GRESHAM INVESTMENT MANAGEMENT

ALTERNATIVE RISK PREMIA IN COMMODITIES

Gresham Research

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ABSTRACT

Alternative risk premia (ARP) are systematic sources of return that can be harvested using long/short strategies across a wide range of asset classes. ARP tend to have low correlation with traditional risk premia earned from passive, long-only, exposure to traditional asset classes such as equities and fixed income. Investment in ARP has gained acceptance and grown considerably in recent years as institutional investors seek to diversify their absolute return allocations and mitigate equity market risk. While most discussions about ARP have centered on the same asset classes used to generate traditional risk premia, we focus on commodities. Specifically, we examine the characteristics of value, carry, momentum and volatility in the underlying liquid commodity futures markets. We also discuss distinct, asset class specific ARP. Finally, we combine a selection of commodity risk premia into a composite and show that adding this composite to portfolios can improve returns and reduce risk.

Alternative Risk Premia (ARP) in commodities have been studied (see e.g. Gorton et. al. 2012) with the general consensus being that they can provide uncorrelated sources of return to risk premia in other asset classes. In addition to the most widely disseminated cross-asset ARP, commodity-specific sources of return can be extracted because of the idiosyncratic nature of commodity markets. We aim to show that ARP in the commodity space can provide a complementary source of return relative to existing ARP benchmarks and possess the potential to improve the risk-return characteristics of modern investment portfolios.

Data in this paper was provided from the following sources: Hedge Fund Research Inc., Eurekahedge Pte Ltd., and Bloomberg L.P

WHAT ARE ALTERNATIVE RISK PREMIA?

ARP are distinct from traditional long-only risk premia because they are extracted through dynamic and systematic investment processes and tend to have low correlation to traditional risk premia extracted from long-only exposure to assets. Frequently, ARP are constructed in a market neutral fashion, where long exposures in highly rated securities are offset by short exposures in poorly rated securities. Since long exposures are hedged, correlations to traditional risk premia are typically low, making ARP an attractive diversifier in representative institutional portfolios.

Historically, most of the academic research on ARP focused on equities (see e.g. Fama, French 1992), but more recent research shows that many ARP are pervasive in multiple asset classes (see e.g. Asness 2013). The premise of alternative risk premia is that investors are compensated for taking on risk, but opportunities may also arise from behavioral biases of market participants.

WHY ALTERNATIVE RISK PREMIA NOW?

Many strategies that were primarily employed by hedge funds can now be accessed as ARP at a lower fee structure when compared to traditional hedge funds. Moreover, ARP strategies tend to be more transparent, allowing investors to better understand risk and return characteristics of risk premia. While sources of true alpha may always exist, over time an increasing share of alpha strategies will be available to investors in risk premia funds.

WHAT ARE THE MOST WIDELY ACCEPTED ALTERNATIVE RISK PREMIA?

Most researchers and practitioners focus on value, momentum / trend following, carry, and volatility as the core alternative risk premia.

Value has been widely studied across asset classes and there is compelling evidence that less expensive assets tend to outperform expensive assets over the long run. As market participants prefer to hold assets with strong recent performance and are reluctant to invest in assets with poor recent performance, it is possible that valuations deviate from equilibrium. An example of a value signal would be large deviations from long term price levels.

Momentum / trend following has gained acceptance across macro asset classes and refers to performance continuation of recent price trends. Momentum tends to dominate at much shorter horizons than value. Persistent momentum, or trends, may occur when market participants initially underreact to information because of behavioral biases. Unlike other ARP, momentum often is not implemented in a market neutral fashion, which can lead to time-varying beta exposures. Trend following strategies have historically provided downside protection because trends tend to be most pronounced when returns are extreme over extended time-periods. These environments often coincide with periods of economic distress.

Carry is typically defined as the outperformance of high yielding assets. The initial research on carry comes from the foreign exchange space, but similar results have now been uncovered in other asset classes including in commodities. Carry is the return that one would earn from holding a financial instrument if the spot price does not change. In the case of commodities, carry is measured by the relative prices of futures with different maturities. Similar to high-yield bonds outperforming low-yield bonds, commodities that have higher carry or roll yield embedded tend to outperform.

Volatility refers to the risk premium that can be earned by systematically selling volatility through options. Implied volatility tends to be higher than realized volatility over the long run. Volatility sellers are effectively providing a hedge to risk-averse market participants. Like all hedge writing strategies, the volatility risk premium has experienced relatively large but infrequent negative returns, but has historically earned relatively small positive returns the majority of the time. Overall, returns can be attractive, but careful risk management is important to harvest the volatility risk premium.

While we do not have access to individual time series from the providers of ARP, the correlations between our implementations of core ARP to indices of those same commodity ARP imply that there can be significant variance of return related to differences in implementation.

Exhibit 1: Commodity ARP Correlations Imply Variance in Implementation

Simulated weekly correlations between Gresham commodity ARP and HFR index equivalents

Jan 2014 – Dec 2018

Momentum	Carry	Value	Volatility
0.69	0.40	-0.04	0.62

Source: Gresham, Hedge Fund Research. Gresham Value and Volatility ARP are stand-alone indices, whereas Momentum and Carry are equal risk weighted averages of two separate indices. Certain risk premia can be captured by a single index while others can require multiple indices to capture the premium.

