THE BACHE COMMODITY INDEX℠: A FACTOR-BASED APPROACH TO COMMODITY INVESTMENT

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THE BACHE COMMODITY INDEX℠: A FACTOR-BASED APPROACH TO COMMODITY INVESTMENT

1 Introduction

The Bache Commodity Index℠ (BCI℠) is a transparent, long-only, investable index that employs dynamic asset allocation based on the price momentum of individual commodity markets. This approach to index construction reduces transactions costs and turnover, and may increase risk-adjusted returns. This methodology should also result in reduced losses during broad-based commodity market declines.

The stated objective of the index is to provide investors with additional sources of return coupled with enhanced risk protection, while preserving the essential properties that make commodity investment attractive to many institutional investors. These include hedging inflation risk and low correlation to equity and debt markets. Other commodity indices offer a single source of return: commodity Beta. The BCI includes Beta, and also includes a Momentum factor and a Relative Roll factor. The Momentum and Relative Roll factors provide alternative sources of return without increasing the overall risk. The historical performance of the BCI suggests that this index may offer better diversification and reduced risk, while providing return levels that are comparable to other commodity indexing strategies.

1.1 Economic Rationale for the BCI

The development of the BCI represents a significant advancement in commodity indexing methodology. The index was designed using the view that the way commodities are held in a commodity index is as important as the choice of commodities and weights. Actively managed commodity programs do not hold a constant level of exposure either to individual commodities or to the commodity markets as a whole. Rather, an active manager varies exposure to particular commodities and sectors over time. The BCI is the first commodity index to incorporate this feature of dynamic asset allocation into an indexing framework. This is achieved while still preserving the essential properties that make commodity investment attractive to many institutional investors.

1.2 Index Constituents and Weights

The BCI is currently comprised of nineteen commodity futures markets. These markets span the energy, metals, and agriculture sectors and trade on seven global futures exchanges. The Advisory Committee for the BCI determines a set of commodities, and a set of allocations to those markets, on an annual basis.

Exhibit 1 details the index components and the maximum weight assigned to each commodity as of December 31, 2008. The maximum weight is the largest percentage of assets invested in a given commodity. The actual weight of a commodity in the index will vary over time because of the asset allocation rule.

Energy	50.0	Crude Oil 25.0, Distillates 17.5, Natural Gas 7.5
Agriculture	27.5	Grains 15.0, Livestock 5.0, Softs 7.5
Metals	22.5	Industrial 12.5, Precious 10.0
Energy: 50.0%		Contracts Traded
Crude Oil WTI Nymex	20.0	All months
Crude Oil Brent ICE Europe	5.0	All months
Gasoil ICE Europe	7.5	All months
Natural Gas Nymex	7.5	All months
Heating Oil Nymex	5.0	All months
Gasoline Nymex	5.0	All months
Metals: 22.5%		
Copper LME	5.0	Mar, May, Jul, Sep, Dec
Aluminum LME	5.0	Mar, May, Jul, Sep, Dec
Zinc	2.5	Mar, May, Jul, Sep, Dec
Gold Comex	7.5	Feb, Apr, Jun, Aug, Oct, Dec
Silver Comex	2.5	Mar, May, Jul, Sep, Dec
Agriculture: 27.5%		
Corn CBT	7.5	Mar, May, Jul, Sep, Dec
Soybeans CBT	5.0	Mar, May, Jul, Nov, Dec
Wheat CBT	2.5	Mar, May, Jul, Sep, Dec
Live Cattle CME	2.5	Feb, Apr, Jun, Aug, Oct, Dec
Lean Hogs CME	2.5	Feb, Apr, Jun, Aug, Oct, Dec
Coffee ICE US	2.5	Mar, May, Jul, Sep, Dec
Cotton ICE US	2.5	Mar, May, Jul, Dec
Sugar ICE US	2.5	Mar, May, Jul, Oct

2 Commodity Investment Strategies

There are several investment strategies in commodity markets, including the buy-and-roll strategy, spread trading, and directional trading. However, major benchmarks currently only emphasize one strategy, the buy-and-roll strategy embedded in indices such as the S&P Goldman Sachs Commodity Index (SPGSCI) or the Dow Jones-UBS Commodity Index (DJUBS). Other common strategies such as spread trading and directional trading are important potential sources of return for investors, but are not captured by these existing benchmarks.

The BCI includes sources of return that offer the investor a more predictable, positive expected return. The three factors incorporated in the index are Beta, Relative Roll, and Momentum. While these return factors are not new, this is the first time multiple return factors have been combined in an investable commodity index.

- Beta is the risk borne by the typical commodity investor today – the risk associated with buying a fixed basket of commodity futures contracts and rolling those contracts forward as they approach expiration.

- Arbitrageurs and spread traders generally employ hedged (or spread) strategies that attempt to extract returns from the forward delivery curve of the commodity. The BCI employs a daily roll methodology, in which the futures contracts in the BCI have a longer

average maturity than other commodity indices. Over the past decade, longer maturity commodity contracts have offered better value than the short-maturity contracts found in most commodity indices.

- Commodity Trading Advisors have typically focused on long/short strategies using momentum models. To capture this factor, a simple momentum model is incorporated into the index.

