# The Role of Real Assets in a Diversified Investment Portfolio

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Stephen L. Nesbitt
Kathy K. Barchick, CFA
Cliffwater LLC
310-448-5000
snesbitt@cliffwater.com
kbarchick@cliffwater.com

**Summary of Findings**

1) Real assets are investments that have a high likelihood of retaining their inflation-adjusted value and generally perform well when traditional asset classes like stocks and bonds perform poorly.

2) Commodities are most frequently thought of as real assets but TIPS, T-bills, timber and energy investments fit as well. Real estate exhibits only modest real asset qualities.

3) TIPS offer the greatest inflation protection with longer term return correlations with inflation of almost 1.0. Commodities and T-bills are close behind with inflation correlations of 0.6 and 0.3, respectively.

4) TIPS and commodities are powerful diversifiers, with significant negative correlations to both stock and bond returns.

5) REITS have shown strong long-term performance but exhibit risk characteristics more like stocks and bonds than real assets.

6) Future real returns for TIPS are directly observable from their yields. Real returns for commodities are subject to considerable debate with history showing return levels comparable to common stocks but investment theory questioning whether this can be repeated. Cliffwater assumes no excess return to commodity futures above the return on underlying collateral.

7) Timber investments, like other commodity investments, are uncorrelated with traditional investments, offer attractive cash yields, and have an expected return that is competitive with stocks. Allocations to energy investments are also growing within the private equity asset class with approximately $7 billion in new assets raised.

8) Efficient frontier analysis shows that portfolio risk can be significantly reduced, with no reduction in return, by modest allocations to real assets.

## Introduction

Most fund sponsors today find themselves in an uncomfortable position with portfolio allocations to stocks and other equity-oriented asset classes reaching 70-80%, and sometimes more. The shift to equity from fixed income occurred over the past decade and was prompted largely by falling bond yields. But the recent bear market has exposed the potential return volatility from stocks and its disruptive consequences upon spending (foundations and endowments) and plan contributions (pensions). And, throwing gas upon the fire, *expected* returns for stocks have actually decreased despite price levels that are 30% off their highs due to a lower level and quality of corporate earnings. As a result, institutional investors are wondering whether they are actually sitting upon low return, high risk portfolios.

One approach is to consider investments in hedge funds, relying upon managers with complete freedom to choose assets and allocations to add (hopefully) three to five percent in excess return while protecting against portfolio losses. Institutional experience with hedge funds has been favorable so far, but the number of available hedge funds that can contribute "alpha" may not be sufficient to satisfy demand.

Another direction is to look at "real assets" as a way to improve returns and diversify equity risk. Real assets are investments that have a high likelihood of retaining their inflation-adjusted value. This is particularly important during periods of high unexpected inflation when traditional assets like stocks and bonds perform poorly. Real assets can also offer diversification benefits during low inflation periods, as they have in the recent bear market.

Commodities are most frequently thought of as real assets. In fact, some commodity prices, like gasoline, coffee and heating oil, are components of the Consumer Price Index. Commodity investing is typically done through futures and swaps on individually traded commodities or indexes comprising groups of commodities like the Goldman Sachs Commodity Index ("GSCI") or Dow Jones – AIG Commodity Index ("DJ-AIGCI")[1]. Commodity investments can also be made through private partnerships that specialize in commodity production. Two examples that have institutional support are timber and energy investments. Timber currently represents over $15 billion in institutional assets; CalPERS, Massachusetts PRIM, and Harvard Management Company are or have been major investors. Energy focused private equity partnerships are currently raising significant institutional capital with Venture Economics reporting that of the $38 billion in private equity currently being raised in 2004, $7 billion is for energy funds. But not all real assets are commodity-linked. One real asset that is completely unrelated to commodities is Treasury Inflation Protection Securities ("TIPS"). TIPS are government issued bonds whose principal and coupon payments increase with CPI inflation. And finally, real estate is often thought of as a real asset and currently represents a meaningful slice of many institutional portfolios.

## Real Assets as an Inflation Hedge

Which assets are best classified as "real" is an empirical question. To find an answer we examined return correlations between different asset classes and inflation covering the 32-year period 1972 through 2003.[2]

Exhibit 1 reports how well individual asset classes performed as real assets. If an asset class was a perfect inflation hedge it would have a 1.0 correlation with the CPI; when inflation rose, so too did the asset class return, and vice versa. The vertical axis in Exhibit 1 measures historical return correlation with CPI inflation. The horizontal axis identifies different measurement periods: monthly returns, rolling one year returns, rolling two year returns, rolling three year returns, and rolling five year returns. Some asset classes may not be highly correlated with inflation over short time periods but are so over longer time periods. Most institutions would be more concerned with the inflation hedging capability of their investments over medium and longer term periods. In fact, having a high return correlation with the CPI over the short term is almost impossible given the Index's construction methodology unless the investment is structured as an economic derivative.

