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Portfolio Diversification in Extreme Environments: Are There Benefits From Adding Commodity Futures Indices?

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Abstract:

Diversifying into commodity futures indices to improve risk-return trade-offs had seemed an inviting prospect a couple of decades ago, due to the increasing correlations between equities themselves and the stable low or negative correlations they exhibited with commodities. But there is a view gaining ground now that the benefits of stock portfolio diversification into commodities have died out due to further changes in the correlation matrices, particularly occurring in times of extreme events. This paper readdresses the aforesaid issue for the period 1999-2010, disaggregated into periods so as to bracket bull and bear phases with large changes in returns. Data for the most important equity and commodity indices are used. One interesting finding is that the role of commodities in optimum portfolio diversification may be more relevant in bear phases.

Key Words: *Commodity Futures, Equity Markets, Sharpe Ratios, Frontier Equity, Optimum Portfolio*

JEL Classification: *G11, G13, G15*

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1. Introduction

Recent times have seen an increasing interest in optimizing portfolios by diversifying into commodities. The prospects of improving the risk-return trade off by such diversification stood clear, given the low or negative correlation between commodities and equities, and the fact that the return on commodity future indices over long periods was quite comparable to that earned on equity portfolios such as the Standard and Poor 500.

The increasing correlations between the various international equity markets over several decades even as low correlations between stock and commodity markets - as well as lower volatilities experienced in the latter - were becoming evident, provided the initial spark for such diversification activities involving commodities. The catastrophic events in the markets, which have taken a toll on institutional and small investors alike, have undoubtedly added urgency to this. At the same time, feelers are being sent out into frontier equity markets in search of a better return to risk trade-off, though, inherently, these may be higher risk markets. In this paper we use recent data and developments in traditional and frontier equity markets, and in commodity markets to judge whether diversification across such a menu can offer a possibility of maximizing the risk-return trade-off, as captured by the Sharpe Ratio.

We address this topic with particular reference to extreme scenarios, when returns have been extraordinarily high or low. It has been postulated that under such extreme conditions, correlations between returns, observed under more normal circumstances, go awry, so that optimum portfolios derived for normal scenarios have to be discarded.

In the next section we look more closely at the relationships between - and factors contributing to the movements in - stock and commodity returns, and also discuss some recent contributions in the literature in these areas. Section III describes the data set used and the methodology of analysis, while the subsequent section presents the empirical results. The empirical analysis in that section will be devoted to the diversification benefits, in terms of improving the return-risk trade off, of including commodity indices (and individual commodities) in pure stock portfolios, for the period 1999.01 to 2010.12. The possibility of diversifying into frontier equity markets to improve the risk-return trade off is also analyzed in this section, using an appropriate frontier market stock index. There is a final, concluding section which elicits the important results and conclusions from the analysis.

2. Equity Markets, Commodity Markets and the Macroeconomic Environment

2.1 Impacts of the Macroeconomic Environment

The possibility of beneficial substitution between commodity markets and security markets under inflationary conditions is, of course, self-evident, much the same way as investment in physical assets like real estate offers a hedge against inflation. While anticipated inflation can lead to gains from holding bonds and equities, unexpected inflation often hurts them while being favorable to investors in commodities. According to Demidova-Menzel and Heidorn (2007), the inflation-hedging properties of commodities derive from the fact that they are, after all, real assets, the prices of which rise in tandem with inflation. In fact, of all asset classes, commodities are one of the few which tend to benefit from rising inflation. When demand for goods and services rise, the price of these rise, and so do the prices of commodities which are used to produce these goods and services. Of course, the main vehicle for investment in the commodity sector is commodity futures, and the question is whether these also offer such opportunities as for individual commodities. Early studies by Greer (1978), Kolluri (1981), Bodie (1983), Schneeweis, Spurgin and Warsager (1997), have all, already, provided evidence to this effect.

Other changes (other than inflation) in economic variables which may drive a wedge between movements in commodity and equity prices are not hard to enumerate: private consumption spending (perhaps affected by an indirect tax policy announcement), government spending, and industrial production, all fit the bill. All these factors impinge differently on commodity and stock markets, with a more direct effect on the latter. But government policies, especially in developing nations, related to commodity stocks affecting the market supply, affect commodity markets directly, as do changes in weather patterns.