FINDING DISCRETE ARP IN COMMODITIES

The cross-asset risk premia detailed in the section above also exist in the commodities space, and tend to have low correlations to the same ARP in other asset classes. Further, the unique structure of commodities markets provides opportunities to extract other independent risk premia. Crucially, many contract months are liquid for most commodities, and the relative pricing of different maturities can yield a premium. Given that price changes of futures contracts for a commodity along the forward curve tend to have high correlations, risk can be reduced significantly by taking positions in spreads instead of taking positions in outright contracts.

Strong economic links between certain commodities also present unique opportunities. For example, WTI Crude Oil is closely linked to both Brent Crude Oil and its distillates such as RBOB Gasoline. By exploiting similar known relationships, it is possible to harvest established ARP such as carry and value in a way that is uncorrelated to a common market neutral implementation. By construction, such an approach eliminates sector bets, which tend to be a significant driver of cross-sectional carry. In other words, the opportunity set in commodities is larger than the small number of individual markets would suggest because relationships

between commodities and between multiple contracts along the term structure provide additional independent return streams from which ARP can be harvested.

We classify such premia, as well as calendar spreads and other tradable statistical relationships not captured by core ARP categories, into a separate group we call discrete ARP. Discrete ARP have low historical correlations to core ARP.

Exhibit 2: Discrete ARP Have Low Correlation to Core ARP

Simulated weekly correlations between discrete ARP and core ARP

Jan 2007 – Dec 2018

Momentum	Carry	Value	Volatility
0.18	0.17	-0.03	0.05

Source: Gresham, Hedge Fund Research. Gresham Value and Volatility ARP are stand-alone indices, whereas Momentum and Carry are equal risk weighted averages of two separate indices. Certain risk premia can be captured by a single index while others can require multiple indices to capture the premium. Discrete ARP is an equal risk weighted average of six separate indices.

Domain expertise in commodities can help improve both returns and risk management. Standard risk models tend to provide risk estimates based on recent history. However, seasonal variations in risk tend to be extremely important for commodity markets as well as commodity spreads. Knowing which periods are representative of the current environment can be beneficial for forecasting risks and returns. Other examples include the timing of delta hedging trades for options; anticipating relevant events can play a critical part in managing the volatility risk premium.

Concepts such as value and momentum are well understood, but practitioners face many choices when they implement a risk premia strategy. Different approaches to harvesting the same ARP can have very different characteristics and domain expertise can help in finding optimal implementations.

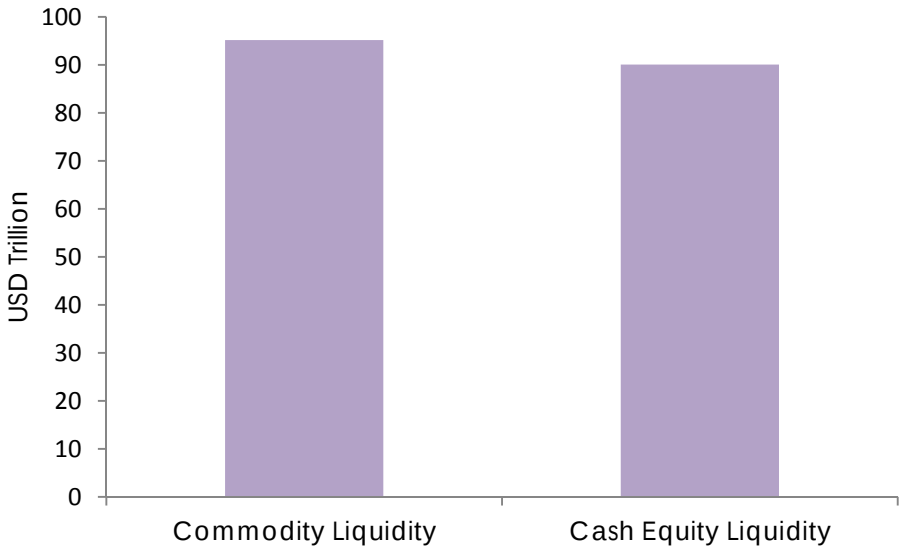
UNIVERSE AND LIQUIDITY

Liquid underlying instruments are essential for extracting ARP in a scalable manner. Exchange-traded commodity futures and options provide the optimal trading vehicle for implementing systematic risk premia models because they are price transparent and very liquid.

Commodities that are included in the universe are generally liquid. In aggregate, more than 90 Trillion USD are traded annually in the universe. This is comparable to the total annual dollar volume in U.S. cash equities.[1] While liquidity varies substantially by commodity, even the least liquid commodities in the universe have liquidity comparable to S&P500 stocks.

