

# ***The For and Against Arguments for Including a Commodities Allocation in a Well Diversified Portfolio: A White Paper***

Produced: February 24<sup>th</sup>, 2011

By: Mark Murphy, CFA

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## **Executive Summary**

Raffa Wealth Management's Investment Committee convened on February 3rd 2011 to discuss the inclusion of commodities in the firm's overall investment strategy. The meeting covered the many issues surrounding investing in commodities and was a lively and thoughtful discussion.

The topics covered included the viability of commodities as an investment and as an asset class, whether a commodities allocation provides improved returns, better diversification, an inflation hedge and a hedge against event risk. Issues related to taxes and fees, practical problems with ETFs and funds, the change in market dynamics, behavioral considerations, and indirect commodity investing were also assessed.

The following committee members were in attendance and participated in the discussion:

- Bill Snider, CFA, Co-founder and Managing Partner at BroadOak Capital Management
- Philip English, Ph.D., CFA, Assistant Professor American University, Department of Finance and Real Estate
- Alexandre M. Baptista, Ph.D., Associate Professor of Finance, Dean's Research Scholar, at The George Washington University School of Business
- Robert J. Willen, CFA, Portfolio Manager at Wagner Bowman Management Corp.
- Andrew Kline, CPA, CFP®, Managing Member of ARK Financial Services
- Gergana Jostova, Ph.D., CFA, Associate Professor of Finance at the George Washington University School of Business
- Steven K. Heger, CLU, President of Raffa Financial Services, Inc.

After weighing the merits of the issues the Investment Committee was able to reach a consensus. Commodities are an asset class – if only in practice and not necessarily in fact. Their returns will provide diversification benefits to a portfolio of stocks and bonds – namely that they will reduce overall portfolio volatility and in some cases provide hedges against significant event risk and inflation. The challenge, however, is that while they may provide these benefits, their inclusion will almost certainly decrease the portfolio's return over time and this will likely include short periods of dramatic underperformance due to the extremely speculative nature of investment in this class. Such speculative behavior will cause the class to be significantly overbought at times – evidenced by the current contango effect.

Our conclusion, therefore, is that commodities may be recommended on a client by client basis after a collaborative judgment is made that the benefits to that client outweigh the cost.

In an effort to determine an ideal commodity allocation RWM has back- tested their inclusion as part of the RWM strategy and evaluated other studies on preferred commodity allocations. We have determined that the optimal level for commodities in an investor's portfolio is from 10% to 12.5% of an investor's allocation to equities. The investment to commodities would reduce the portfolio's allocation to U.S. Stocks.

## **Against the Inclusion of Commodities**

Much has been written about commodities as a useful addition to an investor's portfolio. Investors have taken this to heart as commodity investments have exploded over the past decade. The number of commodity exchange traded funds and notes have grown from 2 with \$4 billion invested in November of 2005 to 95 with \$98 billion invested in 2010. Many articles and research papers have stated the benefits of investing in commodities, but do these benefits really exist and are they practically achievable? The following reviews the problems surrounding commodity investments, debunks several of the supposed advantages, and supports the belief that investing in commodities through futures contracts and through physical possession should not be part of a well diversified investment portfolio.

Commodities are fungible raw materials used to produce other goods. On their own they produce minimal benefits, but are an important part of production for countless items. They have been traded on exchanges for many years, but only in the past two decades have they begun to be viewed by some as an allocation in a diversified investment portfolio and their own asset class. However, many find fault with the presumption that investing in commodities is anything more than speculating. Those voicing this opinion include renowned investor Seth Klarman, President of the Baupost Group, Rick Bookstaber, Senior Policy Analyst at the SEC, Jack Bogle, founder of Vanguard, and academic and consultant Ken French. Commodities have minimal intrinsic value and do not possess characteristics that allow them to be analyzed. Commodities do not produce any cash flow and any increase in value relies on selling the same item to someone else for a greater price. This is simply speculating and a prudent investment portfolio should not include an allocation to a speculative investment.

In addition, there is some question as to whether commodities as a whole are even an asset class. An asset class is defined as a group of investments that have similar characteristics, attributes and risk/return relationships. However, commodities have a very minimal correlation with each other and are far from homogeneous. The price

relationship of cotton with coca and oil with pork bellies is tenuous at best, whereas stocks and bonds tend to generally move up or down based on the bullish or bearish trends of the market. Moreover, an asset class will appreciate over time. However, as Dylan Grice, a head economist at Societe Generale has asserted in a recent paper, commodities have been in a 140 year bear market. Real commodity prices have been flat, while treasury bills, bonds and stocks have all appreciated. Commodities today, silver, oil, wheat, are the same as they were a thousand years ago, but today the cost is much less to mine, process, or grow the commodity. Thus, their value is less than it has been historically.