**Exhibit 1: Commodities as an Inflation Hedge**

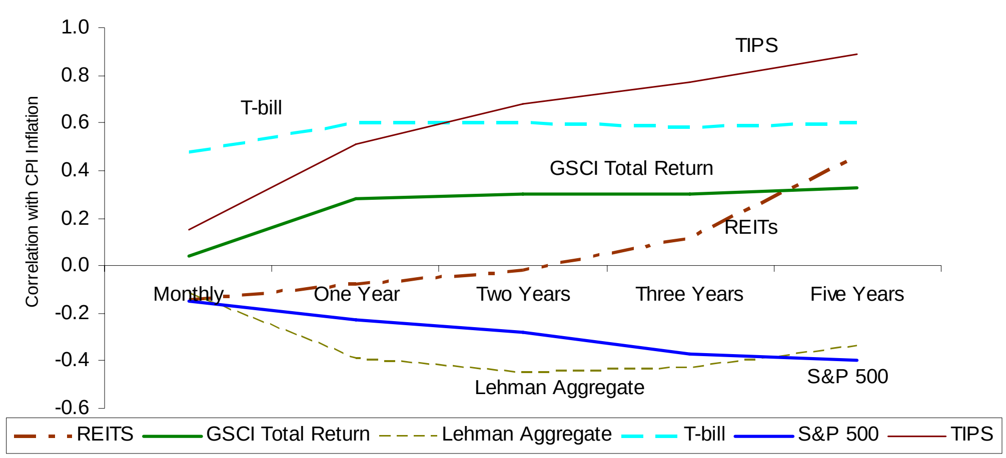



Exhibit 1 shows that most asset classes are uncorrelated with inflation – correlation close to zero – over short one month time periods. The exception is 30-day Treasury bills which have a one month correlation of approximately 0.5. Over longer measurement periods it becomes clear which investments fall into the real asset category. Traditional institutional investments, stocks and bonds, as measured by the S&P 500 and Lehman Aggregate Indexes, respectively, do not. Their correlations with inflation are negative over all time intervals, and fall steadily as the time interval lengthens. The negative correlation for stocks is somewhat surprising given the notion that equity investments represent a claim on corporate real assets.

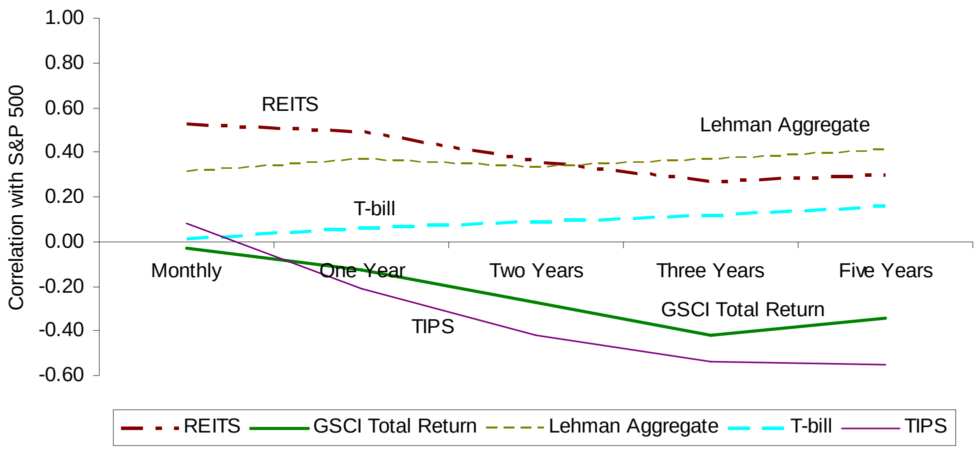
TIPS and Treasury bills turn out to be the best inflation hedges. The evidence that the correlation between TIPS and inflation approaches a perfect 1.0 over five year intervals is not surprising given their direct tie to CPI changes.

Commodities, represented by the GSCI Total Return Index, are also a strong inflation hedge with a low positive correlation for short one month periods, rising rapidly to average approximately 0.3 over medium and long term time intervals.[3] Return correlations between REITS and inflation are mixed. Monthly correlations are negative, like stocks and bonds. They increase for one and two year time intervals but are still negative. Over longer three and five year periods, REIT correlations are positive with inflation and actually exceed the correlation between commodities and inflation over five year intervals.

