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‘Investing’ in Commodity Futures Markets: Are the Lambs Being Led to Slaughter?

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Practitioner's Abstract

Investments into commodity-linked investments have grown considerably over the last five years as individuals and institutions have embraced alternative investments. However, unlike investments in equities or real estate, commodity futures markets produce no earnings and are arguably not even a capital asset. So, the source of returns and the expected returns for commodity futures investments is unclear. This paper examines the history of returns for static long-only futures investments over five decades. The research highlights the following features of commodity futures investments: 1) returns to individual futures markets are zero, 2) returns to futures market portfolios depend critically on the weighting schemes and the embedded trading strategy, and 3) historical returns are not statistically different from zero and are driven by price episodes such as 1972-1974.

Key Words: commodity index funds, commodity investments, futures prices

"*Commodity contracts, however, are not included in the market portfolio. Commodity contracts are pure bets, in that there is a short position for every long position….I believe that futures markets exist because in some situations they provide an inexpensive way to transfer risk, and because many people both in the business and out like to gamble on commodity prices.*" Fischer Black (1975, p. 172-176).

Introduction

As of March 31, 2011, the CFTC reported that 195 billion dollars was invested in instruments indexed to U.S. commodity futures prices (see Figure 1). More dollars are expected to flow into the commodity markets over the next three years as the California State Teachers Retirement System adds nearly $2.5 billion to their commodity allocation and other institutions continue to allocate portions of their portfolio to commodity investments (Krishnan and Sheppard, 2010). The impact of this 'financialization' of commodity futures markets has been the subject of intense debate and scrutiny in recent years (e.g., USS/PSS, 2009; Irwin and Sanders, 2011).

Oddly, the source of returns (if any) to commodity futures investments does not seem to be as highly disputed. Indeed, stalwart investment companies such as the Vanguard Group present investments in commodity index funds as potential alternative investments (Stockton) and the CME Group, Inc. asserts that futures returns stem from "the existence of these risk premia…consistent with futures prices' role as biased predictors of expected spot prices" (Abrams, Bhaduri, and Flores, p. 5). The prevalent view within the investment community seems to be that futures positions earn a return for providing risk-transfer services to hedgers.

This view of commodity futures markets—while consistent with the traditional Keynesian risk premium or normal backwardation theory—stands on fairly wobbly empirical legs. Dusak (1973), Marcus (1984), and Kolb (1992) found no empirical evidence that long futures positions earn a market risk premium. As shown in the opening quote, Black (1976) provides perhaps the most cutting argument against futures markets as "investments": futures markets are simply side bets on prices, not capital assets.

The focus of this paper is long-only commodity index returns. We do not consider the potential returns to "tactical" or "strategic" commodity investments that may actively, but subtlety, manage the individual index components or the switching of contracts (e.g., GSCI "Enhanced" Commodity Index). Likewise, we do consider the role of commodity investments within a larger portfolio. It is fairly trivial that if long-only index funds have a positive expected return, then the low correlation with traditional investments would give them a non-zero weight in a mean-variance optimized portfolio (Fortenbery and Hauser, 1990).

In this paper we seek to better understand the returns to long-only commodity futures investments. First, we provide some background with regards to the flow of investment money into long-only investments and their actual performance. Second, the return to individual futures markets is investigated, including theoretical underpinnings. Common misconceptions regarding "contango" and "roll returns" are dispelled. Third, commodity portfolio returns are analyzed including the "diversification return." Finally, the results are discussed within the framework of long-term expected returns.

Background

The flow of money into commodity investments in the last decade was boosted by academic research that showed "equity-like" returns for a portfolio of commodity futures while also providing diversification benefits relative to traditional asset classes (Gorton and Rouwenhorst, 2006b; Erb and Harvey, 2006).

Prior to these key studies, other academics had found evidence of positive returns to long-only futures portfolios. In particular, Bodie and Bosansky (1980) found annual returns of 9.77% to a collection of 23 markets from 1950-1976 and Greer (2000) documented a 12.2% total annual return from 1970-1999 to a futures market portfolio. Gorton and Rouwenhorst (2006b) kick started the recent commodity investment movement by showing annualized returns to commodity futures of 10.69%. While a bit more skeptical of the source of returns, Erb and Harvey (2006) also endorsed long-only commodity futures investments. Data compiled by Barclay's shows that all commodity-linked investments grew rapidly during this period (Figure 2).

Despite the academic endorsement, actual returns to commodity investments have been disappointing. The iShares S&P GSCI Commodity Index Trust is an exchange traded fund (ETF) designed to mimic the performance of the Goldman Sachs Commodity Index (GSCI)—one of the most widely followed commodity indices. The ETF was initially offered to the public in July of 2006 at a price near $50 per share. Since then, the share price has generally declined (see Figure 4) and an initial investment of $10,000 in the fund at its inception would now be worth around $7,000 (as of May 2011). The annualized return for just the last three years is a negative 19% (Morningstar). The negative return has occurred over a period of time when there has been a general upward trend in overall commodity prices. The disappointing performance of this and similar funds has led market observers and investment professionals to search for possible explanations for the poor performance.