Furthermore, investing in commodity futures is a zero sum game meaning for every dollar someone earns, someone else loses a dollar. One group sells the future contract, while another buys the contract. If this is the case, over the long run how does one expect to earn a return greater than zero? One may be lucky enough to invest in a commodity that has a rising price over a period of time, but it is likely that over the long run its real return will be close to zero. This is demonstrated over an extremely long time period from Grice's data.

The investment management firm Dimensional Fund Advisors (DFA) had heard of the many supposed benefits of commodities and had seen the large swing in popularity of investing in raw materials. They researched these purported advantages and published their opinion in the paper "Commodity Futures in Portfolios" in 2004. Their research analyzed the S&P Goldman Sachs Commodity Index (S&P GSCI), one of the first and most popular commodity indices. They measured its performance from its inception in January of 1991 through June of 2004 and found several of the supposed advantages do not hold water.

When investing in commodity futures contracts no money is exchanged between buyer and seller of the contract, leaving the funds that would be used to purchase the contract available to be invested elsewhere. The funds are then typically invested in Treasury bills. The S&P GSCI Total Return Index measures the return of the profit or loss on the futures contracts of 24 commodities as well as the return of Treasury bills; a so called

“fully collateralized” position. DFA then looked to see if investing in the fully collateralized S&P GSCI has provided positive average excess returns above the return on T-bills. They found this claim to be false in the 1991 to 2004 time period. While the S&P GSCI did have excess returns above the One Month T-bill, the average S&P GSCI excess returns were not reliably different than zero. The S&P GSCI excess returns were highly variable and the short time period combined to not provide enough evidence that the excess return of 2.7% for the time period would occur over longer time periods. This also does not include reductions in return for management fees and trading costs, which would lower the S&P GSCI performance further.

Updating the DFA study by looking at monthly returns from 1991 through December 2010 does not make the S&P GSCI look any better. Using the same methods as the DFA analysis, the annualized average of quarterly excess returns is 3.04%, but is not reliably different from zero for the extended time period either. Once again the variability of the S&P GSCI’s returns and time period does not allow one to conclude that commodities have a positive excess return over Treasury Bills. Similarly, just because one flips a coin 20 times and it comes up heads every time does not mean that going forward it will continue to do so. Statistically, one cannot say that commodities have a positive excess return based on the data from the time periods used. The study did not include the S&P GSCI returns for the period from 1970 to 1991 as the data is simulated and may be affected by selection bias. The rules for inclusion in the index were created in 1991 and lacking what was known two decades later it is unlikely the same rules would have been applied in 1970. Thus, this time period was excluded from the analysis to avoid any potential bias. However, using the index returns in the simulated data back to 1970 results in an annualized average of quarterly excess returns of 6.56%. This is reliably different from zero, but the data can’t be taken at face value.

A second benefit DFA investigated was that commodities provide diversification benefits as they offer meaningful reductions in risk when added to a portfolio of stocks and bonds. The author found that there was no significant relationship between the S&P GSCI and stocks and bonds when examined monthly, but there was a negative correlation when examined quarterly. However, the negative correlation was minimal.

The correlation between the S&P GSCI and the Russell 3000 and S&P 500 was -0.15 and -0.16, respectively and the correlation between the S&P GSCI and bonds ranged from 0.00 to -0.08 based on the bond index used. The author took portfolios of stocks and bonds varying from 60/40 to 80/20 stock to bonds and from simply to widely diversified leaving the average annualized returns the same for the portfolios and then added the S&P GSCI to the portfolio in a combination that would bring about the lowest standard deviation possible. They found that adding the S&P GSCI reduces standard deviation by a trivial amount. The largest reduction across the nine portfolios was a six basis point decrease in standard deviation. In the more fully diversified portfolios adding the S&P GSCI had the least effect. As small as the benefits are, the evaluation was still exaggerating their benefits as the analysis was being done with perfect hind sight. Looking forward it would be incredibly unlikely to know the exact combination of assets that would result in the greatest reduction in volatility.

Expanding on the initial tests, the correlation through December 2010 between the S&P GSCI and the Russell 3000 and S&P 500 measured quarterly has increased to 0.15 and 0.14, respectively. For bonds the results have been mixed with some correlations increasing and others decreasing producing a range of -0.24 to -0.31, excluding the One Month T-Bill. Stocks have become significantly more correlated and bonds are slightly less correlated with the S&P GSCI. These results more than net out and would not lead to any improvements for adding commodities to a portfolio as found in the DFA paper's analysis. When looking at quarterly data going back to 1973 (The Intermediate Government bond benchmark incepted in 1973.) the correlation decreases with the S&P 500 compared to the 1991 to 2010 time frame to -0.10 (Russell 3000 incepted in 1979.) and bonds correlation increased ranging from -0.16 to -0.24. Testing this data does show portfolio diversification advantages as there is a significant reduction in the standard deviation. While this does make commodities futures look like they are potentially a good portfolio diversifier in a longer time frame, the extended data has potential biases.

