

# Commodities – A diverse and complex asset class



Demand for commodities exposure is soaring as investors seek to capitalise on long-term trends and diversify portfolios. The commodities asset class is, however, difficult to master. The investment community is still getting to grips with the fundamental drivers of commodity prices. This research paper highlights the knowledge needed to approach the asset class. It examines macroeconomic and long-term drivers of prices within the sector and sets out a number of considerations to take into account when trading commodities in the short-term.

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Commodities have grown rapidly as an asset class during the past decade, with investments by both institutional and retail investors surging over the last two to three years. Indeed, in a recent institutional investor survey conducted by Barclays, 69% of respondents noted that they intended to either initiate or increase their exposure to commodities over the coming year<sup>1</sup>.

Investing in commodities is not, however, a simple proposition. The asset class is extremely broad and taking a one-size-fits-all approach to investing in individual commodities is dangerous. Because many investors are moving into the asset class for the first time, it is not surprising that the investment community is still getting to grips with the fundamental drivers of commodity prices.

In theory, commodity prices should reflect the demand and supply equilibrium of physical goods, with uncertainty in pricing coming only from storage costs and the perishable nature of some commodities. Consequently, Vrugt-Bauer-Molenaar-Steenkamp (2004)<sup>2</sup> concluded that business cycles, the monetary environment and market sentiment variables can be used to tactically invest in commodities and deliver superior returns. In reality, however, determining the fair value of commodities is complex. This could be because of the uncertainty in determining supply (natural disasters, monopolistic decisions, political landscape) and demand (inventory, consumption, growth). Commodities also reflect our ever-changing consumption patterns, as technologies transform and economics shift.

This paper will firstly attempt to give readers an insight into the macroeconomic and long-term drivers of commodities prices. Secondly, the paper will set out a number of considerations that investors and fund managers should take into account when trading commodities in the short-term. We then conclude that when investing in commodities investors need to factor both long-term fundamentals and short-term trends into their investment processes.

### Long-term drivers of commodities prices

In this section, we discuss the bigger picture drivers of commodity prices and why you need to consider these issues when investing in commodities. We start by looking at global demand and the rise of emerging market economies, then analyse the winners and losers in the commodities sector throughout the business cycle. Finally, we look at volatility and correlation among different individual commodities and between commodities and commodity-related equities.

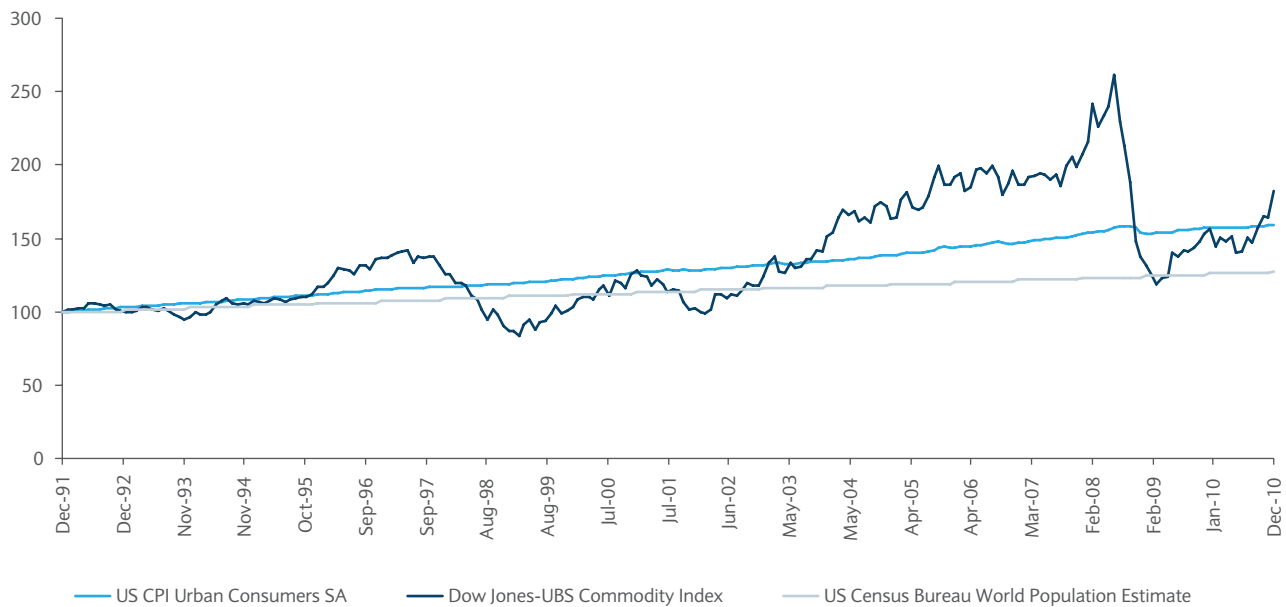
#### *Is rising demand correlated to commodity prices?*

Over the long term, commodities reflect demand-side trends. The attached graph shows that from 1991 to the present day, the DJ UBS Commodities Index has gone up 3.20% per annum, which is in line with rising consumption (demand) as reflected by the growth in global population (1.29% per annum) plus inflation (2.48% per annum).

