Gaining Exposure to Emerging Markets in Institutional Portfolios: The Role of Commodities

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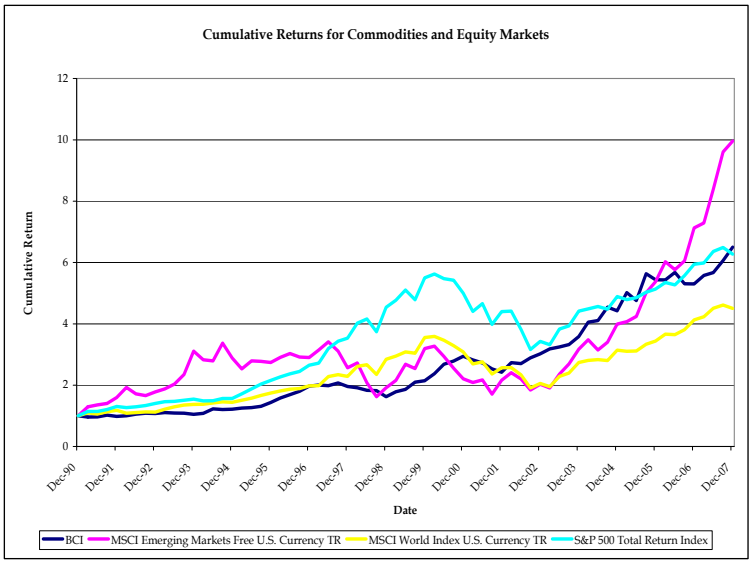
Introduction

Two significant investment themes in the past decade have been the growing importance of physical commodities in the workings of the global economy (hereafter, the "Commodity" theme), and the increasing importance of "developing" nations such as Brazil, Russia, China and India as sources of economic growth and poles of wealth accumulation (the "Emerging Markets" or "EM" theme). Because these and other developing countries are either major exporters of commodities such as oil, or primary sources of demand for physical commodities for domestic consumption or inputs in export production, it is not surprising that these two investment themes are linked. However, outside of these casual observations, there is relatively little research that explores the possible linkages between these two investment themes.

This paper sets out to explore some of those possible linkages, and correspondingly the extent to which investments in commodity assets and emerging-markets assets are overlapping bets on the same or similar economic trends. Our goal is to offer plan sponsors and other long-term institutional investors with information that could be useful elements for the efficient formulation of investment strategy. A question of particular interest is whether a well-designed portfolio of EM investments can replace the role of commodities in a diversified portfolio. Alternatively, it may be that a well-designed commodity portfolio makes EM investments redundant. Neither of these hypotheses is supported by the empirical data, however. Instead, we find that commodity and emerging-markets investments are interrelated, but are not redundant.

Asset Markets and Economic Growth

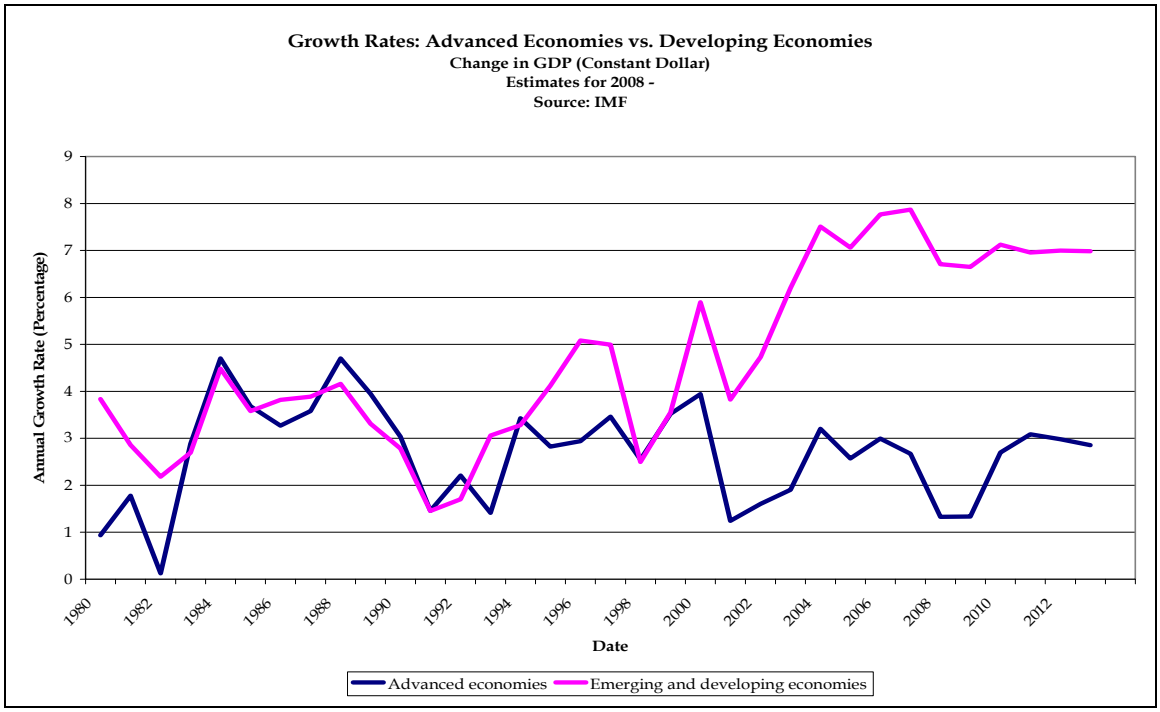


One way to visualize the significance of both the EM and Commodity themes on a stand-alone basis is simply to view the returns to long-only investments in these asset classes. Here we use the Bache Commodity Index[1] (BCI) as a proxy for commodity returns, MSCI Emerging Markets and MSCI World equity indices for international exposure, and the S&P 500 index for US exposure. We can see that since 1990, both

[1] See further public information and research regarding the Bache Commodity Index at www.alternativeanalytics.com. Returns and other information are available via Bloomberg.

emerging-markets equities and commodities have outperformed US and global equities. This performance has been much more pronounced since 2000.

