FIRST QUADRANT

Balanced Risk Commodities

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FQ Perspective

by Ed Peters

Due to the increasing allocation to commodities reported in the popular press we believe there is a strong consensus that commodities should be a part of any well diversified portfolio both to hedge bonds against the risk of expected inflation as well as to participate in inflationary growth. While equities offer real economic growth, inflationary growth can erode earnings. Commodities are a likely candidate to hedge against the erosion of principal in bonds and the inflationary erosion of earnings. Commodities also significantly reduce risk when added to portfolios of stocks and bonds. However, investing in commodities is problematic for many reasons.

First, it is impractical for most investors to buy physical commodities, so the only alternative is futures. Yet, the return from futures can vary from the return of physical commodities for multiple reasons tied to pricing and the way that futures markets work. For instance in financial futures markets futures and physicals must converge at expiration. Many commodity futures, like wheat, do not have this requirement.

Second, commodities, unlike financial futures, are quite dissimilar from one another and developing a uniform approach to investing in commodities is difficult. For instance, some commodities, like agricultural commodities, are renewable while others, like gold, will always be in limited supply. Some are tied directly to the economy such as energy and industrial metals, while others such as livestock, have only a tenuous relationship to the broader economy. Some are difficult to store and are perishable, while others are inexpensive to store and last for decades, or in the case of gold, forever. So a common approach to investing in commodities based upon valuation, for instance, is a challenge.

Third, due to these dissimilarities, there has not been consensus on how to create an index that captures what it means to "passively" invest in commodities. For equities, the concept of an index was easy. Since investors want to own the market portfolio in the manner of the Capital Asset Pricing Model (CAPM), a stock index owns stocks in the weight they exist in the market. But what of commodities? There is no natural method to weigh them as they appear in the marketplace, though many have tried. The most popular approach uses "production" but that puts an undue weight on commodities that are drawn pre-existing out of the ground rather than those that are grown. So most commodity indices are not a satisfying way to passively invest in commodities, causing many to abandon the idea of passive commodity investment and focus exclusively upon active management. Yet these active managers still use the admittedly flawed commodity indices as the beta component of their returns. Unfortunately this brings us back to the reason for investing in commodities in the first place. That is, inflation hedging and diversification.

In this article we describe a new method for long-only investing in commodities. This approach weighs commodities by their risk contribution and targets optimal diversification. However, unlike conventional "index" strategies, it is not static. Weights change based upon the changing risk environment, but these weight changes are based upon rules, not judgment or an alpha forecast, so it qualifies as "passive" though it is not "static." Based on our simulation study illustrated in this article, we believe that this Balanced Risk Commodity Index (BRCI) is a far superior construct than other commodity indices, and can outperform most active managers and can deliver a more efficient beta return swamping the "inefficient beta plus alpha" that composes the typical active manager's total return.

While it can have superior risk and return characteristics, the BRCI can also have the same, if not better, inflation hedging and diversification properties with stocks and bonds than the more conventional indices.

The Inefficiency of Conventional Commodity Indices

It is common to look at the diversification of a portfolio or index through the number of assets and the capital weight of those assets. The Goldman Sachs Commodity (GSCI) and the Dow Jones UBS Commodity (DJ UBS) indices are the most popular commodity indices used as benchmarks. The GSCI is frequently used because it has a liquid cash settled futures contract, so it offers an easy way to passively invest in commodities. The GSCI weights commodities according to their world wide production which gives it a 77% capital weight to energy. This raises questions about the diversification of the index, so the DJ UBS modifies the weighting scheme by placing maximums on sectors and individual commodities. As a result, the DJ UBS has a 33% weight in energy and so looks more diversified. Both indices have a large number of commodities in them. The GSCI has 24 while the DJ UBS has 19 futures.