<sup>1</sup> Barclays Commodities Investor Conference, December 2010

<sup>2</sup> Vrugt, E., Bauer R., Molenaar R., Steenkamp T., LIFE Working Paper 04 – 012 'Dynamic Commodity Timing Strategies'

Figure 1:<sup>3</sup>



Even in the agricultural sector we tend to find a high correlation between agriculture prices and broad demand side indicators over the long-term. If we consider the period from 1969 to the present day, the S&P GSCI Agriculture Index has gone up 5.48% per annum<sup>4</sup>, in line with rising consumption resulting from global population growth and inflation. However if we were to remove the decade of hyperinflation in the 1970s from our analysis, agriculture would look even more compelling from an investment perspective. Interestingly, since the end of the 1980s, growth in agriculture prices (0.06% per annum) has lagged both the growth in population (1.45% per annum) and inflation (3.17% per annum)<sup>5</sup> so in this sense we can conclude that the sector, although often described as over-valued, is still fundamentally cheap.

*What effect has the rise of emerging market economies had on commodity prices?*

The rise of emerging market economies over the last decade has fuelled a large rise in consumption that has not been met by a similar increase in supply. This higher demand, combined

with low supply, has been a key contributor to rising commodity prices. This demand for commodities has been a significant factor in rising inflation in both rapidly industrializing economies, such as China and Brazil and in countries that import raw materials, such as the US and Germany. This rise in commodity prices, which are largely priced in US dollars, is not, however, all it appears. Changes in currency valuations must be considered.

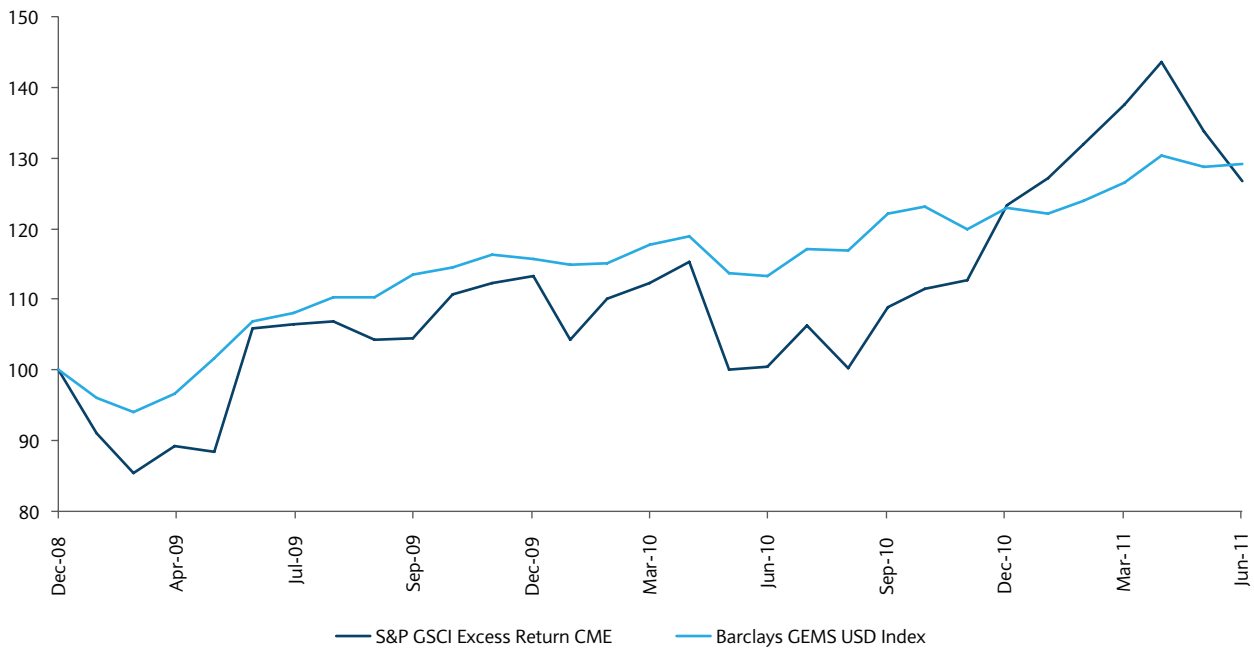
As an illustration, since the credit crisis in 2008, free-floating emerging market currencies have rallied by more than 22% against the US dollar, as shown in the below graph. The S&P GSCI Index of commodities also rallied by almost the same amount up to December 2010. Thus, in real terms, consumption-based economies (including emerging markets and frontier markets) have not seen real increases in commodity prices which are quoted and traded in US dollars. This means lower price elasticity of demand from emerging economies and hence makes US dollar quoted commodities investments attractive.