Furthermore, commodities have been heralded as performing at their best when stocks and bonds are performing at their worst. Their diversification benefits kick in when

they are needed most with the ability to hedge event risk. However, recent history has shown that this is not always the case. With the financial crisis of 2008 the S&P 500 lost 38% of its value and was one of the worst years on record. Over this time the S&P GSCI fell 46%. In this very significant case, commodities clearly did not provide the same diversification benefit and event risk hedge that is claimed they provide.

Finally, the author examined whether or not commodities were inflation hedges. The author examined the correlation between the S&P GSCI, stocks, and bonds and the rate of inflation measured by the U.S. CPI. He found that monthly the relationships were minimal, but quarterly the S&P GSCI was positively correlated with inflation at 0.28. Meanwhile, the Russell 3000, S&P 500 and bonds were predominately negatively correlated with inflation at -0.26, -0.28 and from 0.01 to -0.16, respectively. Similar to the diversification benefit analysis, the author created nine portfolios with similar allocations and diversifications and calculated their real returns. He then left the real returns constant and added the S&P GSCI to try to reach the lowest possible standard deviation. If an asset is an inflation hedge then there will be noticeable reductions in the standard deviation of a portfolio's real returns in times of inflation. The author found that there were no meaningful inflation hedge benefits. The largest reduction across the nine portfolios was a seven basis point decrease in standard deviation in the least diversified portfolio. Once again the benefits are likely overstated as the allocations were made with perfect hindsight. The reason behind the minimal change is the high volatility of the S&P GSCI with a quarterly standard deviation of 16.6% compared to 1.0% for inflation. Adding commodities to a portfolio adds a great deal of volatility that is unrelated to inflation. Using a high volatility investment like commodities futures to hedge against a low volatility trend is a significant mismatch. The hedge could add more problems than inflation brings about.

Looking at the S&P GSCI's correlation with inflation through December 2010 the quarterly correlation has increased to 0.60 and has decreased for fixed income ranging from -0.30 to -0.48 excluding the One Month T-Bill. However, the correlation with inflation has risen for equities with the S&P 500 and Russell 3000 increasing to 0.04 and 0.06, respectively. Using the extended time period and recreating the analysis



performed by DFA does not result in any portfolios with an allocation to the S&P GSCI reducing the standard deviation, while maintaining the same return. From 1973 the S&P GSCI's quarterly correlation with inflation decreases from the 1991 to 2010 range, but is higher than the initial study at 0.38. The S&P 500's correlation decreases from the 1991 to 2010 range, but is up from the initial time period moving to -0.09. Bonds correlation range rises from the 1991 to 2010 time period, but decreases from the initial time period to -0.18 to -0.36, excluding the One Month T-Bill. When testing this data it does show inflation hedging benefits for the portfolio as there is a significant reduction in the standard deviation. While this does make commodities futures look like they have potential inflation hedging benefits in the long run, the extended data has potential biases.

Tax issues further discourage investment in commodity futures. Commodity indexes are composed of many short term futures contracts that are rolled forward monthly. Gains and losses are therefore realized often. Taxes on gains in futures are charged based on a 60/40 ratio of the taxpayers long term and short term tax rates regardless of how long futures contracts, or the fund, are held. Thus, even if you hold a position in an ETF for over a year period you will have to pay a tax rate higher than one's long term capital gains tax rate. Another tax wrinkle is that investments that are physically held in gold, silver, and platinum are all taxed as collectibles meaning their tax rates, if held over a year, are 28%. This is much higher than the long term capital gains tax rate of 15%. Commodities are tax inefficient investments for taxable investors given their high tax rate and commodity indices high turnover.

In the same vein as tax issues, commodities futures also have higher fees than other investments. The least expensive ETFs and mutual funds have expense ratios of 50 basis points with many well above 100 basis points. The least expensive ETFs and mutual funds for stocks and bonds can be below 10 basis points. There is much greater turnover in commodity funds, even in the passively managed portfolios, compared to typical stock and bond funds that lead to increased costs. These higher fees eat into returns and help eliminate any benefit a commodity investment would provide.