Each of the factors is not only investable, but can be separated from the others as a stand-alone benchmark or investment. The factors were designed to be easily traded with minimal transactions costs. Different leverage levels can be attributed to different factors to reflect the mix of commodity strategies employed by a given investor. The BCI represents one approach to investing in these commodity return factors. It is an unleveraged investment vehicle that provides diversified exposure to each factor across a number of futures markets.

Analysis shows that the Beta factor provides the bulk of the volatility in the BCI. The other two factors provide high risk-adjusted returns. Combining these three factors in a portfolio generates consistently higher returns on both an absolute and a risk-adjusted basis.

3 Data and Methodology

Although the index incorporates all three of these factors, it is possible to separate them for purposes of analysis and return attribution. The factors can also be separated for investment purposes or for use as a custom benchmark. Each of the factors is investable. Different leverage levels can be assigned to different factors to reflect the mix of commodity strategies desired by a given investor. In this section the method used to calculate commodity factors is described.

3.1 Style Factors

Discussing these style factors necessarily involves delving briefly into the nuances of commodity index construction. It is natural to compare indices primarily by examining which commodities are included and in what proportions. An equally important aspect of an index is the strategy used to trade a particular commodity. Each commodity has several eligible delivery months. The trading rules for an index must describe which of the eligible months the contract will hold and on what date(s) the index will shift its holdings to the next contract.

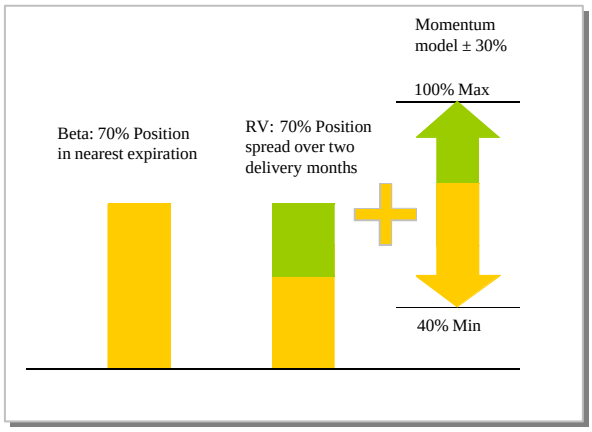
Commodity Beta Factor

The Beta factor defined here is the return to holding the active contract until the weekday prior to the fifth calendar day of the month prior to expiration (the *contract roll date*).[1] For example, on the fourth of January, the position in Crude Oil for February delivery is sold and the proceeds are used to purchase Crude Oil for delivery in March. The transaction is assumed to take place at the close of trading, and settlement prices from the exchanges are used to compute these returns. The Beta factor will be similar to the combined spot and roll return of major commodity indices such as the SPGSCI or the DJUBS. These indices roll contracts during a short window in the early part of the month. The Beta factor is the dominant source of both risk and return in the BCI.

Relative Value/Daily Roll Factor

The BCI takes positions in two delivery months in each commodity. It trades each day and maintains a constant weighted-average maturity in each commodity market. The average maturity of the futures contracts in the BCI is longer than the maturity of the Beta factor. The Relative Roll factor is a synthetic spread trade that will be profitable if the price of the contract closest to expiration falls in price relative to the longer maturity contracts. It is the incremental return to extending the average maturity of contracts. The Relative Roll factor should not be confused with the spot and roll index returns that some commodity indices publish. The Relative Roll factor is not the entire roll portion of the BCI return. It is the difference between the BCI roll return and the roll methodology of indices like the SPGSCI.