<sup>3</sup> Source: Bloomberg as at 7 July 2011, World Bank Website as at 20 July 2011

<sup>4</sup> Source: Bloomberg as at 7 July 2011

<sup>5</sup> Source: Bloomberg as at 7 July 2011

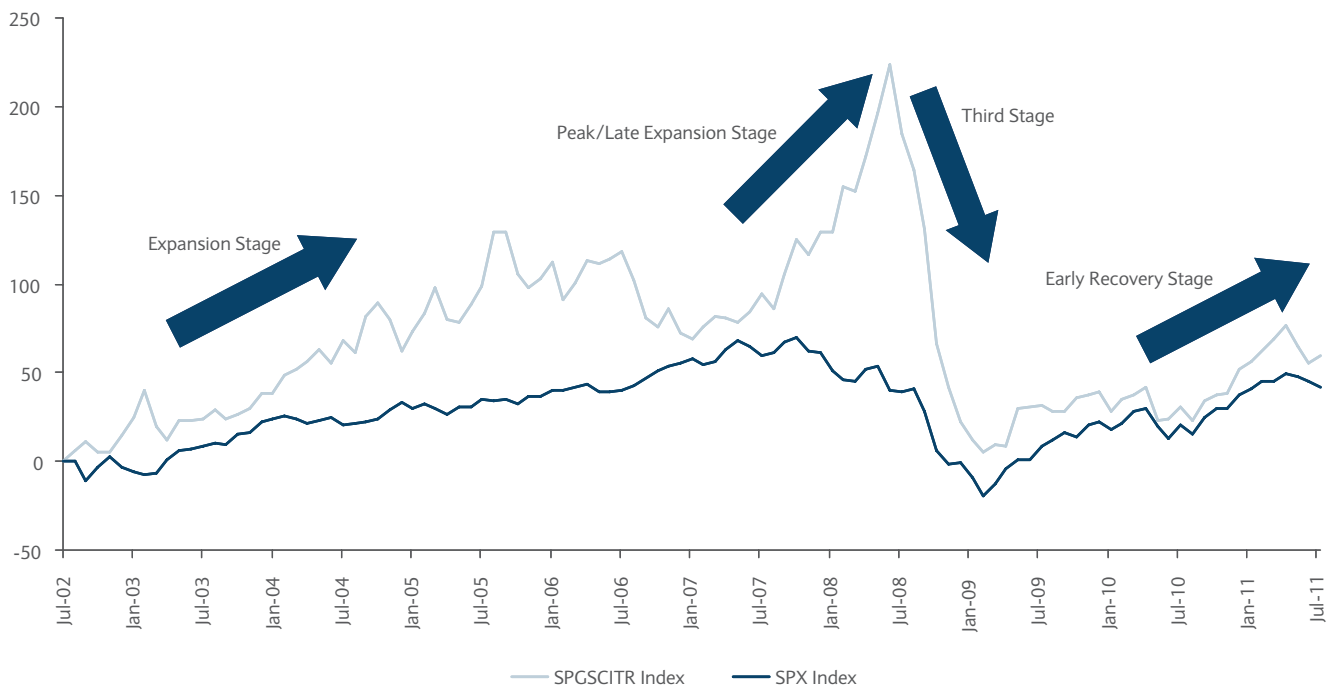
Emerging market currencies have appreciated at a similar rate as commodity prices<sup>6</sup>



Thus despite the current focus on the supply side economics for commodities, it is demand that seems to be determining trajectories in commodity prices. As our consumption patterns change, each commodity and its importance in our lives changes as well. We have gone through an era where lifestyle changes (for example the rising use of semiconductors increasing the demand for palladium), are now dominating consumption patterns and the rise of emerging market economies has created multiple consumption patterns that are reflected by rising and often volatile commodity prices.