When commodities markets were originally created they existed to allow producers of commodities (farmers, mining operations, ranchers) to be able to lock in future prices for their goods today. They wanted to eliminate the risk of deflation of their products. Speculators were willing to step in to be counter parties to these contracts and provided liquidity for the market. In return they received a premium by way of a lower futures price. Thus, today's spot price was higher than the future price, which is a market condition known as backwardation. However, as commodities have become more popular as an investing tool the markets have moved away from this fundamental dynamic. Prices are now widely driven by traders who are looking to hedge against inflation and gain exposure to the price movement of the underlying commodity, and not the commodity producers looking to hedge against deflation. Commodity producers are now just a small fraction of the market. Hedge funds, swap dealers, and other "non-commercial" parties account for more than 50% of all open interest (and trading) in U.S. futures markets, according to studies released by the Commodities Futures Trading Commission. As a result, markets now tend towards contango, the market condition where futures prices are higher than spot prices. Commodity markets and prices have therefore become disassociated with their original purpose and are being swamped and driven by those uninterested in the underlying good as a factor of production, but as a financial instrument.

Even if one believes that commodities do offer performance, diversification and inflation hedging benefits, actually receiving the benefits from investing in commodities is not a given. A primary vehicle for investment in commodities are ETFs. Many purport to track the value of individual commodities or commodity indexes like the S&P GSCI and DJ-UBS Commodity Index, however many ETFs do not closely track the value change of their underlying commodity or basket of commodities. The following examples show the incongruity. The United States Oil Fund has fallen 44% from its April 2006 inception, whereas the price of crude oil climbed 28% over the period. The S&P GSCI has returned 65% since the beginning of 2009, but investors have only earned about 13%. The PowerShares DB Agriculture Fund rose 3% from January 2007 to July 2010, while the represented commodities' prices gained 19%. The culprits behind these discrepancies are contango and pre-rolling. Contango, as mentioned previously, is the

term for the market condition when future prices are higher than current spot prices. Applied to ETFs this means the futures contract the ETF will buy is more expensive than the contract that it is selling as it comes upon expiration. Historically, most commodities markets have been in backwardation, so the counter party would be receiving a premium for entering into the contract. With future contracts continuously cheaper than the expiring contract the commodity trader would receive a positive roll yield by selling expiring futures contracts at higher prices and buying new contracts at lower prices and rolling the contracts forward. However, contango eliminates this benefit and thus reduces an ETF's performance compared to the underlying goods. ETFs tracking the S&P GSCI and other commodities are required to buy the next month's futures contracts between the fifth and the ninth business day of each month to maintain the exposure to the commodity. As this is public knowledge other traders can game the system by simply selling their contracts before the funds, which drives down the price, and buy the next contracts before the funds which drives up the price. This process known as pre-rolling has eaten further into the potential returns for a commodity ETF.

New ETFs have been launched to try to combat this problem by purchasing futures contracts of varying maturities as opposed to monthly, only purchasing commodities that are in backwardation, or by varying the time of the month that new contracts are purchased. However, these changes do not completely eliminate the contango problem and only purchasing and physically holding commodities can eliminate an investor's exposure to the problem for extended periods of time.

Taking physical delivery of a commodity can help avoid the pre-rolling and contango issues, but that creates large logistical problems for funds. It can work with gold, but taking physical delivery of oil barrels for investment purposes would be a large burden, not to mention the likely lack of regulatory approval for a fund that held oil strictly for investment purposes. In addition, there are the added storage and insurance costs with holding commodities. Thus, a fund that physically holds a basket of commodities cannot exist.

ETNs, or Exchange Traded Notes, a similar investment vehicle to ETFs, track more closely to the underlying commodities, but open up the investor to counterparty risk as they are unsecured debt obligations. These have been exposed as potentially quite risky in the wake of the Lehman Brothers collapse as they were the counter party to several ETNs.

More recent studies have been conducted that look at the portfolio performance benefits of adding commodity futures to a portfolio. A study completed by Conover, Jensen, Johnson, and Mercer in 2010 states that adding commodities has an impact on the portfolio, but the results of their inclusion are statistically insignificant. They do not substantially improve expected portfolio return. Additionally, research prepared by Erb and Harvey in 2006 examined whether average commodity futures have 'equity-like' returns. They found that it has not been the case and the average returns of individual commodity futures contracts have been indistinguishable from zero.

Professors Gorton, from the University of Pennsylvania, and Rouwenhorst, from Yale University, released a seminal paper, "Facts and Fantasies about Commodity Futures," (Completed in 2004. Updated through 2006.) which is widely responsible for the rapid rise in popularity of commodities in institutional and retail investment portfolios. They created an equally weighted basket of goods and measured its characteristics from 1959 to 2004 and their findings were a revelation to the investment world. They found that the basket of commodities offered the same return and risk premiums as equities, were negatively correlated with equity and bond returns, and were a hedge against inflation and unexpected inflation. In addition, they found commodities diversification benefits work best when stocks and bonds are performing at their worst.

These findings supercharged the interest in investing in commodities and led many to add allocations to their portfolios, however there are several issues with the findings that make it extremely unlikely to be able to attain the same results in the real world. The index that was created in the study is designed to invest \$1 in each of a basket of 36 commodities that join the index over time. However, there are no products that are formulated in this way and slightly different holdings could yield much different results.