Returns to Individual Futures Markets

Erb and Harvey (2006) examine futures markets returns within four potential frameworks: 1) the Capital Asset Pricing Model (CAPM), 2) a Keynesian risk premium or "normal backwardation," 3) Cootner's (1960) hedging pressure hypothesis, and 4) returns associate with "convenience yield" (Kaldor, 1939).

Importantly, theories of hedging pressure (see Bessembinder, 1992; Basu and Miffre, 2009) and those connecting returns to storage signals based on convenience yield do not prescribe static, long-only futures investments. Rather, these theories suggest that risk premiums are time-varying and may accrue to either long or short positions and a dynamic investment strategy is needed to capture them. Even then, evidence of time varying risk premiums is mixed and it is difficult to disentangle returns to risk-bearing from potential informational inefficiencies in the market (Frank and Garcia, 2009).

Only the CAPM and Keynesian "normal backwardation" would prescribe a static long-only position in commodity futures markets. But, here, the evidence is decidedly against the existence of risk premiums within individual commodity futures markets. Dusak (1973) and Marcus (1984) demonstrate that the returns to individual futures markets do not earn a market risk premium in the CAPM framework. Likewise, Kolb (1992) shows that "normal backwardation" is not normal. That is, on average, futures prices equal expected spot prices and there is no downward bias in futures prices that allows returns to accrue to long position holders.

Given this lack of empirical support for either CAPM or Keynesian risk premiums, it is not surprising that most researchers have found that the return to individual futures markets is on average zero. Indeed, Erb and Harvey (2006) find that the average return to 12 futures markets from 1982-2004 was -1.71% with no individual market producing statistically positive returns. Gorton and Rouwenhorst (2006b) study 36 individual markets and find that 18 had positive returns and 18 had negative returns. None of the individual markets had statistically significant positive returns.

To verify these results, monthly returns were collected for 20 commodity futures markets from 1950 through 2010. The average annualized geometric returns by market by decade are shown in Table 1. The data are only presented for complete decades. So, a market that started trading in 1978 would not show any data in the 1970's but would show a complete return history for the 1980's. The data arranged in this manner to keep the markets within each decade consistent and complete.

The average return across all markets and time periods is -0.5% per year. The dispersion of individual market returns is wide. Corn and wheat futures markets had annual average returns of -4.6% and -4.5%, respectively. Copper had the only return (8.6%) statistically different from zero at the 5% level (two-tailed, t-test). Lumber had a marginally statistically significant negative return of 7.7% (p-value=0.0987). Looking at each decade individually, the 1970's were a favorable time period for commodities. In that decade, only oat futures had a negative average return. In every other decade, the number of markets with negative returns roughly equals the number with positive returns and the average return is relatively small. Overall, these data are consistent with those presented in the literature and suggest that returns to individual futures markets are essentially zero.

Some researchers (e.g., Till, 2006) explain the cross-market variation in returns with the relative difficulty of storage. Others look at the break-down of futures returns and pin poor returns for both individual markets and index investments on "contango" (e.g., Robison, Loder, and Bjerga, 2010). Contango simply refers to the typical situation in commodity futures markets where the term structure of prices is positive—futures contracts further from expiration on a given date have a higher price than those contracts closer to expiration. A contango futures price structure is commonly referred to as a "normal carry" or "carrying charge" market.

Because futures contracts expire on a set schedule, one futures contract cannot be held indefinitely. Instead, long-only investors have to "roll" out of expiring contracts (prior to delivery) and into another contract that is further from expiration. The process of switching or rolling contracts is accomplished with a simultaneous sale of the expiring contract (e.g., March) and purchase of the next contract (e.g., May). There is a misconception among some commodity investors that the price difference between these two contracts (e.g, March and May) has a direct impact on investment returns.

Commodity index investors have to repeatedly "roll" positions as contracts expire by selling the nearby contract and moving their long position to a more deferred contract. Therefore, it is commonly reported that buy-and-hold index investors will steadily lose money if the market is in a normal carry or "contango" because long ownership is rolled into increasingly higher priced contracts. For instance, if a long-only investor owns a March futures contract that must be sold at 500 and replaced with a long May futures contract priced at 505, then it is thought that this detracts from returns because ownership at 500 is replaced with ownership at a higher price of 505.

On the surface, this reasoning appears intuitive and would make sense for a single asset such as common stock on a single company. However, the corn futures market is not a single asset (if it is an asset at all). Instead, it is a series of distinct assets distinguished by the unique expiration month. March corn futures are not May corn futures. Rolling a long position from March corn to May corn futures is really not any different from rolling a long position in the auto industry from GM to Ford. The difference in the prices between the GM stock sold and the Ford stock purchased has no direct bearing on the return to the new long position in Ford. The only thing that determines the realized return is the change in the price of the asset held.