Changes in monetary policy can also have differential effects on commodity returns and equity prices. Take the case of a restrictive monetary policy: an announcement of an interest rate hike would hurt investors in equity markets, while those who have invested in gold or other commodities or commodity futures may benefit. The same applies for bond markets. Schneeweis and Spurgin (1996) have noted a negative correlation between the Salomon Brothers U.S Government Bond Index and the MAR Energy Commodity Index – which stands to reason, given the positive correlation between interest rates and energy costs.

The movements of commodity prices relative to that of manufactured goods have been traditionally of interest to development economists as well, since this illustrated the disadvantageous trends in the terms of trade faced by developing countries over longer periods of time. However, it may be noted that all commodity prices, including those of commodities typically exported by developing countries, do not move in tandem.

The lack of correlations between various commodity price movements is easily explained: fundamental economic factors do not impact the various commodity markets in an identical fashion. Weather conditions like snowfall, rainfall, and demand drivers like inflationary expectations have different impacts on various commodity prices. For instance, heavy snowfall can cause shipment difficulties for cattle, increasing meat prices, while protecting wheat from damage, increasing supply and keeping wheat prices down. Also, the supply of commodities like cereals and oil seeds are more quickly changed (by favorable weather conditions etc), while for items like coffee, cocoa and sugar, there is a longer lag - since planting trees and cane are high cost activities, not based on short-run profit considerations.

2.2 Evidence on the Benefits of Portfolio Diversification

The advantage of (investing in) commodity indices is that these can perform well even as some individual commodity markets are depressed. This is possible given the low or negative correlation between some commodity pairs. Also, a commodity index can increase in value over time, even when the various components do not increase, since there is 'rebalancing' within the index, derived from reallocation between the sectors on a price - percentage basis. As long as there is the commodities constituting the index do not exhibit perfectly correlated price movements, a price-reweighed index can extract returns based on differential volatilities and mean-reverting tendencies (due to supply-demand adjustments) of the various commodity markets.

The available evidence on correlation between stock and commodity returns broadly maps these being low or negative during past decades, but rising in recent years. But some of the results are contradictory, so that a fresh look - as done on this paper - should always be welcome.

According to Greer (2000), the commodity-stock correlation, as derived for the Chase Physical Commodity Index (CPCI) and the S&P 500 stock index, was negative, at -0.14 for the extended period of 1970 - 1999. Scheeweis and Spurgin (1996) provide data on correlations between commodity and stock indices during the 1990s. It is interesting to note that commodity indices like Dow Jones, GSCI and CRB, as well as managed CTA indices, all have mainly negative correlations with the S&P 500 index, ranging from 0.15 to -0.30. According to Coaker (2006), the correlation between natural resources and the S&P 500 was negative in 17 out of 35 years during the 1970 - 2004 periods, and less than 0.49 for all five year stretches in this period.

As regards the hypothesis of an increasing correlation between stocks and commodities in recent years, the view of Buyuksahin, Haig and Robe (2010) is that during three sub-periods for the period 1991 - 2008, there has been no perceptible change in the correlation between S&P 500 and the commodity index S&P GSCI. However, there is also a proposition, derived from the study of financial markets that correlations between various asset returns increase in extreme environments,

particularly in bear markets (Campbell, Kodeijk and Kofman, 2002). Cheung and Miu (2010) do not find evidence of a negative correlation between stock and commodity markets during bear phases. As for the latest period, post-2008, the commodity-stock correlations seem to have increased according to ETFDesk.com (2010). Thus, the results in the literature on correlations, and the changes in these, between commodity and equity returns are by no means uniform or conclusive.