**Real Assets as Portfolio Diversifiers**

Exhibit 1 demonstrated that commodities, TIPS, T-bills and, to a lesser extent, REITS are inflation hedging "real assets." Stocks and bonds, which dominate institutional portfolios, are poor inflation hedges. Though real assets respond well to inflation, that trait does not necessarily imply that they are good diversifying assets within a portfolio of stocks and bonds. Exhibit 2 addresses directly the diversification potential of real assets by showing the correlation of real assets and traditional asset classes with common stocks, the largest institutional portfolio holding.

**Exhibit 2: Correlation with S&P 500 Index**

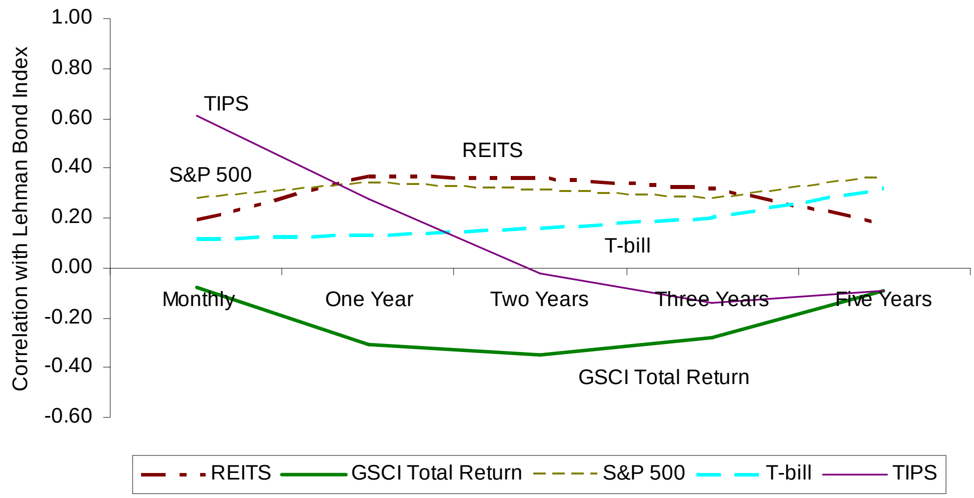



Only commodities and TIPS offer powerful diversification benefits when combined with common stocks. TIPS show correlations approaching -0.5 over longer time intervals and commodity correlations are only slightly higher, ranging between -0.4 for three year intervals and -0.5 for five year intervals.

REITS are less effective diversifiers when compared to TIPS and commodities, with correlations of positive 0.3, despite the strong inflation hedging character they showed over five year intervals in Exhibit 1. And the same can be said for T-bills, though they fare better than REITS on both criteria.

The diversification benefits of real assets when added to a bond portfolio are shown in Exhibit 3 where correlations are measured against the Lehman Aggregate Bond Index. TIPS and commodities are shown to be strong diversifiers when combined with bonds, as they were when combined with common stock in Exhibit 2. Interesting is the fact that TIPS correlations drop sharply as the time interval lengthens. They have the highest correlation with bonds, 0.6, when monthly returns are used but one of the lowest correlations with bonds, -0.1, when five year returns are used. This is not surprising given that TIPS, like traditional bonds, generally react to changes in real yields in the short term, but over longer periods it is inflation that constitutes most of TIPS returns and in a positive way, while affecting traditional bonds in a negative way.

**Exhibit 3: Correlation with Lehman Aggregate Bond Index**




## Historical Returns

Exhibit 4 compares the performance of commodities, represented by the Goldman Sachs Commodity Total Return Index, for its entire history beginning December 31, 1971 through December 31, 2003, with the S&P 500 Index and CPI inflation.