Exhibit 2: Style Factors*



*RV= Relative Value

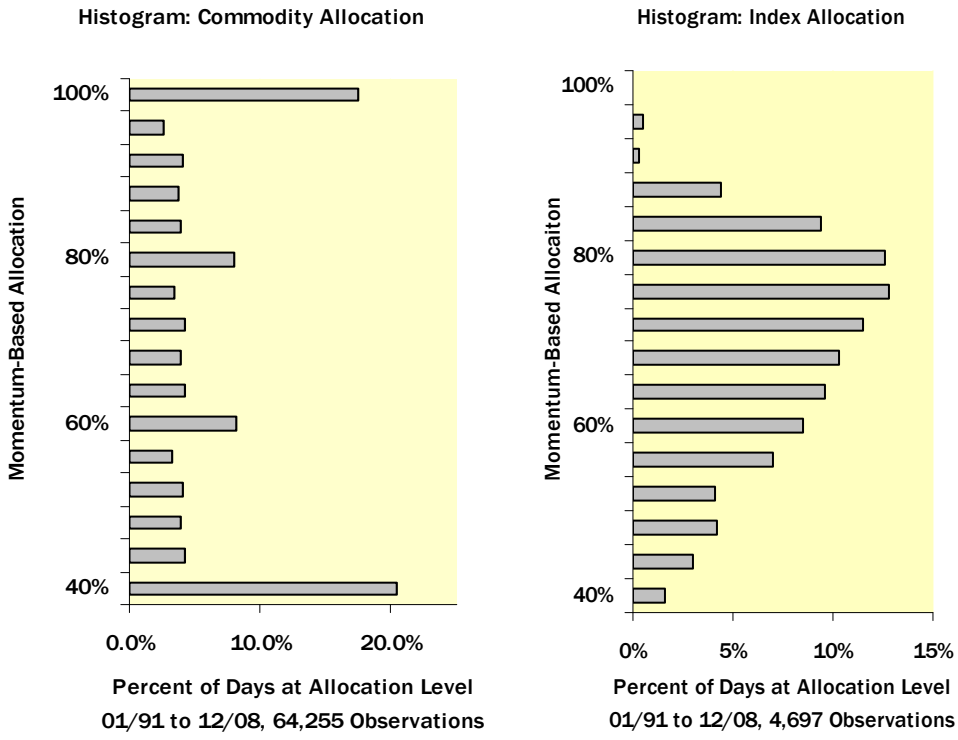
Momentum/Risk Reduction Factor

The Momentum factor utilizes a momentum-based trading rule to hold varying amounts of a given commodity depending on recent price movements. To minimize turnover and trading costs, there is a maximum daily position change in each commodity. All trade signals are executed with a one-day delay. The official price used to calculate the index is the settlement price.

Three signals are evaluated for each commodity, a short-term signal, a medium-term signal, and a long-term signal. Each signal can be positive or negative. Based on these signals, the target allocation takes on one of four possible values: 40%, 60%, 80%, and 100% of the maximum allocation. Thus, the position in each commodity will never be more than 100% or less than 40% of the maximum allocation. Each trading signal is equally likely to be positive or negative, so that over a long time period each signal will be positive about half the time and negative about half the time. Thus the long-run level of investment in each commodity market is halfway between the 40% minimum investment level and the 100% fully invested level, or at the 70% investment level.

Exhibit 3 below shows the histogram of combined signals for individual commodities (left) and for the composite index (right). The signals for individual commodities are likely to be at the extremes, as the short-, medium-, and long-term signals tend to have the same sign. However, the histogram for the composite index allocation shows that the average allocation across the index is usually between 64% and 80% and is rarely above 90% or below 50%.

Exhibit 3: Commodity and Index Allocations



3.2 Principal Assumptions

Cash Management

One of the central features of a commodity index is the method that cash flows are handled. While commodity futures do not pay dividends or interest, cash is generated or paid each time a futures contract is rolled. If this cash is used to buy more of the individual commodity, then the market value of the position in that commodity remains constant. However, if the cash is used to buy more of the *index,* then commodities that are more backwardated than the index average will have their allocation implicitly reduced and commodities in contango will be implicitly increased.[2] For this reason, it can be difficult to compare the compound returns of an individual commodity–which would assume direct cash flow reinvestment–to the contribution that a commodity delivers to the returns of an index.

Our indexing methodology is value-weighted, so any cash generated from the sale of a commodity futures contract is used to purchase securities. For the Beta factor calculation, any cash generated from the sale of the front-month futures position is entirely reinvested in the deferred contract.[3] The Relative Roll factor is computed the same way, although both the roll methodology (Daily Roll factor) and the mix of nearby and deferred contracts are different.[4] Cash management for the Momentum factors is more complex because the level of investment in each market is changing over time. For this factor, cash generated by a sale is used either to purchase contracts in the next delivery month for that contract or to purchase Treasury bills. Treasury bills are purchased (sold) when the momentum-based model determines that the allocation to the market should be reduced (increased).[5]

Rebalancing

When more than one futures market is included in an index, the weight assigned to each index component is rebalanced each day. [6] This daily rebalancing approach applies to sector indices as well as to composite indices, and is applied to the Beta, Relative Roll, and Momentum factor calculations. [7]

Collateral Returns and Notional Funding

Returns are generally calculated on a total return basis, which means that all futures positions are assumed to be fully collateralized (100% margin) with Treasury bills. Excess returns are also reported. These exclude the Treasury bill returns on both futures positions and on the Treasury bills held in the Momentum factor calculations. Percentage gains or losses are based on the notional index value, which may include a Treasury bill position. Hedged positions generally do not have equal amounts of notional funding. When describing the return to a hedged position (e.g., long the Relative Roll index, short the Beta index) it is assumed that equal dollars are held in each position even though the number of futures contracts may differ.[8] All hedged returns are reported as excess returns in order to avoid double-counting of Treasury bill returns, and are calculated using the notional amount of the long side of the hedge as the denominator in the return calculation.

All returns are based on compound annual returns unless otherwise noted. Hedged positions that are long one factor index and short another are assumed to begin the year with the same notional investment but the level of investment in the hedged trade is allowed to vary through the year.[9]

The Beta and Relative Roll index returns are based on the assumption that an investor allocates 70% of available capital to the Beta strategy and 30% to Treasury bills. This assumption simplifies the task of measuring the contribution of the Momentum factor. Since the momentum index holds an average of 30% in Treasury bills, [10] a 70% investment in the Beta and Relative Roll indices will have the same average exposure to futures markets as the Momentum index.

The factor returns are designed using an additive approach. When layered in this way, the Relative Roll and Momentum factors operate as overlay strategies. So, for example, if the Momentum *index* is 40% long in some commodity (the minimum allocation), then the Momentum *factor* will have a 30% short position in this commodity. This is because the Momentum factor is calculated relative to the fixed 70% long position in the Relative Roll index. So, although each of the indices is always long every commodity, the factors can be net long or short.