The positive hedging benefits of commodity indices in portfolio diversification have been, of course, noted from at least a decade ago. See, for instance, the papers by Kaplan and Lummer (1998), Abonamy and Mathur (1999), Vos and Aarter (2003) etc. Since commodities and stocks do not move in a synchronized fashion, diversification reduces potential risk, while improving returns at the same time, especially as returns on commodities have been attractive, comparable to returns from equity portfolios. In this context it may be noted that during the five-year period ending March 31, 2006, the Dow Jones AIG commodity index returned 10.6% as against 2.6% for the S&P 500 equity index. The pattern holds in longer time spans as well. Over the 1991 – 2005 periods, the return to the Rogers International Commodity Index was 10.7%, while the S&P 500 posted 11.53%.

The recent increases in volatility experienced in stock markets around the world added strength to this view, that it is possible to take the efficiency frontier into lower volatility areas. In this regard, it can be noted that some of the commodity indices have exhibited –historically – lower volatility than equity indices. For instance, Schneeweis and Spurgin (1996) noted monthly standard deviations of 2.35 and 2.5 for the CRB and the Dow Jones commodity indices during the 1987 – 1995 periods, while the S&P 500 posted a higher value of 4.27%. From January 1990 through March 2006, annualized monthly volatility was 13.9% for the S&P 500, while it was 12.1% for the Dow Jones- AIG commodity index.

Evidence from more recent years also seems to underline the positive contribution of commodities in improving the risk-return trade-off. Kazemi, Schneeweis, and Spurgin (2005) study the effects of adding commodity indices ranging from 10 to 20% of the total asset portfolios to pure stock and portfolios of S&P 500 and the Lehman Bond Index. They note an increase in the Sharpe Ratio from around 0.3 to around 0.4 for the period 2001 to 2006. CISDM (2005), analyzing the period 2000 – 2004, report enhanced performance in terms of an increase in annualized returns by more than three percentage points and a perceptible reduction in standard deviation when commodity indices are added to stock and bond portfolios, with a weight ranging from 10 to 20% of the total asset portfolio. The present analysis will deal with a later, and more extended period, and will include sub-periods with extreme events, and will concentrate on stock and stock cum commodity portfolios.

It may be added that, in addition to these benefits of diversification, commodities may also offer some protection to investors against “event risk”, such as those arising from financial crises, wars and other geopolitical events. One

example of such an event risk is the Iraqi invasion of Kuwait in 1990. Then as during the stock market crash of 1987, commodities performed well, while equities crashed. The multi-period analysis in the present paper may offer some insights in this regard, since it includes periods of extreme scenarios with bear phases.

3. Data and Methodology

3.1 Data Series

For the purpose of the study, monthly data on returns during the period 1999 to 2010 was collected, for the following commodities and equity and commodity indices:

Equity Markets: S&P 500; MSCI Barra Emerging Markets and Frontier Markets

Commodity Indices: The Goldman Sachs Commodity Index (GSCI for short); Rogers International Commodity Index (RICI); Dow Jones UBS (DJUBS)

Commodity: Gold.

3.2 Commodities versus Commodity Futures Indices

Before introducing the commodity future indices used, it may be useful to clarify the distinction between commodity stocks and commodity futures. A casual look at any data series can reveal that the ownership of physical commodities (any group of these) would not have yielded a return exceeding inflation over a long period, say 1970 to 2009. The reasons may be many, ranging from improvements in production technology, emergence of synthetic materials etc. However, commodity future indices have, on the other hand, given returns rivaling that received on sound equity investments, over extended periods of time.

The reason for the superior performance of commodity futures relative to ownership of physical commodities is that the return on the former is more complex and varied. The total return to commodity futures consists of three components: the spot return, the roll return, and the yield. The spot return is the return to investment in physical commodities. The roll return is earned in the process of rolling or trading futures contracts as they mature and must be replaced. Rolling returns are achieved by closing one futures contract and taking a position in another futures contract having a later expiration date. The yield is the interest earned on the fixed income investment pledged to the futures exchange in order to maintain the collateral required to back the futures investments.

A break up of the total futures returns in this manner reveals the difference between physical commodity stock investments and futures investments. Between 1970 and 2008, the GSCI spot index gave an average annual rerun of about 4.8%, while the S&P GSCI futures index returned about 11.8%. The difference between the two returns is explained by the roll and collateral returns, available only in futures investments. The excess return on futures is mainly attributable to the

(discounted) futures contract rolling up to the spot price as the delivery date approaches.