"Contango" *per se* has no direct impact on the realized returns to individual futures contracts. Contango is simply the structure of the futures market. A market in contango is one that is displaying a return to carry (nearby contracts prices lower than deferred contracts). A market that is not in contango is one that has an inverted structure (nearby contract prices higher than deferred contracts). Part of the misconception stems from the common approach to breaking down the realized excess return to a long-only futures position into two components: "spot" and "roll" returns.

Examples of the “spot” and “roll” returns are illustrated in Table 2. In this example a futures position is rolled on the last trading day of the month prior to the expiration month. So, the March futures position is sold at the end of February at 500 and simultaneously a May futures contract is purchased at 505. In this case, the market is in contango and the “roll” returns are negative. However, the realized market return in the month of March is purely a function of the change in the May contract. In this example, the May contract price stays at 505 for a return of zero. It is only *ex post* that one can break-down the returns to a -1% “roll” return and a +1% “spot” return. Notice, the realized return is calculated using only the prices of the May contract (505/500). The March contract and the market term structure have no direct bearing on the realized return from the May contract.

Continuing with the example in Table 2, the investor sells the May contract at 546 and buys the July contract at 525 as he rolls out of the May contract at the end of April. In this case the market structure is inverted by 4%, generating a “roll” return of positive 4%. However, the act of rolling from one contract month to the next does not produce a realized return. The return in May is purely a result of the change in the price of the July contract. In this example, the July contract price did not change and the realized excess market return is zero. Purely as an *ex post* exercise, one can look back and break-down the return to a 4% return to the “roll” and a -4% “spot” return (spot return=excess return-roll return). Importantly, the calculation of both the “roll” and “spot” return rely on comparing prices across different futures contract months. But, the realized return only depends on the change in the price of the contract month actually held. While the “roll” and “spot” returns may be useful ways to conceptualize the nature of returns, they are not realized returns. As argued by Burton and Karsh (2009), contango only impacts the relative returns of spot and futures commodity investments not the absolute level of returns in futures.

Still, a number of commodity investments have been introduced that attempt to minimize the impact of contango and roll returns. For example, Goldman Sach introduced an enhanced GSCI that “attempts to boost returns and sidestep the issue of contango” (Seeking Alpha). However, a careful distinction must be drawn between contango’s direct impact on realized futures returns (none) and contango as a market signal. That is, while “roll” returns are not a direct part of the realized return, the market structure could be a market signal.

Gorton, Hayashi, and Rouwenhorst (2007) link high returns with risk premiums that vary inversely with physical inventory levels, which are signaled by futures markets that have an inverted structure or exhibit backwardation. Naturally, this led the authors to introduce a new commodity ETF that exploits this finding by “concentrating the portfolio in the backwardated portion, or at the least-contango portion of the commodities space” (Crigger, Ludwig, and Hougan, 2010).

The efficacy of market term structure (contango or inverted) as a market signal for higher returns or the existence of risk premiums is not the focus of this paper. Indeed, it is quite possible that an inverted market structure is a proxy for a market situation where long commodity futures positions earn a risk premium. In which case, the “roll” return is a market signal that suggests a particular strategy. For example, a positive “roll” return (inverted market structure) is a *signal* that the realized return in the subsequent period will be positive. This is quite different from the misconception that rolling in an inverted market *creates* a positive realized return.

The balance of the evidence suggests that static long-only positions in individual futures markets have an expected return of zero. The idea that "return to roll" is a realized return is fiction. The actual process of rolling a long futures position to a new futures contract does not produce a return, either positive or negative. So, from where does the return come?

Returns to Portfolios of Futures Markets

The starting point in understanding the source of returns is to dig into the question of how you can get positive returns from assets that have average individual returns of zero. The answer appears to be diversification and the arithmetic properties of geometric returns and the variance reduction inherent in a portfolio (Erb and Harvey, 2006).

Erb and Harvey (2006) point out the mathematical properties that make diversification the only "free lunch" in finance (Campbell, 1992). When a portfolio of assets is formed, the portfolio return is equal to the weighted average returns of the components plus the *diversification return*. The diversification return is then the difference between the portfolio's geometric return and the weighted average geometric return of the portfolio's constituents.

An example of the diversification return is shown in Table 3. In this example, there are two assets that have geometric or holding period returns of zero. However, the geometric return of the equally weighted portfolio of the two assets is 4%. The 4% is the diversification return—the return to the portfolio is greater than the average geometric return of the two components (0%). Erb and Harvey (2006) refer to this as turning "water into wine."

