Asset Allocation: The Case for Diversified Inflation Hedging Strategies

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Editor's Note

This is an annual update to the white paper on inflation that was initially written in February 2005. The original white paper was written in response to the article, "Inflation: Avoid that Sinking Feeling," in the fall 2004 issue of CFQ. (CFQ *was the title of a magazine published by Commonfund from 1999–2006; it continues to be published today, but has been renamed* Mission Matters.) *The focus of that article was on defining inflation and reviewing historical data on the correlations between inflation and various asset classes. This white paper expands upon the article and the original white paper with updated CPI data and additional data through the fourth quarter 2008. The research continues to provide evidence that a diversified portfolio of inflation hedging strategies—commodities, private real estate, natural resources and inflation-indexed bonds—can improve long-term risk adjusted performance, particularly in periods of unanticipated inflation.*

The white paper will discuss the following:

- *Correlation of inflation to various asset classes*
- *How asset classes performed in inflationary environments*
- *How to invest in commodities and understand the historical returns of commodities*

Why Inflation Matters: Policy Portfolios and the Cost of Inflation

A fiduciary with responsibility for a perpetual pool of assets supporting a mission-based organization faces unique challenges in combating inflation. The objective for a perpetual pool of assets is to provide a consistent level of support for the long term—often referred to as maintaining intergenerational equity between the current generation of beneficiaries and future generations. Investment policy must take into account nonproductive price increases that reflect inflation in the market basket of goods and services bought by those investment assets so that inflation will be offset by undistributed returns of the perpetual pool of assets. That is, the return from the investment assets must be at least equal to the distribution or spending rate plus inflation to achieve intergenerational equity.

Since only real returns matter over long periods of time, constructing a portfolio that increases the probability of achieving real returns greater than spending is worth pursuing. One way of doing this is to place in the portfolio assets that hedge against inflation or, more importantly, unanticipated inflation. Once inflation has been built into the system, financial assets adjust to price levels that reflect the future anticipated rate of price changes. Bond prices decline as interest rates increase; and, P/E ratios contract since future earnings streams are discounted at a higher rate. It is the unanticipated acceleration in inflation that can be most damaging to portfolios and against which investors should want some form of protection.

Unanticipated Acceleration in Inflation

It is the unanticipated acceleration in inflation that can be most damaging to portfolios and against which investors should want some form of protection.

Many portfolio evaluation systems and planning models used to construct a policy portfolio primarily consider nominal returns and the distribution of those returns. Once the portfolio is constructed, the median nominal return is then examined assuming a stable inflation rate (historically, around 4 percent). However, formulating nominal returns based on a constant inflation rate is not realistic.

A better approach to constructing a policy portfolio is to add asset classes that may generate real returns during periods of unexpectedly higher inflation. Conceptually, adding these asset classes to the portfolio should reduce the amount of "left tail" (downside) risk of the distribution of future potential real returns. Left tail risk is that segment of the distribution of future potential returns where real returns are negative. One cause of negative real returns is a higher inflation environment. Owning assets that might do well in an unexpectedly higher inflationary environment could reduce the number of potential events with negative real returns. The figure below demonstrates the damaging effects inflation can have on the real value of a traditional portfolio invested in stocks and bonds with a 5 percent spending or distribution policy.

FIGURE I

Cumulative Inflation-Adjusted Performance

(70% Equity/30% Fixed Income, 5% Spending)

	Dec 65–Dec 69	Jan 70–Dec 79	Jan 80–Dec 89	Jan 90–Dec 99	Jan 00–Dec 08
S&P	3.17%	5.87%	17.54%	18.23%	-3.60%
Fixed Income	-2.66%	6.91%	12.43%	7.70%	6.38%
Inflation	4.30%	7.38%	5.08%	2.94%	2.54%

The equity portion of the hypothetical portfolio is based on monthly returns of the S&P 500 Index (12/65–12/08), and the fixed income portion is based on monthly returns of the Barclays Aggregate Bond Index (1/76–12/08) and the Ibbotson Associates Long Term Corporate Bond Index (12/65–12/75). The hypothetical portfolio is rebalanced to 70/30 annually on 1/1/yy and 5% is distributed annually on 1/1/yy.

Source: Ibbotson, Bloomberg

Assets that Hedge Against Inflation

The case for including inflation hedging strategies in a policy portfolio is based on two hypotheses: (1) that allocations to such strategies improve long-term portfolio performance; and, (2) that these strategies reduce overall portfolio risk.

For the purpose of this paper, inflation hedges are defined as:

- Commodities (liquid, exchange-traded futures contracts)
- Private equity real estate (illiquid investments in property)
- Natural resources (illiquid private partnership investments in oil, gas and timber)

Investing in these assets entails risks. Please see the Appendix for a discussion of some of these risks.

The Inflationary Cycle and its Correlations

During the 1980s and 1990s, the return from many commodity and hard asset classes lagged returns earned from investments in financial assets—stocks and bonds—as the U.S. economy experienced an extended period of decelerating inflation and disinflation. Financial assets soared after a bottom in the bond market in 1981 and a bottom in the equity market in August 1982. Despite selected periods of indigestion (the stock market crash of October 1987), the equity and bond markets continued their respective bull market runs into the late 1990s. However, during the period of 2000 through 2008, this pattern was broken: the equity market staged a sharp, nearly 50 percent, correction between March 2000 and October 2002, followed by a nearly 100 percent rally only to collapse again by 50 percent in 2008 and early 2009. Meanwhile, Treasuries, after peaking in June 2003, remained in a narrow trading range only to soar in 2008 as investors sought the safety of government protection and liquidity. The market continues to debate the potential inflationary pressures from monetary and fiscal stimuli against the devastating effects of the credit and liquidity freeze caused by the U.S. housing recession and global economic slowdown.

The years since 1970 include periods of rapidly increasing rates of inflation as well as periods of disinflation and decelerating inflation. In general, the decade of the 1970s was a period of accelerating inflation, while the decades of the 1980s, 1990s and the early 2000s were periods of decelerating inflation or disinflation. The first seven months of 2008 represented an inflationary period. However, a violent drop in energy prices sparked a more than 13 percent decline in annualized CPI in the fourth quarter. The decline was fueled by the sharp correction in global economic activity, as well as by the severe credit and liquidity crisis that followed the collapse of Lehman Brothers, the nationalization of Freddie Mac and Fannie Mae, the sale of Merrill Lynch to Bank of America, and the AIG bailout. Could the first decade of the new millennium be a repeat of what happened in the 1970s?

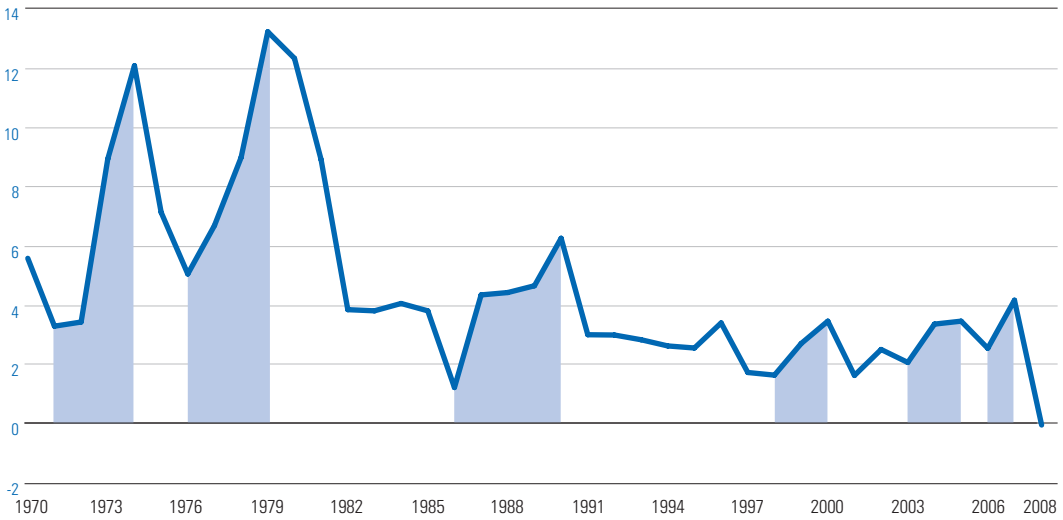
Accelerating Inflation Defined

Periods of accelerating inflation are defined as years when the year-over-year inflation rate, as measured by the CPI, reflects an increase.