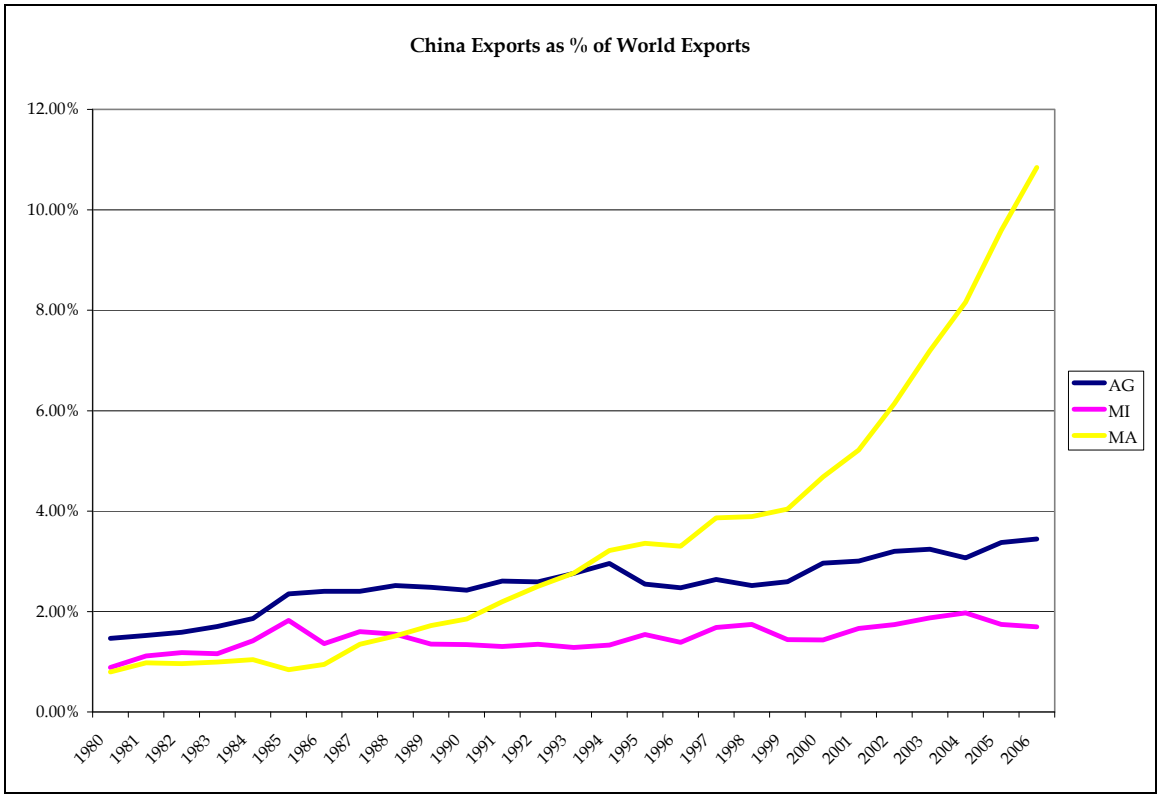
Coincident with the performance of emerging-markets equities has been the accelerating growth rates in emerging-markets economies, particularly when compared against the less-dynamic growth rates of advanced economies. Figure 2 shows that prior to 2000, global growth rates were relatively similar and synchronized. Since 2000, there has been substantial change in the level of certain individual growth rates, but still some synchronization.

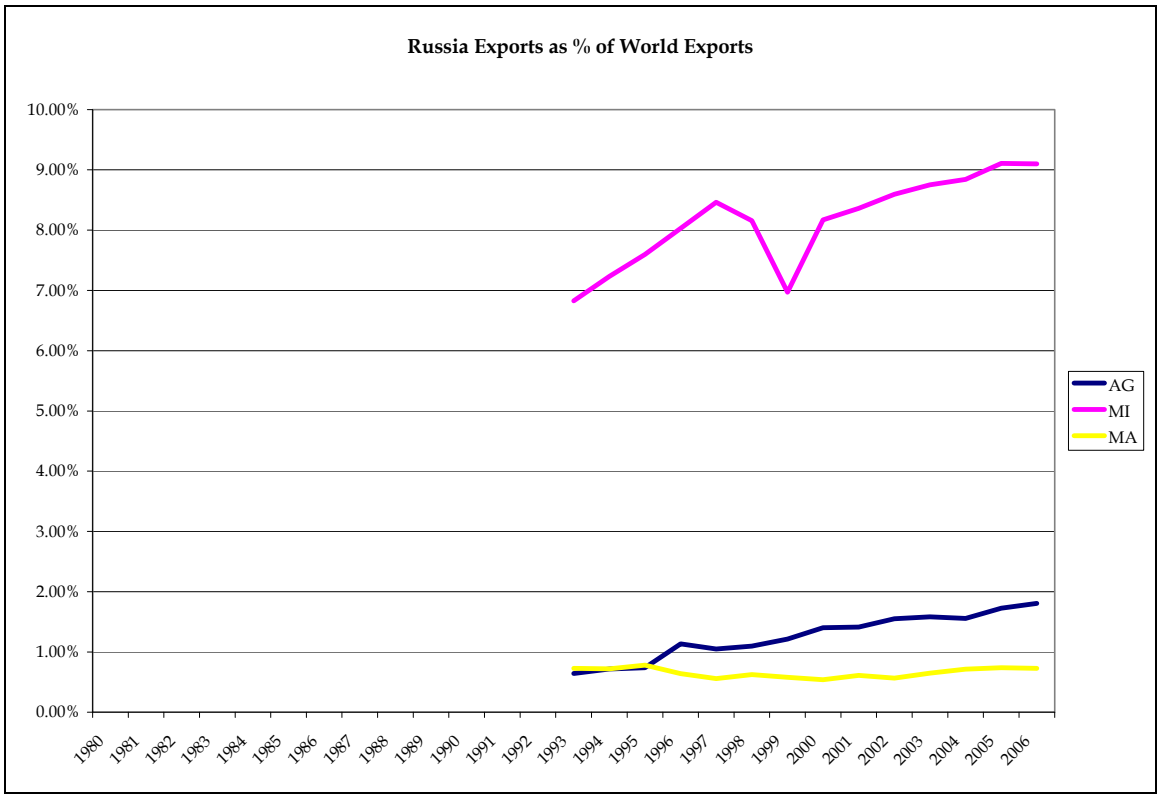


We can see that this growth has not been evenly distributed across sectors of emerging-markets economies, particularly export-oriented sectors that provide cycles of reinvestment and wealth accumulation. Two charts demonstrate this in absolute terms by plotting the percentage of world exports made up of exports from the reporting country. For China, most growth has come in the manufacturing sector ("MA"); while in Russia, most growth has come from the export of fuels and minerals ("MI"). We can also see this in relative terms in the table below, which gives the percentage increase in sector exports over the period 2000-2006.[2]

[2] All quantities are authors' calculations based on WTO data.

Export Growth by Sector		
Country	Sector	Increase 2000-2006
Brazil	Agricultural products	156%
Brazil	Fuels and mining products	307%
Brazil	Manufactures	115%
China	Agricultural products	99%
China	Fuels and mining products	210%
China	Manufactures	307%
India	Agricultural products	125%
India	Fuels and mining products	638%
India	Manufactures	142%
Russian Federation	Agricultural products	120%
Russian Federation	Fuels and mining products	193%
Russian Federation	Manufactures	137%
World	Agricultural products	71%
World	Fuels and mining products	163%
World	Manufactures	76%





As we can see from the table below, coincident with the recent growth of emerging-markets economies has been the current boom in commodity prices. However, the commodity-price boom has been:

1) Far more broad-based: Fuels, metals and agricultural products are simultaneously in "boom" phase, which is rare;
2) Longer in duration: Typical booms last 20-24 months, whereas almost all commodities have been booming for 36 months or more;
3) Greater in magnitude than previous commodity booms: Current price appreciation has been 100% or more for many assets, compared to an average price appreciation of 40% from previous booms; and,
4) Synchronized with global industrial production.[3]

[3] IMF (2008).