But, there is, in fact, a fourth source of return from commodity index investment, that due to ‘rebalancing’ within the index. A rebalancing strategy involves reallocating positions out of commodities within the index that have over-performed into those which have underperformed, and may yield higher returns if the commodity markets exhibit mean-reverting tendencies over time.

3.3 Choice of Commodity and Equity Indices

Standard and Poor Goldman Sachs Commodity Index (GSCI in our study), Dow Jones UBS Commodity Index and the Jefferies Commodity Index of Thomas Reuters are the most popular commodity futures indices. GSCI is the most dominant of these, and may represent up to 80% of the total investment in these indices. WE have chosen to work with the GSCI, the DJUBS, and the Roger International Commodity Index, which has gained popularity in recent years.

The GSCI index, created in 1991, is more concentrated than the DJUBS index, with some 75% of the weight given to the energy sector, as of 2005. At that point in time, the GSCI consisted of 24 commodities, with six energy products, five industrial metals, eight agricultural products, three livestock products, and two precious metals, with the respective weights scheduled to be changed once an year. The weights are dependent on the world production pattern of the various commodities in the index. This production-centric orientation means that the index’s returns may be more correlated to world growth than may be desirable from a diversification stand point. Also, the energy sector dependence may mean that the index is exposed to an extremely volatile sector.

The DJUBS index is a good choice to be used alongside the GSCI, since it is designed to avoid such concentration - which would, undoubtedly, increase the volatility of the index. The DJUBS invests in nineteen futures markets, based on each market’s liquidity and production over a five-year period. It limits the representation of any single commodity group to 33% and that of any individual commodity to 15% of the index, to ensure adequate diversification. The weighing system is such that the index is less pulled along by world growth than the GSCI index.

The differences between the two indices, and the greater sector concentration of the GSCI, are obvious from a quick look at the composition of the indices. The GSCI, as stated earlier, has 74% in the energy sector, the DUBS has 33%. The GSCI has 13% in the agricultural sector; the DJUBS has much more, at 30%. The GSCI has only 8% in the major area of industrial metals, the DJUBS has 20%. Finally, in precious metals and live stock, the GSCI has a total of only 5%, while the DJUBS has 17%. Thus, there is hardly any sector dominance in the DJUBS index to speak of.

The Rogers International Commodity Index (RICI), appearing on the scene in 1998, is the most diverse and most international of the various commodity

indices, and thus a good candidate to be included in a study like the present one. It was created by Jim Rogers, the cofounder of the Quantum Fund with George Soros. RICI consists of 35 commodities, and includes some rather unusual commodities, such as oats, barley, azuki beans, enjoying the limelight along with more traditional items like Zinc, nickel etc.

The major equity index included in the study, S&P500, hardly needs any introduction, and was an obvious choice for the study. One problem with the S&P500 index, of course, its total U.S orientation, looking only at the 500 major, large-cap, U.S based firms. Thus, inclusion of at least another index was considered a must for this study. One candidate was the Morgan and Stanley All Country World Index (MSCI ACWI), which encompasses the equity markets of twenty-four OECD countries and twenty-one emerging markets. But, when looking for diversification benefits, a larger exposure to emerging markets may be warranted, and so we opted to go in for an index more strongly linked to emerging and frontier markets.

The MSCI Emerging and Frontier Market Index (MSCI Barra EFM), chosen for the analysis here, includes large, middle and small cap representation in some of the most dynamic economies in the world. Frontier market countries chosen for representation in the index includes Argentina, Croatia, Serbia, the Baltic nations excluding Latvia, Ukraine, five nations of the Gulf Cooperation Council, some South Asian nations, and Kenya, Mauritius and Nigeria in Africa. Typically, one expects higher returns from this index as compared to, say, the Standard and Poor indices, but the risks posed by these markets are also greater. Still, in recent years, the search for better return-risk trade-offs has directed investor interest to these markets in a significant fashion.