The diversification return is actually an undisputable arithmetic fact stemming from the following two facts: 1) arithmetic averages are always greater than geometric averages and the difference increases with variance, and 2) the return series for a portfolio of assets will always be less variable than the average variance of the components. So, because the portfolio of assets is less volatile than the average component, the geometric mean of the portfolio will be greater than the average geometric mean of the components. Erb and Harvey (2006) show that diversification return can be expressed as,

(1) $$DR = \frac{1}{2}\left(1 - \frac{1}{k}\right)\bar{\sigma}^2(1 - \bar{\rho}),$$

where, k = the number of portfolio components, $\bar{\sigma}^2$ = the average variance of the components, and $\bar{\rho}$ = the average correlation across assets. So, the diversification return is an increasing function of asset variability and the number of assets and a decreasing function of the average correlation between the individual asset returns. Commodity futures returns happen to display the characteristics that provide a considerable diversification return. A large number of markets (high "k") are available that are very volatile (high $\bar{\sigma}^2$) and commodity futures markets tend not to be highly correlated outside of closely linked market segments (low $\bar{\rho}$). For a portfolio of 10 markets with average annualized standard deviations of 25% and correlations of 0.20, the diversification return will be 2.25%.

In order to measure the diversification return found in commodity futures markets portfolios are formed from 1961 through 2010. When using historical commodity futures returns, there has been some debate as to how to handle the starting date for new contracts as well as contracts that are de-listed. For example, Gorton and Rouwenhorst (2006b) use all commodity futures contracts—bringing them into the portfolio when they start trading and removing them if they are delisted—arguing that commodity prices do not have a "survivorship bias" such as that found in the equity markets. However, Gorton and Rouwenhorst's (2006b) approach leads to the inclusion of markets that may never have achieved sufficient trading liquidity for active trading and efficient pricing (e.g., butter futures). Perhaps more importantly, allowing contracts to enter as they are listed may bias results if the introduction of contracts to particular sectors is not random. For instance, dairy futures contracts were developed and delisted in the mid-1990's as those markets were de-regulated and burdensome government-owned inventories were reduced. Conversely, futures markets may be de-listed due to very low volume of trade, abnormal pricing performance, or if a structural change in an industry reduces the need for risk-shifting. These factors may not be unrelated to market fundamentals that drive prices change. So, a more consistent approach to selecting and retaining futures markets used in historic simulations may be preferred.

Erb and Harvey (2006) take a more consistent approach by examining a consistent set of 12 markets from 1982-2004 that spans the major commodity sectors (energy, metals, grains, livestock, and tropical products). Here, we follow a similar approach. Data are collected on 10 markets that have continuously traded since 1961 and 20 markets that have traded continuously since 1991. The markets are the same as those listed in Table 1, where the 10 markets that show complete trade in the 1960's make up the 10 market portfolio and all of the listed markets comprise the 20 market portfolio. Portfolios are constructed using equal weights across markets and rebalanced monthly. The portfolio returns are broken out by decade and presented in Table 4.

As shown in Table 4, the 10 market index had a geometric annual return of 3.6% over the 50 years of data. However, over the entire sample, the annual average return is not statistically different from zero at conventional levels of significance. By decade, only the 1970's produced returns (15.1%) that were statistically significant at the 10% level (p-value = 0.0541). The 1980's and 1990's produced negative returns. The 20 market portfolio produced a comparable return of 2.8% from 1991 to 2010. For the 20 market portfolio, the returns are not statistically different from zero in aggregate or in any decade.

A closer examination of the pattern of annual returns for the 10 market portfolio is provided in Figure 4, where it is clear that returns in the 1970's were driven by a few select years. Indeed, the three tumultuous years from 1972-1974 when the U.S. underwent dramatic macroeconomic shifts accounts for 96% of the decade's returns and 68% of all returns during the 1961-2010 sample. Over the entire sample, the average annual geometric return is 3.6%. If you remove just 1973, the average annual return falls to 2.0% and from 1975 forward the average annual return is -0.01%. The 1972-1974 episode is clearly an important driver in finding positive portfolio returns. It can be debated if these years should be included in forming expectations for futures years. However, their importance in historical simulations is beyond debate.

The "diversification return" to the commodity portfolios is calculated as the difference between the average geometric return of the component markets and the geometric return of the portfolios. Not surprisingly, the diversification returns behave as suggested by equation (1). The diversification returns for the 10 markets averages 2.8% over the 50 year span. The diversification return is higher in volatile decades (1970's and 2000's), and in a given decade it is higher for 20 markets than 10 markets in the portfolio. Overall, these results suggest that a portfolio of 20 futures markets will produce a diversification return of around 3% per year. However, as shown in the 1980's and 1990's a positive diversification return does not assure a positive realized return.