**Exhibit 4: Stock and Commodity Returns, 1972 to 2003**

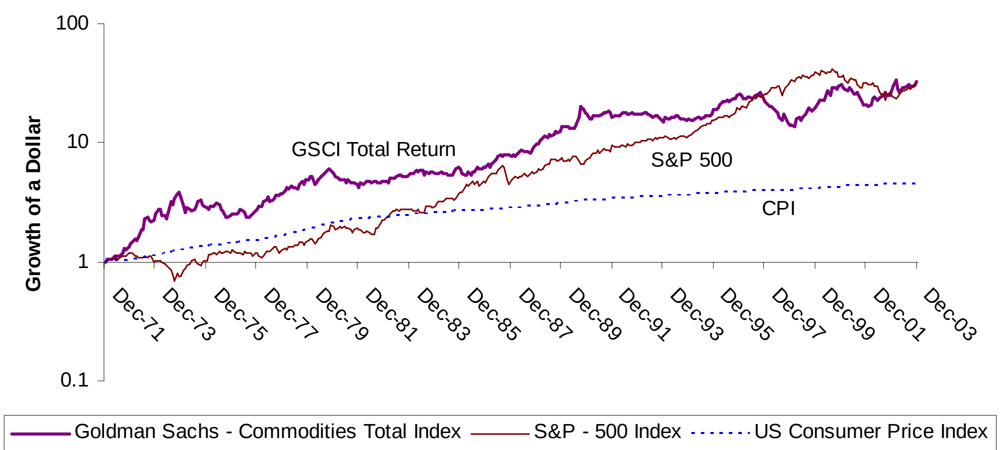



Exhibit 4 portrays an attractive return profile for an investment in fully collaterized commodity futures, which the GSCI Total Return Index represents. Two sub-periods are recognizable. The GSCI performed very well during the 1970s, a period when inflation was high and the S&P 500 Index produced negative real returns. However, from the 1982 start of the bull market in stocks, through 2003, stocks have outperformed the GSCI. Over the entire time period the S&P 500

Index and the GSCI Total Return Index have performed the same.[4] Exhibit 5 details returns for the sub-periods and includes the other asset classes.

**Exhibit 5: Commodity Returns (%) during Inflation and Disinflation**

| | (Inflationary) December 31, 1971 to July 31, 1982 | (Disinflationary) July 31, 1982 to December 31, 2003 | Combined Periods: 1972 to 2003 |
|---|---|---|---|
| S&P 500 | 5.0 | 14.7 | 11.4 |
| Lehman Aggregate | 6.0 | 10.0 | 8.7 |
| T-bills | 8.1 | 5.8 | 6.5 |
| GSCI Total Return | 15.9 | 9.5 | 11.5 |
| TIPS | 11.8 | 8.2 | 9.4 |
| REITS | 10.7 | 14.0 | 12.9 |
| CPI | 8.5 | 3.0 | 4.8 |

The sub-period returns in Exhibit 5 are consistent with expectations. During the inflationary first period, the GSCI Total Return Index was the best performing asset class with a 15.9% annual return. The S&P 500 Index was the worst performing asset class with a 5.0% annual return. Over the longer disinflationary second sub-period, it was the S&P 500 Index with the highest return, 14.7%. The GSCI Total Return Index returned a lower 9.5%, between an 8.5% TIPS return and 10.0% Lehman Aggregate Bond Index return. Stocks and the GSCI performed almost identically over the entire 32-year period at 11.4% and 11.5%, respectively.

The GSCI Total Return Index represents an investment in a basket of commodities fully collaterized by T-bills. Consequently, T-bill returns are a component part of the GSCI Total Return Index. The difference between the GSCI Total Return Index and T-bills represents the performance of a basket of commodity futures alone, uncollaterized. This is also referred to as "excess return." Over the combined periods uncollaterized commodity futures returns, or commodity excess returns, averaged 5.0% annually, 11.5% minus 6.5%. Commodity excess returns were 7.8% during the inflationary time period and 3.7% during the disinflationary period.

The existence of an excess return to commodities, also called "risk premium", is the subject of considerable academic and practitioner debate. Past returns clearly show large positive commodity excess returns, though they are not statistically significant due to their high volatility.[5] Many question whether these results are repeatable because commodity investments are claims on non-revenue generating, fixed quantity assets, unlike stocks and bonds where investors receive cash flow from dividends or interest income. For buyers of commodity futures to earn a positive excess return either (1) a portion of real economic growth is being allocated to real assets, e.g. commodities, or (2) sellers/producers of commodities agree to sell at futures prices below their fair value – expected future spot price – as an insurance premium to eliminate business uncertainty. As to (1), economists point out that the supply of commodities, or their substitutes, should increase in response to any short-term increase in real commodity pricing, preventing commodities from systematically claiming an increased fraction of real wealth. As to (2), there is evidence that this occurs, particularly in energy-related commodities.[6]

The magnitude of returns to commodity futures buyers from futures sellers is difficult to measure and to forecast. In particular, Cliffwater's valuation approach to forecasting return, which takes account of current yield, expected cash flow growth, and exit price, does not lend itself to commodities because there is no associated cash flow, so that only price is a factor. Given the uncertain economics surrounding commodity futures real returns, Cliffwater takes a conservative position and assumes a zero real return. The expected return on commodities is therefore based solely upon the expected return for the underlying collateral backing the commodity futures. The GSCI Total Return Index assumes T-bills as the collateral but there is no reason why other assets classes can't play that role. For example, several investment management firms use TIPS as underlying collateral because it too is positively correlated to inflation, has low risk, and is readily acceptable as margin. Other firms use more aggressively managed cash portfolios as collateral, as they do when constructing derivative-based enhanced S&P 500 portfolios.

Exhibit 6 shows Cliffwater's expected returns, risk, and correlations for commodities and other real and traditional asset classes.

