business day), the excess return portfolio becomes 80%/20% quantity-weighted in the first to second nearby baskets (i.e., November to December futures contracts). To calculate the excess return of the entire GSCI index portfolio, we need the portfolio, or value-based, weights of the two baskets. As in the case of the crude oil-only example above, the way to calculate these weights is as the ratio of the quantity weights multiplied by their prices (i.e., 80% and 20% of the total fair values of the futures contracts).

So, at the end of the first day of the roll, the portfolio weight for the first nearby basket (the November GSCI contract) is as follows:

$$\begin{aligned} &PW1(\text{Nov7}) \\ &= \frac{80\% * TV1(\text{Nov7})}{80\% * TV1(\text{Nov7}) + 20\% * TV2(\text{Nov7})} \\ &= \frac{80\% * \text{FairValue}_{\text{NOV\_GSCI}}(\text{Nov7})}{\begin{pmatrix} 80\% * \text{FairValue}_{\text{NOV\_GSCI}}(\text{Nov7}) \\ +20\% * \text{FairValue}_{\text{DEC\_GSCI}}(\text{Nov7}) \end{pmatrix}}. \end{aligned}$$

The portfolio weight for the second nearby basket (the December GSCI contract) is calculated similarly and the excess return for the GSCI index portfolio becomes:

$$\begin{aligned} &\text{Rtn}_{\text{Excess}}(\text{Nov8}) \\ &= PW1(\text{Nov7}) * \text{Rtn}_{B1}(\text{Nov8}) \\ &\quad + PW2(\text{Nov7}) * \text{Rtn}_{B2}(\text{Nov8}) \\ &= PW1(\text{Nov7}) * \text{Rtn}_{\text{NOV\_GSCI}}(\text{Nov8}) \\ &\quad + PW2(\text{Nov7}) * \text{Rtn}_{\text{DEC\_GSCI}}(\text{Nov8}), \end{aligned}$$

where the contract returns are calculated from the fair values of the respective GSCI futures contracts.

Thus, the replication of the GSCI excess return index with GSCI futures contracts reduces to the simple case we examined earlier.

The GSCI Total Return Index

The GSCI total return index is constructed to be comparable to simple investing in traditional assets. Uncollateralized futures investments, such as those represented by the returns in the GSCI excess return index, can be thought of as fully-levered transactions, while fully-collateralized futures investments are unlevered.

To make futures investing comparable to typical long positions in equities and bonds, the futures need to be fully collateralized. In a fully-collateralized futures purchase, the investor pays the face value of the futures as collateral at the time that the futures position is opened. Hence, the investor receives the Treasury bill rate on this collateral as well as the return for holding the futures contract.

In other words, the investor receives the excess return described above plus the T-bill return on the collateral. This fully-collateralized return is called the total return and is the basis for the GSCI total return index.

The only difference between the excess return and the total return is the T-bill return on the collateral. Hence, the total return index is constructed from a return series that is just the sum of the excess return from that day and the T-bill return. Table 6 shows the returns generated by the sample excess return indices calculated above (both the crude oil-only and the crude and wheat versions), the T-bill returns, and the resulting total return indices for November.

For an example calculation, we take the crude oil and wheat total return index for November 2:

$$\begin{aligned}
&\text{Index}_{TR}(\text{Nov2}) \\
&\quad = \text{Index}_{TR}(\text{Nov1}) \\
&\qquad * \begin{pmatrix} 1 + \text{Excess Return}(\text{Nov2}) \\ + \text{TBill Return}(\text{Nov2}) \end{pmatrix} \\
&\quad = 100 * (1 - 0.0005 + 0.0001) \\
&\quad = 99.96.
\end{aligned}$$

Table 6: Crude Oil-Only and Crude Oil and Wheat Total Return Indices

		Crude Oil Only		Crude Oil and Wheat	
Date	T-Bill Return (%) (since day before)	Excess Return (%) (since day before)	Total Return Index (at end of day)	Excess Return (%) (since day before)	Total Return Index (at end of day)
1-Nov-95	0.01		100.00		100.00
2-Nov-95	0.01	1.35	101.36	-0.05	99.96
3-Nov-95	0.01	-0.22	101.15	-0.37	99.60
6-Nov-95	0.04	-1.28	99.89	-0.28	99.36
7-Nov-95	0.01	-0.34	99.56	-0.11	99.26
8-Nov-95	0.01	0.92	100.49	0.62	99.89
9-Nov-95	0.02	0.11	100.62	-0.49	99.42
10-Nov-95	0.01	-0.02	100.61	0.69	100.11
13-Nov-95	0.05	-0.12	100.53	-0.51	99.65
14-Nov-95	0.02	0.17	100.73	0.14	99.82
15-Nov-95	0.02	0.40	101.15	-0.39	99.44
16-Nov-95	0.02	1.25	102.43	1.05	100.51
17-Nov-95	0.02	1.57	104.06	1.11	101.64
20-Nov-95	0.05	-0.39	103.71	-0.20	101.49
21-Nov-95	0.01	-0.50	103.20	-0.46	101.03
22-Nov-95	0.01	-0.06	103.15	0.29	101.33
24-Nov-95	0.03	0.00	103.19	0.21	101.57
27-Nov-95	0.04	2.34	105.64	1.15	102.78
28-Nov-95	0.01	-0.27	105.36	-0.32	102.46
29-Nov-95	0.01	-0.38	104.97	0.23	102.71
30-Nov-95	0.01	-0.44	104.52	-0.48	102.22

The GSCI Spot Index

The GSCI spot index measures the price levels of commodities, not returns available to investors. At the end of every business day, the GSCI is composed of the same proportions by weight of the underlying commodities and expirations as the portfolio represented by the GSCI excess returns. Thus, we can use the same baskets we constructed for the excess return index. However, for the spot index, we use these to weight prices, not returns.