Properties of Commodity Price Booms 1960-2007 (IMF 2008)

	Current phase	Latest turning point[2]		Price Changes (percent) From latest turning point	Price Changes (percent) Average of past booms	Duration (months) From latest turning point	Duration (months) Average of past booms[4]	Synchroniz-ation with industrial production[5]
Crude oil (IMF APSP)[6]	Boom	December-01	T	210.1	54.0	73	18	0.189***
Metals	Boom	March-03	T	104.8	43.0	58	22	0.236***
Aluminum	Boom	April-03	T	29	41.0	57	22	0.025
Copper	Boom	October-01	T	212.5	61.0	75	21	0.259***
Nickel	Boom	October-05	T	74.9	84.0	19	29	0.301***
Food	Boom	November-04	T	30.4	21.0	38	18	0.103
Maize (corn)	Boom	November-04	T	62.2	39.0	38	19	–0.139
Wheat	Boom	April-05	T	124.1	38.0	32	20	–0.103
Soybeans	Boom	January-05	T	83.9	42.0	36	18	0.11
Palm oil	Boom	January-05	T	116.8	61.0	36	20	–0.015
Soybean oil	Boom	January-05	T	100.9	50.0	36	18	0.066
Beef	Slump	September-04	P	–25.1	35.0	. . .	20	0.091
Beverages	Slump	February-06	P	0.0	47.0	. . .	19	0.109
Agricultural raw materials	Boom	December-04	T	2.2	28.0	37	20	0.128
Rubber	Boom	January-05	T	77.2	56.0	36	21	0.07

Sources: IMF commodity price database; and current IMF staff calculations.
[1]See text for details.
[2]T stands for trough, P for peak.
[3]Average price increase during past booms (excluding the current boom).
[4]Average duration of past booms (excluding the current boom).
[5]Coefficient of a regression of the cyclical state in the commodity price on the cyclical state in global industrial production (see Harding and Pagan, 2006, for details); *** denotes significance at the 1 percent level.
[6]IMF average petroleum spot price.
Table Source: IMF 2008

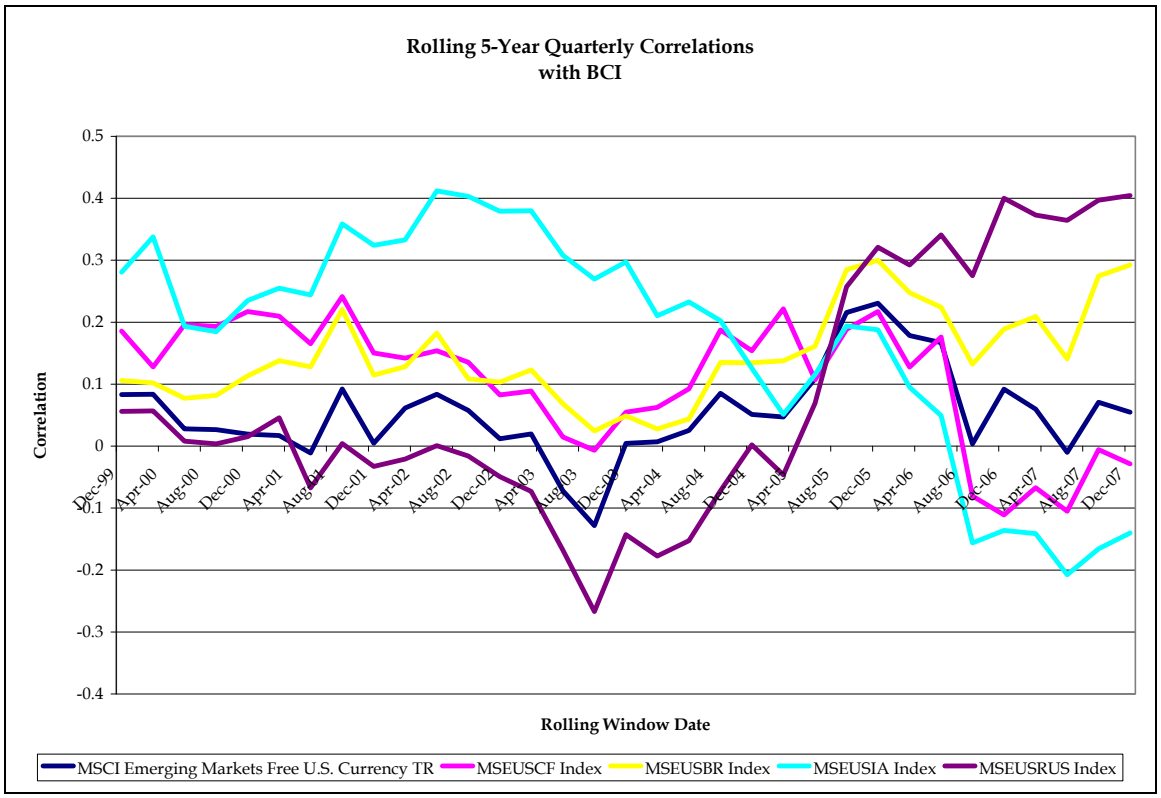
From the above information, we can see that certain emerging-markets countries have a substantial exposure to commodity markets, and that fuel and mineral producers especially have been in a position to generate substantial capital inflows. We also raise the possibility that larger emerging-markets economies that concentrate on international manufacturing and/or domestic consumption growth may actually have negative exposure to international commodity markets. The question is: To what extent are emerging-markets asset prices integrated with international commodity prices?

Are Emerging Markets Equity Markets and Commodity Markets Integrated?

An initial look at the correlation between the BCI and MSCI country indices for Brazil, China, India and Russia, as well as EM and the World, indicates that for the period 1995-2007, the correlation between commodity markets and equity indices has been uniformly near zero. Correspondingly, the correlation of equity markets has been relatively high across diverse indices.

