REAL ASSETS IN INSTITUTIONAL PORTFOLIOS: THE ROLE OF COMMODITIES

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1. Introduction

Investor focus on real assets has grown over the last decade as certain global macroeconomic trends have evolved to enhance the value of the asset class. These trends include the rapid growth of China and India, rising energy costs, a greater focus on bio-fuels, and currency fluctuations that increase demand for dollar-denominated commodities. As the significance of the asset class has increased, institutional investors have begun to explore the role that real assets can play in their portfolios through opportunistic, tactical or strategic investment policies. While many investment professionals agree that real assets provide diversification benefits, there has been surprisingly little research into the appropriate allocation of real assets for a given investment mandate. This paper seeks to define the possible risk and return enhancement, and the potential inflation hedge, of real assets to traditional stock and bond portfolios. In particular, this paper focuses on the benefits that one specific subclass of real assets, commodities, bring to the real asset portion of a diversified portfolio.

Commodities are at the center of many of the global macroeconomic trends impacting financial markets, and are expected to play an important role in investment performance over the next decade. Commodities in the form of futures contracts have unique qualities that make them a positive, liquid contribution to the real asset portion of a diversified portfolio. The sources of return to commodity investment differ from the sources of return to other real asset categories. The low correlation of commodities with other asset classes means that the hurdle rate for adding commodities to a real asset portfolio is relatively low. The following analysis suggests that a real asset portfolio should hold 10% to 25% in indexed commodity investments, with the remainder allocated to direct real estate, real estate investment trusts (REITS), natural resource partnerships, and Treasury inflation-protected securities (TIPS).

What is a Real Asset?

Investor understanding of what constitutes a real asset can be unclear, partly because the term 'real' has two distinct meanings in finance. One definition of 'real' is related to *real returns.* A *real return* is the return to an investment after adjusting for inflation. The opposite of a real return is a nominal return. A second definition is related to *real assets.* A *real asset* is a tangible asset that has intrinsic value. Real assets include land, property, equipment, raw materials, infrastructure, intellectual property, and real options. The counterpart to a real asset in finance is a financial asset, which is an ownership claim on a real asset. Stocks, bonds, and options are financial assets.

The ambiguity in the definition of real assets may be best summed up by the lead sentence in a recent *Pensions and Investments* article, which reads, "Real assets — a cocktail of asset classes to protect pension plans from the ravages of inflation — are gaining favor among pension fund executives."[1] Readers are left to wonder whether pension fund executives are convinced that real assets offer better protection against inflation than financial assets, or whether pension fund executives are focusing on real returns rather than nominal returns, or both.

For the purposes of this article, the definition of real assets borrows something from both financial uses of 'real'. A *real asset* is defined as a tangible asset that offers a reasonable expectation of inflation protection. For comparison, a *real return* asset (TIPS) that offers direct protection against inflation is also included.

Intrinsic Value

Contrary to financial assets such as stocks and bonds, real assets generally have intrinsic value, and they tend to be less liquid than their financial counterparts. This is because ownership transfer of physical assets like real estate is more cumbersome and costly than shares of stock. In the case of physical commodities, direct investment would involve transaction costs, transportation costs, storage, and spoilage costs that could significantly reduce the liquidity of the investments. However, at the same time there are more liquid methods for investing in real assets. For example, commodity investment through futures contracts represents a highly liquid means of gaining access to the investment benefits provided by commodities.

In certain cases the distinction between real and financial assets may not be that clear. Securitizing ownership of real assets may substantially change the value of cash flows associated with the underlying assets. For example, investment in real estate can take place in the form of direct investment in commercial, residential, and other properties. Alternately, REITs, which are financial assets, can also be used to gain access to the real estate markets. The investment dynamics of REITs are different from direct investment in real estate.

2. Data and Methodology

A series of benchmarks (listed below) was selected to examine the role of commodities and other real assets in the institutional portfolio. Quarterly data is used for all indices, as many are only available on a quarterly holding period. Additionally, quarterly data allows cross-correlations among less liquid asset classes that may be difficult to detect at shorter time frequencies. For the purpose of this study, the following financial and real assets are used (all returns are measured in USD):

Indices Used

Financial Assets:

[1] Arleen Jacobius, "U.S. Pension Plans Get Real in Fighting Inflation: 'Superclass' of TIPS, Infrastructure and Commodities Being Created by Some," Pensions and Investments Online, November 12, 2007.