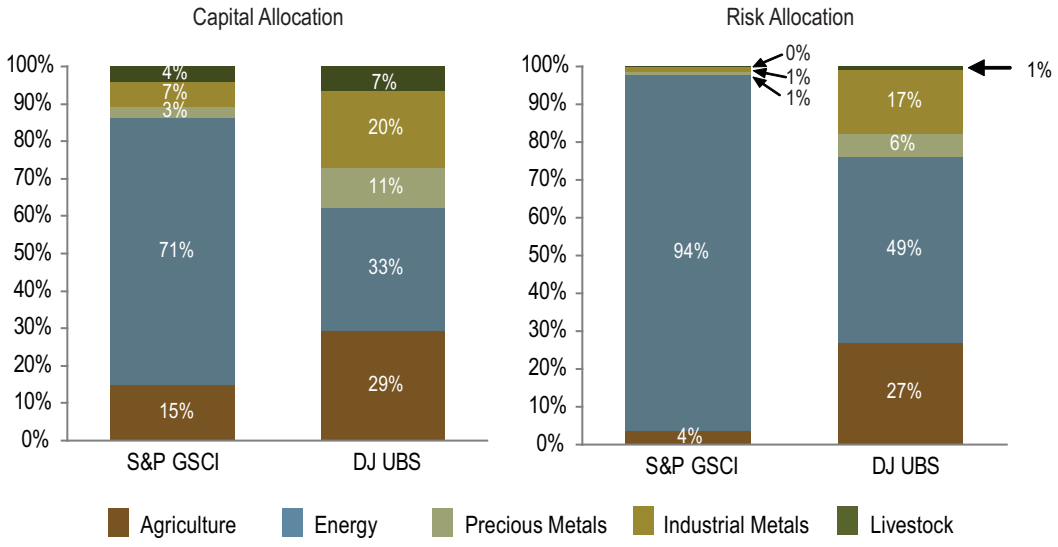
However, if we look at the risk budgets of each index neither looks diversified at all. There are five primary commodity sectors: Agriculture, energy, industrial metals, precious metals, and livestock. The capital weights are determined once a year. Chart 1 below shows the most recent capital weights of the GSCI and DJ UBS on the right while the left shows the risk budget weights.

The GSCI is almost entirely an energy index. Not only is 71% of its capital invested in energy, over 90% of its risk budget is in energy. The other sectors make a small contribution to the index. Precious metals, for instance, are virtually non-existent. So those who consider gold an important investment receive virtually no exposure through the GSCI. The DJ UBS is better, but still 49% of its risk budget is given to energy with the balance primarily in agriculture. There is exposure to industrial metals, but precious metals and livestock, again, receive virtually no weight.

Chart 2 shows the return contribution of the different sectors from January 1988 – June 2010, and we can see that the return contribution of each sector is very similar to their risk weights. This is no coincidence. Research has shown that there is a strong relationship between risk and return contribution in a portfolio.

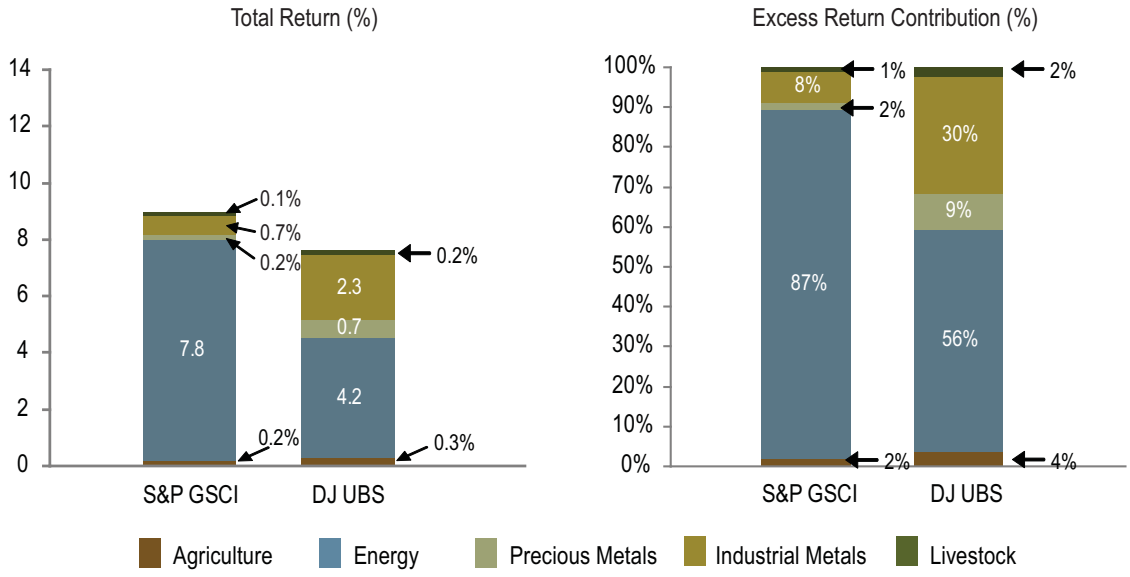
From this analysis we can see that the most common commodity indices do not really give true diversification, but are energy heavy both in their returns and risk contribution.