Erb and Harvey (2006) argue that the diversification return is closely linked to the portfolio weighting scheme. Simplistically this can be seen in Table 3. The two assets have identical initial and terminal values. So, an initially equally weighted portfolio or a "let it run" portfolio would have a return of zero even though the equally weighted and rebalanced portfolio has a return of 4%. Erb and Harvey (2006) argue that this loss of diversification return to initially equally weighted portfolios is due to "covariance drag" or the correlation between an asset's returns and the portfolio weights. Gorton and Rouwenhorst (2006a) dismiss this notion and emphasize that diversification returns are indisputable mathematical properties of the geometric returns of portfolios. Instead they suggest that an equally weighted and continuously re-balanced portfolio (as opposed to an initially equally weighted and let-it-run portfolio) represents an "embedded" trading strategy.

The portfolio weighting scheme for commodity futures investments is a crucial point. Unlike equities that have clearly defined market capitalization and a strong economic justification for value-weighted portfolios, futures markets have a zero market capitalization. Therefore, there is not a clear way to weight a portfolio. Some commercial indices, such as the S&P GSCI, attempt to use a value-weighting scheme based on production in the underlying physical markets. However, this approach results in a commodity index that is heavily (>70%) weighted in the energy markets.

As pointed out by Fung and Hsieh (2002), an equally weighted portfolio is a "contrarian" strategy because the portfolio is rebalanced by "selling winners" and "buying losers." Conversely, the initially equally weighted and let-it-run portfolios are a momentum-driven allocation strategy where winners naturally increase their weight in the index and losers naturally reduce their portfolio weight. So, when evaluating the past performance of a portfolio of commodity futures markets, it is very difficult to disentangle the source of the returns between diversification returns and strategies embedded within portfolio weighting scheme.

Summary, Conclusions, and Discussion

The presented research summarizes prior research on commodity futures returns, examines returns across five decades of data and discusses possible theoretical underpinnings for returns to long-only futures positions. The paper does not address the potential for strategic or tactical commodity portfolios or the role of commodity investments in larger, more traditional, investment portfolios. Instead, the focus is on understanding the potential source of returns to a static long-only commodity futures investment. The following conclusions are reached.

First, there is little empirical evidence for theories that support positive returns to long-only positions in individual futures markets. Neither the CAPM nor Keynesian risk premium concepts have much empirical support within the literature. The data strongly suggest that the returns to individual futures markets average zero. Realized futures returns are also unrelated to the market term structure (contango or backwardation). The actual process of rolling a long futures position to a new futures contract does not produce a return, either positive or negative. Returns to long-only commodity futures investments therefore must come from the portfolio level.

Second, the "diversification return" to a portfolio of futures markets is a mathematical fact stemming from the arithmetic of geometric portfolio returns. However, the diversification return alone does not assure positive returns. An equally-weighted portfolio of 10 commodity futures markets had two decades of negative realized returns (1980's and 1990's) even though the diversification return was reliably positive.

Third, the weighting scheme for the portfolio is a critical and confounding factor. There is not a clear economically justified weighting scheme for commodity futures contracts. All portfolio weighting schemes are an embedded trading strategy. Equally weighted and continuously rebalance portfolios are contrarian strategies and let-it-run portfolios are momentum strategies. It is very difficult to attribute portfolio returns to the various components which suggest that it may likewise be difficult form expectations for returns in the future.

Overall, these results provide some skepticism with regard to expected returns for long-only commodity futures investments. The returns from 1951-2010 for a 10 market portfolio and the returns from 1991-2010 for a 20 market portfolio are near 3% per year but not statistically different from zero. Plus, the returns can clearly be negative for decades (1980's and 1990's) only to be punctuated by positive returns surrounding major commodity upheavals such as we saw in 1972-1974.

A component of the returns is the diversification return. However, the diversification return can be swamped by poor returns among the individual markets, resulting in negative realized returns. Or, the particular portfolio weighting scheme and embedded strategy may work to reduce or enhance the overall return.

Portfolio trading strategies may be unintentional and "embedded" or intentional strategic choices. Returns generated from these portfolios may stem from market inefficiencies or time-varying risk premiums. Regardless, as more money flows into these markets, inefficiencies will be eliminated and risk premiums will be reduced. The typical expense ratio for a long-only index fund is 1% per year. It is not unreasonable to use this as a point estimate of expected returns to these investments (before expenses).

References

Abrams, R., R. Bhaduri, and E. Flores. "A Quantitative Analysis of Managed Futures in an Institutional Portfolio." The CME Group (http://ftp.cmegroup.com/education/files/Lintner_Revisited_Quantitative_Analysis.pdf). Accessed May 10, 2011.

Basu, D., and J. Miffre. "Capturing the Risk Premium of Commodity Futures." EDHEC Risk and Asset Management Research Center, EDHEC Business School, February 2009.

Bessembinder, H. “Systematic Risk, Hedging Pressure and Risk Premiums in Futures Markets.” *Review of Financial Studies* 5(1992):637-667.

Black, F. “The Pricing of Commodity Contracts.” *Journal of Financial Economics* 3(1976):167-179.

Bodie, Z., and V. Rosansky. “Diversification Returns and Asset Contributions.” *Financial Analysts Journal*. May/June(1980):26-32.