FIGURE II

Year-Over-Year Changes in CPI

1970–2008



Source: Bureau of Labor Statistics

However, a closer review of the year-over-year CPI inflation trend during these periods reveals that the economy had three sub-cycles of unexpected decelerating inflation: in the 1970s (1975–1976); in the 1980s (1980–1986); and in the 1990s (1991–1998), and three periods of unexpected acceleration in inflation since 1980: January 1987 to October 1990; April 1998 through March 2000; and February 2002 through September 2008.

How Inflation Correlates

To look at the correlations between inflation hedging strategies, commodities, and financial assets against the inflation rate as measured by the Consumer Price Index (CPI), refer to Table I on the next page.

Table I has been updated through December 2008, yet the conclusions one can make from it are similar to our past studies. The figure examines the historical correlations (quarterly) of various asset classes to the CPI for periods of time that data is available, as far back as 1970. The numbers help us infer whether certain asset classes can provide a good hedge against current inflation.

TABLE I

Quarterly Correlation Between Selected Asset Classes and Inflation

January 1970–December 2008[1]

(Dates indicate the earliest date that data was available and included in the correlation.)

	Correlation	Beginning Date
Inflation Hedge Strategies		
Commodities		
Dow Jones AIG Commodity TR Index[2]	0.32	Jan 70
Private Real Estate		
NCREIF—Property Index	0.41	Jan 78
Natural Resources		
Commonfund Capital Energy and Natural Resources Programs	0.43	Sep 89
Treasury Inflation Protected Securities (TIPS)	0.21	Jan 97
Individual Commodities		
Gold	0.24	Jan 70
Silver	0.13	Jun 70
West Texas Intermediate (WTI) Crude Oil	0.34	Jan 83
Wheat Futures	0.09	Jun 70
Financial Assets		
S&P 500	(0.08)	Jan 70
Barclays Aggregate Bond Index[3]	(0.23)	Jan 73
Cash (3-Month Treasury Bill)	0.57	Jan 70

1 Inflation source, BLS, CRI Inflation, seasonally adjusted quarterly data
2 Index based on Equally Weighted Collateralized Futures Index (1970–1990) and DJ-AIG TR Index (1991–2008)
3 Bonds are the Lehman Government Credit Index (1973–1975) and Barclays Aggregate Bond Index (1976–2008)

The data in Table I confirm what one would expect—inflation hedging strategies are generally positively correlated with inflation. The strongest correlation is in the energy and natural resources sector, followed by the private real estate market. Inflation is also positively correlated with individual commodities such as gold, oil and wheat. The oil data show the same correlation to inflation whether the data is run from 1983 when crude oil (WTI) futures came into existence or from 1970 based on posted oil prices. We chose to show the correlation using the actual WTI futures rather than a more arbitrary collection of data for 1970–1983. The assumption that inflation has a negative effect on stocks and bonds is confirmed by the negative correlation of the S&P 500 at 8 percent and the Barclays Aggregate Bond Index at 23 percent. This underscores the damaging impact of inflation on traditional portfolios. The second half of 2008, however, proved to be one for the history books as massive deceleration in economic conditions drove investors to sell equities, commodities, and credit-risk-based assets. This reduced the negative correlation of stocks to inflation. As one would expect, cash is positively correlated to inflation at 57 percent, and suggests that cash is an excellent hedge against inflation as short-term rates adjust after inflation is known. However, as a practical matter, an allocation to cash would reduce an institution's ability to meet its long-term obligation, given that cash has a long-term real return that is near zero.

A Focus on Commodities

Historically, commodities are positively correlated to inflation (Table I), so one needs to answer the following questions.

- How do commodities perform in periods of rising versus falling inflation rates?
- What are the different ways in which investors can get exposure to this asset class?
- What are the overall portfolio effects of an allocation to commodities, real estate and natural resources?

How Have Commodities Performed in Unanticipated Inflation Environments?

Not surprisingly, commodities (as measured by a combination of an equally-weighted, collateralized futures index for the period of 1970–1990 and the Dow Jones AIG Commodity TR Index [DJ-AIG TR] for the period of 1991–2008), outperformed both stocks and bonds during periods of rising inflation over the period. Also not surprisingly, the performance of commodities, while positive, lagged the returns of stocks and bonds during periods of falling inflation. But, of note, for the entire period, commodities outperformed bonds and essentially matched the performance returns of equities.

Unanticipated Inflation Defined

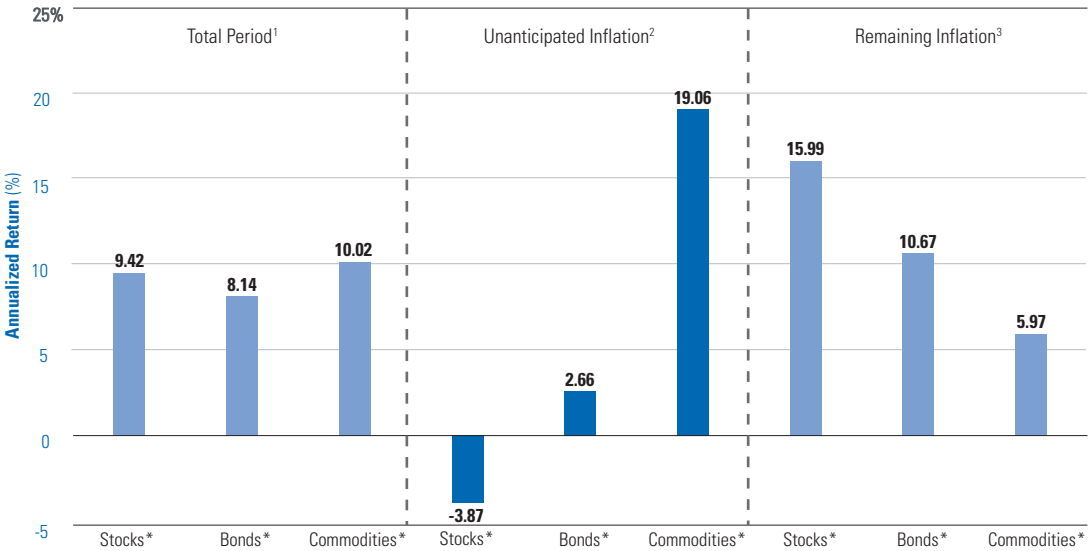
Periods of unanticipated inflation are defined as occurrences when the CPI is greater than the 3-month Treasury bill (T-bill) rate for that period. For each period we consider the 3-month T-bill rate as a gauge of what holders of riskless assets expect to receive in return to preserve purchasing power for that period of time. We then compare that rate to actual inflation as defined by the CPI at the end of the period.

FIGURE III

Commodities Have Performed Better in Periods of Unanticipated Inflation (Annualized Returns)

1970–2008

Numbers in Percent (%)



**Data based market indices as follows: Stocks (S&P 500 Index); Bonds (Barclays Aggregate Bond Index 1976–2008; Lehman Government Credit Index 1973–1975); Commodities (for period of 1970–90, an equally-weighted, collateralized futures index; for period of 1991–2008, the Dow Jones-AIG TR Index).*

1 156 quarterly observations
2 48 quarterly observations
3 108 quarterly observations. Remaining inflation could include periods when the Treasury bill appropriately anticipated inflation, as well as periods of lower inflation or disinflation.

The beneficial aspect of commodities has historically been even stronger during periods of unanticipated inflation. As shown in Figure III, during periods of an unanticipated rise in inflation, stocks lost -3.87 percent while bonds returned just 2.66 percent. In contrast, commodities returned 19.06 percent during periods of an unanticipated acceleration in inflation.