CHART 1: ALLOCATING TO COMMODITIES: *Capital versus Risk*
January 1988 – December 2009



Sources: Bloomberg, Global Financial Data (GFD)

CHART 2: ATTRIBUTION[1]
January 1988 – June 2010



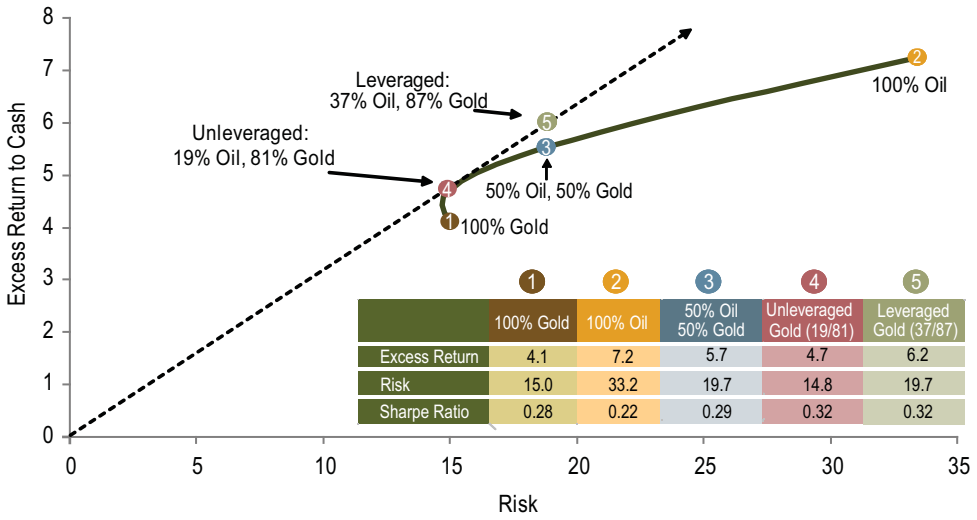
Sources: Bloomberg, Global Financial Data (GFD)

Balanced Risk Commodity Index

Given the strong relationship between risk and return attribution we can postulate that a risk balanced portfolio would also be return balanced, and so offer true diversification. In addition, as shown previously in "Balancing Betas" we can expect risk balancing to optimize the Sharpe ratio of the portfolio. We have constructed such a Balanced Risk Commodity Index (BRCI) along the lines of our Essential Beta strategy as outlined in previous articles. The BRCI contains 20 commodities selected for their liquidity and diversifying properties. The risk balancing is done over three dimensions:

- Across sectors,
- Within sectors, and
- Through time using the FQ Market Risk Index.

CHART 3: BALANCING RISK THROUGH EXCHANGE-TRADED FUTURES: *Example Gold and Oil*
January 1988 – December 2009



Sources: Bloomberg, Global Financial Data (GFD). Gold is gold futures and Oil is WTI oil futures, constant maturity; Rebalanced monthly.

In the following sections we will examine the methodology and benefits of the Balanced Risk Commodity Index.

Beating the Market with No Skill

One of the primary benefits of risk balancing is the ability to create a portfolio with a higher Sharpe ratio without additional proprietary information. We will illustrate this with a simple portfolio of gold and oil futures.

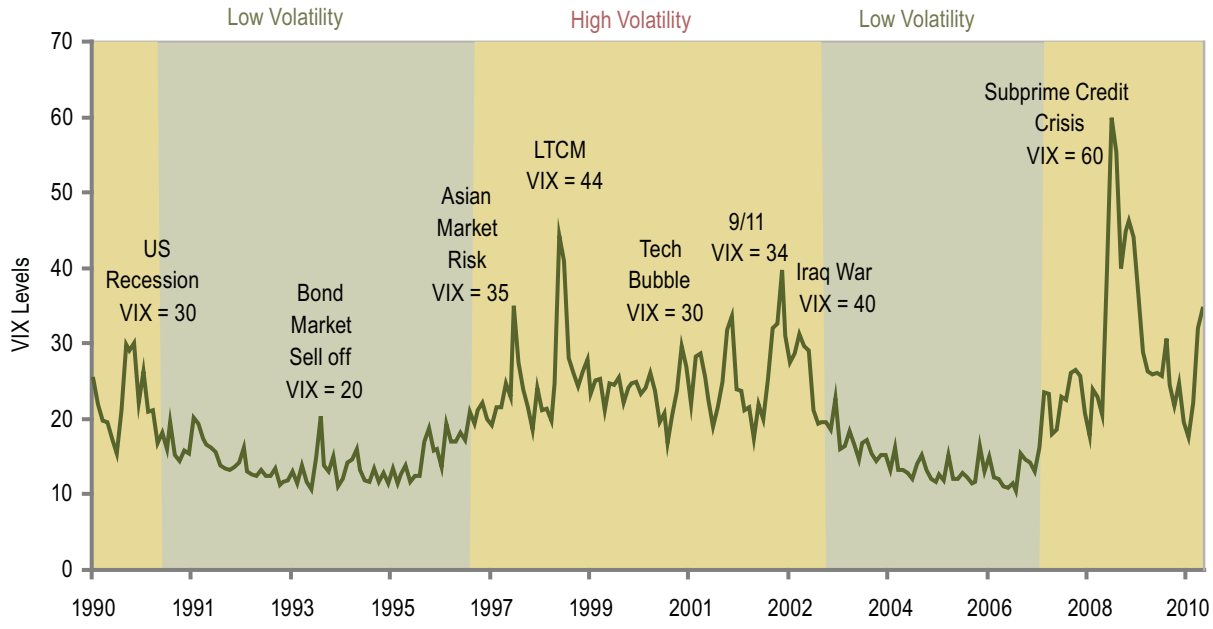
Chart 3 shows the "efficient frontier" for combinations of oil and gold with excess return to cash on the y-axis and risk on the x-axis for the period