Burton, C., and A. Karsh. “Capitalizing on Any Curve: Clarifying Misconceptions about Commodity Indexing.” Credit Suisse Asset Management, LLC, September 2009. (https://www.credit-suisse.com/us/asset_management/doc/wp_commodities_200909_en.pdf). Accessed May 23, 2011.

Campbell, J.Y. “Diversification: A Bigger Free Lunch.” *Canadian Investment Review* 13(2000):14-15.

Commodity Futures Trading Commission. “Index Investment Data.” March 31, 2011 (http://www.cftc.gov/MarketReports/IndexInvestmentData/index.htm). Accessed May 11, 2011.

Cootner, P. H. “Returns to speculators: Telser vs. Keynes.” *Journal of Political Economy* 68(1960): 396-404

Crigger, L., O. Ludwig, and M. Hougan. “US Commodity Launches Contango-Killer ETF.” *Index Universe*, August 10, 2010. (http://www.indexuniverse.com/sections/news/7921-us-commodity-funds-launches-contango-killer-etf.html). Accessed May 11, 2011.

Dusak, K. “Futures Trading and Investor Returns: An Investigation of Commodity Market Risk Premiums.” *Journal of Political Economy* 81(1973):1387-1406.

Erb, C.B., and C. Harvey. “The Strategic and Tactical Value of Commodity Futures.” *Financial Analysts Journal* 62(2006):69-97.

Fortenbery, T.R., and R.J. Hauser. “Investment Potential of Agricultural Futures Contracts.” *American Journal of Agricultural Economics* 72 (1990):721-726.

Fung, W., and D.A. Hsieh. “Asset Based Style Factors for Hedge Funds.” *Financial Analysts Journal* September/October(2002):16-27.

Gorton, G., and K.G. Rouwenhorst. “A Note on Erb and Harvey (2005).” Yale ICF Working Paper No. 06-02, January 2006a.

Gorton, G., and K.G. Rouwenhorst. “Facts and Fantasies about Commodity Futures.” *Financial Analysts Journal* 62(2006b):47-68.

Gorton, G., F. Hayashi, and K.G. Rouwenhorst. "The Fundamentals of Commodity Futures Returns." Yale ICF Working Paper No. 07-08, June 2007.

Greer, Robert J. 2000. "The Nature of Commodity Index Returns." *Journal of Alternative Investments* Summer(2000):45-52.

Irwin, S.H., and D.R. Sanders. "Index Funds, Financialization, and Commodity Futures Markets." *Applied Economics Perspectives and Policy* 33(2011):1-31

Kaldor, N. "Speculation and Economic Stability." *Review of Economic Studies* 7(1939):1-27.

Kolb, R.W. "Is Normal Backwardation Normal?" *Journal of Futures Markets* 12(1992):75-90.

Krishnan, B. and Sheppard, D. "Analysis: Commodities Supercycle? Pensions Loath to Commit." Reuters, October 13, 2010. (http://www.reuters.com/article/2010/10/13/us-commodities-institutions-idUSTRE69C3CV20101013). Accessed May 23, 2011.

Marcus, A.J. "Efficient Asset Portfolios and the Theory of Normal Backwardation: A Comment." *Journal of Political Economy* 92(1984):162-164.

Morningstar. "iShares S&P GSCI Commodity-Indexed Trust GSG." (http://quote.morningstar.com/ETF/f.aspx?t=gsg). Accessed May11, 2011.

Robison, P., A. Loder, and A. Bjerga, "Amber Waves of Pain." *Bloomberg Businessweek*, July 22, 2010. (http://www.businessweek.com/magazine/content/10_31/b4189050970461.htm?chan=magazine+channel_top+stories). Accessed May 11, 2011.

Stockton, K.A. "Understanding Alternative Investments: The Role of Commodities in a Portfolio." Vanguard Investment Counseling & Research (https://institutional.vanguard.com/iam/pdf/commodities_WP.pdf?cbdForceDomain=true). Accessed May 11, 2011.

Till, H. "A Long-Term Perspective on Commodity Futures Returns." EDHEC Risk and Asset Management Research Center, EDHEC Business School, October 2006.

United States Senate, Permanent Subcommittee on Investigations (USS/PSI). "Excessive Speculation in the Wheat Market." Washington, D.C., June 24, 2009. (http://hsgac.senate.gov/public/index.cfm?FuseAction=Documents.Reports). Accessed, May 10, 2011.