	Description	Result
(1)	100% Treasury Bills	Collateral Return
(2)	Add Beta Index, Subtract Treasury Bills (1)	Beta Factor (Beta Excess Return)
(3)	Add Relative Value Index, Subtract (2)	Relative Value Factor (Excess of R.V. over Beta)
(4)	Add Momentum Index, Subtract (3)	Momentum Factor (Excess of Momentum over R.V.)

3.3 Constructing the Factor Return Series

Sub-Index and Composite Index Calculations

Daily returns for individual commodities are aggregated into sector indices representing Energy, Metals, and Agriculture. Weights in the sector indices and the composite index are given in Exhibit 1. Returns are calculated assuming daily rebalancing, both for the sub-index and for the composite index.[11]

Daily prices for two active futures contracts were collected from multiple sources from January 1990 through December 2008. Sources were Bloomberg, TickData, and Datastream. When the three sources did not agree on a particular price, the exchange was contacted. The sources for Treasury bill yields are Bloomberg and Reuters. The final roll date for all series is the business day prior to the fifth calendar day of the month prior to expiration. Rolls scheduled for holidays or for unexpected closures are assumed to be rolled on the date following the market closure.

No adjustments were made for markets that suspended trading due to trading limits prior to 2007. For this time period, the model assumes that if a market was open then settlement prices were available for trade. After January 1, 2007 the model assumes that no trades took place in a market that settled at its trading limit. No trades were assumed on U.S. federal holidays even if the market (e.g., the London Metals Exchange) was open.

4 Results

The results of our analysis show that the Beta factor provides the bulk of the return and also the bulk of the volatility. The other two factors provide positive returns. Furthermore, adding the Relative Roll and Momentum factors to a commodity index provides diversification benefits, as the factors are not highly correlated.

Exhibit 4 summarizes the factor returns for the composite index. The first three columns are the returns to each factor as on a stand-alone basis, assuming that an investor held that factor and hedged out the other factor exposures. Returns are reported on a compound annual basis. The next three columns report the returns to combining the factors. Beta is base case. The Beta strategy consists of the Beta factor plus the T-bill rate. The Relative Roll strategy adds the Relative Roll factor to the Beta strategy. The Momentum strategy incorporates all four sources of return.

The final three columns of Exhibit 4 show the standard deviation of the strategy indices. The standard deviation is based on monthly returns.[12]

4.1 Discussion of Composite Factor Returns

The compound annual return (excluding collateral return) for the Beta factor was 1.2% from January 1991 to December 2008. The Relative Roll factor would have added an additional 1.7% per year. Finally, adding a Momentum strategy on top of the Relative Roll strategy would have added another 3.2% per year. The compound annual return of all factors, including the collateral return, is 10.3%. This compares to a 5.4% total return for the Beta strategy alone.[13] The additional return comes with a slightly higher risk. The standard deviation of the BCI, which includes all four factors as sources of return, was 12.4%, as compared to 12.5% for the Beta strategy.

4.2 Discussion of Composite Factor Volatility and Correlation

Important diversification benefits can be obtained in commodity investment by incorporating multiple return factors. As shown in Exhibit 5, the annual volatility of the composite Beta factor is 12.5%. The Sharpe ratio for the Beta factor is estimated to be 0.10. On a stand-alone basis, other factors offer higher return-to-risk. The Relative Roll factor returned 1.7% (see Exhibit 4) with a standard deviation of 1.1%, for a Sharpe ratio estimated at 1.58. The stand-alone Momentum factor returned 3.2% (see Exhibit 4) with a volatility of 3.6% for a Sharpe of 0.88. Adding these two factors to the Beta Strategy adds 4.9% additional return per year while increasing the annual volatility by 0.1% from 12.5% to 12.4% (Exhibit 4).

The correlation of Relative Roll with Beta is consistently negative (Exhibit 5, right columns). This is because when prices are rising, commodity prices tend to move into backwardation, and falling prices lead to increased contango. Momentum and Beta factors have a long-run correlation that is low (-0.04). However, Exhibit 5 shows that the correlation is positive during rising markets and negative during falling markets. This underscores the synthetic put feature of the Momentum factor.

The correlation among the factors is also an important consideration. The correlation between Relative Roll and Beta for the composite index is -0.50.[14] From a portfolio perspective, combining this factor with Beta results in both a higher excess return (7.1% vs. 5.4%) and a lower volatility (12.0% vs. 12.5%). The Momentum factor is positively correlated with the Beta factor.