from January 1988 – December 2009. Note that oil and gold have very different risk/return characteristics. Oil is almost three times more volatile than gold and has a lower Sharpe ratio. Also the correlation between oil and gold is a low 22%. The curve shows the risk/return tradeoff for various combinations of oil and gold. We have noted one point on the curve with a number "3" where we have a portfolio that is 50% gold and 50% oil which has a Sharpe Ratio of 0.29. This example was chosen merely for illustration but suppose this was the risk level needed to diversify the stock and bond portfolio. While the capital is evenly balanced the risk budget is highly tilted towards oil, so if we wanted to balance the risk between oil and gold we would have to go down the efficient frontier to the portfolio labeled "4" which is 81% gold and 19% oil. At this point we have diversified risk and increased the Sharpe ratio to 0.32, but have reduced the overall return and risk target. Suppose this risk level is not adequate for our diversifying needs. If so, we have two choices. The first is that we forget about risk diversification and go back up the curve to the less efficient 50/50 portfolio, or we can lever portfolio 4 and move up the dotted line to portfolio "5."

Portfolio 5 has the same risk as portfolio 3, but also has the same Sharpe ratio as portfolio 4. So it has a higher expected return than portfolio 3. Note that we have increased the return of our combination of oil and gold at the same level of risk, and we have done it with no proprietary information. That is, with no skill. Portfolio 5 does need to use "leverage" but in this case we are leveraging in the exchange traded futures market. This is not really leverage in the way we typically think of leverage. That is, we are not borrowing securities from a third party and paying them interest. In the futures market there is no third party. We merely buy more in face value than we have in cash backing the futures contract. So if we buy $1.2 million in notional exposure, but have $1 million in the bank, we have effectively leveraged our position. But there is no counter party risk, and no liquidity issues other than the exchange itself. While over levering can be dangerous, a modest amount of leverage can actually reduce risk as it does in this case.

The Balanced Risk Commodity Index takes this concept and expands it to the five commodity sectors as well as the individual commodities within each sector. Risk balancing can improve the Sharpe ratio at each step. In addition, the BRCI compensates for a flaw in the above analysis. So far we have assumed that risk is stable over time. As we have seen since 2007 in particular, this is not the case and never has been. The BRCI takes into account the fact that risk changes over the business cycle and the capital weights of the portfolio constituents must change if we are to keep the risk budget constant.

CHART 4: VOLATILITY REGIMES IMPACT ASSET ALLOCATION
January 1990 – June 2010



Sources: Chicago Board Options Exchange, First Quadrant, LP

Volatility Regimes and the Market Risk Index

Most asset allocation studies use long term risk and correlation data in order to construct the covariance matrix for optimization. This methodology makes an implicit assumption that risk is fairly constant over time and short term changes in risk are not important. Unfortunately markets do not work that way. Instead we do have long periods of high and low uncertainty which translates into high and low volatility regimes. We have written a more extensive article on this which can be seen in the references, but a brief recap will be made here.

Chart 4 shows the 3 month moving average of the VIX index going back to 1990. We have divided the chart into "High Volatility" regimes when the VIX is above its median of 19, and "Low Volatility" regimes when the VIX is below the same median. We can see that these periods last for years. In addition the transition from low to high is fairly orderly. The VIX measures when the cost of hedging an equity portfolio is rising, reflecting rising uncertainty in the marketplace. We can also note that spikes in the VIX typically happen when it is already in the High Volatility regime, or when uncertainty is already high. When people are already nervous, it does not take much to set them off.

The FQ Market Risk Index combines the VIX with credit spreads, global monetary policy and global economy activity to measure the level of uncertainty in the markets. In the BRCI we try to keep the risk target and the risk budget of the portfolio constant but let the capital budget change. This means that the level of leverage will also vary over time. During low volatility periods we need more leverage to achieve our risk target than in high volatility regimes where leverage is not needed.

More detailed information can be seen in our previous article "Using Volatility Regimes" and a forthcoming article showing the relationship of market uncertainty and commodities directly.

Constructing the BRCI

The FQ Balanced Risk Commodity Index (BRCI) balances risk across the same three dimensions as Essential Beta. That is:

- Across Sectors,
- Within Sectors, and
- Through Time using the FQ Market Risk Index.