3.4 Methodology

We proceed as follows. First, correlations are obtained between all the stock indices, from the entire period, as well as for a number of sub-periods. This will enable conclusions about whether correlations between commodities and stocks have increased in recent times, making diversification less attractive. The changes in correlation between frontier market stock indices with traditional indices will be also of interest.

Next, we will proceed to study the benefits of diversification, as manifested in changes in the Sharpe Ratio. As is well known, the Sharpe ratio is a measure of the risk-adjusted return of an investment, often used to rank portfolios- on their risk-adjusted return performance, and is given as:

$$\text{The Sharpe Ratio} = \frac{r_x - r_f}{\sigma_x},$$

that is, as the excess return of the portfolio in question over the risk free return divided by the standard deviation of the portfolio.

One advantage this ratio has over the CAPM model is that it uses the volatility of the portfolio return instead of measuring the volatility against a benchmark index. While not possessing any real meaning as an isolated number, a ratio greater than one is considered to be sound. Still, instead of being viewed as an isolated number, it is the changes in the ratio across portfolios, which are of interest. Initial portfolios with only stock indices will be observed to note their annualized return over the aggregate period as well as sub-periods. The Sharpe ratios of these portfolios will be also calibrated. Subsequently, individual commodities and commodity indices will be added to see how the annualized returns and Sharpe ratios of these pure stock portfolios are affected.

4. Empirical Analysis

Table 1 presents the correlations of the S&P 500 index and the MSCI Barra Index with all the other indices in the study, for the entire period.

Table1. Correlations of % Changes in Monthly Returns: 1999.01 to 2010.12

	GSCI	ROGERS	DOW UBS	GOLD	MSCI Barra	S&P 500
S&P 500	0.3212	0.3662	0.1766	-0.1116	0.8295	1
MSCI Barra	0.5161	0.5888	0.1232	0.0688	1	0.8295

As would be expected, the two equity indices are highly correlated. Gold has the least correlation with the equity indices of all the commodity items, while GSCI and RICI show correlations above 30%. However, the scenario can differ considerably from sub-period to sub-period within the whole range, as seen in Table 2.

A close look at tables shows that the ‘suspicion’ that correlations between commodities and equities have been increasing is justified. However, this development is of very recent origin, at least in the case of the Standard and Poor index. Even for the MSCI Barra index, a large increase in the correlation is only visible after 2008.

Thus, while the correlation of S&P 500 with the GSCI commodity index is 0.32 for the whole period, it is only 0.0662 for the period up to 2003 and 0.004 for the range 2004 – 2007. The correlation for the entire period is then pushed sharply up by the increase in correlation since 2008 to 0.6442. The correlations of the Standard and Poor Index with the other commodity indices exhibit the same pattern. It is only in the case of gold that the correlation with S&P 500 has not seen any perceptible change after 2008, with a mildly negative correlation of returns being still exhibited.

Table 2. Correlations of % Changes in Returns, Various Sub-Periods

1999-2003						
	GSCI	ROGERS	DOW UBS	GOLD	MSCI Barra	S&P 500
S&P 500	0.0662	0.1661	-	-0.1411	0.9051	1
MSCI Barra	-0.0467	0.0414	-	0.0468	1	0.9051
2004-2007						
S&P 500	0.0039	-0.016	-0.1416	-0.0593	0.7073	1
MSCI Barra	0.1450	0.0413	0.1866	0.0840	1	0.7073
2008-2010						
S&P 500	0.6442	0.6290	0.2038	-0.1308	0.8648	1
MSCI Barra	0.7928	0.7334	0.1134	0.0722	1	0.8648
1999-2006						
S&P 500	0.0451	0.1161	-0.5863	-0.1078	0.7754	1
MSCI Barra	0.0118	0.2175	0.4687	0.0715	1	0.7754
2007-2010						
S&P 500	0.6119	0.5944	0.1891	-0.1123	0.8513	1
MSCI Barra	0.7762	0.7255	0.1159	0.0793	1	0.8513

In the case of the frontier MSCI Index, the correlations increase already in the 2004 to 2007 period, but these increases are much smaller than those seen for the subsequent period measured after 2008. With the two equity indices providing contradicting evidence about increasing correlation with commodities between 1999 and 2007, it is only for the post-2007 period that we can confirm increasing correlation between equity returns and commodity index returns.