Exhibit 3: Commodity vs. Cash Equity Liquidity

Annual Dollar Volume in 2018 for U.S. Cash Equities and the universe of commodity futures

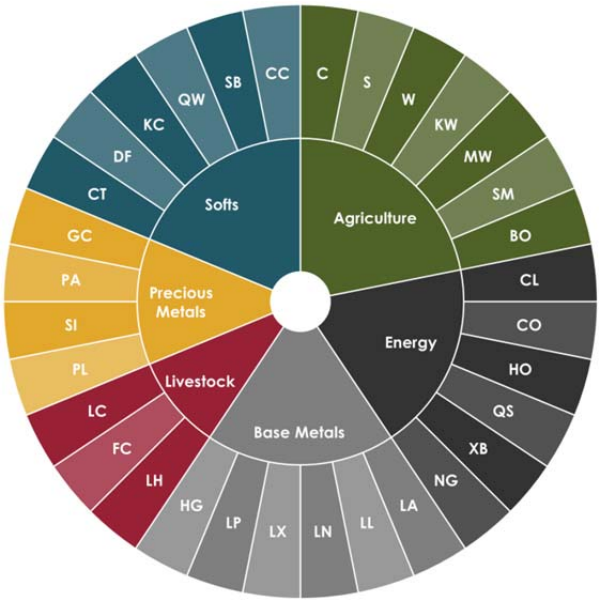


Source: FIA, SIFMA, Gresham

Gresham, as a commodities investment specialist selects what it considers the most diverse and globally relevant universe of commodities possible while preserving that liquidity advantage. The exhibit below lists all commodities in that universe and assigns them to sectors.

[1] https://www.sifma.org/resources/research/us-equity-stats/

Exhibit 4: A Liquid and Diverse Universe of Commodities



Ticker	Commodity	Sector
C	Corn	Agriculture
S	Soybean	
W	Wheat (CBOT)	
KW	Wheat (KC)	
MW	Wheat (MGE)	
SM	Soybean Meal	
BO	Soybean Oil	
CL	WTI Crude Oil	Energy
CO	Brent Crude	
HO	Heating Oil	
QS	Gas Oil	
NG	Natural Gas	
XB	Unleaded Gas (RBOB)	
LA	Aluminum	Base Metals
LP	Copper (LME)	
HG	Copper (NY)	
LN	Nickel	
LX	Zinc	
LL	Lead	
LC	Live Cattle	Livestock
LH	Lean Hogs	
FC	Feeder Cattle	
GC	Gold	Precious Metals
SI	Silver	
PL	Platinum	
PA	Palladium	
CT	Cotton	Softs
SB	Sugar	
QW	White Sugar	
KC	Coffee	
DF	Coffee (Robusta)	
CC	Cocoa	

The exhibit lists all commodities in the universe and assigns them to sectors.

Note that this universe should not be static and that new market research can be beneficial because a larger universe increases breadth, which has the potential to increase risk-adjusted returns (see e.g. Grinold and Kahn 2011).

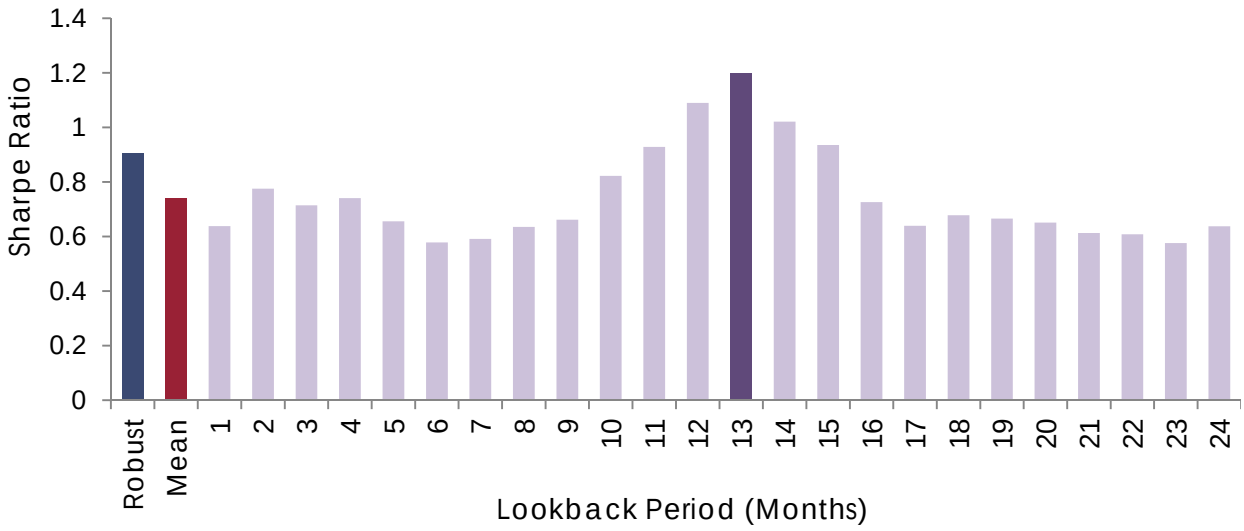
RESEARCH APPROACH

Nuances involved in signal generation and portfolio construction can have significant effects on return characteristics. One of the biggest obstacles in successfully extracting ARP is the issue of backtest overfitting and multiple selection bias (see e.g. Harvey et. al. 2016). All backtests are inherently biased, but the degree of bias depends on how much in-sample optimization has taken place. In our experience it is imperative to evaluate results on a walk-forward basis and

minimize the amount of bias by employing robust modeling techniques such as parameter averaging. This can lead to better out-of-sample performance and more reliable backtest results.