- MSCI World Index
- Lehman Global Aggregate Bond Index

Real Assets:

- NAREIT-All Index: Subsectors include Equity, Mortgage, and Hybrid REITS
- NCREIF National Index: Subsectors include Apartment, Industrial, Office, Retail, Farmland, and Timberland
- Alerian Master Limited Partnership Index.
- Bache Commodity Index (BCI)

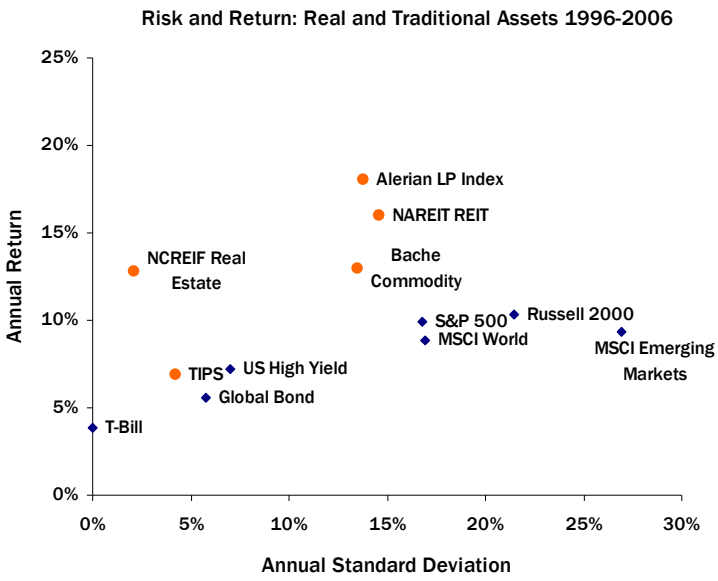
Real Return Assets:

- TIPS Index

Both the historical risk and return properties of real assets are examined in the following sections, as well as the portfolio benefits when combined with financial assets. In particular, the analysis examines whether an allocation to a futures-based index of commodities enhances a real asset based portfolio, and the results that follow indicate that it does.

3. Properties of Real Asset Returns

Real assets dominated global stock and bond returns over the past ten years. Real asset returns were in a range from 7%-19%. Stock and bond benchmarks returned 6%-10% over the same period. Annualized volatility, as measured by standard deviation, ranged from 2%-15% for real assets, as compared to 6%-17% for financial assets. This was also true of other measures, like the Sharpe ratio and maximum drawdown. Given these results, the growing interest in increasing allocations to real assets in the institutional portfolio is not surprising. This is particularly true for investors capable of bearing the liquidity risk associated with these assets.



The commodity index in the chart above (Bache Commodity Index or BCI) has a 13% annualized return and Sharpe ratio of .66, which compares well against other liquid, securities-based indices. The BCI has a low correlation with global stocks and bonds. In addition, the BCI has the highest correlation with US inflation of all the asset classes analyzed. This suggests that, at least for the time period in question, the BCI would make a good hedge against price inflation – particularly cost-push price inflation that tends to affect

commodity prices. Interestingly, over this time period, real estate, either via direct investment or through REITS, does not seem to make a good inflation hedge.

Real Asset Indices: March 1996 to December 2006. Quarterly Data

	TIPS	NAREIT All	NCREIF National	Bache Comdty	Alerian Master	MSCI World	Lehman Global	U.S. Inflation
Annualized Mean	7%	16%	12%	13%	19%	10%	6%	3%
Annualized St. Deviation	4%	15%	2%	14%	12%	17%	6%	1%
Sharpe Ratio	0.62	0.81	3.76	0.66	1.22	0.34	0.26	NA
Maximum Drawdown	-3%	-24%	0%	-21%	-11%	-46%	-6%	-1%
Maximum Return	8%	19%	5%	18%	18%	21%	9%	2%
Minimum Return	-3%	-11%	1%	-11%	-11%	-18%	-3%	-1%
Correlation with MSCI World	(0.52)	0.33	0.19	(0.11)	(0.07)	1.00	(0.17)	(0.28)
Correlation with Lehman	0.47	0.05	(0.04)	(0.17)	0.07	(0.17)	1.00	(0.26)
Correlation with U.S. Inflation	0.05	(0.13)	(0.09)	0.50	(0.03)	(0.28)	(0.26)	1.00

NAREIT and NCREIF Real Estate Sector Indices: March 1996 to December 2006. Quarterly Data