What do these increasing correlations signify for the possibilities of beneficial diversification from a pure stock portfolio to a combined stock-commodity portfolio? To answer this question, it will be useful to derive the Sharpe Ratios for the sub-periods covered in Table 2.

Table 3 presents the annualized returns and the Sharpe ratios for two different portfolios. One, with 100% S&P 500 equity index, and the other with a weight of 15% for the GSCI commodity index. Table 3 is for the complete range, 1999.01 to 2010.12.

Table 3. Annualized Returns and Sharpe Ratios 1999.01 – 2010.12

	Returns, annualized %	Sharpe Ratio
S&P 500	1.04	-0.06
S&P 500 + GSCI	4.76	0.14

As can be seen, including the commodity index GSCI improves the returns and the Sharpe Ratio – from being mildly negative, which indicates that the risk-free

asset has done better, to a positive number. It may be noted that optimizing portfolios including commodities usually come up with weights between 6 to 20% or so for commodities, so that a choice of weight of 15% for the commodity index seems reasonable.

It will be more instructive to look at the period in a disaggregated fashion, distinguishing bull and bear phases. We proceed to divide the entire period into four sub-periods, into two bull phases and two bear phases, as dictated by the performance of (the returns on) the equity indices. The phases are:

A bull phase: 2009.3 to 2010.12 **Bull phase:** 2003.10 to 2007.10

A bear phase: 2007.11 to 2009.02 **Bear phase:** 2000.01 to 2003.02

The annualized returns show support for such a disaggregation, for instance, the annualized returns for the S&P 500 index for the second bear phase (starting 2007.11) is -52.4%.

Table 4. Beneficial Effects of Diversification, away from Pure S&P 500: 1999.01 – 2010.12

	Annualized Returns %	Sharpe Ratio
S&P500	1.04	-0.06
S&P500 + GSCI	4.76	0.14
S&P500 + Gold	4.04	0.21
S&P500 + Dow Jones UBS	2.05	0.01
S&P500 + RICI	4.95	0.15
S&P500 + MSCI Barra FRONTIER	5.89	0.23

Tables 4 to 8 show the benefits – or drawbacks, as the case may be – of adding commodity indices, commodities (i.e., gold) and other equity indices (the MSCI Frontier Index) to a pure S&P 500 portfolio, for the entire period as well as the sub-periods. In each case, the addition is with a weight of 15%.

As can be seen from Table 4, including commodities improves the performance of the portfolio. Gold seems to be contributing best in terms of improvement of the Sharpe Ratio, but the beneficial effects of adding GSCI and RICI (Rogers International Commodity Index) are also evident. The striking contribution of gold in improving the Sharpe Ratio can be explained in terms of the very low correlation (in fact, negative) that returns from gold has with S&P500 returns for the entire time span.

Adding the equity index MCSI Barra Emerging and Frontier Markets also improves the Sharpe Ratio of a pure S&P500 index. This may be explained in terms of the high returns of the MSCI index that gives this beneficial effect, despite the rather high correlation between changes in monthly postings for the two indices.

Table 5 provides information similar to Table 4, but for the bull phase period of 2009.3 – 2010.12. We have also added the effects of diversification away from a pure MSCI index in this table and the subsequent tables.

Table 5. Diversification away from Pure Stock Portfolios: Bull Phase 2009.2 – 2101-12

Portfolio	Annualized Returns%	Sharpe Ratio
S&P500	31.05	1.73
S&p500 + GSCI	34.77	1.94
S&P500 + Gold	29.72	2.03
S&P500 + Dow Jones	29.18	2.0
S&P500 + RIC1	31.85	1.83
S&P500 + MIC1 Barra	33.75	1.84
MSCI Barra	48.91	1.86
MSCI + GSCI	46.17	1.84
MSCI + Gold	44.18	2.00
MSCI + DOW Jones UBS	41.53	1.83
MSCI + RIC1	36.28	1.51

A glance at the table shows that adding commodity indices or gold improves portfolio performance. The sharpest increase in the Sharpe Ratio comes from adding gold, though the reruns to gold lie, in fact, below that of the Standard and Poor index. The beneficial effect of adding gold on the risk-return profile is then clearly traceable to the low correlation, in fact negative, between gold and the S&P500 index for this bull phase. See Table 4, which covers the correlations for this phase.