Exhibit 5 below shows simulated Sharpe Ratios of a hypothetical cross-asset momentum models with different look backs. A common approach is to select the best in-sample parameter (13 months in this case). Of course, in-sample results of optimal parameters are highly unreliable because they suffer from high selection bias. It can be a good policy to select a robust average of parameters instead, shown in the blue bar in the figure below. The Sharpe ratio of the robust average tends to benefit from diversification and suffers from far less selection bias than optimal parameters chosen in-sample.

Exhibit 5: Sharpe Ratios for Different Look backs of a Multi-Asset Momentum Model
Jan 1990 – Dec 2018



Source: Gresham. The x-axis shows number look back months of a momentum index signal and the y-axis shows Sharpe ratios.

Diversification among modeling frameworks can be even more important than diversification among parameters. Not all modeling frameworks work all of the time, but different frameworks tend to underperform at different times. While the targeted premia such as carry or value are important, returns and risk characteristics can vary significantly based on the modeling approach employed. Timmermann (2006) provides a framework for determining when robust modeling techniques such as forecast combinations are likely to be effective – namely, when different forecasts are based on different data and/or techniques, and the forecast biases are relatively uncorrelated. In these circumstances, forecast combinations can provide both more information and less noise.

The quality of the data used for backtests represents a challenge and can be a significant source of error. Commodity futures and options data presented in this paper have been reviewed thoroughly for errors. All indices shown start in January of 2007 whereas benchmark data start dates range from December of 2006 to March of 2013.

EMPIRICAL EVIDENCE FOR ALTERNATIVE RISK PREMIA IN COMMODITIES

It is noteworthy that identical risk premia often have low correlation across asset classes. Exposure to these premia in the commodity space can be beneficial even if an investor already has exposure to risk premia in other asset classes. Discrete commodity ARP have even lower correlation to risk premia across assets as well as to established premia in commodities. The case for commodity ARP is strengthened further by comparisons to asset classes such as equities, bonds, commodities and hedge funds.

Exhibit 6a: Diversification Potential of Commodity Risk Premia

Weekly correlations of commodity risk premia indices vs. other asset risk premia

Jan 2014 – Dec 2018

		Commodities				
	Risk Premia	**Momentum**	**Carry**	**Value**	**Volatility**	**Discrete**
Equities	**Momentum**	0.20	0.15	-0.05	0.21	0.12
	Carry	-0.04	0.02	-0.12	0.14	0.03
	Value	-0.07	0.00	-0.21	0.19	-0.05
	Volatility	0.13	0.14	-0.08	0.23	0.02
Currencies	**Momentum**	0.41	0.14	0.10	0.03	0.00
	Carry	-0.11	-0.04	-0.04	0.23	0.06
	Value	-0.01	0.03	0.01	-0.01	0.01
	Volatility	0.04	0.08	0.01	0.21	0.07
Credit	**Momentum**	0.15	0.16	0.12	0.10	-0.01
	Carry	-0.02	-0.04	-0.04	0.11	-0.03
	Volatility	0.10	0.08	0.06	0.10	-0.06
	Combined	0.21	0.19	0.00	0.27	0.05

Source: Gresham, Bloomberg, HFR.

Exhibit 6b: Diversification Potential of Commodity Risk Premia

Weekly correlations of commodity risk premia indices vs. other assets classes

Jan 2007 – Dec 2018

	Commodities				
Asset Class	**Momentum**	**Carry**	**Value**	**Volatility**	**Discrete**
Equities	-0.10	-0.05	-0.07	0.26	0.01
Bonds	0.02	0.07	-0.03	0.03	-0.02
Commodities	-0.01	0.01	-0.01	0.22	-0.23
Hedge Funds	0.14	0.06	-0.03	0.30	0.05

Source: Gresham, Bloomberg. The exhibit shows correlations between ARP in commodities using Gresham indices (columns) with well-known risk premia in other asset classes (rows). Risk premia in other asset classes are represented by HFRX risk premia indices. The row labeled "combined" is an equal risk weighted average of all the HFR risk premia indices above. Correlations above 0.3 are denoted in red. Equities, Bonds, Commodities & Hedge Funds are represented using the S&P500 Total Return Index, Bloomberg Barclays U.S. Bond Aggregate, Bloomberg Commodity Total Return Index and the HFRX Global Hedge Fund Index respectively.

Above we also present correlations of commodity ARP to long-only asset classes and hedge funds. Correlations are mostly negative or moderately positive to both long-only asset classes and hedge funds. This suggests that commodity ARP may complement modern portfolios exposed to equities, bonds, commodities and hedge funds.

Exhibit 7 shows that a substantial number of commodity ARP had attractive Sharpe ratios in the past. We caution never to take simulated results at face value and believe that the results below need to be significantly adjusted downward to reflect future expected performance. However, valuable information may be present in the relative performance of premia. Notably, discrete ARP tend to have the highest risk-adjusted returns, which suggest that only focusing on momentum, carry, value and volatility may not effectively capture absolute return opportunities in commodities. The strong evidence on the aforementioned commodity ARP coupled with low correlations, suggests that a commodity ARP composite may be successful.