	NCREIF Apartment	NCREIF Industrial	NCREIF Office	NCREIF Retail	NCREIF Farmland	NCREIF Timerland	NAREIT Equity	NAREIT Hybrid	NAREIT Mortgage
Annualized Mean	12%	13%	12%	12%	12%	9%	16%	12%	15%
Annualized St. Deviation	2%	2%	3%	3%	8%	6%	14%	21%	26%
Sharpe Ratio	4.58	3.73	2.72	2.60	0.93	0.82	0.86	0.40	0.41
Maximum Drawdown	0%	0%	0%	0%	0%	-7%	-21%	-59%	-57%
Maximum Return	6%	7%	7%	8%	23%	12%	19%	27%	26%
Minimum Return	2%	1%	0%	0%	0%	-7%	-11%	-20%	-32%
Correlation with MSCI World	0.05	0.05	0.18	0.23	0.25	0.21	0.34	0.11	0.07
Correlation with Lehman	(0.10)	(0.11)	(0.09)	0.20	0.06	0.03	0.04	0.08	0.16
Correlation with U.S. Inflation	(0.04)	0.01	(0.05)	(0.20)	(0.44)	(0.23)	(0.11)	(0.07)	(0.18)

* Source: U.S. inflation data comes from the U.S. Federal Reserve.

4. Portfolio Analysis

An important ingredient in creating efficient portfolios is taking advantage of as much diversification as possible. It is clear from the following table that there is very little correlation among real asset sectors.

Correlation Matrix

		1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
TIPS	*1*		.12	-.24	.11	.28	.47	-.52	.05	-.16	-.51
NAREIT All	*2*	.12		.02	.02	.35	.05	.33	-.13	.44	.34
NCREIF National	*3*	-.24	.02		-.20	-.03	-.04	.19	-.09	-.01	.17
Bache Commodity Index	*4*	.11	.02	-.20		-.03	-.17	-.11	.50	-.06	-.16
Alerian Master LP Index	*5*	.28	.35	-.03	-.03		.10	-.14	.17	.25	-.12
Lehman Global Bond	*6*	.47	.05	-.04	-.17	.10		-.17	-.26	-.12	-.24
MSCI World Equity	*7*	-.52	.33	.19	-.11	-.14	-.17		-.28	.55	.96
CPI	*8*	.05	-.13	-.09	.50	.17	-.26	-.28		-.23	-.29
Lehman High Yield	*9*	-.16	.44	-.01	-.06	.25	-.12	.55	-.23		.59
S&P 500 Index	*10*	-.51	.34	.17	-.16	-.12	-.24	.96	-.29	.59	

Explained Variance: Eigenvalues for Principal Components (PC)

Value	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6	PC 7	PC 8	PC 9	PC 10
Eigenvalue	3.14	1.81	1.61	1.01	0.79	0.53	0.45	0.35	0.29	0.03
% of Variation	31.4	18.1	16.1	10.1	7.9	5.3	4.5	3.5	2.9	0.3
Cumulative %	31.4	49.5	65.7	75.7	83.6	88.9	93.4	96.8	99.7	100.0

Component Loadings: Correlations between Variables and Principal Components (PC)

Variable	PC 1	PC 2	PC 3	PC 4	PC 5	PC 6	PC 7	PC 8	PC 9	PC 10
TIPS	-.61	.61	-.04	.12	.17	-.09	.14	-.38	.20	-.01
NAREIT All	.40	.60	-.37	-.07	.21	-.44	-.25	.07	-.15	.00
NCREIF National	.27	-.13	.30	-.78	.42	-.03	.19	-.04	.00	.00
Bache Commodity Index	-.26	-.25	-.69	.24	.46	.01	.22	.24	.12	.01
Alerian Master LP Index	-.10	.61	-.42	-.46	-.33	.22	-.05	.18	.21	.00
Lehman Global Bond	-.28	.60	.42	.16	.39	.39	-.12	.12	-.15	.01
MSCI World Equity	.93	-.04	-.06	.12	.18	.18	-.14	-.07	.15	-.12
CPI	-.41	-.35	-.66	-.23	.08	.24	-.24	-.25	-.19	.00
Lehman High Yield	.68	.37	-.31	.09	-.15	.14	.42	-.08	-.25	-.01
S&P 500 Index	.95	-.04	-.07	.12	.08	.11	-.12	-.13	.15	.12

**Note: Correlations larger than 50% or more negative than -50% are highlighted in the above tables.*

To further understand the nature and extent of the diversification of the core assets, a principal components analysis of the correlation matrix of all of the candidate indices is conducted above. The most significant factor is found to be associated with listed equity, explaining more than 31% of the total variation in the candidate portfolio. The second most significant factor is an interest rate factor; the third is the commodity/CPI factor, which explains roughly 16% of the variation in portfolio returns. The fourth major factor is the real estate factor, which explains roughly 10% of the total variation.