Yet, it may be mentioned that the pure stock portfolio itself does a good job during this bull phase. After all, the Sharpe Ratio notches up a number considerably greater than one. This opinion is reinforced when we look at the columns to the right dealing with the MSCI Frontier index. The returns to this index are greater than to any of the combined portfolios. It is only the addition of gold to the pure MSCI portfolio, which can drive up the Sharpe Ratio-, and in this regard, we can note the low correlation that gold has with the MSCI index, from Table 2. For both the equity indices, correlations with commodity indices have risen sharply for the last period, 2008 – 2010, and it is only gold which still exhibits a really low or negative correlation with these indices.

We now proceed to present results of diversification for the other bull phase before taking up the developments in the bear phases.

Table 6. Portfolio Diversification Effects, Bull Phase 2003.03 – 2007.10

Portfolio	Annualized Returns %	Sharpe Ratio
S&P500	13.52	1.28
S&P + GSCI	14.75	1.52
S&P + Gold	9.07	0.79
S&P + RIC1	16.76	1.5
S&P+ MSCI	17.85	1.75
MSCI Barra Frontier	34.64	1.99
MSCI + GSCI	30.22	1.84
MSCI + Gold	31.93	2.074
MSCI + RIC1	32.14	1.995

From Table 6, we can see that the addition of commodities to the equity portfolios during this bull phase increases the Sharpe Ratio when the commodity indices GSCI and RIC1 are added to the portfolio. But these may be considered rather marginal benefits, and it is in the case of an addition of the MSCI Frontier equity index that the Sharpe Ratio shows a substantial increase. This effect can be traced to the large returns posted by the MSCI index during this period, and to the relatively low (compared to the other sub-periods) correlation between the two indices during this period (see Table 2). Finally, adding gold to a pure S&P500 portfolio during this bull phase period reduces the returns and the Sharpe Ratio. The correlation between gold and S&P500 is less beneficial compared to the other periods, and returns to gold were also low during this phase.

Coming to the performance of the MSCI portfolios, adding gold or commodity indices gives hardly any improvement in the Sharpe Ratio, with gold being the best bet. All in all, the most notable improvement in portfolio performance in the bull phases is when the frontier equity index is added to the S&P500 index.

Table 7 focuses on diversification benefits for the equity portfolios in the 2007 to 2009 bear period.

Table 7 Portfolio Diversification Effects, Bear Phase 2007.11 – 2009.2

Portfolio	Annualized Returns%	Sharpe Ratio
S&P500	-52.4	-2.75
S&P + GSCI	-50.76	-2.33
S&P + Gold	-41.9	-2.64
S&P + DJUBS	-48.02	-2.72
S&P + RIC1	-47.6	-2.51
S&P + MSCI	-55.2	-2.78
MSCI Barra Frontier	-65.5	-2.13
MSCI + GSCI	-48.5	-1.59
MSCI + Gold	-55.4	-2.06
MSCI + DJUBS	-59.69	-2.2
MSCI + RIC1	-54.92	-1.82

From the table above, it is seen that adding commodity indices or gold to a stand-alone S&P500 portfolio can mitigate the bear phase effects to some extent, improving the Sharpe Ratio – though not making it attractive! The best impacts come from including GSCI, RIC1 and gold in that order. In stark contrast to the bull phase scenarios, adding the MSCI frontier index will worsen the performance results thrown up a pure S&P500 portfolio.

Let us now consider the other bear phase marked for this study. Table 8 provides the portfolio diversification benefits noted for this period.