Exhibit 4. BCI Factor Returns, Strategy Returns, and Strategy Volatility January 1991 to December 2008

	Annual Return to Each Factor				Benefit of Additional Factors			Volatility of Strategy Indices		
	Collateral Factor	Beta Factor (70%)	Relative Roll Factor (70%)	Momentum Factor	Beta Strategy	Beta/ Relative Roll Strategy	BCI(All Factors)	Beta Strategy	Beta / Relative Roll Strategy	BCI(All Factors)
1991	5.3%	-10.1%	1.3%	1.7%	-4.8%	-3.5%	-1.8%	13.1%	12.4%	12.3%
1992	3.8%	3.7%	0.0%	1.8%	7.5%	7.5%	9.3%	7.0%	6.6%	6.8%
1993	3.0%	-8.1%	0.6%	2.4%	-5.2%	-4.6%	-2.1%	7.3%	6.9%	5.9%
1994	4.9%	8.0%	1.3%	1.9%	12.9%	14.2%	16.1%	9.2%	8.4%	9.1%
1995	6.4%	10.6%	-1.4%	2.1%	17.1%	15.7%	17.8%	6.7%	6.1%	6.7%
1996	6.9%	25.6%	0.2%	4.5%	32.4%	32.6%	37.1%	10.5%	9.8%	12.4%
1997	5.0%	-8.2%	1.9%	0.7%	-3.1%	-1.3%	-0.6%	8.9%	8.4%	8.8%
1998	4.0%	-23.7%	0.8%	2.0%	-19.8%	-18.9%	-17.0%	12.3%	11.7%	8.7%
1999	6.1%	22.1%	1.2%	2.4%	28.2%	29.4%	31.8%	11.7%	11.2%	12.9%
2000	7.9%	24.1%	1.3%	4.1%	32.0%	33.3%	37.4%	12.5%	11.9%	14.4%
2001	2.9%	-22.1%	2.2%	-0.8%	-19.2%	-17.0%	-17.8%	13.5%	12.8%	11.5%
2002	2.0%	20.3%	2.4%	0.0%	22.3%	24.7%	24.7%	12.1%	11.6%	13.6%
2003	1.2%	18.5%	2.1%	-3.0%	19.7%	21.8%	18.9%	13.4%	12.7%	15.1%
2004	1.7%	8.7%	5.8%	6.1%	10.4%	16.2%	22.2%	14.2%	13.8%	16.2%
2005	3.9%	16.5%	5.0%	-1.4%	20.4%	25.4%	24.0%	13.2%	12.7%	14.2%
2006	4.6%	-11.6%	2.6%	1.9%	-7.0%	-4.4%	-2.5%	13.4%	13.0%	12.7%
2007	5.3%	14.8%	1.3%	1.1%	20.1%	21.5%	22.6%	12.0%	11.7%	12.5%
2008	1.2%	-27.7%	1.3%	14.5%	-26.5%	-25.2%	-10.7%	23.3%	23.0%	19.4%
1991-2008	4.2%	1.2%	1.7%	3.2%	5.4%	7.1%	10.3%	12.5%	12.0%	12.4%

Notes: Performance statistics prior to 2007 are pro forma
Returns for full period are compounded

Definitions:

Beta Factor	70% investment in commodities, 30% cash. Rolls take place once per month
Relative Roll Factor	Additional return (over Beta Factor) from incorporating Daily Roll Methodology
Momentum Factor	Additional return (over Beta Factor) from incorporating Momentum Factor
Beta Strategy	70% Beta Factor + T-Bill
Beta/Relative Roll Strat.	Beta Factor + Relative Roll Factor
BCI	Beta + Relative Roll Strategy + Momentum Factor

Exhibit 5. Volatility, Sharpe Ratio, and Correlation of Commodity Return Factors

	Factor Volatility			Factor Sharpe Ratios			Factor Correlations		
	Beta Factor (70%)	Relative Roll Factor (70%)	Momentum Factor	Beta Factor (70%)	Relative Roll Factor (70%)	Momentum Factor	Relative Roll with Beta	Momentum with Relative Roll	Momentum with Beta
1991	13.1%	1.2%	2.5%	(0.77)	1.09	0.68	-0.64	0.03	-0.14
1992	7.0%	0.9%	1.9%	0.53	(0.01)	0.93	-0.49	-0.05	-0.02
1993	7.3%	0.8%	2.2%	(1.11)	0.79	1.09	-0.57	0.20	-0.57
1994	9.2%	1.2%	2.2%	0.86	1.04	0.86	-0.66	-0.09	0.16
1995	6.6%	1.1%	1.8%	1.60	(1.28)	1.14	-0.59	-0.22	0.23
1996	10.5%	1.5%	3.1%	2.43	0.10	1.45	-0.58	-0.37	0.78
1997	8.9%	0.9%	2.5%	(0.92)	2.12	0.27	-0.62	-0.05	0.04
1998	12.3%	0.9%	4.0%	(1.93)	0.88	0.49	-0.66	0.49	-0.82
1999	11.7%	0.8%	3.3%	1.89	1.47	0.73	-0.59	-0.31	0.40
2000	12.5%	1.1%	3.6%	1.93	1.18	1.14	-0.58	-0.34	0.63
2001	13.5%	1.3%	3.6%	(1.63)	1.65	(0.21)	-0.62	0.04	-0.45
2002	12.1%	0.9%	3.3%	1.68	2.65	(0.01)	-0.56	-0.27	0.52
2003	13.4%	1.5%	3.8%	1.38	1.42	(0.77)	-0.47	-0.31	0.54
2004	14.2%	1.0%	3.8%	0.61	5.88	1.58	-0.43	-0.19	0.51
2005	13.2%	1.0%	3.6%	1.25	4.75	(0.38)	-0.54	-0.27	0.33
2006	13.4%	1.0%	2.9%	(0.86)	2.71	0.65	-0.41	0.12	-0.24
2007	12.0%	0.7%	2.9%	1.23	2.00	0.37	-0.44	0.05	0.14
2008	23.3%	0.6%	8.5%	(1.19)	2.14	1.71	-0.47	0.34	-0.58
1991-08	12.5%	1.1%	3.6%	0.10	1.58	0.88	-0.50	-0.07	-0.04