Each dimension can improve the Sharpe ratio of the portfolio as it increases diversification.

The methodology is straight forward. First, an overall risk target is set for the portfolio. One of the issues with a commodity portfolio is that the low correlation among the commodities limits the amount of risk that a portfolio can achieve if we limit the weights to a total of 100%. A true risk balanced commodity portfolio without leverage could only have risk of about 8%. That could, in fact, be a reason that other less diversified weighting schemes are commonly used. However, this is a cash and futures portfolio, so we are not limited to a total weight of 100%. For instance, a risk balanced portfolio with a 12% risk target requires a leveraged weight of about 120%. However, this 12% portfolio can be better diversified and can have less total risk than the GSCI which has no leverage as we will see below. For the purposes of this analysis we will use a 12% risk target.

Next we risk balance within the sectors, and risk balance across the sectors. This is where the leverage comes in. Precious metals and livestock are the more diversifying commodity sectors because they have low and often negative correlations with the other three. Yet, they are also the lower volatility sectors. So the only way to risk balance the portfolio is to leverage the precious metal and livestock sectors. Interestingly Erb and Harvey (2006) found that livestock had the best correlation with inflation among the commodity sectors, yet it receives little weight in either commodity index. While there is no reason to believe that this relationship will continue, it does point to the fact that we cannot be sure which sector will tie in with inflation and ignoring whole sectors can affect the properties of the portfolio. The BRCI corrects this issue by giving equal risk weight to each sector.

Finally, we risk balance through time using the FQ Market Risk Index allowing the capital weights of each sector to vary according to the risk regime we are currently experiencing.

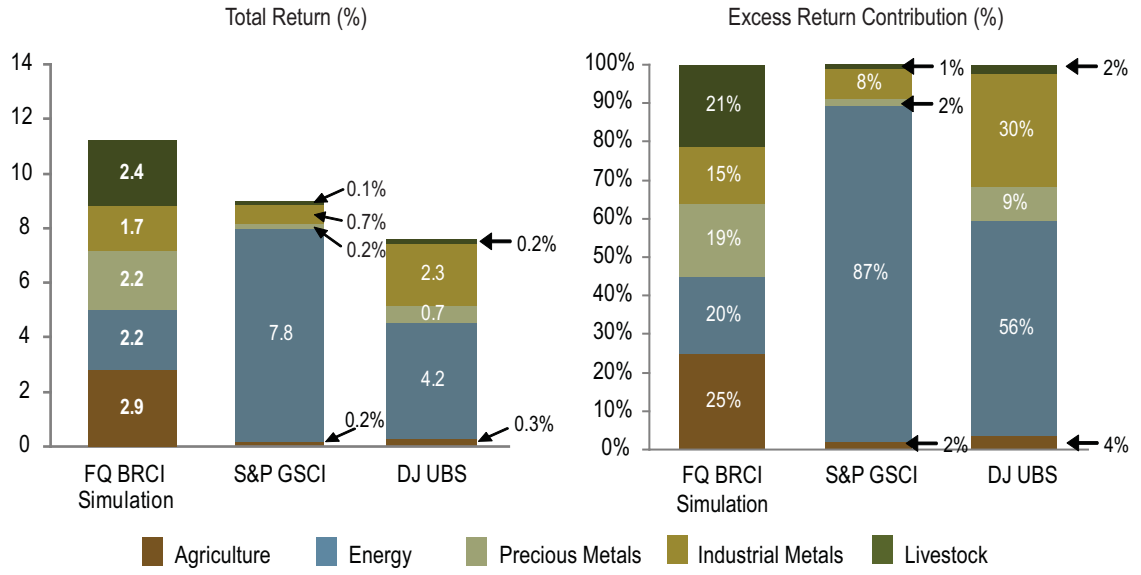
Simulation[1]

The BRCI simulation used in this illustration uses nearby futures contracts and cash from 1988 to June 2010. The futures contracts are rolled to the next nearby to avoid potential delivery. The simulation also targets a total risk level of 12%.

Chart 5 updates Chart 1 to include the return attribution of the BRCI simulation along with the GSCI and DJ UBS.

The BRCI can have a much more even return attribution by sector reflecting its more diversified risk composition. In addition, the total return can be higher.