One can also not invest in fractional contracts which would be required to hold equal amounts in all of the commodities contracts. Investing in the index they created by purchasing futures contracts or ETFs for all of the commodities included would be too cumbersome and expensive. Most current funds invest to match existing indexes like the S&P GSCI and DJ UBS Commodity Index, which have very different compositions than the index created in the study. The index the authors created also suffers from survivorship and selection bias. It used only futures contracts that have survived through the length of the study, while contracts that were introduced over the time period that failed were not included. Contracts were also chosen based on their liquidity. This selection bias could also have an impact on the contracts performance. The research also does not factor in transaction costs, management fees or taxes which are significant costs given the frequency of the turnover in the portfolio. These would have considerably reduced the index's performance.

It is likely that investors already have an exposure to commodities. If an investor is invested in a broad stock market mutual fund, many companies included have direct exposure to commodities. If an investor wants a greater concentration, there are stock funds specifically geared toward certain sectors of the economy that can help them target commodities. The stocks of companies directly linked to commodities have a correlation level of 0.40 with the main commodities they work with. This gives a typical portfolio an exposure to the investment without the much higher volatility found in commodity prices.

Another argument used to support investing in commodities is that there is a finite quantity in the world and with potential supply decreasing prices will be forced to climb. However, as Dylan Grice says, "When you buy commodities, you're selling human ingenuity." New technology is continuously being explored and developed to use commodities more efficiently or limit the dependence on them. Hybrids and electric automobiles reduce the population's dependence on oil. Optical fibers have replaced copper in wires for communication. Instead of investing in commodities, one can invest in the companies that reduce our dependence on commodities or develop methods to harness their attributes more proficiently.

Gold has historically been used as a store of value and has become an increasingly popular investment with the market turbulence over the last several years. The commodity has an annualized return of 23% over the past 5 years, and some proponents are trumpeting a price target of \$10,000 per troy ounce. However, many of the same problems exist with gold as commodities as a whole. While the current nominal price of gold is at an all time high, when inflation is considered the metal has not appreciated at all. The value of gold in 1980 was \$2,251 a troy ounce using today's dollars, whereas the current value of gold is approximately \$1,330. Meanwhile inflation has risen by 3.45% annually since 1980. Thus, the investment has fallen far short of keeping up with inflation. Warren Buffett has said investing in "gold is not an investment; it is an investment in fear." He makes the point that it provides no inherent benefits, like cash flows provided by other investments, and the investor is wagering on a market collapse. In addition, it has significant ongoing storage and insurance costs that can significantly eat into profits. The S&P GSCI Gold index has returned 6.27% annually since its inception in 1978 through December 2010. This is well below the S&P 500 and Barclays Aggregate Bond Index. It also has a quarterly standard deviation of 17.74, higher than both of the aforementioned indexes. Thus, on its own, gold has not performed as well and has been more volatile than the general stock and bond markets. However, it may still provide diversification benefits. The S&P GSCI Gold Index quarterly correlations with the S&P 500 and Barclays Aggregate Bond Index are -.01 and .09, respectively. A simple portfolio was created with a 60/40 breakdown between stocks (S&P 500) and bonds (Barclays Aggregate Bond Index) and a second portfolio was created adding gold in order to try to attain the same return as the 60/40 portfolio, but at a lower standard deviation. When added to the simple stock and bond portfolio gold reduces the standard deviation by 11 basis points. This is a nominal reduction and also would have required the investor to have perfect foresight in order to know the right allocation of stocks, bonds, and gold to maintain in order to achieve the least volatile return. Gold does not produce any clear benefits when added to an investment portfolio.

Over the past decade the popularity of commodity investing has soared based on the purported benefits of better returns, increased diversification, and inflation hedging. However, these benefits appear to be minor if they occur at all, with issues surrounding

the historical data. Even if the benefits do exist it is quite difficult for an investor to achieve the level of performance the underlying commodities produce. Based on these findings commodities do not provide added benefits to investors and should not be a part of a well diversified portfolio.

### **For the Inclusion of Commodities**

Commodities have existed for hundreds of years, but only in the past few decades has extensive research been dedicated to them as investments. The research findings have been very favorable towards adding commodities to a diversified investment portfolio. This has led to a tremendous increase in investing in the raw materials by institutions and individuals. The following reviews the benefits of investing in commodities, addresses several of the supposed problems with investing in commodities, and supports the belief that investing in commodities through futures or through physical possession should be part of a well diversified investment portfolio.