*What effect do business cycles have on commodities?*

Commodity prices are correlated with the business cycle as commodity demand is largely driven by consumer consumption and industrial usage, both of which fluctuate during different phases of the business cycle. Different commodities are, however, impacted in different ways by the separate phases of the business cycle. Energy and industrial metals are heavily influenced by business activities and consumer confidence. Precious metals, particularly gold, are generally considered as a safe haven currency rather than a commodity. The commodities sector that is least impacted by the business cycle is agricultural commodities.



<sup>6</sup> Source: Bloomberg 7 July 2011, Barclays GEMS USD Index tracks the performance of 15 emerging market currencies

In the expansion stage of the business cycle, commodity prices generally follow a moderate uptrend. This stage starts with supportive monetary and fiscal policies, encouraging manufacturers to build up inventories and improving consumer confidence on the back of falling unemployment. The yield curve is upward sloping and the stock market rises. Both industrial metals and energy are likely to gain in this cycle, particularly crude oil, which is widely used in industrial production and consumer consumption such as transportation.

In the peak/late expansion stage, commodities prices continue their upward trend. The late expansion stage is normally characterized by a flattening yield curve, volatile stock markets, soaring labor costs, higher-than-trend inflation and restrictive monetary policies. Unlike equity markets, commodities tend to perform strongly during this stage. This can be partially explained by investors' demand for an inflation hedge. In this period, gold in particular, attracts investments as both a safe haven currency and a means to preserve purchasing power.

In the third stage of the business cycle, the economy tends to grow at a very low rate or even fall into recession. Commodities generally suffer in this period as inflation pressure recedes and real demand sinks. The contraction stage is normally characterized by supporting fiscal and monetary policy, negative returns on stock markets, increasing unemployment and low inflation or deflation. Most commodities tend to experience large price corrections during this period. In addition, as the use of derivatives has increased, volatility, which is often experienced during this stage, has grown more intense. Gold tends to suffer less compared to other commodities as investors pull money from risky assets and invest in safe-haven currencies and securities.

In the early recovery stage, the economy starts to show early signs of green shoots and commodities prices start to recover. Investor confidence is still very weak, and prices tend to be highly volatile. This stage is normally characterized by a bottoming-

out of short-term interest rates, a steep yield curve, recovering stock markets, a moderate recovery in the job market and slightly higher inflation. Manufacturers also start to rebuild their inventories in order to prepare for the full recovery. Energy and industrial metals prices tend to recover well during this period, and gold benefits from loose monetary policy creating some inflation pressure.

Although the above mentioned phases of the business cycle give investors a broad indication of the returns they might expect from commodity investments, it is important to note that predicting a change in the business cycle is not straightforward. For instance the highs reached by many commodities in July 2008 have not yet been matched despite other risky assets reaching that point in 2010. Global dynamics are changing, which introduces further complications. Economic cycles are now global and a large number of economies need to be considered to ascertain demand. An investment process that can dynamically look at a number of indicators to predict business cycles leads to better timing in commodities investments.

#### *Are Individual Commodities Highly Correlated?*

Many investment managers and investors see commodities as an amorphous asset class, which although part of the 'alternative investments' group of assets, is nevertheless simple to understand. Indeed, a senior investment consultant has been quoted as stating that: 'Commodities are a relatively easy asset class to understand and to invest in, so they provide low hanging fruit for pension funds' diversification purposes'<sup>7</sup>. This is incorrect and simplistic. Individual commodities react in very different ways to market shocks. As an asset class, commodities are as complex and diverse as equities. This can be effectively demonstrated by looking at correlation statistics.

The below table, sets out correlations between 8 different commodity futures from 31 December 1999 to 30 December 2010:

#### **The correlation between commodities varies widely<sup>8</sup>**

	Gold	Gasoline	Heating Oil	Crude Oil	Natural Gas	Copper	Wheat	Soy Beans
Gold	1.00							
Gasoline	0.20	1.00						
Heating Oil	0.24	0.82	1.00					
Crude Oil	0.20	0.83	0.88	1.00				
Natural Gas	0.15	0.34	0.46	0.34	1.00			
Copper	0.27	0.38	0.35	0.37	0.06	1.00		
Wheat	0.27	0.12	0.19	0.19	0.08	0.23	1.00	
Soy Beans	0.09	0.09	0.16	0.17	0.08	0.23	0.52	1.00

<sup>7</sup> Financial Times, FTfm section, March 20,2006, p3

<sup>8</sup> Source: Bloomberg, Barclays as at 30 December 10

Even commodities within each of the sectors (which we divide into energy, precious metals, industrial metals and agriculture) exhibit little correlation. For example gasoline and natural gas, both part of the energy sector, have a low correlation of 0.34. Similarly wheat and soy beans have a correlation of just 0.52. On the other hand, a number of commodities within each sector do demonstrate high correlation, for example within energy the correlation between gasoline and crude oil is 0.83. Intuitively this makes sense as gasoline is a product derived from crude oil, and demand for one should therefore be reflected in demand for the other.