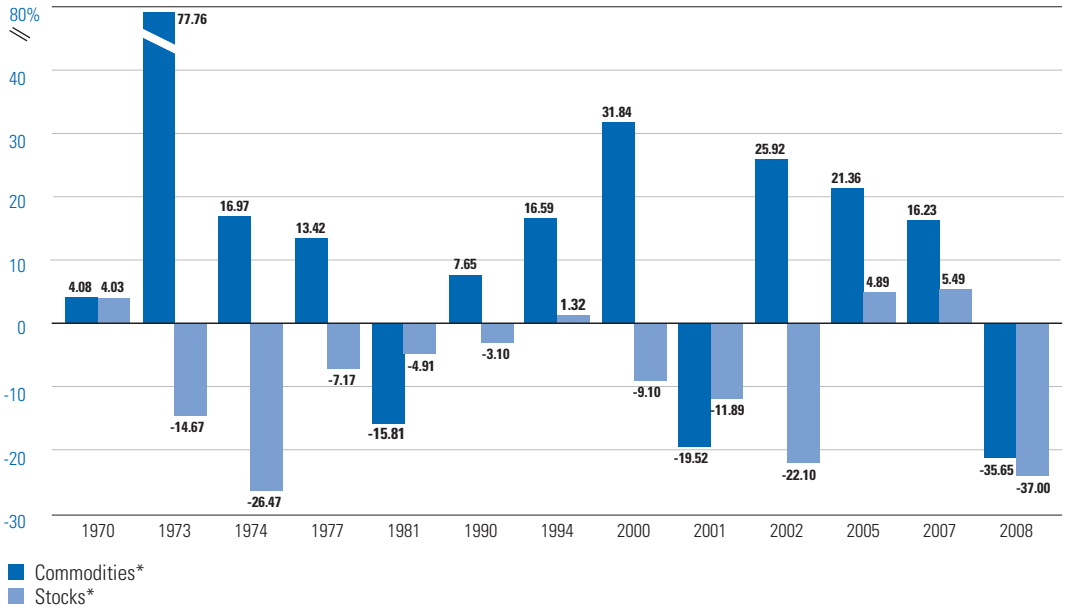
The Benefits of Diversification: Commodity Returns during Periods of Weakness in the Stock and Bond Markets

A test for the value of commodities in a portfolio is whether they can provide a boost to performance during periods of weakness in the equity or bond markets. We evaluated how commodities performed during those periods since 1970 when the stock market returned less than 5 percent (Figure IV) or when the bond market returned less than 5 percent (Figure V). The results are impressive. During those years when the equity market was up less than 5 percent, commodities posted an average gain of 12.4 percent annually. Excluding 1973, when energy prices rose substantially and the economy experienced a severe inflation shock, the average commodities return was an impressive 6.9 percent while equities returned -8.8 percent.

FIGURE IV

Commodity Returns During Years of Stock Market Returns Less than 5 Percent

Commodity Returns Averaged 12.4 Percent in These Years
Numbers in Percent (%)



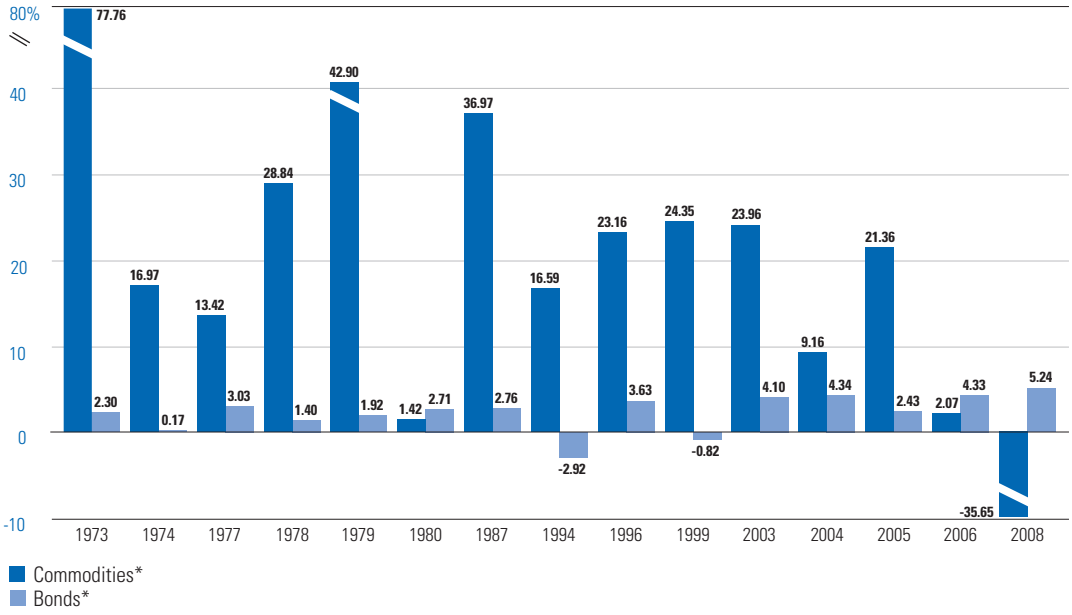
**Data based market indices as follows: Stocks (S&P 500 Index 1970–2008); Commodities (for period of 1970–90, an equally-weighted, collateralized futures index; for period of 1991–2008, the DJ-AIG TR Index).*

Moreover, during the years that the bond market returned less than 5 percent, commodities were up on average 20.2 percent annually. Excluding 1973, the average commodities return was 16.1 percent, while bonds returned 2.3 percent. These results provide solid evidence that commodities have historically provided upside performance during projected periods of weakness in either the stock or bond markets and show the importance of this asset class to overall portfolio diversification. Of course, there can be no assurance that these historical patterns and performance will continue in the future.

FIGURE V

Commodity Returns During Years of Bond Market Returns Less than 5 Percent

Commodity Returns Averaged 20.2 Percent in These Years
Numbers in Percent (%)



**Data based market indices as follows: Bonds (Barclays Aggregate Bond Index 1976–2008; Lehman Government Credit Index 1973–1975); Commodities (for period of 1970–90, an equally-weighted, collateralized futures index; for period of 1991–2008, the DJ-AIG TR Index).*

Passive investment is best characterized by:

- Long-only commodity index
- Cash collateralized (not managed)
- No variation in timing of contract rolls
- No additional leverage beyond margin

Active management is best characterized by:

- Long or short positions
- Use of swap transactions to obtain commodity exposure
- Underweight/overweight certain commodity sectors and/or specific commodities to take advantage of mispricings
- Actively manage collateral
- Actively managed contract roll dates
- Additional leverage

How to Invest in Commodities

Investors can gain exposure to commodities in four ways:

- Owning actual commodities
- Investing in commodity-based stocks
- Passive investment in commodity indices through mutual funds, ETFs or ETNs
- Active management and trading (long-only and long/short)

In practice, owning actual commodities is difficult: carrying costs are high, storage is difficult and, except for highly speculative periods, it is difficult to generate sustained performance.

Investing in commodity-based stocks can provide some exposure to underlying commodities; however, performance is often more closely correlated to the equity markets than to changes in commodity prices.

The approach that provides the best exposure to the correlation benefits of commodities is either passive or active investment in exchange-traded commodities. Which approach is best for an investor depends on their investment objectives. In a passive or active approach, investors in commodities typically buy a series of futures contracts tied to a particular commodity index, most notably DJ-AIG TR or the Goldman Sachs Commodity Index (GSCI). The underlying contracts of the index are then rolled as they get close to expiration. "Rolled" means the spot contract is sold with the proceeds used to buy the deferred contract, i.e., sell September and buy October. The long-term returns from this rollover (usually monthly or every two months) can be greater than or less than the price appreciation of the underlying commodities depending on the "roll return."

The difference between passive and active investment in commodities is generally a function of (1) the management of the underlying collateral associated with the futures contracts, and (2) the timing of the contract "rolls." Active managers can also engage in other strategies as noted in the sidebar on the preceding page. In passive investing, the collateral (typically Treasury securities) is not actively managed; and, the timing of the contract rolls does not change (e.g., each month, typically between the fifth and the ninth business day, the investor sells the expiring contract and purchases the next contract). The return that investors earn from passive investing, therefore, is the return on the underlying cash collateral plus the gains/losses (roll return) from buying and selling the futures contracts.

The source of return from active investing is similar, yet managers seek additional incremental return through active management of the underlying collateral and by timing contract rolls. Active management can also include overweighting or underweighting certain commodities to take advantage of perceived pricing anomalies.