Correlation of Quarterly Returns	RUSSIA	MSCIW	INDIA	EM_E01	CHINA	BRAZIL	BCI
RUSSIA	100%	43%	39%	61%	24%	55%	7%
MSCIW	43%	100%	50%	73%	40%	68%	-11%
INDIA	39%	50%	100%	74%	43%	69%	12%
EM_E01	61%	73%	74%	100%	63%	84%	7%
CHINA	24%	40%	43%	63%	100%	48%	12%
BRAZIL	55%	68%	69%	84%	48%	100%	17%
BCI	7%	-11%	12%	7%	12%	17%	100%
common sample 1995-2007							

We can take a more granular look at the correlation structure of these markets with commodity prices through correlations estimated over a rolling 5-year window:



Interestingly, we see that correlations with commodity markets for all countries, save India, rose substantially from the beginning of the latest commodity boom. However, since the first quarter of 2006, those correlations have diverged, with commodity-exporting economies like Brazil and Russia maintaining or elevating their positive relationships with commodity prices, and the commodity-importing economies of China and India experiencing substantial declines in their correlation. Not surprisingly, our broad-based index of EM equities as a partial average of our individual equity indices has become relatively uncorrelated.

To further examine the importance of equity-market factors and commodity-market factors, we conduct a principal components analysis of returns, 1995-2007:

	BCI	BRAZIL	CHINA	EM_E01	MSCIW	INDIA	RUSSIA
Mean	3.5%	5.1%	2.2%	3.2%	2.5%	4.1%	11.8%
Median	3.6%	4.8%	-0.4%	4.2%	2.7%	6.4%	5.9%
Maximum	18.3%	53.9%	80.7%	26.6%	21.1%	31.3%	171.4%
Minimum	-10.7%	-39.4%	-35.2%	-23.6%	-18.4%	-21.8%	-75.2%
Std. Dev.	6.3%	19.5%	20.2%	12.8%	7.8%	15.0%	39.1%
Skewness	0.036	-0.079	1.093	-0.239	-0.204	-0.017	1.448
Kurtosis	2.442	2.980	6.080	2.330	3.646	1.727	7.602
Jarque-Bera	0.685	0.055	30.912	1.468	1.265	3.512	64.048
Probability	0.710	0.973	0.000	0.480	0.531	0.173	0.000

	Comp 1	Comp 2	Comp 3	Comp 4	Comp 5	Comp 6	Comp 7
Eigenvalue	3.8707	1.0689	0.7628	0.5432	0.4409	0.2126	0.1008
Variance Prop.	0.5530	0.1527	0.1090	0.0776	0.0630	0.0304	0.0144
Cumulative Prop.	0.5530	0.7057	0.8146	0.8922	0.9552	0.9856	1.0000
Eigenvectors:	**Vector 1**	**Vector 2**	**Vector 3**	**Vector 4**	**Vector 5**	**Vector 6**	**Vector 7**
BCI	0.0634	-0.9316	-0.1398	0.0661	0.2768	0.1638	-0.0287
BRAZIL	0.4590	-0.0549	-0.0932	0.1989	0.1223	-0.8112	0.2550
CHINA	0.3308	-0.1464	0.6992	-0.5621	-0.0810	0.0411	0.2367
EM_E01	0.4874	0.0395	0.0406	-0.0364	-0.0290	-0.0183	-0.8699
MSCIW	0.3991	0.3157	0.0037	0.1693	0.7078	0.4147	0.1987
INDIA	0.4059	-0.0677	0.0789	0.5565	-0.5928	0.3406	0.2174
RUSSIA	0.3380	0.0441	-0.6892	-0.5481	-0.2206	0.1584	0.1862

From the principal components analysis, we can see that the bulk of contemporaneous-return variation (55%) is explained by a common equity-market factor, while a commodity-market factor explains roughly 15% of total return variation.

However, given the nature of market dynamics, one might be dissatisfied with analyses, like correlation and principal components, that assume that all interrelationships between asset markets are contemporaneous. Rather, given that we are investigating longer-horizon interactions, we can and should be concerned with lead-lag type relationships. We begin by testing whether commodities, as proxied by the BCI, are "co-integrated" with the emerging-markets equities, as proxied by the MSCI EM index. Co-integration between economic quantities suggests that there is a long-run equilibrium relationship, such that short-term departures from that relationship tend to induce mean-reversion back to that equilibrium.

Unrestricted Cointegration Rank Test

in RETURNS

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None	0.201436	11.6971	15.41	20.04
At most 1	2.48E-06	0.00013	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level

Trace test indicates no cointegration at both 5% and 1% levels

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None	0.201436	11.6969	14.07	18.63
At most 1	2.48E-06	0.00013	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level

Max-eigenvalue test indicates no cointegration at both 5% and 1% levels

Unrestricted Cointegration Rank Test

in LEVELS

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None	0.188763	10.881	15.41	20.04
At most 1	6.03E-05	0.0031	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level

Trace test indicates no cointegration at both 5% and 1% levels

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	5 Percent Critical Value	1 Percent Critical Value
None	0.188763	10.878	14.07	18.63
At most 1	6.03E-05	0.0031	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level

Max-eigenvalue test indicates no cointegration at both 5% and 1% levels

As indicated in the table above, standard test statistics for the presence of co-integration indicate that there is no long-run equilibrium relationship between commodity *returns* and equity market *returns;* nor is there a relationship between commodity price *levels* and equity market *levels.*

Lack of co-integration, however, does not mean that there are not lead-lag relationships in variables. We can evaluate the range of possible linear lead-lag relationships using a very general, but standard, unrestricted Vector Autoregression (Var) model, which is a standard tool of macroeconomists.[4] In essence, in a Var model, each return series is modeled as a function of lagged realizations of itself and all other series in the model. In the table below, for reasons of space, we only present t-statistics for each parameter in the VAR, estimated on commodities and equity indices. Our models for the behavior of China equities, commodities, and EM equities, are respectively the most significant.

[4] See, for example, Hamilton (1994) or Lutkepohl (2005).

Vector Autoregression Estimates
Sample(adjusted): 1996:1 2007:4
Included observations: 48 after adjusting endpoints