Notes: Performance statistics prior to 2007 are pro forma

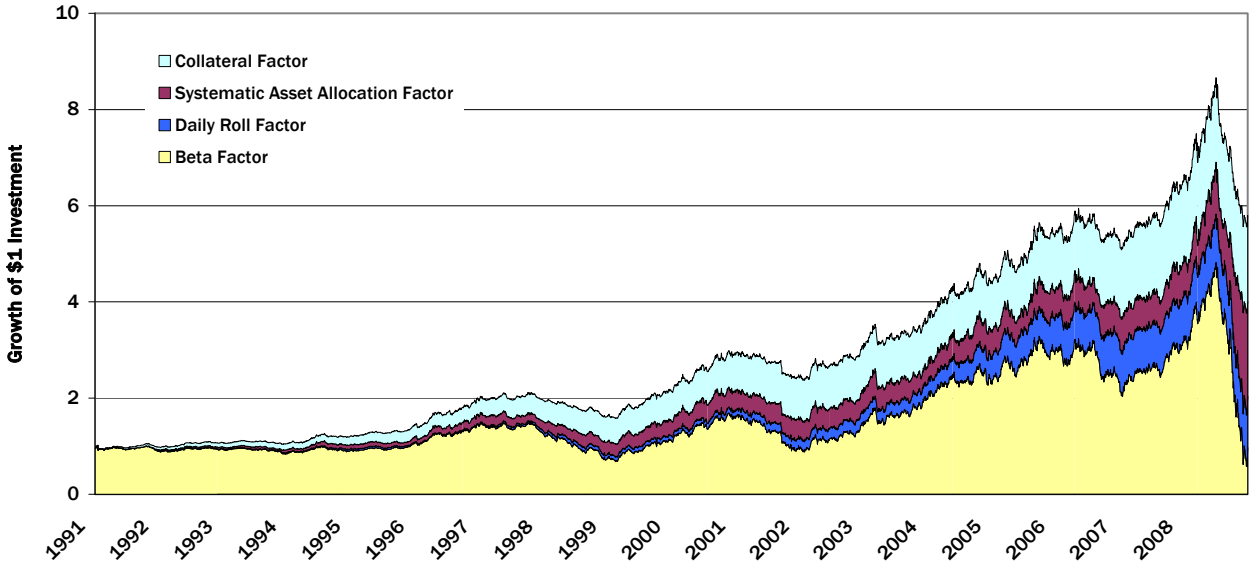
Factor definitions are given in Exhibit 4.

Definitions

Factor Volatility	Annualized standard deviation of daily factor returns on a stand-alone basis
Factor Sharpe	Annualized factor excess return divided by factor standard deviation
Factor Correlations	Correlation coefficient based on daily returns for each factor

Exhibit 6 shows the growth of $1 in the BCI. The return is separated by factor. A dollar invested in the BCI in 1991 would be worth approximately $5.80 at the end of December 2008. By comparison, a dollar invested in the Beta strategy alone (including collateral) would have increased to approximately $2.83.

Exhibit 6: Cumulative Factor Returns for Composite Index
1991-2008



4.3 Sector Index Return Comparison

As shown in Exhibit 7, factor returns differ considerably across commodities and commodity sectors. For example, over the period studied, energy Beta contributed nearly 1.8% per year on a compound basis, while metals Beta was close to 2.1% per year and agriculture Beta was a negative -2.2% per year. Among individual commodities, Beta was positive for all the energy contracts except natural gas, and was negative for five of the eight commodities in the agriculture sector.