Perhaps more interesting are the low correlations between individual commodities in different groups. The correlation between natural gas and copper, for instance, is only 0.06. This low correlation between individual commodities is reflected throughout the table. The explanation for this is that individual commodities are all driven by different fundamentals. For example, copper prices rise and fall in line with worker strikes, shipping problems and political unrest in Chile, Peru and South Africa, as well as with Chinese demand. Natural gas, on the other hand, is heavily influenced by changes in the weather and US storage levels. It is therefore unsurprising that the correlation between the two commodities is only 0.06.

A fund manager therefore needs firstly to understand the key drivers of each commodity, and secondly to develop and make use of a systematic method which identifies expected price changes as a function of fundamental shifts. An investor wishing to invest in the sector must keep in mind the low correlations between individual commodities; a diversified portfolio will contain a broad mix of assets. This rule of thumb is as appropriate for commodities as it is for equities.

#### *Are commodities correlated to resource stocks?*

Investors in resource intensive countries like Australia have access to some of the world's largest resource companies through their domestic stock markets, such as BHP Billiton and Rio Tinto. These two companies mine and produce most precious and industrial metals, as well as iron ore and coal (which are not considered liquid commodities due to the contact pricing system). BHP Billiton also offers exposure to oil and gas production. Many Australian investors therefore don't see the need to invest in commodities as an asset class given their exposure to both these companies through the equity market.

Perhaps counter intuitively, however, individual commodities are not highly correlated to either of these two stocks. Table 2, below, sets out correlations between equities and commodities (from 31 December 1999 to 30 December 2010):

The correlation between both BHP Billiton and Rio Tinto and the ASX 200 is high; largely because the two companies together form a significant proportion (15.83%) of the index<sup>10</sup>. Conversely, neither company's performance is highly correlated with either the S&P GSCI Excess Return Index or the Dow Jones-UBS Commodity Index (two of the most referenced commodities indexes). Investing in either of the two companies does therefore not give an investor the same diversification benefits as investing directly in commodities.

Investors wishing to diversify by investing in commodities cannot therefore rely on their exposure to Australian resource stocks; a direct investment is necessary.

#### The correlation between commodities and some commodity-related equities is not always strong<sup>9</sup>

	BHP	Rio Tinto	S&P 500	ASX 200	S&P GSCI Excess Return Index	Dow Jones-UBS Commodity Index
BHP	1.00					
Rio Tinto	0.60	1.00				
S&P 500	0.46	0.41	1.00			
ASX 200	0.61	0.51	0.80	1.00		
S&P GSCI Excess Return Index	0.34	0.30	0.25	0.30	1.00	
Dow Jones-UBS Commodity Index	0.40	0.34	0.34	0.34	0.90	1.00

<sup>9</sup> Source: Bloomberg as at 30 December 2010

<sup>10</sup> [http://www.spdr.com.au/etf/fund/fund\\_holdings\\_STW.html](http://www.spdr.com.au/etf/fund/fund_holdings_STW.html)

## Are commodities inordinately volatile?

Commodities have a reputation for volatility. Clearly this reputation is partly justified; short-term changes in weather patterns, for instance, can lead to large swings in the agricultural and energy sectors. The asset class is not, however, as volatile as investors might assume. It is our view that excess volatility is therefore not a reason to avoid investing in the sector.

A study by Kat -Oomen<sup>11</sup> (2006) calculated a number of volatility measures for 42 individual commodities for the period from 1987 to 2005. The results do show that some individual commodity futures can be very volatile; for example electricity at 56.1% and sugar at 41%. Clearly investing in only one or two commodities is a risky proposition! Average annualised volatility across all 42 commodities was only 27.8%. The study calculated that the volatility of the average US large cap stock is 29.5%.

Thus the average commodity is actually slightly less volatile than the average US large cap stock. Investors should bear this in mind when considering an investment in commodities; as with any asset, diversifying reduces volatility.