Using the crude oil and wheat index as our example, on November 1, the total value of the first nearby basket is 258,604.8840 (from Table 4). However, we want our spot index to start at 100 rather than this rather large and awkward number. Therefore, we calculate a normalizing constant that will scale down the total value of the basket[4]:

$$\begin{aligned} NC &= \frac{TV1(Nov1)}{100} \\ &= \frac{258{,}604.8840}{100} \\ &= 2{,}586.048840. \end{aligned}$$

Anytime during the month that the index consists only of the first nearby basket, the spot index is just the total value of the first nearby basket scaled down by the normalizing constant. For instance, on November 2, the spot index is as follows:

$$\begin{aligned} \text{Index}_{\text{Spot}}(Nov2) &= \frac{TV1(Nov2)}{NC} \\ &= \frac{258{,}485.2015}{2{,}586.048840} \\ &= 99.95. \end{aligned}$$

During the roll period, the total values of the first and second nearby baskets are weighted 80%/20%, 60%/40%, 40%/60%, and 20%/80% on the 5th through 8th business days, respectively.

On November 7, the 5th business day, this leads to a spot index of the following:

$$\begin{aligned} \text{Index}_{\text{Spot}}(Nov7) &= \frac{\begin{pmatrix} 80\% * TV1(Nov7) \\ +20\% * TV2(Nov7) \end{pmatrix}}{NC} \\ &= \frac{\begin{pmatrix} 80\% * 256{,}505.3608 \\ +20\% * 255{,}741.6930 \end{pmatrix}}{2{,}586.048840} \\ &= 99.19. \end{aligned}$$

Sample spot indices for crude only and for crude oil and wheat are presented in Table 7 with the sample excess return indices for comparison. The spot index diverges from the excess return index during the roll period. What is not obvious from the index levels, but can be seen from the percentage change and difference columns in the Table 7, is that the percentage changes in the excess and spot return indices are again the same, after the roll is completed.

To summarize, the key distinctions between the three GSCI indices are that the excess return index measures investor returns from an uncollateralized commodity futures investment, the total return index measures investor returns from a fully-collateralized commodity futures investment, and the spot index measures commodity price levels, not investor returns.

[4] Note that the normalizing constant is updated every year to maintain continuity when the production weights are updated.

Table 7: Crude Oil-Only and Crude Oil and Wheat Spot Price Indices

	Crude Oil Only					Crude Oil and Wheat				
Date	Spot Index (at end of day)	Excess Return Index (at end of day)	Change (%) Spot (since day before)	Change (%) Excess (since day before)	Spot-Excess (since day before)	Spot Index (at end of day)	Excess Return Index (at end of day)	Change (%) Spot (since day before)	Change (%) Excess (since day before)	Spot-Excess (since day before)
1-Nov-95	100.00	100.00				100.00	100.00			
2-Nov-95	101.35	101.35	1.35	1.35	0.00	99.95	99.95	-0.05	-0.05	0.00
3-Nov-95	101.13	101.13	-0.22	-0.22	0.00	99.58	99.58	-0.37	-0.37	0.00
6-Nov-95	99.83	99.83	-1.28	-1.28	0.00	99.30	99.30	-0.28	-0.28	0.00
7-Nov-95	99.21	99.49	-0.62	-0.34	-0.28	99.13	99.19	-0.17	-0.11	-0.06
8-Nov-95	99.80	100.41	0.59	0.92	-0.33	99.64	99.81	0.51	0.62	-0.11
9-Nov-95	99.58	100.52	-0.21	0.11	-0.33	99.06	99.32	-0.58	-0.49	-0.09
10-Nov-95	99.24	100.50	-0.34	-0.02	-0.32	99.59	100.00	0.53	0.69	-0.15
13-Nov-95	98.82	100.37	-0.43	-0.12	-0.31	98.96	99.49	-0.63	-0.51	-0.12
14-Nov-95	98.99	100.55	0.17	0.17	0.00	99.10	99.64	0.14	0.14	0.00
15-Nov-95	99.38	100.95	0.40	0.40	0.00	98.72	99.25	-0.39	-0.39	0.00
16-Nov-95	100.62	102.21	1.25	1.25	0.00	99.75	100.29	1.05	1.05	0.00
17-Nov-95	102.20	103.81	1.57	1.57	0.00	100.86	101.40	1.11	1.11	0.00
20-Nov-95	101.80	103.41	-0.39	-0.39	0.00	100.65	101.19	-0.20	-0.20	0.00
21-Nov-95	101.30	102.89	-0.50	-0.50	0.00	100.19	100.72	-0.46	-0.46	0.00
22-Nov-95	101.24	102.84	-0.06	-0.06	0.00	100.48	101.02	0.29	0.29	0.00
24-Nov-95	101.24	102.84	0.00	0.00	0.00	100.69	101.23	0.21	0.21	0.00
27-Nov-95	103.61	105.24	2.34	2.34	0.00	101.84	102.39	1.15	1.15	0.00
28-Nov-95	103.33	104.95	-0.27	-0.27	0.00	101.52	102.06	-0.32	-0.32	0.00
29-Nov-95	102.93	104.55	-0.38	-0.38	0.00	101.75	102.30	0.23	0.23	0.00
30-Nov-95	102.48	104.10	-0.44	-0.44	0.00	101.26	101.81	-0.48	-0.48	0.00

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