Table 8. Portfolio Diversification Effects, Bear Phase, 2000.01 – 2003.02

Portfolio	Annualized Returns%	Sharpe Ratio
S&P500	-15.84	-1.06
S&P + GSCI	-9.67	-0.79
S&P + Gold	-12.11	-1.03
S&P + RICI	-11.16	-0.917
S&P + MSCI Barra	-20.5	-0.98
MSCI Barra Frontier	-12.99	-0.69
MSCI + GSCI	-4.74	-0.36
MSCI + Gold	-7.34	-0.51
MSCI + RICI	-5.207	-0.38

The results seen in Table 8 are in conformity with those in Table 7 for the other bear phase. Adding the GSCI commodity index and the Roger commodity index to a pure S&P 500 index improves performance as reflected in the Sharpe Ratio, with the best result obtained from the GSCI. Adding gold or the MSCI frontier equity index hardly makes a difference to the level of performance. In the case of stand-alone MSCI frontier portfolio, adding GSCI, RICI or gold can improve performance, in that order of ranking.

Taking a bird's eye view of all the tables together, we may note some differences between the bull and the bear phases, with extreme scenarios represented by the later bull and bear phases where the changes in annualized returns were close to or more than 50 to 60%. In the bull scenarios, adding commodity indices, gold, or the frontier equity index, all improved performance relative to a stand-alone Standard and Poor index equity index. But for the two bull scenarios taken together, only the GSCI and the RICI indices, and the MSCI Barra Frontier equity index had a consistent positive impact, with GSCI and MSCI showing a greater impact. And, in the case of a pure MSCI Barra index, adding other indices or gold hardly made a difference. The index performed sufficiently well on a stand-alone basis.

Coming to the extreme environments represented by the bear scenarios, the addition of commodity indices improved portfolio performances of stand-alone portfolios of S&P500 as well as MSCI Barra. Combining equity indices seems to be a bad idea when it comes to bear phases, and gold also seemed unable to effect any improvement in the portfolio performance. The GSCI and RICI indices had the best impact, in that order of ranking.

5. Concluding Comments

The case for including commodities in a pure equity portfolio depends squarely on the ability of these 'real' assets to reduce risks in view of the low correlations of the returns of these two types of assets. The returns offered by commodities are comparable to that of stocks, usually exceeding those of the latter when markets are depressed. And, while commodity returns tend to be volatile, they

move to different impulses from that affecting equity markers, so that the risks of the combined portfolio are lowered. Historically, commodity investments have been seen in a defensive role, as commodities have given good returns in times of slumping equity (and bond) returns. Such a role could persist into the future only if the nature of correlations between commodity and equity returns does not change drastically.

Such a scenario with beneficial portfolio diversification is, naturally, not a permanently given one. There is a view that the benefits from diversification into investments are no longer feasible because of the increasing correlation of commodity and stock returns. Updating of research in this area is hence a continuing necessity. This paper takes up this task for the most recent time periods. Using monthly data for the 1999 to 2010 period, the possibility of improving the risk-return trade off performance of pure equity portfolios by adding commodities, commodity indices or even exotic frontier equity market holdings is analyzed. Particular attention was given to periods of extreme events, when annualized returns touched high levels. The study covered the period 1999 to 2010, and used monthly data for the leading equity index, Standard and Poor 500, the relatively new MSCI Barra Emerging and Frontier Market equity index, and the GSCI, DJUBS and RICI commodity indices. The effects of adding gold to stand-alone equity portfolios was also studied.

Is it indeed the case that the benefits of diversification into commodities have died out because of the increasing correlations of commodity and equity returns? What is found in the present analysis is that diversification into commodities still has some mileage to give in terms of improving the risk-return trade off, as captured by the Sharpe Ratio. The results are more evident in extreme environments with bear attitudes, though adding commodity indices does not provide a complete turn-around to an attractive Sharpe Ratio (there is just noticeable improvement in a poor ratio). The GSCI index does best, uniformly, in bull and bear phases, in contributing to better portfolio performance, with gold being an unreliable partner, lending a helping hand only in some periods (especially not in bear phases). In bull phases, reaching out to exotic frontier markets seem to be just as fine in terms of improving performance as relying on proven commodity index partners such as the GSCI index.

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