**Exhibit 6: Expected Returns, Risks, and Correlations**

| | U.S. Stocks | U.S. Bonds | T-bills | REITS | TIPS | Commod-ities | Timber | CPI |
|---|---|---|---|---|---|---|---|---|
| Expected Return (%) | 7.75 | 7.75 | 2.75 | 7.75 | 4.50 | 3.00 | 7.00 | 2.50 |
| Expected Risk (%) | 17.00 | 4.00 | 1.00 | 16.00 | 6.00 | 18.00 | 17.00 | 0.90 |
| Correlations: | | | | | | | | |
| U.S. Stocks | 1.00 | | | | | | | |
| U.S. Bonds | 0.35 | 1.00 | | | | | | |
| T-bills | 0.10 | 0.10 | 1.00 | | | | | |
| REITS | 0.30 | 0.15 | 0.00 | 1.00 | | | | |
| TIPS | -0.25 | 0.00 | 0.00 | 0.00 | 1.00 | | | |
| Commodities | -0.20 | -0.05 | 0.10 | -0.25 | 0.35 | 1.00 | | |
| Timber | 0.10 | -0.05 | 0.00 | 0.10 | 0.00 | 0.80 | 1.00 | |
| CPI | -0.35 | -0.40 | 0.60 | 0.25 | 0.75 | 0.30 | 0.25 | 1.00 |

The 3.00% return assumption for commodities is based upon an assumption that the underlying collateral is managed cash, returning 0.25% above T-bills. If TIPS were used as collateral, the expected return would be 4.5%. Risk and correlations assumptions would also need to be modified, but only slightly because TIPS have low risk compared to commodities and similar correlations. This strategy of combining commodity futures with TIPS collateral is attracting a good deal of interest and is sometimes referred to as "double real" since both the commodity futures and the TIPS collateral are real assets.

## Real Asset Investment Strategies

### *TIPS*

An investment in TIPS may be implemented in either a passive or active manner. A passive portfolio is designed to match the risk, return and characteristics of an index by owning a market value weight of the securities in the chosen index. There is no expectation of the return exceeding the benchmark as the manager will not be making any decisions regarding the direction of interest rates, the shape of the yield curve or relative value among bond market sectors. The fees to implement a passive strategy should be very low (10 basis points or less).

The objective of an actively managed TIPS portfolio is to earn a return that exceeds that of a chosen index. The level of expected excess return and the corresponding amount of excess risk versus the index will be a function of the amount of latitude the manager has with the portfolio. For example, an active management strategy could be as simple as allowing the manager to make duration and yield curve decisions utilizing the limited universe of the twelve TIPS currently outstanding or could be as complex as allowing the manager to utilize the full spectrum of nominal bonds (e.g. investment grade corporate, high yield, mortgages, etc.) and global inflation linked bonds on either a hedged or unhedged basis. Fees will generally correspond to the amount of latitude allowed in the portfolio.

Another opportunistic strategy involves leveraging the TIPS portfolio to achieve a higher level of return while maintaining the favorable inflation hedging characteristics. A leveraged TIPS strategy entails purchasing a portfolio of TIPS but financing a portion of the portfolio – generally 50% -- by borrowing against them in the government repo market. As long as the cost of borrowing is below the unleveraged expected TIPS return, leverage will increase total portfolio return and risk.

*Commodities*

Similar to TIPS, an investment in commodities could be invested in either a passive or active manner. The total return of the GSCI Commodities Index assumes full collateralization using T-bills. As such, it is very simple to closely replicate this return.

Active strategies range from less to more complex. On the less complex side are strategies that utilize futures or swaps to gain exposure to the respective commodity index and utilize an enhanced cash strategy to add value versus the index. As long as the return of the enhanced cash outperforms the embedded index's T-bill rate, the total return of the portfolio should exceed that of the selected commodity index. Other variations of this strategy include collateralizing the futures or swaps with TIPS to provide a "double real" return or other types of collateral in order to increase the potential return of the strategy. These strategies provide return in excess of the benchmark as long as the underlying collateral return exceeds T-bill returns. Additionally, the risk of the portfolio is increased, though generally by a modest amount.

Additional hybrid strategies are also available incorporating commodity investments. For instance, there are products that blend a commodity index with a dollar hedged global inflation linked bond portfolio as well as products that combine exposure to a commodity index along with exposure to equity securities of commodity producers. The goal of each offering is to provide a hedge against inflation at an attractive return. The fees for these strategies will correspond to the amount of latitude allowed in the portfolio but can range from 20 to 100 basis points.