### Short-term drivers of commodity prices

Like any financial instruments, commodity prices are also impacted by short-term drivers. Although these short-term drivers may not impact commodity prices in the long run, they do tend to impact the volatility of returns. In a paper on the drivers of commodity prices, Ilmanen has shown<sup>12</sup> that these short-term factors have persisted for a substantial part of market history by looking at a number of these factors, such as trend, roll yield, inflation, seasonality and cyclicity across commodities (amongst other asset classes). Some of these factors are being actively used by Commodity Trading Advisor (CTA) hedge funds and others are taken into account by fundamental investors in their strategic asset allocation process. These factors have not significantly changed in importance, however as seen from the August 2007 'Quant led Crash' in the markets, some of these factors have become, or are on track to become, crowded out.

In the following section we will measure the impact and predictability of a number of short-term factors that we believe are important considerations for any commodity investor wanting to manage downside risk and volatility. It becomes clear when investigating the effect of these short-term factors that none of them can individually predict commodity prices on an ongoing basis. It is therefore essential that investment professionals use these short-term indicators together, and in conjunction with longer-term indicators, in order to make useful predictions on commodity prices.

### Can inflation expectations impact energy prices?

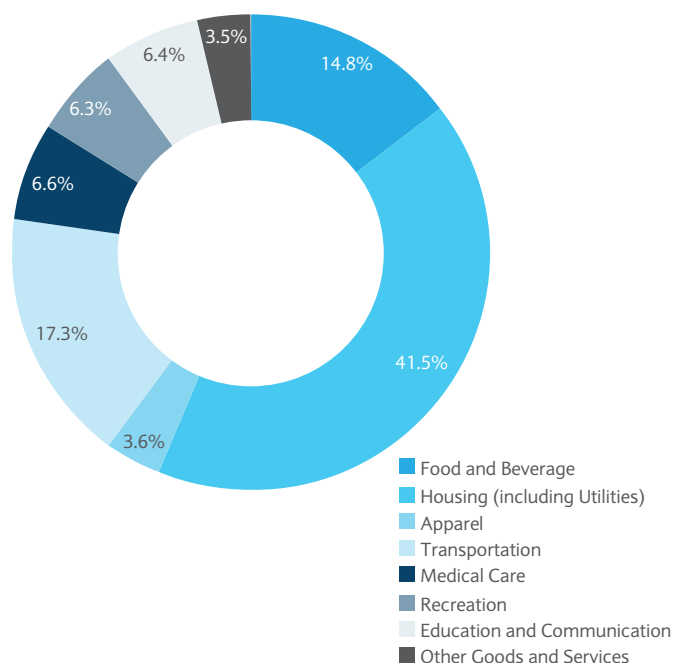
Commodity related components make up about 40% of the US CPI total, including energy with about 9.07%. Energy is mainly used in housing and transportation, soft commodities in food, beverage and apparel and industrial metals throughout the CPI basket.

<sup>11</sup> What Every Investor Should Know About Commodities (Part 1), Cass Business School

<sup>12</sup> Ilmanen, Antti Expected Returns. An Investor's Guide to Harvesting Market Rewards. Wiley Finance 2011

<sup>13</sup> Source: United States Department of Labor, Bureau of Labor Statistics as of December 2010

US CPI Breakdown<sup>13</sup>



While it may be apparent that rising commodity prices cause high inflation expectations, it is also worth examining the relationship the other way – how inflation expectations can impact commodity prices. Inflation expectations can be obtained from both consumers and professional forecasters and we review each category below to see if they assist in predicting energy prices.

Firstly, we can look at the University of Michigan Survey 1 Year Ahead Inflation expectation as a representative measure of consumer inflation expectations. Each month, a randomly selected sample of around 500 American households are surveyed about expected changes to key macroeconomic variables such as inflation, interest rates, and unemployment. Since 1977, respondents have been asked the following question about inflation: 'By about what percent do you expect prices to go (up/down) on average, during the next 12 months?'. The following graph depicts the relationship between the levels of the S&P GSCI Crude Oil Index and the University of Michigan Survey 1 Yr Ahead Inflation Expectation with a one month lag. The graph shows inflation expectations seemingly lagging behind energy prices, which implies that changes in energy prices actually increase/decrease consumers' expectations of inflation. Looking at the relationship the other way, consumers' inflation expectations only predict the next month's crude oil return correctly 56% of the time. Breaking down this analysis into two parts, when consumers increase their inflation expectations, they have been correct 61% of the time in the past 10 years. However, when they lower their inflation expectations, they are only right about 50% of the time.