Roll Return

Roll Return Defined

Profit or loss from selling the front contract and buying the deferred contract to avoid delivery of the physical commodity.

In both passive and active investing, managers seek positive returns stemming from the difference between commodity futures and the spot price for the specific commodity. It is not just the change in the spot prices of underlying commodities that provides the return for most commodity investors (the exception being short-term speculators). For example, in the 21 years between 1983 and early 2004, the spot price of crude oil was up less than 1 percent per year while a rolling investment in the near-term futures contract for crude oil gained an average of more than 15 percent per year. In contrast, from the end of 2004 to the end of 2008, the spot price of crude oil was up 2.65 percent while a rolling investment in the front month futures contract for crude lost 10 percent per year. These examples show that the return from a total return index of futures contracts can be significantly different from the return of the spot commodity itself. (Sources: S&P 500, Morgan Stanley and DJ-AIG TR.)

The higher return from a rolling series of futures contracts versus the spot commodity itself is typically the result of what is called "backwardation" in the price structure of many commodities. Backwardation exists in a commodity when the current price of a given commodity is greater than the price of that commodity at a future date. In the example shown on the next page, if the price of lean hogs for July 2009 delivery is 80 cents per pound, while the price of lean hogs for delivery in October 2009 is only 71 cents per pound, this would be termed backwardation. Backwardation typically occurs when a commodity has a near-term supply shortage, storage or seasonality issue. In contrast, if the price of a commodity for current delivery is less than the price of that commodity for a future delivery, the commodity is termed to be in "contango." Following, on page 10, are examples of a market in backwardation and contango. In general, by rolling futures, one makes money in a backwardated market and loses money in a contango market.

Rolling in a Backwardated Market = Profit/Roll Gain **(Front Deferred)**
Rolling in a Contango Market = Loss/Roll Loss **(Front Deferred)**

Front (July 2009 Delivery)	–	Deferred (October 2009 Delivery)	=	Roll Return = Gain or Loss
SELL Front Contract	–	BUY Deferred Contract	=	Roll Return

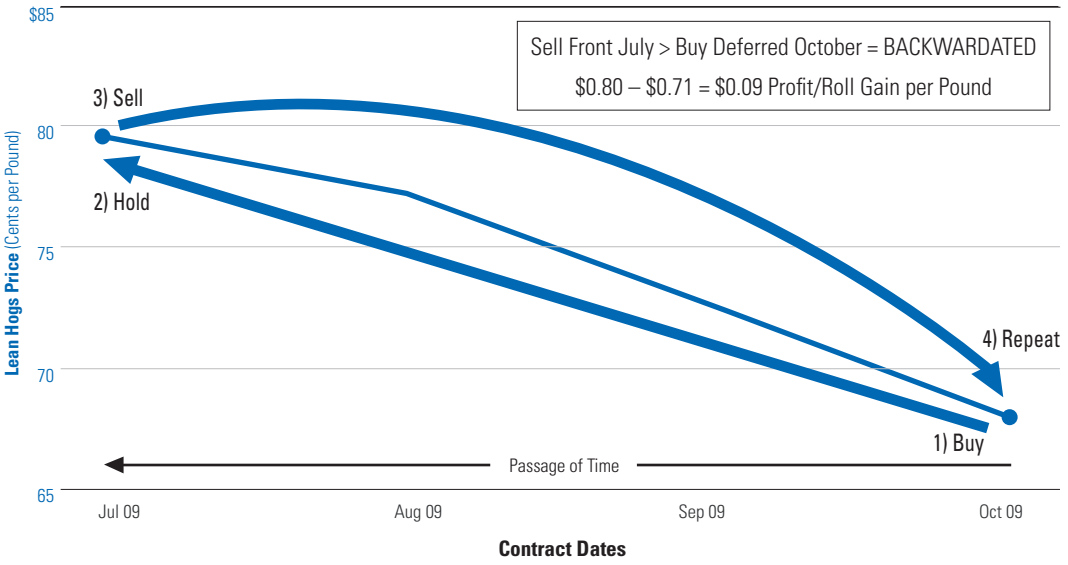
Backwardation

Backwardation usually signals tight supplies or potential supply disruptions. Buyers are willing to pay more for the commodity today than for delivery in the future. Producers or holders of commodities in storage are given the incentive of higher prices to sell into the backwardation and replace their inventory in the future with cheaper forward supplies or production.

FIGURE VI

Example of Lean Hogs Market Backwardation as of January 2009 = Profit/Roll Gain

Rolling down curve, one earns return



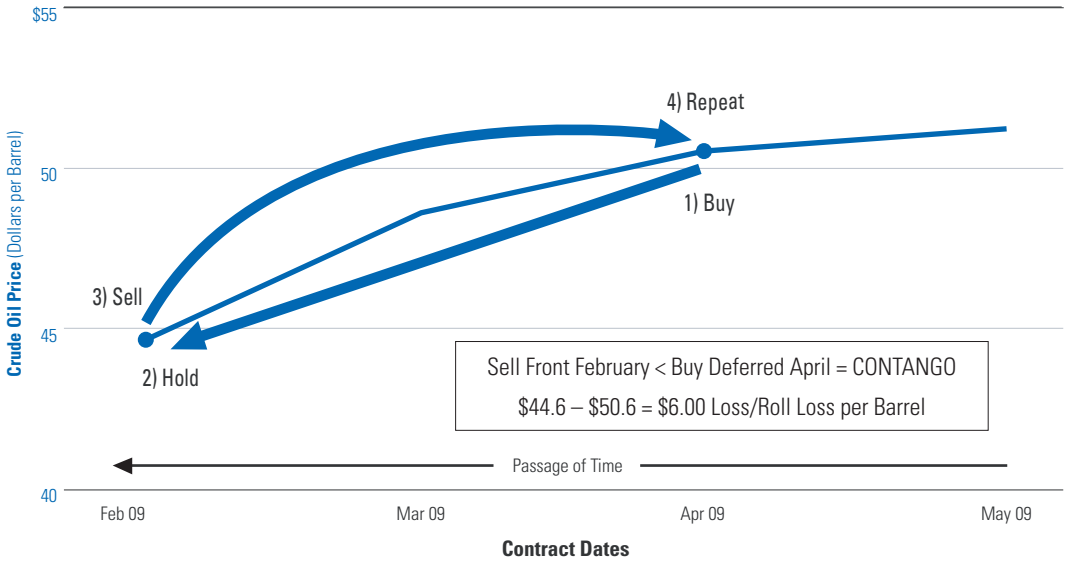
Contango

Contango usually reflects the cost of carrying that commodity from one month to the next. Producers and end users (physical market participants) are encouraged to buy and hold the commodities in the contango market if the interest cost + storage handling + cost of executing delivery are priced into the forward curve.

FIGURE VII

Example of Crude Oil Market in Contango as of January 2009 = Loss/Roll Loss

Rolling up curve, one loses return



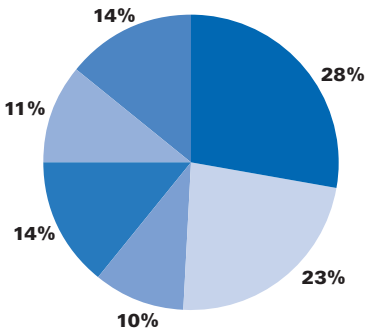
Selecting the "Right" Investable Commodity Index

There are two primary investable commodity indices—the Goldman Sachs Commodity Index (GSCI) and the Dow Jones-AIG Commodity TR Index (DJ-AIG TR)—and a few smaller, less liquid indices. The major difference between the GSCI and the DJ-AIG TR is the composition and weighting of the underlying commodities included in each index and the rebalancing. The GSCI is weighted by worldwide industrial production valued at current prices and does not rebalance. This tends to result in a significant proportion of the index being allocated to hydrocarbons (oil, heating oil and natural gas, etc.), particularly when prices of these commodities are very high.