The backbone for investing in commodities was developed in the seminal paper “Facts and Fantasies about Commodity Futures” by professors Gorton and Rouwenhorst in 2004 (Completed in 2004. Updated in 2006). In the paper they created an equally weighted fully collateralized index of a basket of 36 commodities futures covering the full array that exist. The authors analyzed the index’s performance and characteristics between 1959 and 2004. They found that there are several substantial benefits to investing in commodity futures and that they have the potential to be an attractive asset class that diversifies a traditional portfolio of stocks and bonds.

First, they examined how the commodity futures index returns compared to stocks and bonds. They measured stocks by the S&P 500 and bonds by the Ibbotson corporate bond index. They found that stocks and commodities have had similar average returns and risk premiums, but commodities have had a lower standard deviation than stocks resulting in a higher Sharpe Ratio for commodities. Commodities futures also have outperformed bonds and have a greater risk premium. These results carried over to international markets as well. Also, commodities are positively skewed whereas stocks

are negatively skewed. This means stocks have a greater downside risk than commodities.

The authors analyzed the commodities index's correlations with stocks and bonds. In order to eliminate fluctuations that might occur in the short term they reviewed multiple time periods from monthly to 5 year periods. In all time periods other than monthly, commodities had a negative correlation with stocks and bonds. In addition, the negative correlation increased over longer time periods. This means that commodities are useful diversifiers of stocks and bonds and the diversification benefits increase if they are held in a portfolio for the long term. Stocks and bonds do not move in sync with commodities, which reduces the volatility and risk of the portfolio and should increase the consistency of returns. As they had found that stocks had a larger downside risk than commodities, they examined whether the negative correlations held true when equities were performing at their lowest. For the 5% of worst performing months for equities where they fell by 9.18%, commodity futures rose 1.43%, and for the 1% of worst performing months where equities dropped 13.87%, commodity futures rose 2.32%. The diversification benefits of commodities work best when stocks are at their lowest and therefore when they are most needed.

An investor's purchasing power is reduced by inflation. In order to combat this, investors look for investments that hedge the effect of inflation. The researchers compared their commodity futures index's returns with inflation to see if they met this objective. Once again the authors looked at multiple time horizons from monthly to 5 year periods. They found that commodity futures were positively correlated with inflation across all time horizons while stocks and bonds were negatively correlated with inflation across all time periods. In addition, commodities are better correlated with inflation over longer time frames, while stocks and bonds are more negatively correlated.

Bonds are priced to compensate investors for the expected inflation over the life of the bond, however if inflation is unexpectedly higher, the purchasing power from the cash flows of the bond decrease. Similarly, corporations can be hurt by unexpected inflation



with increasing prices from suppliers or labor which in turn would hurt stock prices. Unexpected inflation is also linked to harmful shocks to total output, which is detrimental to stocks. The authors examined whether the commodity futures index could also hedge against unexpected inflation. They found that commodities were even more positively correlated to unexpected inflation than inflation and stocks and bonds were more negatively correlated to unexpected inflation.

When commodities are reviewed in the context of the business cycle the authors found that they provide additional benefits. The constructed commodities futures index the authors developed covers 7 full business cycles. They analyzed this data and found that in the early recession period of the business cycle both stocks and bonds have negative performance, whereas commodities produce a positive return. In addition, in the late expansion stage when stock and bond performances are below their overall averages, commodities futures produce a positive return better than stocks and bonds. This further demonstrates commodities diversification benefits.

Both professors are still confident in their work and of commodities benefits. In recent years the diversification benefits have appeared to diminish as the stock and commodity markets move closer in tandem. When asked in February of 2010 if they felt that commodities still provided a return matching equities, portfolio diversification, and inflation hedging benefits, they both agreed it is still the case. They believe the past few years have just been a blimp in the data as their research covered a much longer time frame. They believe the characteristics that make commodities a useful tool for investors still exist.

It is often held that investors already have commodity exposure in their portfolios, or can gain exposure through holding stocks of firms that are commodity producers. However, attempting to gain exposure to commodities through indirect investing does not closely track commodities futures performance. The authors found that over a 41 year period the cumulative return for equities of commodity producers trailed the matching commodity futures by three times. Also, the correlation of the commodity focused companies with the S&P 500 was 0.57, greater than the correlation of the

commodity intensive companies with the commodity they are most affiliated with. Therefore, commodity intensive companies' stocks act more similar to other stocks than they do commodities futures. A study done by the Center for International Securities and Derivatives Markets in 2005 also found that there is increased portfolio diversification benefits and enhanced risk adjusted performance through direct commodity investments as opposed to investing in stocks and bonds of companies heavily affiliated with commodities. Thus, the correlation between commodities and the companies that work closely with them has been minimal. Stocks of commodity producers do not provide the same experience as investing in commodity futures.

There are many more factors that play a role in the performance of a commodity producing company than just the performance of the commodity. Management's ability to efficiently and expertly direct the company, the company's size, position in the industry, cost structure, other business units, and leverage can all affect a company's stock performance. The commodity producers also may hedge future price risk by purchasing their own futures contracts today, thus eliminating any potential upside or downside of the value of commodities.