Exhibit 7: Sharpe Ratios of Alternative Risk Premia in Commodities

Sharpe ratios of different risk premia indices in commodities

Jan 2007 – Dec 2018

	Commodities				
	Momentum	**Carry**	**Value**	**Volatility**	**Discrete**
Sharpe Ratio	0.54	0.86	0.72	0.80	2.54

ARP in commodities is shown using Gresham indices.

BUILDING A DIVERSIFIED ALTERNATIVE RISK PREMIA COMPOSITE IN COMMODITIES

One challenge we face is selecting a complementary set of risk premia from a potentially vast number of candidates. The vetting process is a critical determinant of the effort's success. Economic intuition and domain expertise can help identify premia that are likely to persist. This aspect of the ARP vetting process is hard to quantify and deep institutional expertise can be advantageous in the risk allocation process.

Quantitative factors are equally important in the selection process. In addition to common criteria such as Sharpe Ratio, drawdowns and correlations to other premia, the distribution of returns is also an essential factor. In order to assess the validity of a premium, return series with negatively skewed returns and fat tails require a much longer history than normally distributed return series as demonstrated by de Prado 2014.

Many ARP in the commodity space have low correlations to each other. Because of the idiosyncratic nature of the asset class, more statistically independent ARP can be harvested than in other asset classes. Low correlations and a relatively large number of independent bets suggest that a composite can do even better than its constituents. Each of the ARP can go through difficult periods, but not necessarily at the same time. Therefore, combining premia with low correlations to each other can reduce risk and can lead to higher risk-adjusted returns.

ADJUSTING THE COMPOSITE FOR MULTIPLE SELECTION BIAS

All simulations are necessarily biased because they suffer from multiple selection bias and there can be crowding over time. We penalize the composite's returns (we assume the discount to be 50% of the average monthly return adjusted for estimated transaction costs) to provide a more realistic estimate of performance. The resulting index portfolio has an average annualized total return of 12.75% with an annualized volatility of 10.21%. The Sharpe ratio is reduced by approximately 50% to 1.25. We show the adjusted composite in Exhibit 8.

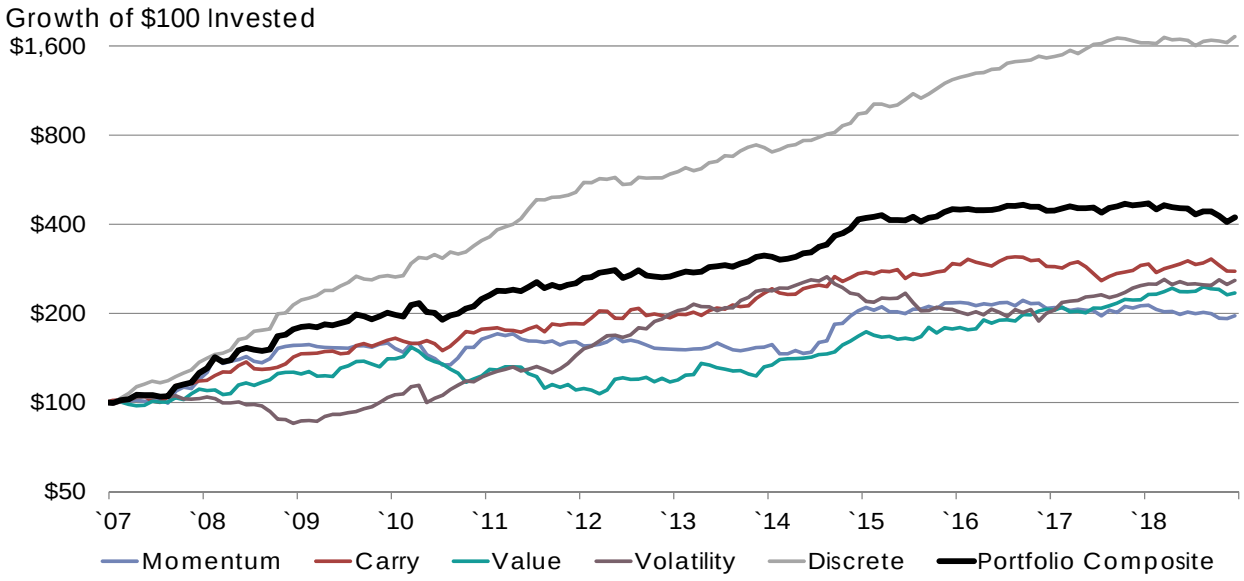
A COMMODITY ARP COMPOSITE

Exhibit 8 below presents cumulative excess returns of individual commodity ARP indices unadjusted for biases including selection bias. While value, carry, momentum and volatility perform well, discrete ARP have the strongest historical results. The combined portfolio equal risk-weights constituent indices and its return is then adjusted for biases and transaction costs in order to conservatively reflect expected performance.

Exhibit 8: Gross Cumulative Returns of Commodity ARP indices

Cumulative return chart of select ARP in commodities including the adjusted composite

Jan 2007 – Dec 2018



Source: Gresham. All ARP indices and the combined index composite are standardized to 10% volatility. Results are in excess of 3-month T-bills. Past results are not necessarily indicative of future results. Commodity Trading Involves Substantial Risk of Loss.