CHART 5: ATTRIBUTION[1]
January 1988 – June 2010 (Net of Fees)

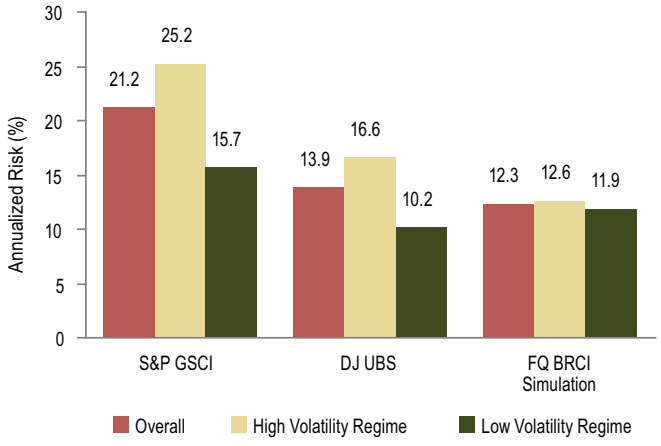


Sources: Bloomberg, Global Financial Data (GFD)

Chart 6 shows the stabilizing effect of using volatility regimes. The red bar shows the average annualized risk over the period, the yellow bar shows the high volatility regime while the green bar illustrates the low volatility regime. In the case of the GSCI and DJ UBS we can see that realized risk follows the regimes, while the BRCI shows more stable risk in the two regimes.

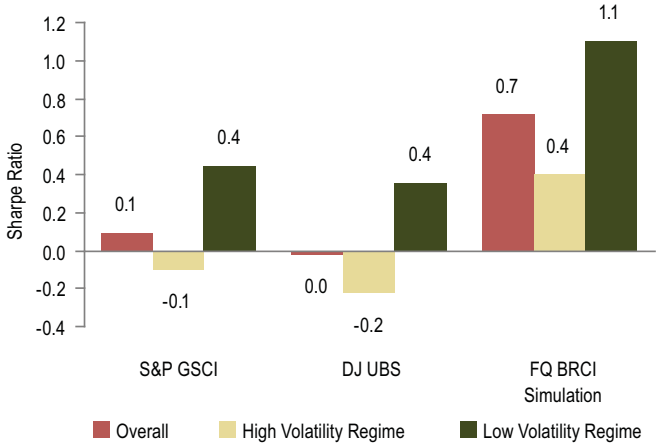
Chart 7 shows the Sharpe ratio and illustrates that whatever excess return the GSCI and DJ UBS earn, it comes during the low volatility period but tends to give it up in the high volatility period. BRCI is able to achieve positive Sharpe ratios in both periods though it is and can attain a higher sharpe ratio in the low volatility regime.

CHART 6: PERFORMANCE STATISTICS – Annualized Risk (%)[1]
January 1988 – June 2010 (Net of Fees)



Sources: Bloomberg, Global Financial Data (GFD)

CHART 7: PERFORMANCE STATISTICS – Sharpe Ratio[1]
January 1988 – June 2010 (Net of Fees)

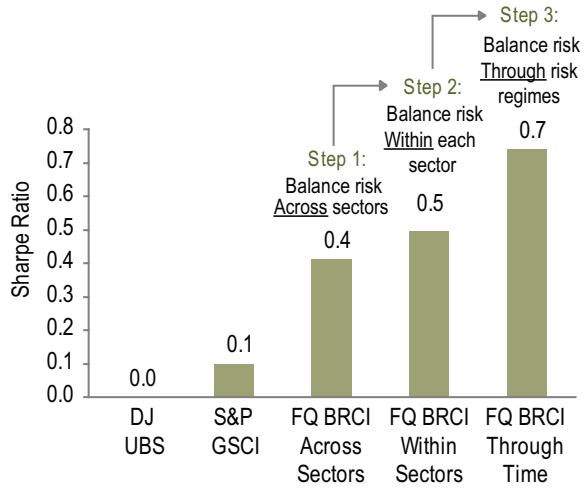


Sources: Bloomberg, Global Financial Data (GFD)

Finally, Chart 8 shows how each stage of risk balancing can improve the Sharpe ratio of the portfolio.

We can see from our simulation study that the BRCI can have superior risk/return characteristics to the GSCI and the DJ UBS, but can it also have the diversifying effects that investors expect of commodities?

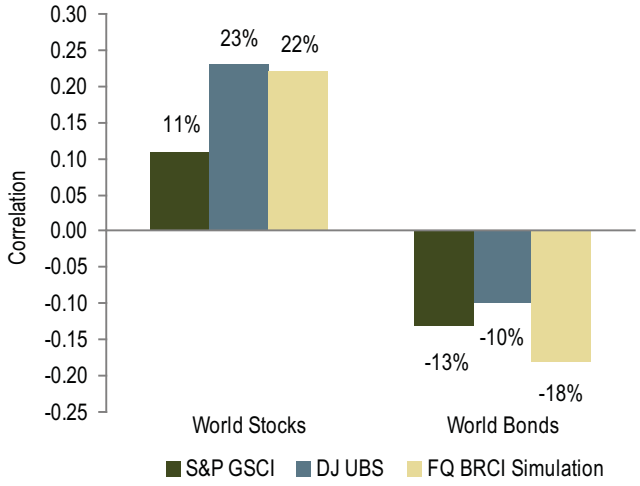
CHART 8: SHARPE RATIO ACROSS RISK BALANCING DIMENSIONS[1]
Simulation: January 1988 – June 2010 (Net of Fees)



Sources: Bloomberg, Global Financial Data (GFD)

Chart 9 shows the correlations with stocks and bonds for all 3 indices and we can see from the simulation that the BRCI can have a similar small positive correlation with stocks and negative correlation with bonds that the other two indices have. So from a correlation standpoint, the BRCI is able to offer similar diversifying characteristics.