### Consumer's inflation expectations are not always accurate<sup>14</sup>

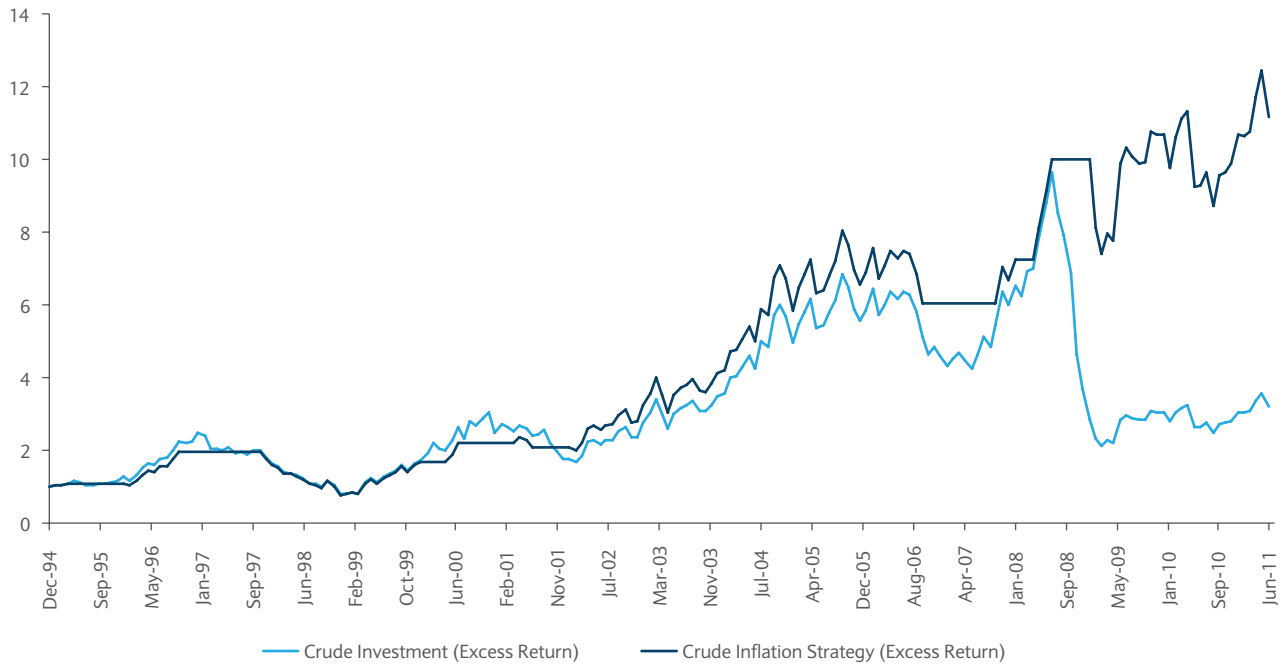


Secondly, we can examine professional forecaster's inflation expectations. Each quarter, the Federal Reserve Bank of Philadelphia publishes median forecasts for 1 Year Ahead and 10 Year Ahead inflation from a survey of professional forecasters. The 10 year professional forecaster's inflation number is fairly stable and we can take it as a long-term inflation trend. The 1 Year Ahead inflation number is a short-term forecast and

tends to be more closely linked to expectations of near-term energy prices.

We ran a model that makes a long investment in crude oil if short-term inflation expectations are above or equal to long-term inflation expectations and disinvests from crude oil if they are not. The results are set out below.

### Inflation expectations as part of a crude-oil investment strategy<sup>15</sup>



Performance Indicators (Dec 2000-Mar 2009)	Crude Investment (Excess Return)	Crude Inflation Strategy (Excess Return)
Annualised monthly return	7.31%	15.82%
Annualised monthly volatility	33.97%	27.77%