Table 1. Returns to Individual Futures Markets, 1961-2010

	----------Annualized Geometric Returns------							
Market	**1960's**	**1970's**	**1980's**	**1990's**	**2000's**	**All**	**T-Stat.**	**P-value**
Corn	-1.7%	2.3%	-9.1%	-7.9%	-6.0%	-4.6%	-1.40	0.1605
Wheat	-6.0%	7.6%	-11.2%	-6.9%	-5.0%	-4.5%	-1.30	0.1925
Soybeans	4.7%	8.4%	-10.4%	-3.1%	13.1%	2.2%	0.59	0.5550
Soybean Meal	15.0%	2.4%	-7.2%	5.4%	17.0%	6.1%	1.41	0.1602
Soybean Oil	9.1%	23.7%	-8.1%	-8.7%	9.2%	4.3%	0.99	0.3202
Oats	-4.9%	-2.2%	-14.3%	-13.9%	11.3%	-5.2%	-1.30	0.1925
Rough Rice				-11.4%	-6.7%	-9.1%	-1.48	0.1389
Live Cattle		4.2%	8.3%	0.8%	0.8%	4.2%	1.43	0.1543
Lean Hogs		15.0%	4.8%	0.3%	-11.3%	2.3%	0.51	0.6072
Lumber		7.2%	-14.1%	-3.7%	-16.1%	-7.7%	-1.65	0.0987
Cotton No. 2	-4.6%	13.0%	6.4%	-4.8%	-5.0%	0.8%	0.22	0.8275
Coffee			-0.6%	-3.6%	-0.8%	-1.7%	-0.25	0.8024
Sugar No. 11	-7.7%	18.8%	-24.7%	6.4%	7.4%	-1.1%	-0.19	0.8477
Cocoa	-8.6%	30.3%	-10.4%	-15.8%	15.3%	0.7%	0.16	0.8701
Heating Oil			6.9%	1.8%	7.2%	5.3%	0.91	0.3633
Crude Oil				6.4%	6.9%	6.6%	0.91	0.3645
Natural Gas				13.0%	-34.6%	-14.0%	-1.29	0.1991
Gold			-11.8%	-7.7%	14.6%	-2.3%	-0.76	0.4471
Silver		16.5%	-21.5%	-4.0%	17.4%	0.1%	0.02	0.9863
Copper	22.5%	2.1%	4.4%	-2.3%	18.5%	8.6%	2.10	0.0364
Average	**1.8%**	**10.7%**	**-6.6%**	**-3.0%**	**2.7%**	**-0.5%**		

Table 2. Example of "Roll" and "Spot" Returns

Date	March Contract		May Contract		July Contract	"Roll" Return	"Spot" Return	Excess Return
1/31/2011	475							
2/28/2011	500	Roll Return	505				5%	5%
3/31/2011		Spot Return	505			-1%	1%	0%
4/31/2011			546	Roll Return	525		8%	8%
5/31/2011				Spot Return	525	4%	-4%	0%
6/30/2011					510		-3%	-3%

Table 3. Diversification Return Example

Time	Price Asset 1	Price Asset 2	Return Asset 1	Return Asset 2	Equal Weighted Return
1	1	1			
2	2	3	100%	200%	150%
3	3	4	50%	33%	42%
4	4	5	33%	25%	29%
5	5	6	25%	20%	23%
6	5	4	0%	-33%	-17%
7	4	1	-20%	-75%	-48%
8	3	2	-25%	100%	38%
9	2	2	-33%	0%	-17%
10	1	1	-50%	-50%	-50%
	Arithmetic Average		9%	24%	17%
	Geometric Average		0%	0%	4%
				"Diversification Return" =	4%

Table 4. Commodity Portfolio Returns, 1961-2010

	----------Annualized Geometric Returns------					
Market	**1960's**	**1970's**	**1980's**	**1990's**	**2000's**	**All**
U.S. Equities (S&P 500)	8.1%	8.5%	13.8%	17.3%	1.4%	9.7%
U.S. T-Bills	4.3%	6.7%	8.4%	4.7%	2.2%	5.2%
U.S. T-Bonds	2.9%	3.5%	13.0%	8.4%	5.5%	6.6%
Equally Weighted Index, 10 Commodities	3.6%	15.1%	-6.3%	-3.6%	10.6%	3.6%
(p-value), two-tailed, t-test	(0.2616)	(0.0541)	(0.2235)	(0.2991)	(0.1285)	(0.1520)
"Diversification Return"	1.8%	4.5%	2.1%	1.5%	3.0%	2.8%
Equally Weighted Index, 20 Commodities				-0.1%	5.9%	2.8%
(p-value), two-tailed, t-test				(0.9695)	(0.2554)	(0.3274)
"Diversification Return"				2.9%	3.2%	3.3%