A COMMODITY ARP COMPOSITE AS A PORTFOLIO DIVERSIFIER

We believe that ARP derived from commodities have the potential to provide substantial utility to modern investment portfolios. Given that ARP have historically had low correlations to traditional long-only assets, as shown in Exhibit 9, they can potentially reduce risks in institutional portfolios. Low correlations are driven by the market neutral implementation of many ARP which helps to eliminate traditional beta exposure. This contrasts with typical hedge fund indices that frequently have positive and significant relationships with equity markets because many hedge fund styles such as long/short equity tend to have positive beta exposure. All returns shown are inclusive of 90-day U.S. T-bills.

Exhibit 9: Commodity ARP Composite Correlation to Asset Classes

Monthly correlations between a commodity ARP composite and traditional asset classes

Jan 2007 – Dec 2018

	Equities	Bonds	Commodities	Hedge Funds
Commodity ARP	-0.04	-0.06	-0.11	0.05

Stocks are represented by the S&P500Total Return Index, Bonds by the Bloomberg Barclays U.S. Bond Aggregate, and Hedge Funds by the HFRX Global Hedge Fund Index. Commodities are represented by Gresham's portfolio index composite. Returns are assumed to be fully collateralized with 90 day T-bills.

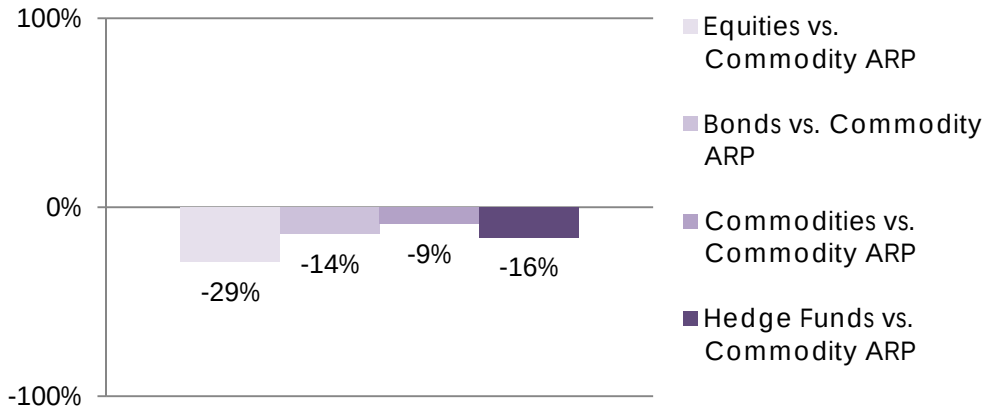
While average low correlations are desirable, they often do not persist during crises. Page and Panariello 2018 demonstrate that correlations for traditional long-only assets tend to increase dramatically during times of stress: diversification fails when it is needed most. Below we examine correlations of the commodity ARP composite with long-only asset classes and hedge funds in the top 5% of days and in the bottom 5% of days for each asset class. We find that correlations were lower during the worst days than during the best days, which indicates that historically commodity ARP have continued to provide diversification in times of crises.

Exhibit 10: Daily Left-Tail vs. Right-Tail Correlations for Key Risk Assets

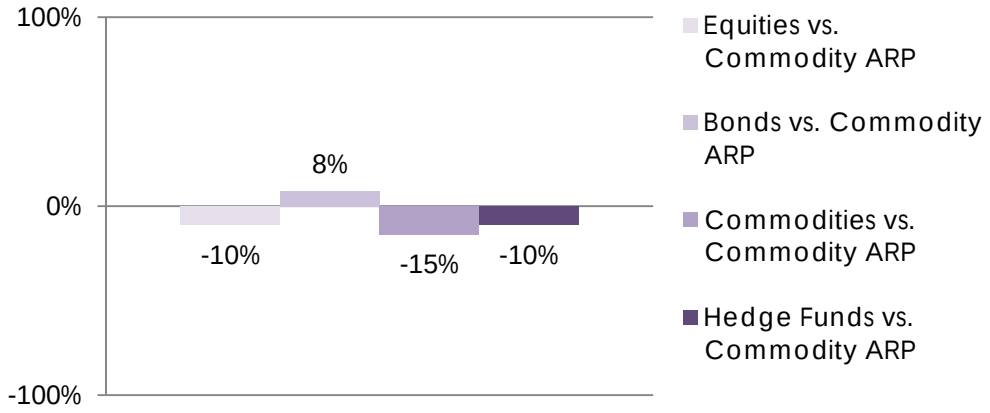
Daily correlations of 5% worst/best days of stocks, bonds, commodities & hedge funds to commodity ARP

Jan 2007 – Dec 2018

Left Tail (<5% Percentile)



Right Tail (>95% Percentile)



Source: Gresham, Bloomberg. Stocks are represented by the S&P500, Bonds by the Bloomberg Barclays U.S. Bond Aggregate, and Hedge Funds by the HFRX Global Hedge Fund Index. Commodities are represented by Gresham's composite index composite. Returns are assumed to be fully collateralized with 90 day T-bills. It is not possible to invest directly in an index.