*Timber*

Unlike commodities and TIPS, timber investments are illiquid and generally take the form of partnership investments or separate accounts. Ownership consists of two components, timber and land, though land represents a small fraction of total value. One of the unique features of this investment is its small market capitalization compared with traditional asset classes and the high percentage of private ownership. The total market capitalization of timber owned by institutions is estimated at $15 billion, which is low compared to a $200 billion REIT market and $700 billion high yield market. The $15 billion is comprised of the NCREIF Timberland Index's $5.8 billion market capitalization, several REITS holding primarily timberland (e.g. Plum Creek and Rayonier), plus estimated holdings of other institutional investors that do not report to NCREIF.[7] However, the market capitalization of non-institutional timber is substantially larger. Estimates are that institutional investors own only 3-5% of total investment quality timberland while corporations own 17-23%, and families and individual investors own the balance[8]. This implies a $300-$500 billion total market capitalization.

The primary geographical focus for timber investments is within three growing regions in the United States (Northeast, Southeast, and Northwest) but the opportunity set is being expanded to include countries such as New Zealand, Australia, Canada and South America (Chile, Argentina, Uruguay and Brazil). As of December 31, 2003, 68% of the market value of the NCREIF Timberland Index was in the Southeast, 26% in the Northwest and 6% in the Northeast. There are two tree types that result in different sets of cash flows and expected returns. "Softwoods", better known as "evergreens", consist of firs, spruces and pines and are more heavily concentrated in the Northwest and Southeast. "Hardwoods", better known as deciduous trees, consist of cherry, maple and oak trees and are more heavily concentrated in the Northeast. Another factor affecting returns is the source of timber, which can be from natural forests or plantations. Each source has its own foresting and harvesting techniques.

Exhibit 7 graphs the NCREIF Timberland Index returns from 1987 through 2003. The Timberland Index is based upon manager supplied appraised values, net operating income, and capital expenditures. Cliffwater has adjusted the returns downward by 1% per year for management fees. Performance far exceeded stocks and bonds during the 1987 through 1992 period, in part reflecting the fact that the series began just before a sharp run-up in timber prices.[9] Beginning in 1993, timber showed more modest returns.

**Exhibit 7: Timber Performance (1987 to 2003)**

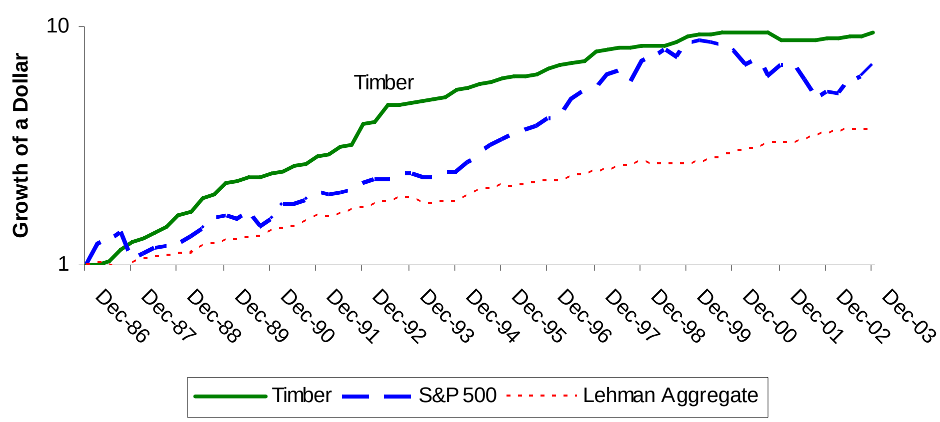



Exhibit 8 shows that timber returns over the past ten years averaged 6.94%, approximately equal to the 7.26% return on the Lehman Aggregate Bond Index but well short of the 11.50% S&P 500 Index return. The impressive 1987 through 1993 period for timber returns followed by the more modest 1994 through 2003 period demonstrates that timber investments are subject to wide performance swings due to cyclical timber pricing, even though short term returns tend to be smoothed by appraisal pricing.

**Exhibit 8: Timber Investment Returns**

| | Timber* | S&P 500 | Lehman Aggregate |
|---|---|---|---|
| Last 10 Years | 6.94% | 11.50% | 7.26% |
| Last 17 Years | 14.16% | 12.05% | 8.01% |

* Timber returns from NCREIF but reduced by 1% for fees

Cliffwater's long-term return forecast for timber is 7.00%, constructed as follows:

| | | |
|---|---|---|
| | Annual growth in timber volume (biological growth) | 4.5% |
| + | Expected inflation | 2.5 |
| + | Real growth in timber prices | 0.0 |
| + | Value-added from management | 1.0 |
| - | Fees | (1.0) |
| = | Expected total return | 7.0% |

Cliffwater's long term expected return is more in line with actual performance over the last 10 years. Industry sources generally agree on a 4-5% annual increase in the volume of timber per acre from biological growth, which can be harvested for cash flow at the option of the investor. Unlike most other commodities – oil being another exception – timber prices have increased in real terms over the last 50 years. Cliffwater assumes here that timber prices experience no real change over the next 10 years. This may be conservative given that timber prices are coming off a cyclical low.