CHART 9: PERFORMANCE STATISTICS[1]
January 1988 – June 2010 (Net of Fees)

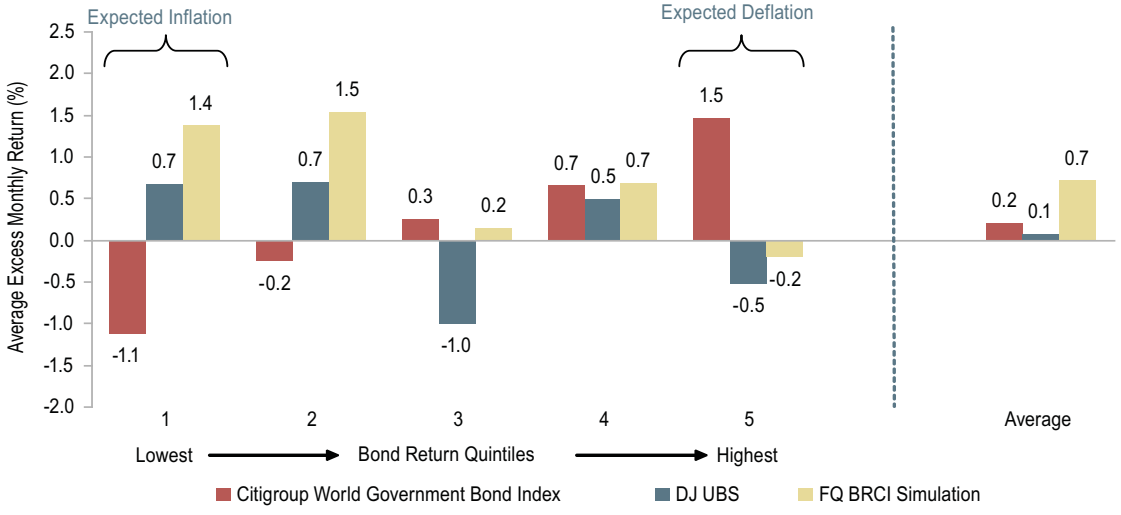


Sources: Bloomberg, Global Financial Data (GFD)

Finally, how does the BRCI perform in periods of rising expected inflation and deflation? Unfortunately traditional inflation indices such as the Consumer Price Index do not reflect inflation expectations, but are instead measures of trailing inflation which we receive with a one month delay. So the best indicator of rising inflation expectations is a significant increase in the yields of intermediate sovereign bonds. Conversely, disinflation or deflationary expectations are signaled by falling sovereign bond yields.

Chart 10 illustrates these effects. We have taken January 1988 – June 2010 monthly excess returns of the Citi World Government Bond Index (WGBI), the DJ UBS, and

CHART 10: BOND TAIL RISK REDUCTION[1]
January 1988 – June 2010 (Net of Fees)



Sources: Bloomberg, Global Financial Data (GFD)

the BRCI simulation and sorted them from low to high based upon the WGBI. We then divided them into quintiles, meaning groups which contain 20% of the observations and averaged them. So, Quintile 1 contains the average of the bottom 20% of WGBI returns, while Quintile 5 has the top 20% of WGBI returns. The DJ UBS and BRCI simulated numbers for each quintile represent their performance during those same periods of poor to good performance of the WGBI. We can see that in Quintile 1, when the WGBI averages a monthly loss of -1.1%, both the DJ UBS and the WGBI have positive returns of +0.7% and +1.4% showing that both are effective hedges against rising interest rates and rising inflation expectations. Conversely during the falling interest rate environment of Quintile 5 when the WGBI produces an average monthly return of +1.5%, the DJ UBS and the BRCI simulation both have negative returns of -0.5% and -0.2% respectively reflecting the disinflationary expectations of those periods.

So we can see that BRCI can offer the same hedging capabilities of the DJ UBS but is less affected by deflationary pressures. This is due to the heavier weight in precious metals and livestock which are not affected as much by deflationary pressures as the other commodity sectors.