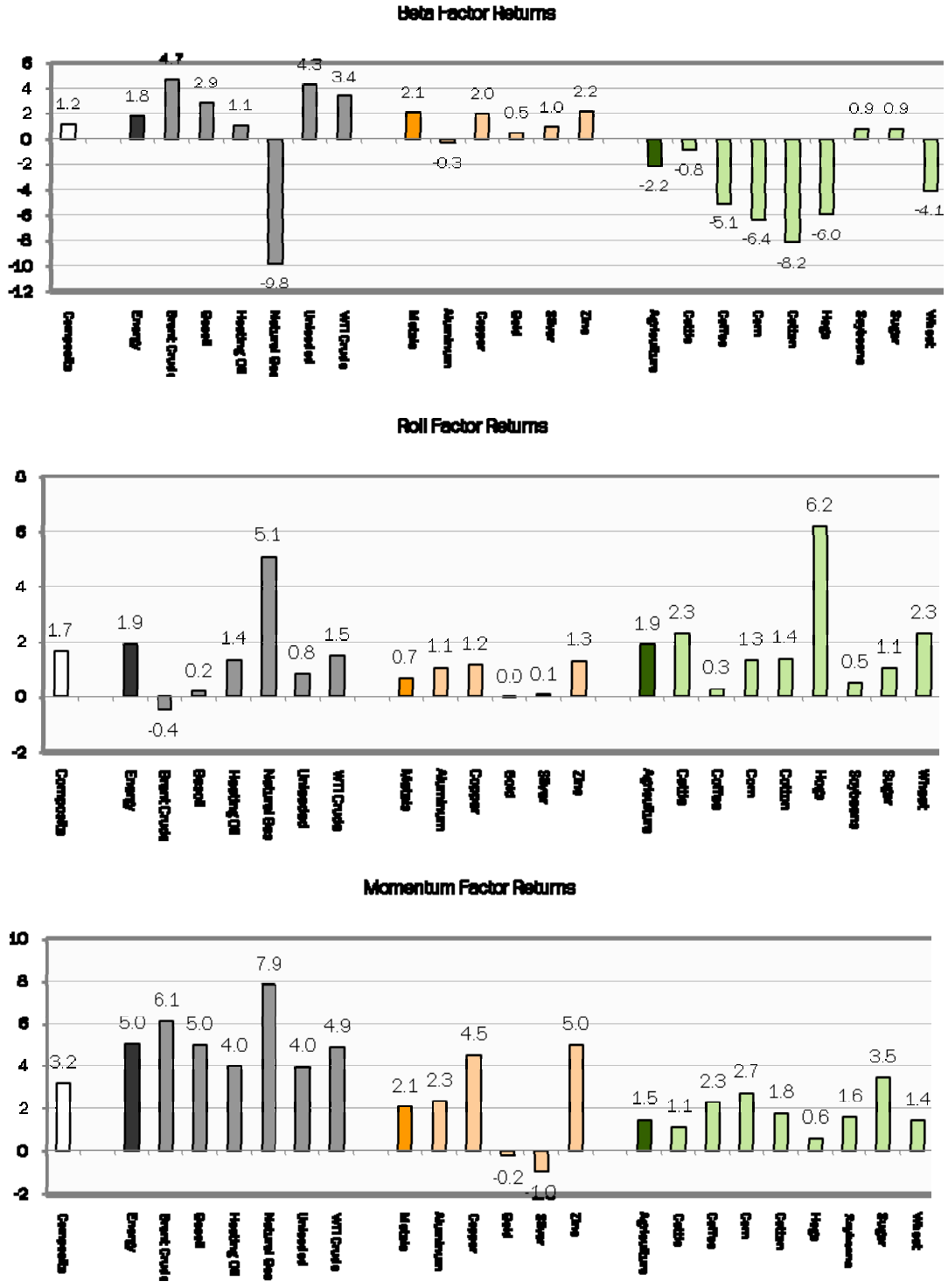
For the Relative Roll factor, all but one commodity (Brent Crude) and all of the sector indices had positive returns. One measure of the benefit of adding these additional sources of return is the fact that at least two of the three sources were positive for each of the commodities studied, and all three were positive for many of the commodities included in the Index.

4.4 Sector Index Correlation Analysis

Commodity style factors have beneficial portfolio properties. Beta style factors have high correlation with commodity markets and low correlation with traditional asset markets. Relative Roll and Momentum style factors have low correlation with other style factors. This implies that adding style factors to an existing commodity investment program will provide diversification. As shown in Exhibit 8, the BCI has a high correlation (at least 0.92) with the SPGSCI ER and the DJUBS ER. The Energy Beta style factor has a very high correlation with these three indices as well.[15]

The Metals Beta factor and the Agriculture Beta factor have a moderate correlation with the diversified indices. The correlations are higher for the DJUBS than the others, which reflect the larger allocation to metals and agriculture in that index. Relative Roll style correlations are all negative. A few of the Momentum factors have correlations which are negative of close to zero.

Exhibit 7: Average Annual Factor Returns for Beta, Relative Roll, and Momentum, January 1991 to December 2008*



* The period for Zinc and Aluminum is January 2002-December 2008.