For its risk assumptions, Cliffwater used a statistical approach outlined by Geltner[10] and Conner[11] to "de-smooth" the timber index returns. The resulting standard deviation is 17%. Cliffwater evaluated correlations as calculated by various industry professionals, including Hancock, UBS and Global Forest Partners[12]. The resulting correlation with inflation is 0.25, which is comparable to the correlation between the GSCI Total Return Index and inflation. Although timberland does not have a direct economic link to inflation, unlike other asset classes, it has a unique "biological growth" component that coincides with inflation growth, resulting in positive correlation over longer time periods. Essentially, as trees grow over time, not only does the volume of timber on any given plot of land increase thereby increasing the value of the timberland, but the larger trees can also be used for higher valued end-goods thereby increasing the per tree value by multiples.

The primary way to access timberland investments is through timberland investment management organizations (TIMOs). There are approximately 20 TIMOs that currently manage timberland investments on behalf of institutional investors. These investments take various forms, including separate accounts (typically for investments larger than $50 million), open/closed end funds and limited partnerships. Additionally, TIMOs may have expertise in one geographical area, such as the Northwest or Southeast, and many are expanding into non-U.S. timberland investments. Fees range from 85 to 150 basis points per annum and may include a performance component.

*Portfolio of Commodity Company Stocks*

Some investment companies offer managed stock portfolios with a commodity sector focus, the most popular being an energy mandate. However, available evidence shows that portfolios of commodity company stocks do not exhibit the diversification or inflation hedging benefits of real assets.[13] Therefore, allocations to commodity company stock portfolios should be based upon the ability of the manager to add value and not an expectation that portfolio returns will behave in an inflation-hedging manner like commodity futures.

## The Optimal Allocation to Real Assets

Exhibit 9 displays an efficient frontier that includes real assets. For comparison purposes, Mix 1 below the efficient frontier shows a diversified institutional portfolio that includes 5% allocations to TIPS and REITS. Such a portfolio, except for the absence of private equity, might represent allocations made by a sponsor seeking return and diversification with traditional asset classes. We next consider how this portfolio can be improved, either by reducing risk or increasing return by allowing an allocation to commodities by way of GSCI futures. Recall that GSCI futures must be fully collaterized but we allow the optimization to select the form of collateral.

**Exhibit 9: Efficient Frontier**

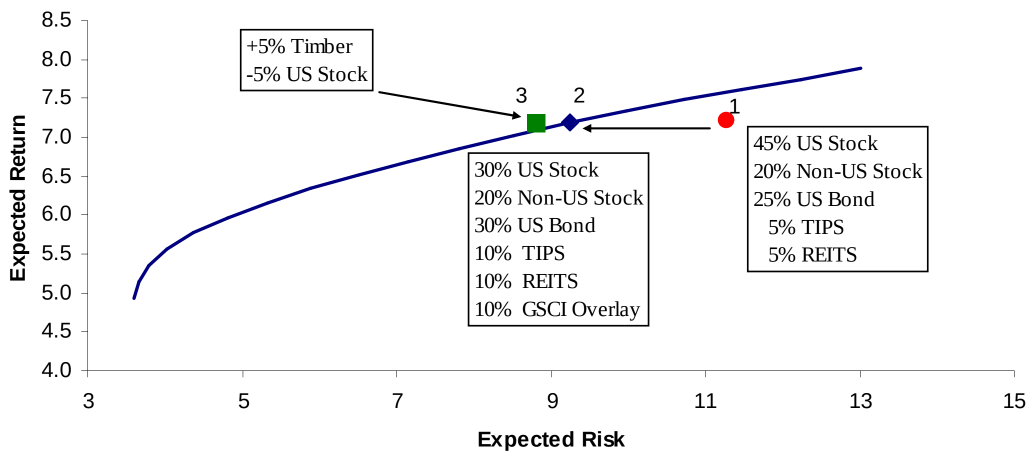



**Exhibit 10: Selected Asset Mixes**

| | A | Mix 3 | Mix 2 | B | C | Mix 1 | D |
|---|---|---|---|---|---|---|---|
| US Stocks | 21 | 25 | 30 | 36 | 42 | 45 | 47 |
| Non-US Stocks | 20 | 20 | 20 | 20 | 20 | 20 | 20 |
| US Bonds | 39 | 30 | 30 | 24 | 18 | 25 | 13 |
| TIPS | 10 | 10 | 10 | 10 | 10 | 5 | 10 |
| REITS | 10 | 10 | 10 | 10 | 10 | 5 | 10 |
| T-bills | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Commodities (GSCI)* | 10 | 10 | 10 | 10 | 10 | 0 | 10 |
| Timber | na | 5 | na | na | na | na | na |
| | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| Expected Return | 6.86 | 7.18 | 7.18 | 7.33 | 7.48 | 7.21 | 7.62 |
| Expected Risk | 7.82 | 8.80 | 9.24 | 9.97 | 10.72 | 11.27 | 11.47 |

* Futures allocations require no capital and are therefore not included when summing allocations to 100%.