Finally, we examine if it may be beneficial to add the commodity ARP composite to representative risk premia allocations. Exhibit 11 demonstrates that adding the ARP composite to the Eurekahedge Multi-Factor Risk Premia Index substantially improves return characteristics. This suggests that commodity ARP may not be

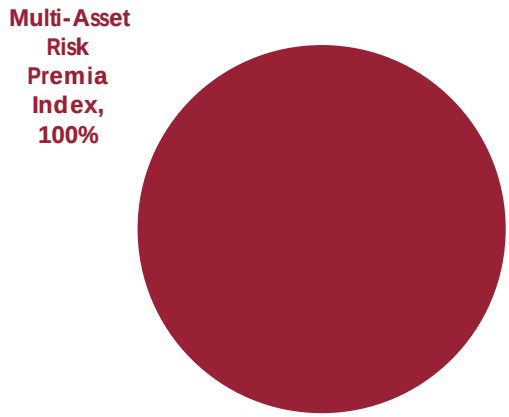
effectively captured by off-the-shelf risk premia products, and that commodity expertise can help to extract return streams that complement other approaches.

Exhibit 11: Simulated Impact of Adding a Commodity ARP Composite to a Risk Premia Portfolio

Performance statistics of a risk premia portfolio vs. adding 20% commodity ARP composite

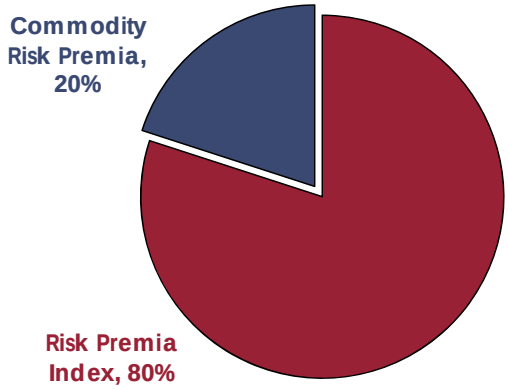
Sep 2010 – Dec 2018

Multi-Asset Risk Premia Index



Average Annualized Total Return	3.03%
Volatility	4.54%
Sharpe	0.57
Maximum Drawdown	-11.55%

Adding 20% Commodity Risk Premia



Average Annualized Total Return	4.46%
Volatility	4.57%
Sharpe	0.88
Maximum Drawdown	-11.04%

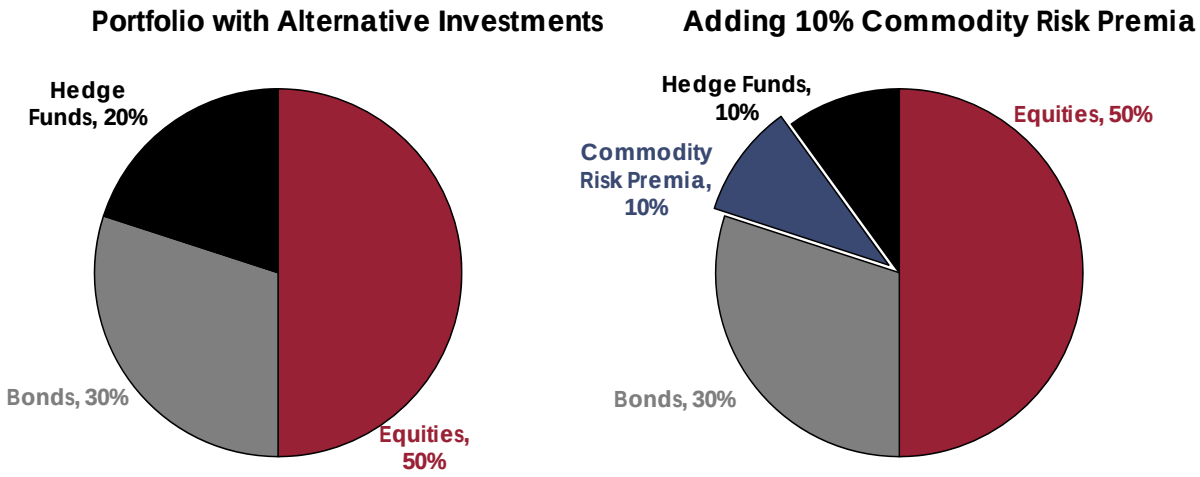
Source: Gresham, EurekaHedge. Past results are not necessarily indicative of future results. Multi-Asset Risk Index is the EurekaHedge Multi-Factor Risk Premia Index. Commodity Risk Premia are represented by Gresham's composite index. Returns are assumed to be fully collateralized with 90 day T-bills. Commodity Trading Involves Substantial Risk of Loss.

In Exhibit 12 on the next page we show return characteristics for a 50/30/20 portfolio and the same portfolio with a 10% allocation to commodity ARP using the adjusted composite from above. Adding a hypothetical commodity ARP composite increases returns while reducing volatility and drawdowns.