Exhibit 8: Correlation Matrix, Factors and Indices 1991-2008

	BCI^{SM} ER	GSCI ER	DJUBS ER	Beta Factor	Roll Factor	Momentum Factor	Energy Beta	Energy Roll	Energy Momentum	Metals Beta	Metals Roll	Metals Momentum	Agri. Beta	Agri. Roll	Agri. Momentum
BCI^{SM} ER		0.93	0.91	0.95	-0.44	0.25	0.91	-0.44	0.27	0.38	-0.08	0.08	0.41	-0.08	-0.02
GSCI ER	0.93		0.90	0.97	-0.48	0.00	0.96	-0.48	0.04	0.30	-0.05	-0.04	0.36	-0.08	-0.12
DJUBS ER	0.91	0.90		0.94	-0.41	0.00	0.83	-0.38	0.03	0.51	-0.14	0.02	0.56	-0.13	-0.11
Beta Factor	0.95	0.97	0.94		-0.50	-0.04	0.94	-0.49	0.00	0.40	-0.10	-0.02	0.46	-0.11	-0.13
Roll Factor	-0.44	-0.48	-0.41	-0.50		-0.07	-0.52	0.92	-0.08	-0.10	0.15	0.00	-0.15	0.38	0.02
Momentum Factor	0.25	0.00	0.00	-0.04	-0.07		0.00	-0.07	0.95	-0.04	0.00	0.36	-0.12	0.00	0.40
Energy Beta	0.91	0.96	0.83	0.94	-0.52	0.00		-0.56	0.04	0.20	-0.02	-0.04	0.19	-0.03	-0.10
Energy Roll	-0.44	-0.48	-0.38	-0.49	0.92	-0.07	-0.56		-0.10	-0.04	0.02	0.01	-0.03	0.02	0.04
Energy Momentum	0.27	0.04	0.03	0.00	-0.08	0.95	0.04	-0.10		-0.05	0.02	0.17	-0.08	0.01	0.14
Metals Beta	0.38	0.30	0.51	0.40	-0.10	-0.04	0.20	-0.04	-0.05		-0.42	0.15	0.24	-0.03	-0.07
Metals Roll	-0.08	-0.05	-0.14	-0.10	0.15	0.00	-0.02	0.02	0.02	-0.42		-0.10	-0.05	0.01	-0.01
Metals Momentum	0.08	-0.04	0.02	-0.02	0.00	0.36	-0.04	0.01	0.17	0.15	-0.10		-0.05	0.00	0.18
Agri. Beta	0.41	0.36	0.56	0.46	-0.15	-0.12	0.19	-0.03	-0.08	0.24	-0.05	-0.05		-0.32	-0.15
Agri. Roll	-0.08	-0.08	-0.13	-0.11	0.38	0.00	-0.03	0.02	0.01	-0.03	0.01	0.00	-0.32		-0.04
Agri. Momentum	-0.02	-0.12	-0.11	-0.13	0.02	0.40	-0.10	0.04	0.14	-0.07	-0.01	0.18	-0.15	-0.04	

5 Conclusion

The factor-based approach is an important advancement in commodity index design. This approach provides diversification not just across commodities and commodity sectors, but across sources of return. Results presented here show that commodity Beta provided the bulk of nominal returns over the past 18 years to the typical commodity investor, but that this return was accompanied by high volatility. The other style factors, Relative Roll and Momentum, provide lower nominal returns but higher risk-adjusted returns than Beta. Furthermore, the low correlation among style factors allows for better diversification.

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[1] For example, at the close of business on Wednesday, January 4, 2006 all contracts for February delivery were rolled to the deferred contract. In December 2005, the 5th was a Monday, so January 2006 contracts were rolled on Friday, December 2. In the rare case that the weekday prior to the 5th is a holiday or a special situation such as a limit move, the position is rolled on the next date. Please refer to the index methodology document for details.

[2] This is true of the way dividends are handled in equity indices as well. Since dividends are assumed to be reinvested in the index, the return of a stock in an index will differ from its return as a stand-alone investment. This effect is far more pronounced in commodity indices, where cash generated (used) in rolls can exceed 1% per month, depending on the commodity.

[3] This is different from the approach taken in most commodity indices, which hold the number of futures contracts constant when rolling but require adding or removing cash when the forward curve for the commodity is not flat.

[4] Note that the different mix of nearby and deferred contracts means that the amount of (notional) capital invested in these factors will differ when the forward curve for the commodity is not flat.

[5] While the difference between cash and Treasury bills may seem minor, the important distinction is that cash generated from sales is not reinvested in the index as a whole. Each of the component commodity markets is self-contained, and each market maintains its own Treasury bill balance.

[6] Note that the rebalancing also applies to the Treasury bill allocation in the individual commodity markets. If a given commodity increases in value by more than the index as a whole, all three positions (nearby futures, deferred futures, and Treasury bills) will be reduced proportionally to bring the commodity to its neutral weight in the index.

[7] Please refer to the index methodology document for details on this calculation.

[8] There is little difference in results if position sizes are held constant and the amount of notional capital is allowed to vary. Furthermore, the difference that is measured using this approach improves the performance of the Relative Roll factor as compared to the Beta factor.

[9] This was done in order to simplify the analysis. Rebalancing the hedged factor positions each day was explored and has a small negative impact on the returns to the Relative Roll and momentum factors.

[10] See section 3.2 for more details.

[11] The index was rebalanced on March 3, 2008. At that time, overall sector allocations remain unchanged, but ICE Gas Oil was added to the index, increasing the total commodity futures market positions to 19 from 18.

[12] Standard deviation and correlation figures were also calculated using daily returns. The differences were not material.

[13] The attribution of Relative Roll and Momentum returns to Roll rather than Spot return is largely an artifact of the way these returns are commonly defined. Since Roll return is defined as return not attributable to an increase or decrease in the price of the commodity, excess returns generated using any trading strategy that has a zero average exposure to the commodity will be attributed to Roll.

[14] This is consistent with the notion that a supply disruption results in both higher spot prices and greater backwardation. Since the Relative Roll factor earns profits from contango and loses in periods of backwardation, a negative correlation between these factors is likely to persist.

[15] This is expected. All indices have a large allocation to energy, energy markets are the most volatile markets in the commodity indices, and the energy markets have the largest intra-group correlation.