When would the BRCI underperform the GSCI and the DJ UBS? Whenever energy far outstrips the other sectors, then portfolios more concentrated in energy like the GSCI and the DJ UBS will outperform. At other times, we can expect that diversification will win out as we know it does over the long term.

Summary

Commodities are accepted as important components of a diversified asset allocation portfolio. Yet, the structured options available to investors have not offered a truly diversified portfolio, leading to disappointing results both from a total return and a diversification standpoint. This is due to the inefficient methodologies being used to create these indices which try to mimic popular stock indices. That is by substituting concepts such as "production weighting" for capitalization weighting. However, these schemes typically result in an overweighting in energy and a downgrading of the more diversifying sectors such as livestock and precious metals. The balanced risk approach creates what we believe to be true diversification with an ability to maximize the Sharpe ratio while keeping the qualities that investors require of commodities. The goal of the Balanced Risk Commodity Index is to diversify stocks and bonds and hedge effectively against inflation. It seeks to accomplish this by balancing risk not only across sectors but also within sectors and through time taking into account the fact that risk changes over the business cycle. By ignoring this fact investors often take more risk when they have little chance of reward, and take too little risk when reward is the strongest. The balanced risk approach seeks to change this by targeting the risk budget rather than a fixed capital weight. We believe that the BRCI thus offers a structured approach that keeps all the benefits of commodity investing while enhancing the rewards of this important yet poorly understood asset class.

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References

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Erb C., Harvey C., *The Strategic and Tactical Value of Commodity Futures,* Financial Analysts Journal (March/April 2006)

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Peters, E. *Using Volatility Regimes: the FQ Market Risk Index,* FQ Perspective (September 2009)

Endnotes

[1] *Please see* ***Simulation Disclosures: Balanced Risk Commodity Index – Simulated Performance*** *(Gross and/or Net of Fees) found at the end of this presentation for information concerning this simulation and the effect of fees on the performance. First Quadrant Balanced Risk Commodity Index ("FQ BRCI") is a risk weighted portfolio, consisting of the following commodities, which serve as proxies to sectors presented above: WTI Oil, Brent Oil, Natural Gas, RBOB Gasoline, Heating Oil, Wheat, Corn, Soybeans, Coffee, Sugar, Cocoa, Copper, Aluminum, Lead, Zinc, Nickel, Gold, Silver, Live Cattle, Lean Hogs. FQ BRCI balances risk across these so that each commodity has an equal risk footing in the portfolio.*

Balanced Risk Commodity Index – Simulated Performance (Gross and/or Net of Fees)
Unless otherwise noted, performance figures do not reflect the deduction of investment advisory fees. These fees are described below. The returns shown will be reduced by the advisory fees and any other expenses the advisor may incur in the management of an investment advisory account. ***Simulated performance is no guarantee of the future results in a live portfolio using the strategy. Potential for profit is accompanied by possibility of loss. General Disclosures:*** The simulated performance used in this presentation will differ from live performance experienced using the strategy for the following reasons: • The simulation assumes that we adjust the risk and capital allocated to commodity positions on a monthly basis after the close on the last day of each month whereas the live product may not adjust the allocations exactly at that time. • The simulation assumes that the strategy and sub-strategy guidelines are constant through the life of the portfolio whereas the guidelines for live portfolios may have changed over the life of each portfolio. • The simulation assumes fixed transaction costs whereas live portfolio transaction costs will be variable. • The simulation assumes all trading takes place once a month (on the last day of the month) whereas live portfolios may trade often during the month. • Hypothetical or simulated performance results have certain inherent limitations. Unlike an actual performance record, simulated results do not represent actual trading. Also, since the trades have not actually been executed, the results may under or over compensate for the impact, if any, of certain market factors, such as lack of liquidity or security positions that need to be rounded based upon contract size when live futures trades are executed. Simulated trading programs in general are also subject to the fact that they are designed with the benefit of hindsight. No representation is being made that any account will or is likely to achieve profits or losses similar to those shown. Unless otherwise noted, performance returns for one year or longer are annualized. Performance returns for periods of less than one year are for the period reported. ***Disclosures Specific to Simulation:*** The simulation is constructed with the goal to diversify risk in a portfolio by strategically allocating risk to several commodities. The simulation also attempts to balance risk relative to commodity weightings. The simulation targets overall portfolio risk allocations based on pre-determined indicators of market risk which may change over time. ***Investment Management Fees:*** All simulated performance results presented are net of fees, which include trading commissions. The FQ investment management fee schedule for this strategy, which is negotiable, is as follows: The FQ investment management asset-based fee schedule for this strategy, which is negotiable, is as follows: $0–$100 million, 0.50%; $100–$350 million, 0.30%; and more than $350 million, 0.15%. Asset-based fees are charged incrementally. Incentive fee arrangements are available and negotiable.

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