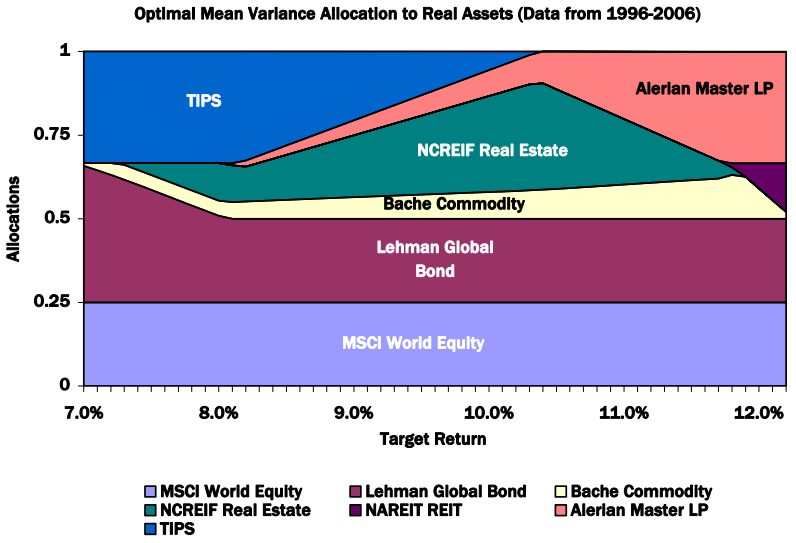
The portfolio benefits of allocating to real assets is further explored by computing the optimal mean-variance portfolios. Again, quarterly data from 1996-2006 is used to estimate variance, covariance and expected returns among the assets. The portfolio is restricted in order to ensure the historical data is not over-fit by allowing the optimizer merely to pick the best performing asset. The portfolio is also required to include at least 50% traditional financial assets. The constraints are in the table at right.

Constraints Used to Compute Optimal Portfolios

	Minimum Weight	Maximum Weight
Traditional Investments		
MSCI World Equity	25%	50%
Lehman Global Bond	25%	50%
Real Assets		
Bache Commodity	0%	33%
NCREIF Real Estate	0%	33%
NAREIT REIT	0%	33%
Alerian Master LP	0%	33%
TIPS	0%	33%

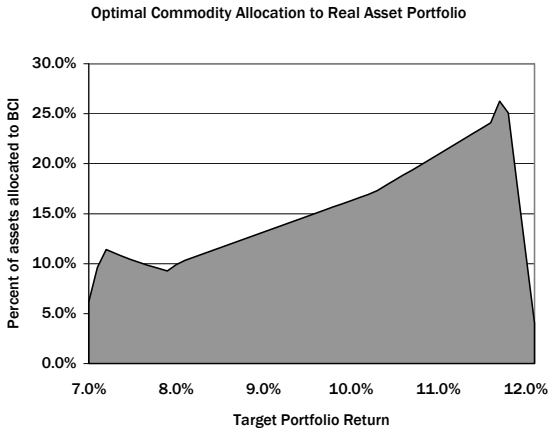
The results (below, right) show the allocation to each benchmark that would give the lowest-risk portfolio for a given return target. From the results, equities (MSCI World) never have more than the minimum (25%) allocation. Bonds (Lehman Global Bond) receive more than the minimum (25%) only for very low-return portfolios. At low target returns the portfolio is heavily weighted towards TIPS, but a higher target return levels allocations are directed toward energy limited partnerships (Alerian MLP) and real estate (NCRIEF National). The BCI has an allocation at every target return level.