The DJ-AIG TR Index is rebalanced annually and limits the exposure to any one broad group to 33 percent (although it may range higher after annual rebalancing). Moreover, no single commodity may constitute more than 15 percent of the index or less than 2 percent of the index at yearly rebalancing. An oversight committee meets to determine the compositional mix and rebalance the DJ-AIG TR Index on an annual basis. The pie charts (I and II) show the yearly rebalancing effect of the DJ-AIG TR Index; energy was increased, post rebalance, to 33 percent from 28 percent at the end of 2008. (Rebalancing occurs during the fifth through ninth business days in the month of January and this year was complete on the close of business January 16, 2009. The reason for the discrepancy between the January 16 and the January 31 balance as shown in Pie Chart II is the relative decline in energy in the last two weeks of the month.) The sector weights decreased 1 and 3 percent for meats and precious metals, respectively, and 2 percent for grains, as they were the strongest relative performing sectors in 2008. The weight of industrial metals increased 6 percent as the sector was weak in 2008. Therefore, by design, the DJ-AIG TR Index has a broader exposure to commodities other than energy when compared to the GSCI; such a high concentration to energy makes the GSCI more volatile. For the period of May 2005 to January 2009, the standard deviation of GSCI was 29.4 percent while the DJ-AIG TR experienced a volatility of 21.6 percent. Accordingly, an investment allocation into the DJ-AIG TR Index should provide greater diversification benefits to an unexpected rise in a broad range of commodities that are outside the energy sector. The pie charts (II and III) below reveal the compositional differences between the DJ-AIG TR Index and GSCI as of January 31, 2009.

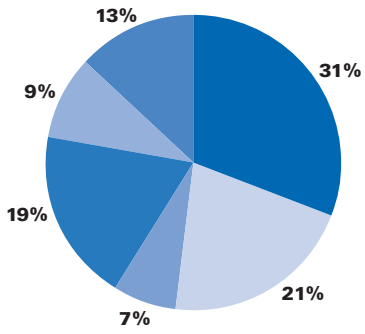
PIE CHART I

Dow Jones AIG Commodity TR Index
December 31, 2008



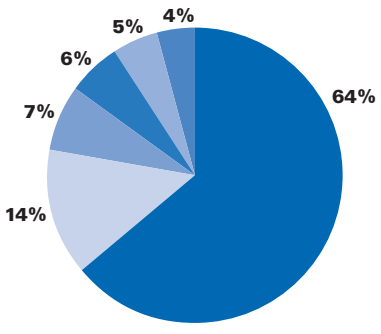
PIE CHART II

Dow Jones AIG Commodity TR Index
January 31, 2009
(Post-Rebalance)



PIE CHART III

Goldman Sachs Commodity Index
January 31, 2009



Energy Grains Meats Industrial Metals Softs Precious Metals

Commonfund Allocation Planning Model (APM)

Please read "Important Notes" in the Appendix for a discussion of the limitations of the APM.

The APM is only a model. The returns depicted by the APM are hypothetical and do not represent the actual returns earned by any investor or investment fund or product. The APM does not guarantee or assure any future investment results.

What is the APM? The APM is an analytic tool that can assist investors in thinking about the potential distribution of returns of various investment strategies.

What isn't the APM? The APM should not be treated as a recommendation concerning any specific investment or asset class, or any mix thereof, or as a tool that can predict specific investment outcomes.

How does the APM work? The APM takes today's yield curve, uses Monte Carlo simulation to project 1,000 different yield curves for next year by changing economic factors that affect the curve, and projects returns for each of 20 asset classes in each of the "new" yield curve environments. The projected returns are based on the regression of the historical relationship between these asset classes and the yield curve. (This historical data upon which the APM relies does not include calendar year 2008.) The model then takes each of the 1,000 "new" yield curves as the next starting point and repeats the process, building another 1,000 yield curves and projecting returns in those environments. The model runs these simulations for 20 years into the future.

Portfolio Construction with Inflation-Hedging Assets

To examine the concept of adding inflation-hedging assets to the portfolio to reduce left tail risk caused by those periods of accelerating inflation and to improve risk-adjusted returns, we used the Commonfund Allocation Planning Model™ (APM) to construct a series of hypothetical portfolios. The APM evaluates a portfolio's expected real returns, not just nominal returns. This proprietary model examines possible future outcomes by using a Monte Carlo simulator to generate random changes in the yield curve and inflation rates. It then examines the results of the changes in the yield curve on the various asset classes in the policy portfolio.

For the first portfolio, we used the average asset allocation from the Commonfund Benchmarks Study® for those educational endowments that have between $101 million and $500 million of assets under management. We then added to this portfolio a series of inflation-hedge asset classes: commodities, private real estate, and natural resources.

The next step in our analysis was to use the APM to project mean returns and standard deviations for the next 10 years for inflation-hedged portfolios as well as for the base case portfolio. The results are presented in the table below.

The APM forecasts that the standard non-inflation-hedged portfolio would produce a mean per year return of 9.47 percent with a 9.29 standard deviation. In scenarios tested with only individual allocations of 5 percent to various inflation hedging strategies such as commodities, private real estate, and natural resources, all the scenarios tested produced higher projected returns with a reduction in standard deviation. The return added was between 5 basis points and 37 basis points, while the standard deviation was reduced between 10 basis points and 59 basis points. This, in turn, suggests that the incorporation of modest inflation hedges to a non-hedged portfolio can produce higher returns with lower risk. A widely diversified portfolio with 5 percent allocations to commodities, private real estate and natural resources, boosted the mean portfolio return to 10.23 percent, 76 basis points higher than the non-inflation hedged portfolio, while reducing the standard deviation 124 basis points to 8.05 from 9.29.

TABLE II

Allocation Planning Model: Projected Returns—All Scenarios

(Percent Annualized; 10 years)

	Mean Return	Standard Deviation
Inflation	3.40%	2.54%
Non-Hedged Portfolio*	9.47	9.29
Inflation-Hedged Portfolios		
A. 5% Commodities	9.52	8.70
B. 5% Private Real Estate	9.82	9.19
C. 5% Natural Resources	9.84	8.71
D. 5% Commodities, 5% Private Real Estate, 5% Natural Resources	10.23	8.05
E. 7.5% Commodities, 7.5% Private Real Estate, 7.5% Natural Resources	10.60	7.52

IMPORTANT: The projections or other information generated by the Allocation Planning Model regarding the likelihood of various outcomes are hypothetical in nature, do not reflect actual investments, and are not guarantees of future results. Results may vary with each use and over time.

**Base case data is from 2008 Commonfund Benchmarks Study for institutions with assets between $101 million–$500 million: 31.9 percent domestic equities, 18.8 percent fixed income, 17.4 percent international equity, 18.9 percent alternatives, 6.5 percent private equity, 3.5 percent emerging equity, 3 percent cash, and 0 percent was allocated to commodities, private real estate, and private equity natural resources. Portfolios A–E reduce allocations pro rata, commodities and natural resources from traditional equity, and private real estate from core fixed income.*

Source: Commonfund Allocation Planning Model

The APM doesn't account for fees and expenses. The return distributions calculated by the APM are based on historical data of the performance of specified market indexes. These data do not take into account the impact of investment fees and expenses. In the case of an actual investment portfolio, fees and expenses would reduce returns (to the extent that they exceeded any performance above the relevant index returns generated by active management strategies).

The APM's output will vary. The APM's output will vary with each use (based upon changes in input assumptions and in the historical performance data on which the APM output is based) and over time.

Investment Risks The investment asset classes depicted in the APM involve varying degrees of investment risk. Alternative assets in particular may involve reduced liquidity and risky investment strategies. Investors in any of these asset classes could lose some or all of their principal. In particular cases (including investments on margin, short selling and similar strategies), investors could lose more than their principal investment. See the explanatory notes at the end of this paper.

Definitions and details Certain terms such as "intergenerational equity," together with complete details of the assumptions underlying the APM, are included in the explanatory notes at the end of this paper.

Nonetheless, in high persistent inflation environments, investors should not expect to generate real returns sufficient to cover the spending requirements of the portfolio, even with a 22.5 percent allocation to inflation-hedging assets. This suggests that even if a portfolio is properly positioned for a reasonable reacceleration in inflation, the real purchasing parity/intergenerational value of the portfolio is still likely to decline in a high inflation environment, as it did in the 1970s.