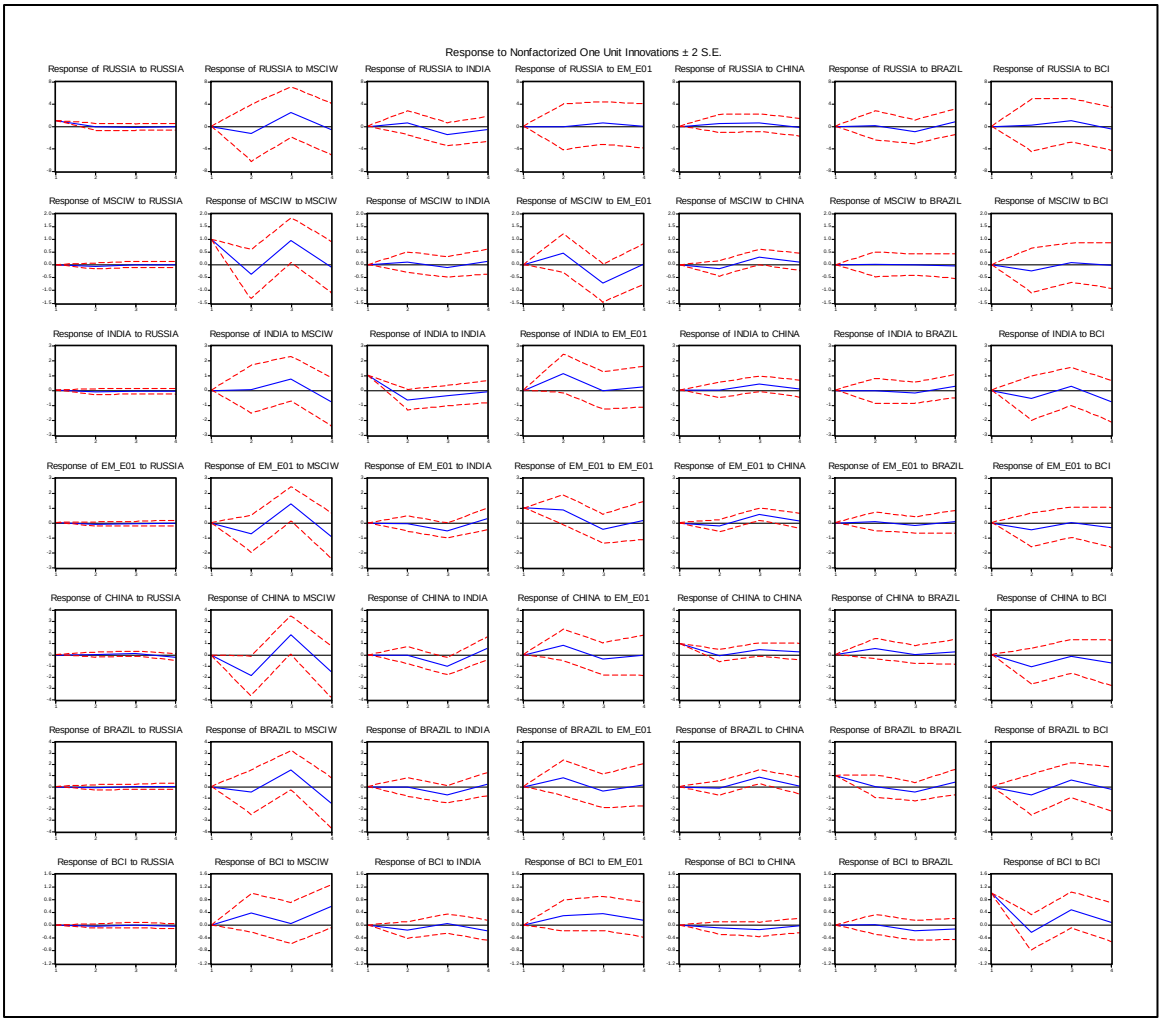
	RUSSIA	MSCIW	INDIA	EM_E01	CHINA	BRAZIL	BCI
RUSSIA(-1)	[-0.25203]	[-0.99818]	[-1.07173]	[-1.07075]	[0.13259]	[-0.76950]	[-0.87993]
RUSSIA(-2)	[-0.53676]	[0.57680]	[-0.69550]	[-0.59491]	[0.95896]	[0.26245]	[0.68973]
RUSSIA(-3)	[-0.14748]	[0.57113]	[-0.77215]	[-0.12315]	[-1.37977]	[0.10778]	[-0.05793]
RUSSIA(-4)	[-0.33697]	[-1.29685]	[-1.72954]	[-3.23495]	[-2.87226]	[-2.33906]	[-1.55985]
MSCIW(-1)	[-0.47616]	[-0.77532]	[0.07787]	[-1.18120]	[-2.12734]	[-0.49040]	[1.25373]
MSCIW(-2)	[1.25573]	[2.09964]	[2.43912]	[2.56460]	[2.95600]	[2.10609]	[1.13138]
MSCIW(-3)	[-0.06295]	[0.84658]	[0.03851]	[0.69380]	[-0.05506]	[0.14881]	[0.86545]
MSCIW(-4)	[-0.08031]	[-0.65844]	[-1.50482]	[-1.43103]	[-0.05925]	[-1.13446]	[-1.45894]
INDIA(-1)	[0.63021]	[0.51296]	[-1.84587]	[-0.20966]	[-0.13260]	[-0.09969]	[-1.19275]
INDIA(-2)	[-0.67777]	[0.13562]	[-1.95518]	[-1.61632]	[-2.43375]	[-1.48963]	[-0.64176]
INDIA(-3)	[-0.34379]	[0.14314]	[-1.23821]	[-0.01301]	[0.76054]	[-0.38334]	[-1.43971]
INDIA(-4)	[-1.46765]	[0.41897]	[0.21631]	[0.53082]	[-0.06769]	[0.31833]	[-1.30741]
EM_E01(-1)	[-0.03970]	[1.18532]	[1.75113]	[1.76878]	[1.24269]	[1.00609]	[1.19396]
EM_E01(-2)	[-0.08296]	[-2.20731]	[-0.22482]	[-1.09084]	[-0.42422]	[-0.65763]	[0.94614]
EM_E01(-3)	[-0.43749]	[0.01365]	[1.02719]	[0.14636]	[-0.49544]	[0.25645]	[1.51263]
EM_E01(-4)	[1.20331]	[0.22412]	[1.10277]	[1.35535]	[1.49227]	[1.35275]	[1.53177]
CHINA(-1)	[0.61475]	[-1.00122]	[0.03037]	[-0.99558]	[-0.24372]	[-0.36484]	[-0.92809]
CHINA(-2)	[0.74183]	[2.35318]	[2.74070]	[3.44134]	[1.22546]	[3.17751]	[-0.30544]
CHINA(-3)	[0.35939]	[-0.28988]	[0.22714]	[0.10653]	[0.07522]	[0.03953]	[-1.24655]
CHINA(-4)	[-0.31207]	[-0.06649]	[0.06270]	[-0.50618]	[-0.79587]	[0.19555]	[-0.07674]
BRAZIL(-1)	[0.11695]	[0.06793]	[-0.08750]	[0.31151]	[1.22164]	[0.06372]	[0.08009]
BRAZIL(-2)	[-1.23670]	[0.31541]	[-0.90434]	[-0.47034]	[-0.01258]	[-1.19610]	[-1.35461]
BRAZIL(-3)	[0.66024]	[-0.93729]	[-0.80106]	[-1.00648]	[0.68892]	[-0.46175]	[-1.60985]
BRAZIL(-4)	[-0.97593]	[-0.00067]	[-0.26966]	[-0.82307]	[-1.35807]	[-0.78398]	[0.06490]
BCI(-1)	[0.08673]	[-0.52262]	[-0.74051]	[-0.82998]	[-1.32172]	[-0.79259]	[-0.82524]
BCI(-2)	[0.90018]	[0.20053]	[0.53242]	[0.04195]	[-0.13014]	[0.75655]	[2.00155]
BCI(-3)	[-0.09361]	[0.81853]	[0.45808]	[0.76949]	[-0.45320]	[1.05477]	[1.30771]
BCI(-4)	[0.28542]	[-0.19905]	[0.15695]	[0.45403]	[0.93776]	[0.49513]	[-0.94291]
C	[0.94364]	[0.79645]	[2.16623]	[2.20874]	[1.33324]	[1.25422]	[1.17175]
R-squared	0.410275	0.514539	0.593268	0.684149	0.747709	0.624671	0.693042
Adj. R-squared	-0.45879	-0.20088	-0.00613	0.218684	0.375912	0.071555	0.240683
F-statistic	0.472086	0.719216	0.989778	1.469819	2.011068	1.129367	1.532061
Akaike AIC	1.643816	-1.7163	-0.66849	-1.19035	-0.4949	-0.24442	-2.61784