Studies completed since the work of Gorton and Rouwenhorst have found that a risk premium for commodities equivalent to equities may not exist. Erb and Harvey observed in their 2006 study that the average long commodity futures position does not have equity like returns and their average return has been close to zero. However, portfolios of commodities futures can achieve equity like returns if the portfolio has sufficient "diversification return." While individual commodities have high volatilities, a portfolio of commodities futures is less volatile. When individual commodity futures move away from their target weight in a commodity portfolio due to this volatility they are rebalanced back to their target weighting. This then enables a portfolio of rebalanced commodities to have a geometric return that outperforms the weighted average geometric returns of the individual commodities in the portfolio.

Research conducted by Nigel Lewis in a 2009 paper echoed many of the sentiments of the Gorton and Rouwenhorst piece. The author examined life cycle investing for long

term wealth accumulation and retirement. Typically the investments involve stocks and bonds and reducing the weighting towards equities throughout the individual's life. He found that by adding commodities, as measured by the S&P GSCI, to this mix it may increase the portfolios return, it reduces the volatility of annualized returns, increases the risk adjusted returns as measured by the information ratio, and reduces extreme downside risk. The major take away from the study is that commodities reduced the volatility of portfolios and thus increased the likelihood that an investor would be able to retire with the preferred size of their portfolio.

A study conducted by Conover, Jensen, Johnson and Mercer in 2010 found that adding commodity futures to an equity portfolio substantially reduces the standard deviation of the portfolio and a significant diversification benefit is derived no matter what equity investment style is employed – value, growth, small cap or large cap. In addition, they found significant correlations between commodities and changes in the Fed discount rate. When the Fed is raising rates in a restrictive monetary environment it increases a portfolio's return and when the Fed is lowering rates in an expansive monetary environment they tend to reduce a portfolio's return. In both cases standard deviation is reduced. This finding also supports the view that commodities are positively correlated with inflation.

Commodities have been found to be a hedge against event risk as well. A major incident such as war, an over throw of a government, drought, flood, or a financial crisis might result in a population losing confidence in financial assets like stocks and bonds. However, as commodities are a physical asset they would maintain their value through such problems. Greer (2007) states that commodities can provide a portfolio protection against unexpected events. In the stock market crash of 1987 commodities, as measured by the S&P GSCI, maintained their value, whereas the stock market plummeted and lost approximately 23% of its value. A war can cause demand for commodities such as oil to rise and concerns about the supply dipping combine to drive up the price. When Iraq invaded Kuwait in 1990 the S&P GSCI rose while the stock market was relatively flat.

DFA's 2004 white paper discredits the use of commodities in a portfolio saying the investment does not provide the benefits that its proponents state. However, the study is also viewing a very short period of time, from 1991 to 2004, that does not allow for several market cycles to play out. Over longer time periods they have been shown to have benefits. In the research DFA presents, the correlations between stocks and bonds and commodities decrease over long periods. Similarly, DFA shows that commodities' correlation with inflation increases as the time period they are measured over is extended. This data agrees with what others have found. Also, the index evaluated in the study, the S&P GSCI, is a production weighted index and thus is heavily weighted towards energy. Historically the index has had a 60% to 80% weighting to energy. This skews the index performance to how oil fairs and makes the index much more volatile compared to an index like the DJ UBSCI, which equally weights the commodity constituents and therefore is not subjected to as high volatility. Plante and Roberge completed a similar study to the DFA work examining the S&P GSCI over the 1970 to 2006 period and its effects on its addition to a 60/40 stock to bond portfolio. They found that it reduced the portfolio's standard deviation and enhanced the portfolio's return. The basis of the return was the collateralized position in T-Bills, the premium provided by hedgers, and rebalancing return. They also observed that from 1980 to 2006 commodities acted as a hedge against unexpected inflation with a correlation of .53 with unexpected inflation.

Investing in commodities through ETFs has become a very popular and more accessible way for investors to enter the market. However, investors often don't see the performance they were expecting due to commodity funds being in a contango pricing state, which results in a negative roll yield, and/or traders pre-rolling the fund. Several methods have been adopted to help combat this problem. U.S. Commodity Funds has developed an ETF, the USCI, which tracks the SummerHaven Dynamic Commodity Index and is managed to avoid the contango issue. The fund follows the index, which focuses on buying futures that are in backwardation. Each month the index is rebalanced with 14 commodities out of a pool of 27. Thus, they can pick and choose which contracts are the most favorable out of the 27 commodities within the index as it relates to contango. The Deutsche Bank's Liquidity Commodity Index Optimum Yield

fund that tracks the DBLCI operates under rules that seek to roll into the futures contracts that maximize the positive roll yield when the particular commodity is in backwardation and minimize the negative roll yield when a commodity is in contango. The PIMCO Commodity Real Return Strategy fund tries to avoid being exploited by traders by not tying itself to an index, not trading at the same time every month, and using the futures contracts with the cheapest roll costs. Another way to avoid the issue is to physically hold the commodity. Funds based around metals can provide this option. Funds and ETFs have developed ways to counter the pre-rolling and contango issues.