We are often asked the question of what the cost of inflation hedging strategies is to institutions' portfolios. The biggest risk remains the scenario of a prolonged deflation similar to the Great Depression. There is no real data from which to draw conclusions, but we acknowledge that there is "an insurance-like premium" to be paid.

Conclusions

What conclusions can we draw from this analysis? Adding asset classes that have inflation-hedging capabilities is likely to reduce left tail risk (poor real performance). Moreover, it might not always be at the cost of reducing right tail opportunities (exceptional real performance in low inflation environments). The addition of inflation-hedged components to a non-hedged portfolio should produce higher returns and provide the added benefit of reducing the downside risk and standard deviation of the portfolio over longer time horizons. It appears that equity securities are the asset class most vulnerable to an unexpected acceleration in inflation. Thus, the real challenge is to place assets in a portfolio not just to hedge against higher inflation, but to offset the damage that unanticipated increases in inflation can inflict on the traditional stock and bond portions of a portfolio.

The short-term execution of inflation-hedging strategies is very challenging. The economic cycles and factors that drive inflation will vary depending on the forces driving the economy. So, while it makes sense in most cases to look for long-term inflation hedges, the execution of the hedge can be very difficult. Flexibility in execution will be rewarded if cycles are effectively evaluated. Adopting and implementing a strict rebalancing model is also an essential part in maintaining a well-positioned portfolio.

If the ultimate objective of a perpetual pool of assets is to generate real returns, there is no universally accepted way to execute a hedging strategy for inflation or, more importantly, an unexpected increase in inflation. Nonetheless, there is strong evidence that nonprofit perpetual investment pools should have a portion of their long-term investment allocation in assets that will help to protect the real purchasing power and intergenerational equity, while offsetting the poor performance of financial assets that typically takes place when unanticipated inflation surfaces. The results of this study strongly suggest that commodities should join private real estate and natural resources in playing a role in implementing this portfolio strategy.

Appendix

TABLE III

Construction of the Equally-Weighted Commodity Futures Index[1]

Commodity data 1970–1990

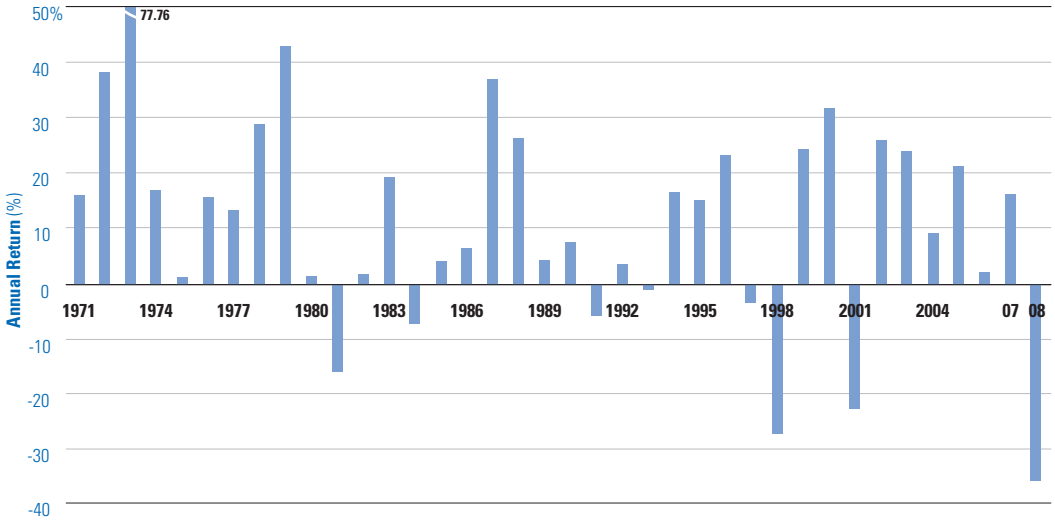
Commodity Future	Sector	Beginning Date
Wheat	Grains	Jul 59
Corn	Grains	Jul 59
Soybeans	Grains	Jul 59
Soybean Meal	Grains	Jul 59
Oats	Grains	Jul 59
Copper	Industrial Metals	Jul 59
Cocoa	Softs	Jul 59
Cotton	Softs	Jan 60
Sugar	Softs	Jan 61
Pork Bellies	Livestock	Sep 61
Soybean Oil	Grains	Nov 62
Silver	Precious Metals	Nov 63
Live Cattle	Livestock	Dec 64
Lean Hogs	Livestock	Mar 66
Orange Juice	Softs	Feb 67
Platinum	Precious Metals	Mar 68
Lumber	Lumber	Oct 69
Feeder Cattle	Livestock	Jan 73
Coffee	Softs	Jan 73
Gold	Precious Metals	Jan 75
Zinc	Industrial Metals	Jan 77
Palladium	Precious Metals	Jan 77
Lead	Industrial Metals	Feb 77
Heating Oil	Energy	Nov 78
Nickel	Industrial Metals	Apr 79
Crude Oil	Energy	Apr 83
Unleaded Gas	Energy	Dec 84
Rough Rice	Grains	Sep 86
Aluminum	Industrial Metals	Jun 87
Propane	Energy	Sep 87
Tin	Industrial Metals	Jul 89
Natural Gas	Energy	Apr 90

1 Source: Gary Gorton and Geert Rouwenhorst, "Facts and Fantasies about Commodity Futures," June 2004

FIGURE VIII

Dow Jones-AIG Commodity TR Index Returns*

1971–2008



**Data based market indices as follows: Commodities (for period of 1971–90, an equally-weighted, collateralized futures index; for period of 1991–2008, the DJ-AIG TR Index).*

TABLE IV

Unanticipated Inflation Time Periods*

15 Time Periods of 48 Quarters

Period	Begin Date	End Date
One	Oct 70	Dec 70
Two	Apr 71	Jun 71
Three	Jan 73	Dec 74
Four	Jul 75	Dec 75
Five	Apr 76	Dec 80
Six	Jul 90	Sep 90
Seven	Oct 92	Dec 92
Eight	Oct 93	Dec 93
Nine	Jan 02	Mar 03
Ten	Jul 03	Sep 03
Eleven	Jan 04	Mar 05
Twelve	Jul 05	Sep 05
Thirteen	Apr 06	Jun 06
Fourteen	Sep 07	Dec 07
Fifteen	Mar 08	Sep 08

**Periods of unanticipated inflation are defined as occurrences when the CPI is greater than the 3-month Treasury bill (T-bill) rate for that period. For each period we consider the 3-month T-bill rate as a gauge of what holders of riskless assets expect to receive in return to preserve purchasing power for that period of time. We then compare that rate to actual inflation as defined by the CPI at the end of the period.*

Was it just the 1970s?

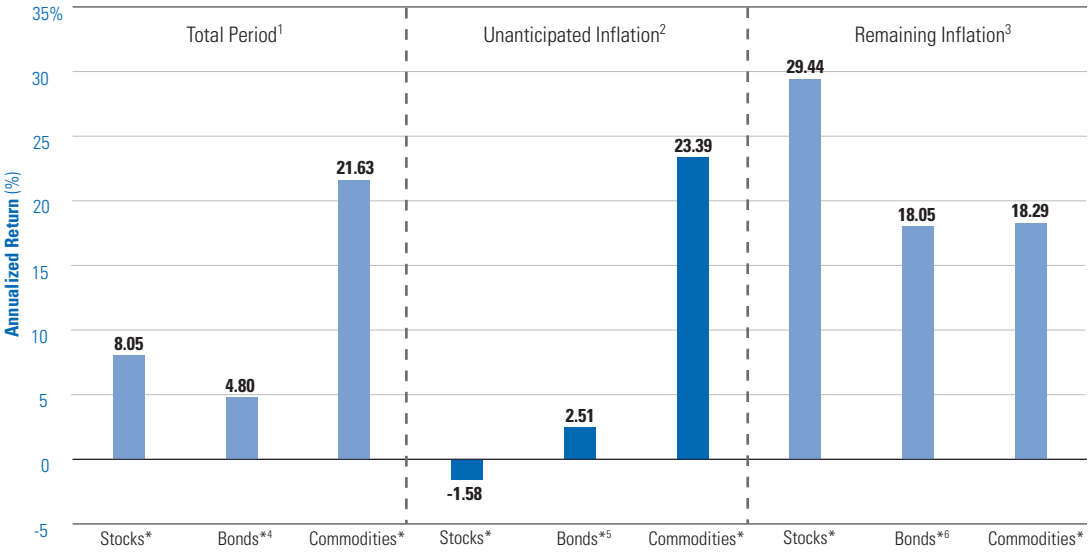
Many investors ask whether the data is just dominated by the oil crisis in the 1970s. The first energy futures were not introduced until the late 1970s and early 1980s (Appendix Table III). The results are dominated by metals, meats and agriculture. Second, when we just look at the post 1980 periods, the relationship remains strong.