Using the Var, we can test if there are any lead-lag relationships between equity markets and commodities. Specifically, we use a Granger causality test to test the null hypothesis of no Granger causality.[5] The results indicate that emerging-markets equity prices *lead* commodity prices, as well as exhibit contemporaneous correlation, and that this effect has increased over time when comparing the period of 1995-2007 versus 1999-2007. We can visualize this relationship via the "impulse response function" of our Var model, which tells us how a shock to one variable influences other variables through time, all other things held constant. From the impulse response analysis, we can see

[5] A Granger causality test is designed to identify those variables which "lead" other in time, by determining the extent to which one variable or variables can forecast another. Specifically, we calculate the Wald statistic associated with a test of exogeneity of BCI.

that shocks coming from emerging-markets equities to commodities decay slower than the other way around. We can see that commodity prices are positively led by global and emerging-markets equities.

Granger Causality Test Dependent variable: BCI 1999-2007				Granger Causality Test Dependent variable: BCI 1995-2007			
Exclude	Chi-sq	df	Prob.	Exclude	Chi-sq	df	Prob.
BRAZIL	14.11095	4	0.0069	RUSSIA	3.093971	4	0.5422
CHINA	8.136453	4	0.0867	MSCIW	5.198797	4	0.2675
EM_E01	0.875533	4	0.928	INDIA	3.588944	4	0.4645
INDIA	3.983581	4	0.4082	EM_E01	7.536969	4	0.1101
RUSSIA	2.769229	4	0.5972	CHINA	2.246107	4	0.6906
MSCIW	12.37687	4	0.0148	BRAZIL	4.68206	4	0.3215
All	52.87	24	0.0006	All	30.59286	24	0.1659



The result that Commodity prices lag, rather than lead, emerging-markets equity prices, suggests that the typical narratives about the role of increased commodity prices in explaining the process of wealth creation and re-investment in emerging economies demands reconsideration.[6]

Implications for the Investment Policy of Institutional Investors

The above analysis has suggested that there is a strong, but somewhat complicated, interrelationship between commodity prices and the performance of emerging-markets equities, and that, while there is some relationship between a "bet" on commodities and a "bet" on emerging markets, these investments are not completely correlated. In this section, we review results relevant to portfolio construction programs that wish to incorporate commodity assets into the same general bucket as emerging markets. In brief, we have seen that commodity prices are related to emerging-markets equity markets, that those correlations are time-varying, and have, because of lag relationship with emerging-markets equities, some element of time diversification when compared to the risk associated with immediate and contemporaneous transmission of shocks. We make the additional observation, but do not investigate it further, that commodity exposure, especially via index products, as a proxy mechanism for garnering emerging markets exposure, may have additional benefits, such as lower transactions costs than direct or index emerging-markets equity investment.

We consider the set of portfolio choices of a typical institutional investor with meaningful international exposure to the following benchmarks:

1996-2007									
Asset Class	Proxy	avg	stdev	skew	kurt	min	max	maxdd	sharpe (4%)
Commodities	BCI	3.4%	6.5%	0.049	-0.600	-10.7%	18.3%	-21.5%	0.736
China Equities	MSCI MSEUSCF Index	2.9%	20.8%	1.039	3.170	-35.2%	80.7%	-83.0%	0.180
Brazil Equities	MSCI MSEUSBR Index	5.8%	19.3%	-0.032	0.191	-39.4%	53.9%	-76.6%	0.502
India Equities	MSCI MSEUSIA Index	5.1%	15.0%	-0.162	-1.225	-21.8%	31.3%	-56.0%	0.552
Russia Equities	MSCI MSEUSRUS Index	13.1%	39.6%	1.491	5.265	-75.2%	171.4%	-91.8%	0.614
EM Equities	MSCI Emerging Markets Free U.S. Cur	3.6%	13.1%	-0.301	-0.626	-23.6%	26.6%	-52.5%	0.393
EM Bonds	Global Emerging Markets	3.1%	4.6%	0.504	0.354	-4.5%	14.3%	-5.1%	0.913
US Equities	S&P 500 Total Return Index	2.6%	8.1%	-0.284	0.493	-17.3%	21.3%	-43.8%	0.388
World Equities	MSCI World Index U.S. Currency TR	2.3%	8.1%	-0.133	0.583	-18.4%	21.1%	-46.8%	0.324
World Bonds	Lehman Global Aggregate	1.5%	2.9%	0.404	-0.088	-3.2%	8.9%	-6.1%	0.319
Hedge Funds	HFR Composite	2.1%	3.5%	-0.078	3.960	-10.0%	13.5%	-10.5%	0.660
Real Estate	Nacreif National	3.1%	1.0%	0.265	-0.161	0.7%	5.4%	0.0%	3.933
Private Equity	Cambridge Associates PE	4.0%	5.4%	-0.357	-0.255	-8.3%	14.9%	-26.1%	1.134

From a principal components analysis, we see that the bulk of asset risk is derived from equity market exposure.

[6] For example, IMF (2008), which argues that sustained elevation in commodity prices has had a substantially positive follow impact on trade, development and institutional reform. Our result does not stand directly at odds with this general hypothesis, though for it to be directly valid one would like to see commodity prices lead domestic equity prices, which are most sensitive to trade, currency, financial and other local factors that are explored by the study.