The efficient frontier depicted in Exhibit 9, and whose detail is given in Exhibit 10, is based upon the following constraints:

- Maximum 20% allocation to non-US stocks;
- Maximum 10% allocation to TIPS;
- Maximum 10% allocation to REITS;
- Maximum 10% allocation to GSCI futures;
- GSCI futures allocation must be less than or equal to the sum of TIPS and T-bill allocations; and,
- No allocation to timber.

The portfolio represented in Exhibits 9 and 10 as Mix 2 greatly reduces risk when compared to Mix 1 by reducing the U.S. stock allocation by 15% and increasing allocations to TIPS, REITS, and bonds by 5% each and allocating 10% to GSCI futures, which would use the 10% TIPS allocation as its underlying collateral. Importantly, as shown in Exhibit 10, the efficient frontier would allocate no assets to T-bills which might otherwise serve as collateral for the GSCI futures. Mix 2 has approximately the same level of return as Mix 1, 7.18% versus 7.21%, respectively, but a much reduced level of risk, 9.24 versus 11.27%, respectively.

Before considering the inclusion of timber, another efficient frontier was created where the excess return for commodity futures was raised from 0%, which we considered a conservative assumption, to 1%. This excess return would be in addition to the expected return on the underlying collateral. The optimal portfolio with a risk level closest to Mix 2 reallocates 10% away from bonds to T-bills with a GSCI futures overlay, bringing the total commodity futures position to 20% of total assets – in notional value, not allocated assets – with 10% in TIPS collateral and another 10% in T-bill collateral. The resulting expected return increases from 7.18% to 7.33% with no increase in risk.

Our final optimization considers the inclusion of timber. Exhibits 9 and 10 show that Mix 3, with a 5% timber allocation, further reduces risk without sacrificing return. Risk falls from 9.24% without timber to 8.80% with timber.

**Conclusion**

This optimization exercise demonstrates that real assets can be added to a portfolio of traditional asset classes to protect against erosion of real asset values during periods of high inflation without sacrificing expected returns. TIPS, commodity futures, timber, and energy investments can be configured in various ways to contribute greater stability to institutional portfolios. Investment management firms are devoting significant resources toward researching and managing real assets, and investment returns are meeting expectations. Cliffwater recommends that fund sponsors with inflation sensitive liabilities include a real asset component to their portfolios. The optimal mix of real assets and strategies employed should depend upon specific fund circumstances and preferences.

[1] The most commonly used commodity index is the Goldman Sachs Commodity Index, a production-weighted index of 24 commodities grouped into five categories: Energy (69%), Livestock (7%), Agriculture (15%), Industrial Metals (7%), and Precious Metals (2%). Estimates are that $20 billion is currently benchmarked to the GSCI.

[2] The year 1972 is when most of the index returns are first available.

[3] The GSCI Commodity Index represents an investment in fully collateralized futures contracts of 24 commodities on a production-weighted basis.

[4] In a recent paper, "Facts and Fantasies about Commodity Futures", Draft: June 2, 2004, Gary Gorton and Geert Rouwenhorst examine commodity returns going back to 1959 and also find a risk premium equal to that of equities.

[5] Stock excess returns are also not statistically significant.

[6] John Maynard Keynes believed that this second condition applied and referred to it as "normal backwardation."

[7] The National Council of Real Estate Investment Fiduciaries.

[8] Goldman Sachs.

[9] The protection of the spotted owl in the Northwest during this period was one factor boosting timber prices.

[10] David Michael Geltner, "Smoothing in Appraisal-Based Returns," Journal of Real Estate Finance and Economics, 1991.

[11] Andrew Connor, "Asset Allocation Effects of Adjusting Alternative Assets for Stale Pricing." The Journal of Alternative Investments, Winter 2003.

[12] Hancock Timber Resource Group, "Timberland as a Portfolio Diversifier," 2003; Global Forest Partners; UBS Global Asset Management.

[13] Gorton and Rouwenhorst (2004) find that equities of companies involved in producing commodities are a poor substitute for commodity futures, with a monthly return correlation between the two of 0.38 and commodity company stocks underperforming matching commodity futures.