FIGURE IX

Commodities Perform Better in Periods of Unanticipated Inflation (Annualized Returns)

1970–1980

Numbers in Percent (%)



**Data based market indices as follows: Stocks (S&P 500 Index); Bonds (Lehman Aggregate Bond Index 1976–1980; Lehman Government Credit Index 1973–1975); Commodities (for period of 1970–1980, an equally-weighted, collateralized futures index).*

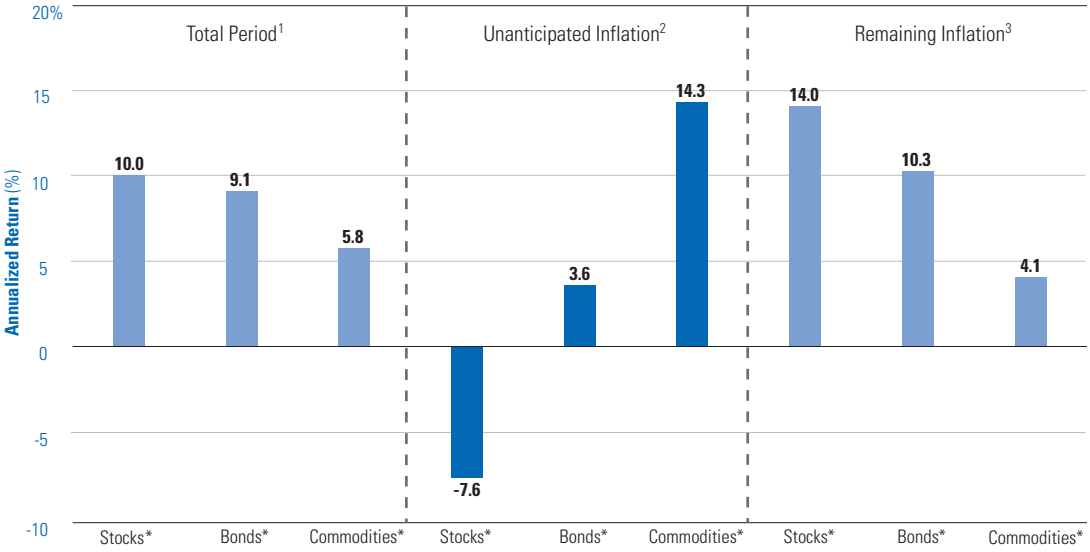
1 44 quarterly observations
2 29 quarterly observations
3 15 quarterly observations. Remaining inflation could include periods when the Treasury bill appropriately anticipated inflation, as well as periods of lower inflation or disinflation.
4 32 quarterly observations
5 27 quarterly observations
6 5 quarterly observations

FIGURE X

Commodities Perform Better in Periods of Unanticipated Inflation (Annualized Returns)

1981–2008

Numbers in Percent (%)



**Data based market indices as follows: Stocks (S&P 500 Index); Bonds (Barclays Aggregate Bond Index 1976–2008; Lehman Government Credit Index 1973–1975); Commodities (for period of 1970–90, an equally-weighted, collateralized futures index; for period of 1991–2008, the Dow Jones-AIG TR Index).*

1 112 quarterly observations
2 19 quarterly observations
3 93 quarterly observations. Remaining inflation could include periods when the Treasury bill appropriately anticipated inflation, as well as periods of lower inflation or disinflation.

Explanatory Notes: Commonfund's Allocation Planning Model (APM)

Commonfund's Allocation Planning Model ("APM") is a proprietary financial simulation tool that can help investors understand the expected outcomes and potential risks of an investment strategy and the interrelationships of the underlying asset classes comprising that investment strategy.

Commonfund's APM is a forward-looking, yield curve-based model that simulates potential future economic scenarios and asset class returns within those economic scenarios. The APM can therefore help investors examine portfolio choice alternatives under different conditions of economic uncertainty on a forward-looking basis.

How does it work?
The APM is, at its core, a "term structure model." That is, the model is based on the term structure of the interest rates. We believe that the investment returns of the asset classes included in the model have been and will continue to be a function of the economic environment and, in particular, changes in the yield curve. Fundamentally there are two principal processes at work in the APM: simulating the term structure; and, defining the asset classes in terms of their historical relationship to the factors of the term structure and the individual asset classes.

Simulating the Term Structure
Our model takes a starting yield curve and uses Monte Carlo simulation to project 1,000 different yield curves each year for 20 years. This is accomplished by changing the factors that affect the curve including:

- Inflation
- Gross Domestic Product (GDP)
- 30-Day U.S. Treasury bill
- 10-Year U.S. Treasury note
- 1-Year BBB Corporate Yield
- 10-Year BBB Corporate Yield

The Monte Carlo simulation that is used in the APM generates random economic conditions that change the yield curve. These changes can be aggressive and incorporate literally thousands of scenarios of low inflation: high GDP growth, low inflation; low GDP growth, high inflation; low GDP growth; etc. However, the evolution of the yield curve in each scenario will not generate in one year drastic or "unreasonable" changes such as a change in one year from negative inflation (deflation) to hyperinflation.

Calculating the Asset Class Returns

The second fundamental process in the APM is generating projected asset class returns for each term structure scenario. This process begins with the selection of a representative index for each asset class. Data may go back as far as 1970 for certain indices but only as recently as 1993 for newer indices. Where no representative index exists, we have used historical data from Commonfund's experience as an investor in this particular asset class (e.g., natural resources). Each asset class's returns are then regressed against the term structure model. The regression analysis generates excess returns assumptions for each asset class relative to the term structure model. These excess returns are then used to construct a variance/covariance matrix that includes all asset classes, further defining them against the term structure model as well as to each other. Essentially, this matrix determines how the returns fit together. The covariance part of the matrix defines how asset class returns move relative to each other and the variance is the dispersion of the returns, or how far they vary relative to each other. Using the excess returns and variance/covariance matrix for the asset classes, the model is able to project how each asset class is expected to perform in each term structure scenario.

Our model takes the starting yield curve, uses Monte Carlo simulation to project 1,000 different yield curves for the next year by changing economic factors that affect the curve, and projects returns for 20 different asset classes in each of the new yield curve environments. The model then takes each of the 1,000 new yield curves as the next starting point and simulates a new yield curve, building another 1,000 yield curves for the next period, and projecting returns in those environments. In order to have the ability to focus on the long term, the model runs these simulations for 20 years into the future and therefore effectively generating 20,000 data points (returns) for each asset class.

What can you do with it?

Commonfund's APM generates a distribution of potential outcomes simulated across thousands of different economic scenarios for given asset allocations. Every simulation describes a potential future trajectory of the economy and projects how the asset classes will perform based on the regression of historical data. Analyzing the distribution of thousands of returns, the model can derive statistical summaries including medians, standard deviations and percentiles for different outcomes for each asset class. The 20-year projections enable us to calculate model annualized returns, medians, standard deviations, market values, and percentiles for different outcomes for entire portfolios over 5-year, 10-year, 15-year, and 20-year time periods. We are able to see the effects of compounding, in terms of both return and risk, as well as examine the "tail risk" of the distribution.

As a tool, the APM aids Commonfund in discussions with investors regarding their asset allocation decisions. It helps us think about how changing, adding, or removing an allocation to any given asset class will affect the risk/return profile of a portfolio. In addition, spending policies, gifts and capital campaigns are important considerations in decision-making and are also incorporated into the model.