With increasing investment by large institutional investors in commodities markets and the rise in recent years of commodity prices, many have claimed that these new investors in the market have thrown the market off from its fundamentals and are speculatively driving commodities prices higher. Keith Black reviewed this issue in a paper in 2009. He found this theory not to be the case with price increases coming from demand outstripping supply. He points to increasing demand from emerging markets, new biofuels, and under production as the major contributors. Increasing commodities prices continue to be driven by demand increases from developing nations such as China, India, Russia, and Brazil. These rapidly expanding economies need raw materials to help build their factories, improve their infrastructure and power their growth. China's energy needs have risen substantially. Their share of worldwide energy consumption has increased to 9.0% from 6.4% from 2004 to 2009. As these countries grow their middle class has risen as well. With their increased income the middle class are increasing their meat consumption in their diet, which increases the need for grains to feed livestock. Therefore, the demand for grain rises, increasing the price. Similarly, the development of biofuels has increased the demand for agricultural products. Grains needed for ethanol production have risen at twice the pace of grains used for food according to Black. Thus, more farmland becomes dedicated towards growing grain for ethanol production and less for other crops. These crops then have reduced supplies driving their price upwards. From 2001 to 2007 the consumption of commodities outpaced production. Thus, with current supplies of commodities being low it drives up the price. The author believes this could be the reason behind the rise of oil in 2008.

Amplifying the price increases from increasing demand is the fact that the supply of some commodities is dwindling. There is a finite amount of some commodities in the world. As these commodities, like oil and gold, are processed and depleted they will begin to become scarcer. With increasing scarcity their prices rise and enhance the value of holding commodities in a portfolio.

Many commodities have direct links to inflation as they are integral parts of goods that make up the consumer price index. For example, crude oil, wheat, and cotton are major components of the transportation, food and apparel portions of the CPI. As they are direct inputs into how inflation is calculated it is logical that if inflation is increasing it is due to increasing prices of the commodities used to calculate it. Therefore, holding investments in these commodities will help guard a portfolio against inflation.

Gold has been recognized globally and throughout history as a store of value. In times of crisis and uncertainty investors know that gold will be recognized as having value while a country's currency or their financial investments may not. By owning gold, investors hedge against event risk such as a financial crises or political risks. Research was done by Baur and Lucey in 2010 examining whether gold really is the hedge and/or safe haven it is portrayed to be. They define a hedge as an investment that is negatively correlated with a portfolio on average, but not always during market shocks. They consider a safe haven as negatively correlated with a portfolio even in stressed markets. They looked at return data from 1995 through 2005 for stocks, bonds, and gold in the U.S., U.K., and Germany. They found that gold is, on average, a hedge and a safe haven against stocks, but not against bonds. They also found that gold's effectiveness as a safe haven in stressed markets only lasts for a short period of time; roughly 10-15 days after a shock in the market, before its value begins to settle.

The popularity of commodity investing has grown by leaps and bounds over the past decade. More positive evidence for investing in commodities continues to emerge through ongoing research. It has been shown that commodities can increase the diversification, and therefore the performance, of a simple portfolio, as well as provide a hedge against inflation and unexpected inflation. Based on these findings, investing in

commodities provides added benefits to investors and should be a part of a well diversified portfolio.

Data used in the DFA paper and in the update of its findings is from the DFA Returns program. The Data gathered by DFA Returns is sourced from:

**S&P 500 Index:**

January 1990-Present: The S&P Data are provided by Standard & Poor's Index Services Group  
January 1926-December 1989: Ibbotson data courtesy of © Stocks, Bonds, Bills and Inflation Yearbook™, Ibbotson Associates, Chicago (annually updated works by Roger C. Ibbotson and Rex A. Sinquefeld).

**S&P GSCI Index:**

March 1970-Present: Morningstar Advisor Workstation

Barclays data courtesy of Barclays Capital.

Russell data courtesy of Russell Analytic Services.

Fama/French data courtesy of Fama/French.

MSCI data courtesy of Morgan Stanley Capital International.

Citigroup bond indices courtesy of Citigroup, formerly Salomon Smith Barney (SSB).

Ibbotson data (bonds and Treasury bills) courtesy of © Stocks, Bonds, Bills and Inflation Yearbook™,

Ibbotson Associates, Chicago (annually updated works by Roger C. Ibbotson and Rex A. Sinquefeld).

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