Figure 1. Commodity Index Investments, December, 2007- March, 2011

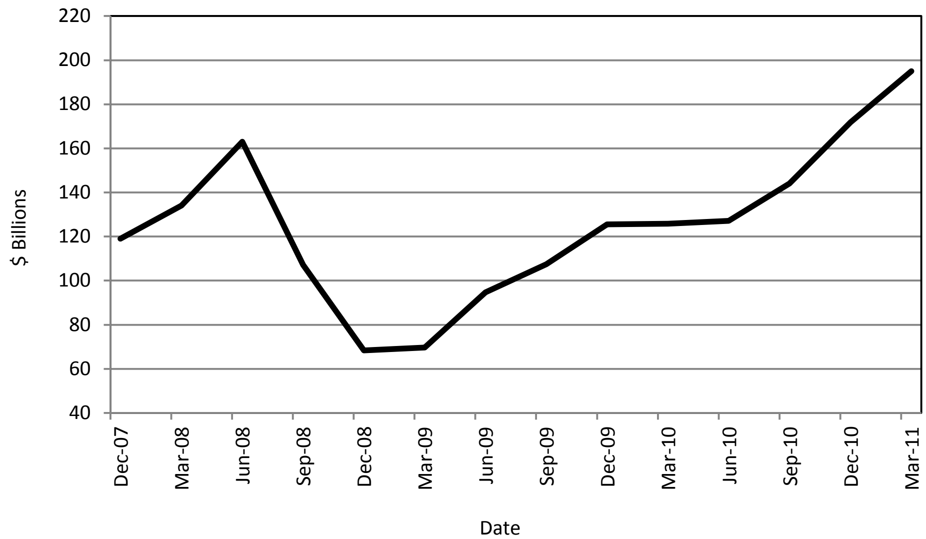

Figure 2. Commodity-Linked Investments, April, 2006 – February, 2011

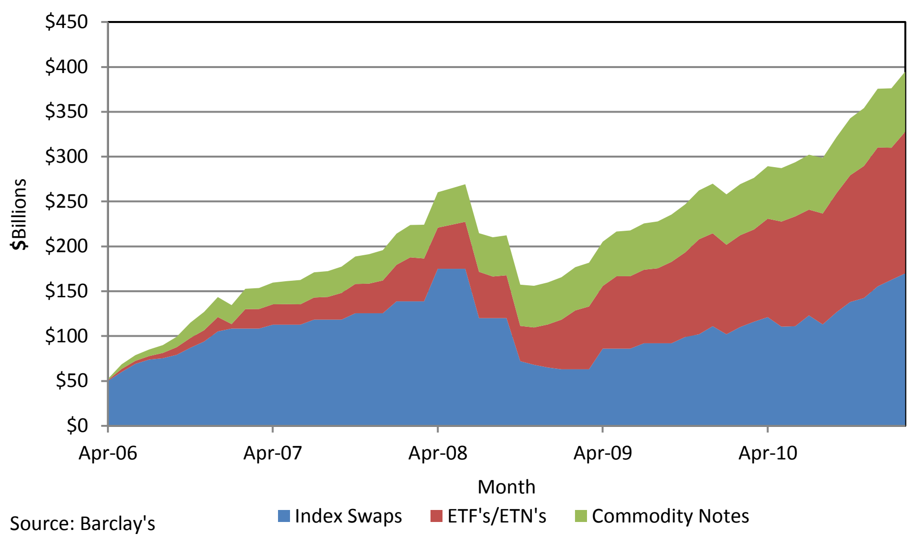

Figure 3. iShares GSCI Commodity Index Trust, 2006-2011

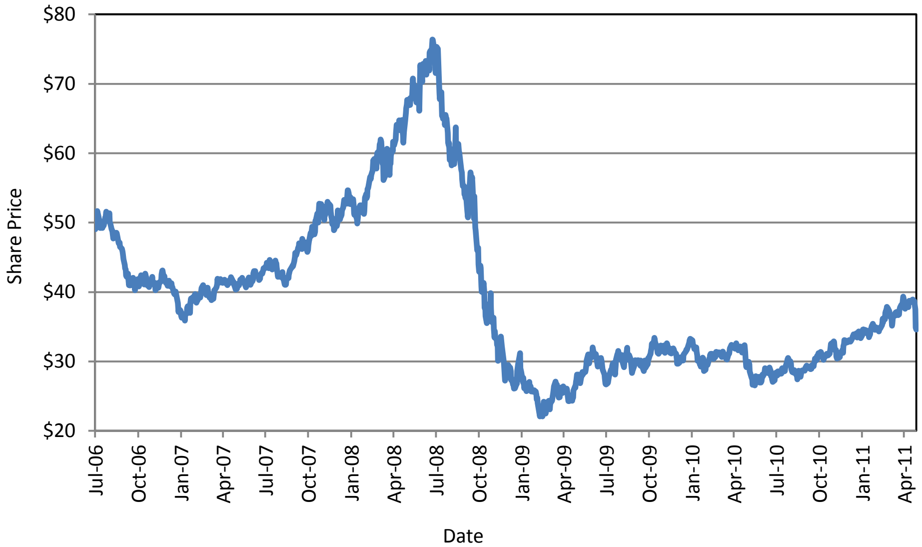

Figure 4. Annual Returns to a 10 Market, Equally-Weighted Portfolio, 1961-2010