With the Commonfund APM, investors also have the ability to ask "what if" questions like "given a specific asset allocation and spending rate (or distribution), what is the model generated probability of not achieving intergenerational equity or a stated investment objective over a defined period of time?" By focusing on determining how often, in terms of number of times in a random model, the nominal market value (after spending) is equal to or greater than the inflation-adjusted market value (grown at inflation only), an investor can gain valuable insight into the portfolio's APM-generated probability of achieving intergenerational equity. By incorporating cash flows into the model, like inflows from gifts and capital campaigns and outflows from spending, distributions or grants, investors are able to understand the long term ramifications of current asset allocation policies and cash flow situations and can gain valuable insight to help with forecasting their budgets.

How does the APM compare to other forecasting models?
Ultimately, the power of a model that incorporates Monte Carlo simulation lies in the ability to produce a range of returns and generate meaningful statistical analysis from the distribution. With historical-based inputs and/or user inputs, a mean variance optimization model can only produce an efficient frontier along which reside optimal portfolios for a given expected return and standard deviation. The APM, in contrast, considers asset allocations from the user's perspective and then generates projected returns, standard deviations, distributions, and probabilities associated with that asset allocation. With this type of analysis, the user is able to understand the likelihood of achieving goals rather than merely focusing on a median and standard deviation of an "optimal" portfolio produced by a mean variance optimization.

The APM has many advantages over mean variance optimization. In addition to generating a distribution of potential outcomes and different economic scenarios as described above (which cannot be accomplished with mean variance optimization), the APM's term structure model has advanced features that distinguish it from most other forecasting models that use Monte Carlo simulation. The model consistently simulates the term structure of interest rates at every point in simulation time thereby providing a more realistic set of the expectations that drive interest rates and a better formulation of the documented dynamic properties of inflation and interest rates.

The APM simulates four term structure components whereas other models known to incorporate term structure models simulate only one or two. Finally, the open design architecture of the APM makes it relatively easy to update and further develop.

The APM has been designed to be a state-of-the-art investment planning tool. Although no analytical model can completely replace informed professional judgment, the APM can provide a better foundation on which to base that judgment.

What are the limitations?

No model or simulation can predict the future or account for the infinite number of possible outcomes. The projections generated by Commonfund's APM are based on assumptions about performance and risk characteristics of various asset classes. Those assumptions are based on historical data that are believed to be accurate and on which the APM relies. The utility of the APM depends greatly on the accuracy of that historical data and its meaningfulness in simulating future events. Commonfund cannot guarantee the accuracy of the data nor does it represent that the data will necessarily represent market conditions in the future.

The model simulates the range of probable outcomes over a 20-year time horizon of varying combinations of asset allocations, inflation expectations, spending policies, capital gifts and rebalancing rules. The reasonableness of the input assumptions made by the user will affect the reasonableness of the simulations. In all cases, the statistical confidence in the predictions falls as the simulation period gets shorter.

The results of the model will vary with any change to the inputs: asset allocation, spending rates or methods, contributions, or beginning market value. The results will also change with any periodic updates to the model starting point.

Because the model uses asset class returns, it should not be used to evaluate or simulate the results of any specific investment program (or fund).

No APM simulation can replicate the exact experience of an institution. As such, the results of the APM should only be used as a general guide. In no way should the APM be a substitute for the important policy choices that an institution must make in developing its investment program.

The asset classes in the model are defined by index data and do not reflect the impact, either positive or negative, of active management or the fees associated with active management. Asset classes not included in the model, or other indices not used to represent the asset classes used in the model, may have characteristics similar or superior to those being analyzed.

Key Terms

Frequency distribution The number of observations within the ranges as defined by the horizontal axis.

High volatility and medium volatility hedged equity An investing strategy that consists of a core holding of long equities hedged at all times with short sales of stocks and/or stock index options. The portfolio may have either a long or short bias depending on the mix of long and short positions. Not necessarily providing complete market neutrality, there will be some movement with the market.

Low volatility hedge An investing strategy that typically targets some kind of absolute return objective, without reference to any market index and emphasizes capital preservation and risk control. Examples of low volatility hedging strategies include several arbitrage strategies (convertible, fixed income and statistical) as well as event-driven strategies.

Mean variance optimization A quantitative asset allocation technique developed by Harry Markowitz that creates optimal portfolios using return, risk and correlation forecasts to combine assets into portfolios that maximize return for different levels of risk. A graph of all optimal portfolios is called the efficient frontier.

Percentile A value on a scale of one hundred that indicates the percent of a distribution that is equal to or below it.

Standard deviation A statistical measure of the degree to which an individual value in a probability distribution tends to vary from the mean of the distribution; the larger the standard deviation, the greater the degree of dispersion around the average value.

Daily/monthly/quarterly liquidity Investment purchases and/or redemptions may be transacted once per day, month or quarter.

Illiquid Investment purchases accepted at the commencement of the investment program (e.g., limited partnerships) permitting redemptions only at liquidation of the investment program, typically after a number of years.

HEPI Higher Education Price Index

CPI Consumer Price Index

Note: For additional information on how Commonfund's APM compares to other asset allocation models, please refer to "How Efficient is Your Frontier?", a white paper authored by the Commonfund Strategic Solutions Group.

For a summary of historical characteristics for each asset class, please see the following table.

Indices Used to Define Asset Classes in the APM

Asset Class	Series	Start Date	End Date	Historical Annualized Return	Historical Standard Deviation
Large Cap Equity	S&P 500 Index	Jan 70	Dec 07	11.68%	15.07%
All Cap Equity	Russell 3000 Index (prior to 1/79 weighted 80% S&P 500, 20% Ibbotson Small Cap)	Jan 70	Dec 07	11.86	15.53
Small Cap Equity	Russell 2000 Index (prior to 1/79 Ibbotson Small Cap)	Jan 70	Dec 07	12.91	20.41
Public Real Estate	NAREIT—Equity REITS	Jan 72	Dec 07	13.28	13.99
International Equity	MSCI World ex-U.S. Index	Jan 70	Dec 07	12.36	16.40
Emerging Markets Equity	MSCI Emerging Markets Equity	Jan 89	Dec 07	16.33	22.11
Private Equity	Venture Economics (buyouts)	Jan 72	Dec 07	15.20	13.38
Venture Capital	Venture Economics (venture capital)	Jul 81	Dec 07	16.41	20.90
High Volatility Hedge	Weighted Indices: Eureka Hedge: 32% North America, 23% Europe, 12% Japan, 13% Asia ex-Japan. HFRI Indices: 10% Event-Driven,10% Macro	Jan 90	Dec 07	16.46	7.22
Medium Volatility Hedge	Weighted HFRI Indices: 85% Equity Hedge, 15% Macro	Jan 90	Dec 07	13.20	5.95
Low Volatility Hedge	Weighted HFRI Indices: 25% each Equity Market Neutral, Fixed Income Arbitrage, Event-Driven and Relative Value	Jan 90	Dec 07	10.24	2.99
Distressed Debt	Altvest Sub Index—Distressed Debt	Jan 93	Dec 07	14.93	9.89
Commodities	Dow Jones AIG Commodity TR Index	Jan 70	Dec 07	11.96	13.95
Natural Resources	Composite returns—CCI Energy programs	Jan 90	Dec 07	15.89	12.59
Private Real Estate	NCREIF—Property Index (50% Leverage—finance at LIBOR + 150bps)	Jan 78	Dec 07	12.39	6.52
TIPS	Citigroup U.S. Inflation Linked Securities (Bridgewater 1/90–3/97 history)	Jan 90	Dec 07	7.24	4.03
Core Bonds	Barclays Aggregate Bond Index*	Jan 76	Dec 07	8.40	5.80
Global Bonds	Citigroup World Government +1	Jan 85	Dec 07	8.92	6.94
Emerging Market Bonds	JPM Emerging Markets Bond Index	Jan 91	Dec 07	14.08	14.43
U.S. High Yield	Merrill Lynch High Yield Master Index (prior to 9/86 CSFB U.S. High Yield)	Jan 70	Dec 07	9.32	8.09
HEPI	Higher Education Price Index	Jun 70	Jun 07	5.28	2.05

**The Lehman Aggregate Bond Index has since been replaced by the Barclays Aggregate Bond Index.*

Important Legal Disclosure

General

See note concerning the offering of securities on the front page of this paper.

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