Exhibit 12: Simulated Impact of Adding a Commodity ARP portfolio to a 50/30/20 Allocation

Performance statistics of a 50/30/20 stocks, bonds, hedge fund portfolio vs. adding 10% commodity ARP composite

Jan 2007 – Dec 2018



Average Annualized Total Return	5.13%	Average Annualized Total Return	6.62%
Volatility	6.45%	Volatility	6.23%
Sharpe	0.75	Sharpe	1.02
Maximum Drawdown	-8.84%	Maximum Drawdown	-7.15%

Source: Gresham, Bloomberg, Hedge Fund Research. Past results are not necessarily indicative of future results. The 50/30/20 portfolio is represented by a 50% allocation to the S&P500 Total Return Index, a 30% allocation to the Bloomberg Barclays U.S. Bond Aggregate, and a 20% allocation to HFRX Global Hedge Fund Index. Commodity Risk Premia are represented by Gresham's portfolio index composite. Returns are assumed to be fully collateralized with 90 day T-bills. Commodity Trading Involves Substantial Risk of Loss.

CONCLUSION

The unique market structure of commodity futures provides the opportunity to extract more independent ARP than in other asset classes. Moreover, we find that different modeling approaches and implementation can lead to a wide range of outcomes even for well understood risk premia. Coupled with low correlation to broad ARP benchmarks, these suggest that adding commodity risk premia may be advantageous and helpful to investors even if they already have exposure to alternative risk premia. Commodity ARP can improve the risk-return characteristics of modern investment portfolios and can also add value to core risk premia benchmarks. We believe that commodity ARP can provide risk mitigation during times of equity and bond market stress because of their diversifying nature.

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LEGAL DISCLOSURES

HYPOTHETICAL OR SIMULATED PERFORMANCE RESULTS HAVE MANY INHERENT LIMITATIONS, SOME OF WHICH ARE DESCRIBED BELOW. NO REPRESENTATION IS BEING MADE THAT ANY ACCOUNT WILL OR IS LIKELY TO ACHIEVE PROFITS OR LOSSES SIMILAR TO THOSE SHOWN. IN FACT, THERE ARE FREQUENTLY SHARP DIFFERENCES BETWEEN HYPOTHETICAL OR SIMULATED PERFORMANCE RESULTS AND THE ACTUAL RESULTS SUBSEQUENTLY ACHIEVED BY ANY PARTICULAR TRADING PROGRAM.

ONE OF THE LIMITATIONS OF HYPOTHETICAL OR SIMULATED PERFORMANCE RESULTS IS THAT THEY ARE GENERALLY PREPARED WITH THE BENEFIT OF HINDSIGHT. IN ADDITION, HYPOTHETICAL OR SIMULATED TRADING DOES NOT INVOLVE FINANCIAL RISK, AND NO HYPOTHETICAL OR SIMULATED TRADING RECORD CAN COMPLETELY ACCOUNT FOR THE IMPACT OF FINANCIAL RISK IN ACTUAL TRADING. FOR EXAMPLE, THE ABILITY TO WITHSTAND LOSSES OR TO ADHERE TO A PARTICULAR TRADING PROGRAM IN SPITE OF TRADING LOSSES ARE MATERIAL POINTS WHICH CAN ALSO ADVERSELY AFFECT ACTUAL TRADING RESULTS. THERE ARE NUMEROUS OTHER FACTORS RELATED TO THE MARKETS IN GENERAL OR TO THE IMPLEMENTATION OF ANY SPECIFIC TRADING PROGRAM WHICH CANNOT BE FULLY ACCOUNTED FOR IN THE PREPARATION OF HYPOTHETICAL OR SIMULATED PERFORMANCE RESULTS AND ALL OF WHICH CAN ADVERSELY AFFECT ACTUAL TRADING RESULTS.

Endnotes

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Glossary

Sharpe Ratio is the annualized return in excess of the risk free rate divided by annualized volatility
Annualized Volatility is the standard deviation of monthly returns, annualized
Correlation is calculated on a monthly basis between respective return streams in the tables

A Word on Risk

COMMODITY TRADING INVOLVES SUBSTANTIAL RISK OF LOSS.
All investments carry a certain degree of risk and there is no assurance that an investment will provide positive performance over any period of time. The value of a portfolio will fluctuate based on the value of the underlying securities.

Futures Markets May be Illiquid. Certain commodity exchanges limit fluctuations in commodity futures contract prices during a single day by regulations referred to as "daily price fluctuation limits" or "daily limits". During a single trading day one may not execute trades at prices beyond the daily limit. Once the price of a futures contract for a particular commodity has increased or decreased by an amount equal to the daily limit, one cannot take or liquidate positions in the commodity unless both a buyer and seller are willing to effect trades at or within the limit. In the past, commodity futures prices have moved the daily limit for several consecutive days with little or no trading. Similar occurrences, or regulatory interventions in the commodity markets, could prevent Gresham from promptly liquidating unfavorable positions and adversely affect trading and profitability.

Trading in Commodity Futures, Forwards, and Over-the-Counter Commodity Contracts is Speculative and Volatile. Prices for commodity futures, forward and over-the-counter commodity contracts are highly volatile. Price movements of commodity interests are influenced by, among other things, changing supply and demand relationships, governmental agricultural and trade programs and policies, climate and national and international political and economic events. Gresham cannot control any of these factors, and therefore can give no assurances that its strategies will be profitable or will not incur substantial losses. For these reasons and others, one should consider an investment in Gresham's strategies as long-term and speculative.

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