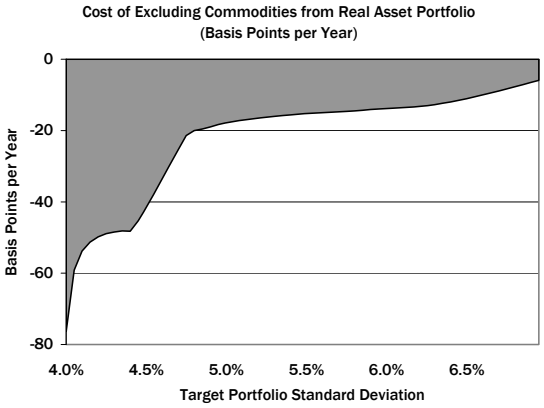
The optimal real asset portfolio, which is the portion of the above portfolio that excludes stock and bond investments, contains a combination of several different real asset benchmarks. The portion of a real asset portfolio that should be allocated to commodities is shown in the chart on page 9. This chart shows that an investor with a relatively low return objective should allocate about 10% of their real asset budget to commodities, and that investors with higher return expectations should allocate as much as 25% to commodities. In this analysis, the combination of benchmarks with the highest Sharpe ratio included a roughly 18% allocation to the BCI.



To analyze the cost of excluding commodities from a real asset portfolio, the analysis above was repeated but without the BCI. The data and restrictions are otherwise the same.

This phenomenon is indicated more explicitly in the chart below, which gives the extra return available at each point on the efficient frontier. Specifically, up to 79 basis points in incremental expected return could be added without increasing expected portfolio risk.





5. Conclusion

In this brief note, we have explored the historical return, risk and portfolio properties of real assets, and shown:

- Real assets may contribute substantially to traditional stock and bond portfolios.

- Certain real assets, such as the BCI commodity index, may serve as a hedge against inflation risk.
- Exposure to commodities adds meaningful risk reduction and return enhancement. For the real asset portfolios considered, the BCI typically demanded a 10-25% allocation.
- Commodities exposure via a passive futures based index has the additional virtue that is perhaps the most liquid of real assets, with the possible exception of TIPS.

References

Deutsche Bank, *An Investor Guide to Commodities*, 2005.

Ibbotson Associates, "Investing in Hard Assets: A Diversification Tool for Portfolios." August, 2006.

Till, H. and Eagleeye, J., *Intelligent Commodity Investing*, Risk Books, 2007.

Appendix I: Index Definitions and Descriptions

Index Definitions

1. Financial Assets:

    a. **MSCI World Index**: A capitalization weighted index of global equities. Note that the US represents somewhat less than 50% of the total world market cap. (Source: Bloomberg)
    b. **Lehman Global Aggregate Bond Index**: A global bond index that includes bonds across all credit spectrums in proportion to dollar amount of such instruments outstanding. (Source: Bloomberg)

2. Real Assets:

    a. **FTSE NAREIT-All Index**: A capitalization weighted blend of the returns to three different classes of REITs. (Source: Bloomberg)
        i. **Equity REIT:** Firms that own, manage and lease investment-grade commercial real estate. Specifically, a company is classified as an Equity REIT if 75% or more of its gross invested book assets is invested in real property.
        ii. **Mortgage REIT:** A company is classified as a Mortgage REIT if 75% or more of its gross invested book assets is invested in mortgage loans or mortgage-backed securities.
        iii. **Hybrid REIT**: Hybrid REITs include those firms with assets that are more than 25% invested in real estate equity and more than 25% invested in mortgages.

    b. **NCREIF National Index**: Weighted index of each of the following sectors. (Source: NCREIF)
        i. **Apartment**: High-rise Elevator Projects, Walk-up buildings, Garden-type Projects management.
        ii. **Industrial:** Flex Space, R&D (Research and Development), Warehouse, Manufacturing.
        iii. **Office**
        iv. **Retail:** Neighborhood Center, Community Center, Super-Regional Center, Single-Tenant.
        v. **Farmland:** An index of annual and permanent cropland, representing more the USD1B in assets, of which more than 50% is located in the Pacific West.
        vi. **Timberland**: An index of timberland concentrated in the Southeast, Pacific Northwest and the Northeast of the US.

    c. **Alerian Master Limited Partnership Index**: The Alerian Master LP Index Series measures the composite performance of energy master limited partnerships and is calculated using a float-adjusted, capitalization-weighted methodology. (Source: Bloomberg)

    d. **Bache Commodity Index**: A futures-based commodity index that allocates approximately 50% of its exposure to energy, 27.5% to agriculture and 22.5% to metals. (Source: Bache Global Commodities Group)

3. **Real Return Assets**:
    a. **TIPS Index**: An index of US Treasury bonds whose principal and coupon is linked to the prevailing rate of inflation, as measured by the CPI-All Urban Consumers index. (Source: Morningstar)