Principal Components Loadings	Comp.1	Comp.2	Comp.3	Comp.4	Comp.5	Comp.6	Comp.7	Comp.8	Comp.9	Comp.10	Comp.11	Comp.12	Comp.13
BCI		-0.487		0.575	-0.473	0.287		0.161	0.276		0.103		
MSEUSCF	-0.227	-0.111		0.396	0.649	0.377	0.243	-0.258		0.18	-0.14	0.14	
MSEUSBR	-0.363	-0.135					-0.289		-0.316	-0.575	-0.55		
MSEUSIA	-0.297		-0.229	0.2		-0.719		0.231	0.121	0.319		0.332	
MSEUSRUS	-0.268	-0.293	0.224	-0.348	-0.123	-0.117	0.241	-0.539	0.518		-0.15		
MSCI.EM	-0.371	-0.137			0.269	-0.168				-0.161	0.589	-0.563	-0.207
Leh.EM	-0.21		-0.566	-0.16	-0.31	0.167	-0.285	-0.371	-0.238	0.415	0.109		0.136
SP500	-0.351	0.23		-0.227		0.34	-0.207	0.207	0.226	0.11	-0.103	0.216	-0.671
MSCIWorld	-0.365	0.21		-0.139		0.199	-0.14	0.291	0.279	-0.232	0.232	0.241	0.643
LehGlobAgg	0.121	0.11	-0.7				0.522		0.187	-0.379			-0.155
HFRFundCom	-0.327		0.217	-0.106	-0.257		0.481		-0.554		0.287	0.355	
NACREIFNational		0.612		0.456	-0.18	-0.147		-0.49		-0.181	0.171	0.158	
CA_PE	-0.306	0.354	0.119	0.153	-0.254		0.366	0.231		0.293	-0.322	-0.53	0.137

Importance of components	Comp.1	Comp.2	Comp.3	Comp.4	Comp.5	Comp.6	Comp.7	Comp.8	Comp.9	Comp.10	Comp.11	Comp.12	Comp.13
Standard devia	2.4451	1.2793	1.2104	1.0129	0.9198	0.7389	0.6945	0.6175	0.5147	0.4344	0.3165	0.2794	0.0826
Proportion of V	0.4599	0.1259	0.1127	0.0789	0.0651	0.0420	0.0371	0.0293	0.0204	0.0145	0.0077	0.0060	0.0005
Cumulative Pro	0.4599	0.5858	0.6985	0.7774	0.8425	0.8844	0.9215	0.9509	0.9713	0.9858	0.9935	0.9995	1.0000

We can investigate further the portfolio and risk properties of the assets in question. We impose the following restrictions on capital allocations:

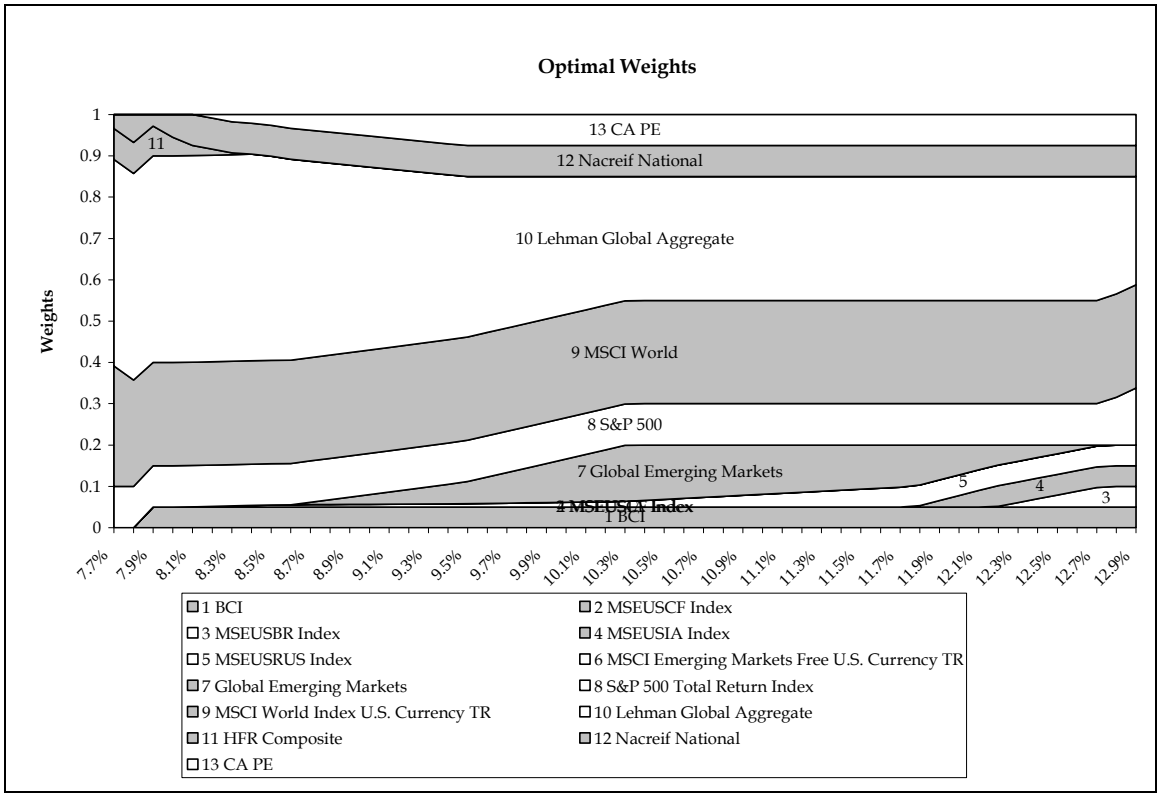
Allocation Constraints	min	max	Asset Class
BCI	0%	5%	EM
MSEUSCF Index	0%	5%	EM
MSEUSBR Index	0%	5%	EM
MSEUSIA Index	0%	5%	EM
MSEUSRUS Index	0%	5%	EM
MSCI Emerging Markets Fr	0%	15%	EM
Global Emerging Markets	0%	15%	EM
S&P 500 Total Return Index	10%	25%	
MSCI World Index U.S. Cur	25%	50%	
Lehman Global Aggregate	25%	50%	
HFR Composite	0%	8%	alt
Nacreif National	0%	8%	alt
CA PE	0%	8%	alt
total alt	0%	15%	
total EM	0%	20%	

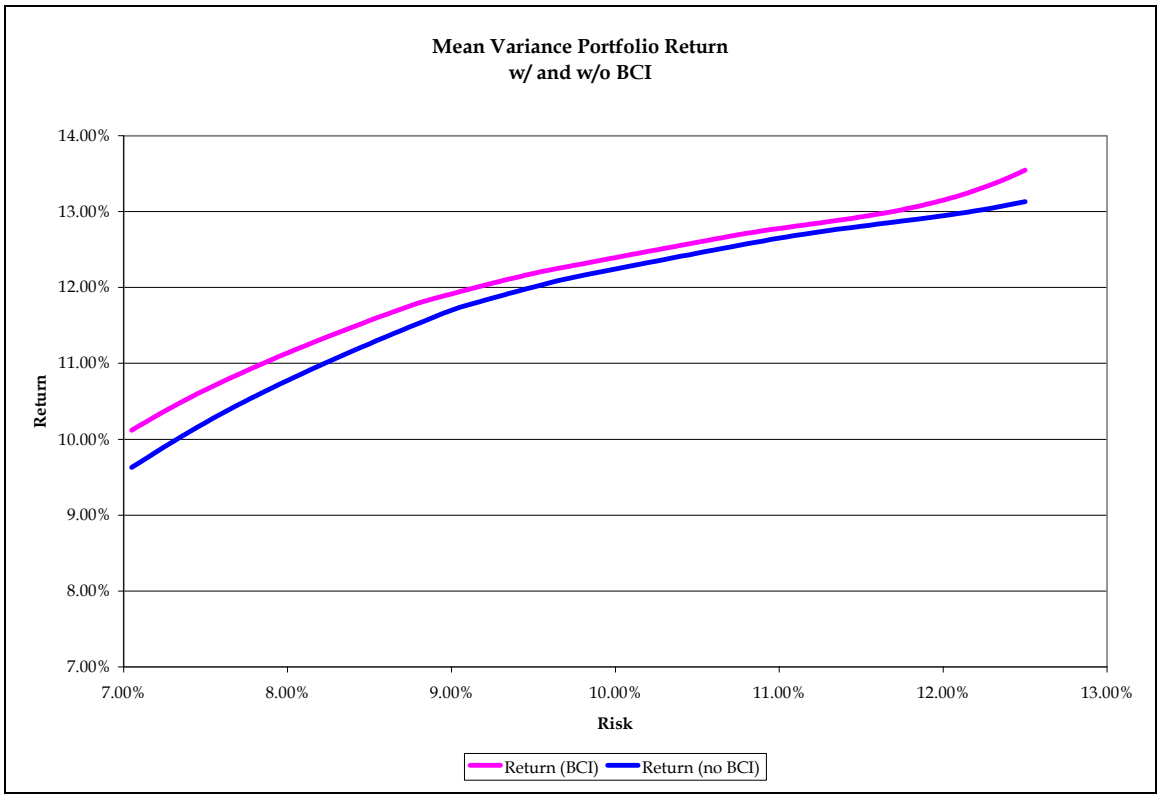
Using standard mean-variance analysis, with expected returns and co-variances estimated from quarterly historical data 1996-2007, we find the following optimal weighting scheme:

[INSERT CHART HERE]

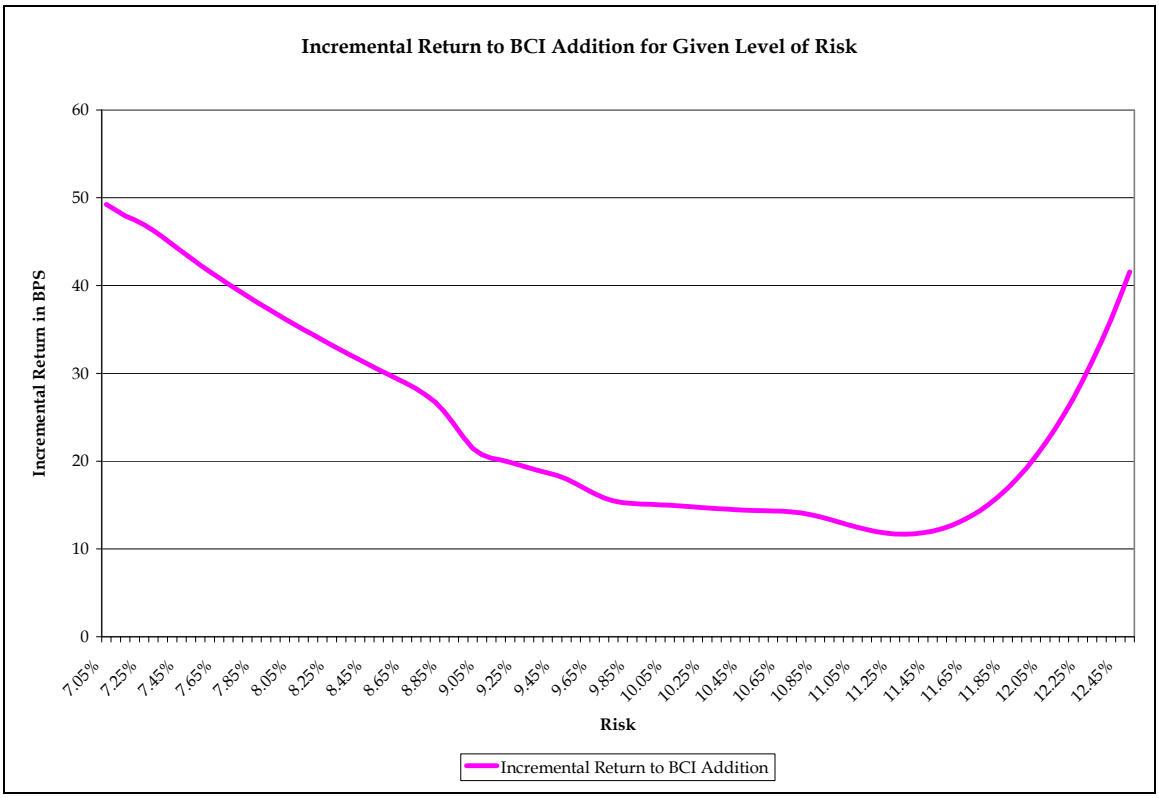
We can see that mean-variance optimization favors a full allocation to commodities in the emerging-markets bucket. This result is driven in part by the diversification benefits that commodities offer relative to emerging-markets equity exposure, as well as improved returns relative to emerging-markets bonds.

More generally, we can generate two efficient frontiers: one that includes allocation to commodities and one that does not, all other restrictions on weights held constant.




Mean Variance Portfolio Return
w/ and w/o BCI
14.00%
13.00%
12.00%
11.00%
10.00%
9.00%
8.00%
7.00%
Return
7.00%
8.00%
9.00%
10.00%
11.00%
12.00%
13.00%
Risk
Return (BCI)
Return (no BCI)

We can see that the efficient frontier that includes an allocation to commodities in the emerging-markets bucket dominates that without the allocation. However, it may be useful to look at this at a more granular level: We can compare the results of the efficient-frontier analysis to determine the incremental return available for a predetermined level of risk, once commodities are added to the emerging-markets risk bucket. Depending on the risk level, we can see that adding commodity exposure allows the investor to realize between 10 and 50 bps of additional return for the given risk.



Conclusion

In this brief analysis, we have examined the interaction between two important themes in investing: the growing importance of emerging markets, and the sustained boom in commodity prices. Given the important role commodity prices play in emerging economies, we have investigated the extent to which commodities and emerging-markets equities are related, and the extent to which their differences are sufficient to warrant inclusion of commodity assets in an optimal portfolio that includes emerging-markets assets. While there is a mild amount of correlation to the investments in commodities and emerging markets, we find that inclusion of commodities offers a substantial amount of risk reduction to an overall portfolio that includes core assets.

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