<sup>14</sup> Source: Bloomberg as 7 July 2011

<sup>15</sup> Source: Bloomberg as 7 July 2011, Barclays



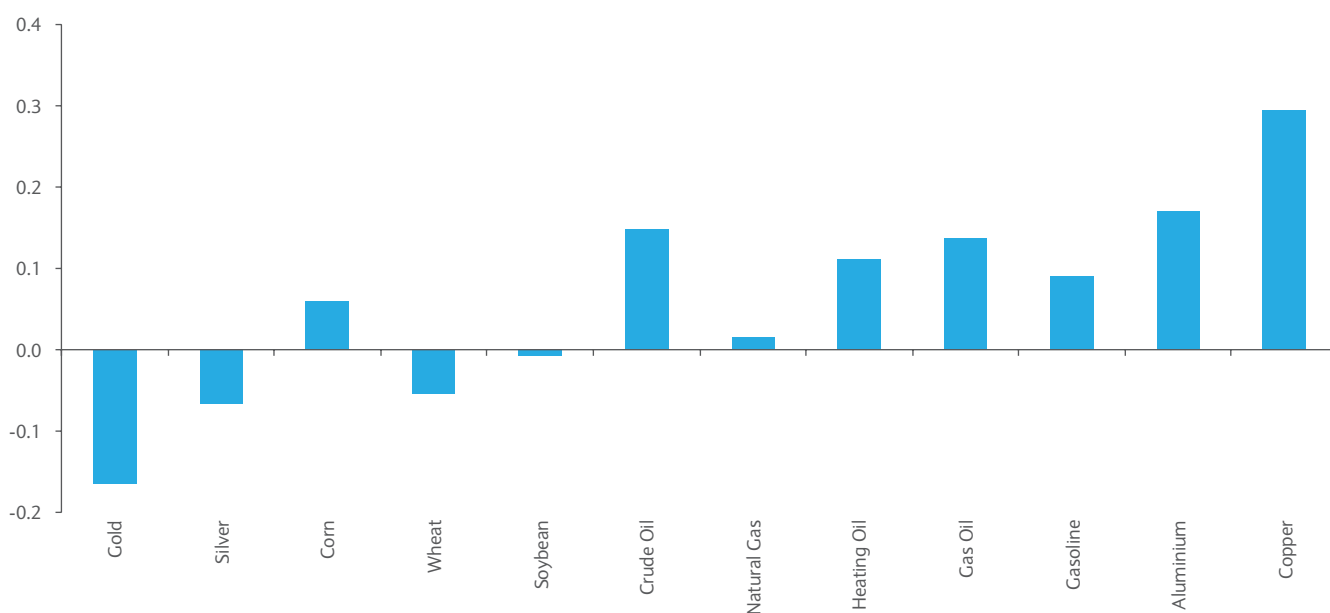
During the period from 1994 to 2011 the 'inflation expectation' strategy outperformed the 'buy and hold' strategy in energy. If we drill down we can see a large period of underperformance for the 'inflation expectation' strategy from 1994 to 2001. There are multiple reasons for this, including the 2000 credit boom and changes in inflation inputs from US property to emerging market demographics. Inflation expectations can thus be used as an indicator of short-term changes in commodity prices, however not a standalone basis. An asset manager should use a blend of indicators in order to get a broader, more accurate forecast.

*What effects do momentum and short-term market anomalies have on commodity prices?*

In order to determine the relevance of momentum and short-term market anomalies on commodity prices we investigate whether the previous month returns give any guidance for the performance of a following month. We completed a monthly self regression on the returns of twelve major commodities. The results seems more encouraging in the industrial metals and energy sectors compared to the precious metals sector and are inconclusive for the agricultural sector.

### Month-on-month momentum varies by commodity<sup>16</sup>

Correlation between monthly excess return with 1 month lag



From the above chart, we can see that gold and silver's previous month excess returns have a negative relationship with the next month's returns, which means these commodity prices tend to revert to certain levels. This may indicate that gold and silver fit into a mean reversion rather than a momentum model.

dampening the correlation numbers. Amongst the commodities in the energy sector, crude oil leads the self correlation table whilst in the industrial metals sector, both aluminium and copper have high self correlations.

The self correlations of the three agriculture commodities Corn, Wheat and Soy bean, are benign; the previous month's return isn't any kind of useful indicator for the next month. This is not surprising as agricultural commodities are perishable and heavily influenced by unpredictable factors such as the weather. The seasonal demand character of these crops is another factor

In order to test the effectiveness of a momentum strategy, we looked at a model which uses previous month returns as a signal to determine next month allocations. If the previous month's return was positive, the model goes long the commodity for the next month. The hit ratios of the 12 commodities are set out in the below table:

### Hit ratios for 12 commodities<sup>17</sup>

	Gold	Silver	Corn	Wheat	Soy bean	Crude Oil	Natural Gas	Heating Oil	Gas Oil	Gasoline	Aluminium	Copper
Jan 99- May 2011	47.1%	48.5%	50.7%	44.9%	50.7%	53.7%	59.6%	55.1%	49.3%	55.1%	50.7%	57.4%
Bull Market (Jan 2002- Dec 2007)	44.4%	41.7%	51.4%	50.0%	48.6%	54.2%	54.2%	54.2%	52.8%	55.6%	47.2%	47.2%
Bear Market (Jul 2008- Mar 2009)	44.4%	66.7%	55.6%	55.6%	77.8%	77.8%	88.9%	77.8%	55.6%	77.8%	77.8%	77.8%

<sup>16</sup> Source: Bloomberg as 7 July 2011

<sup>17</sup> Source: Bloomberg, Barclays as at 7 July 2011

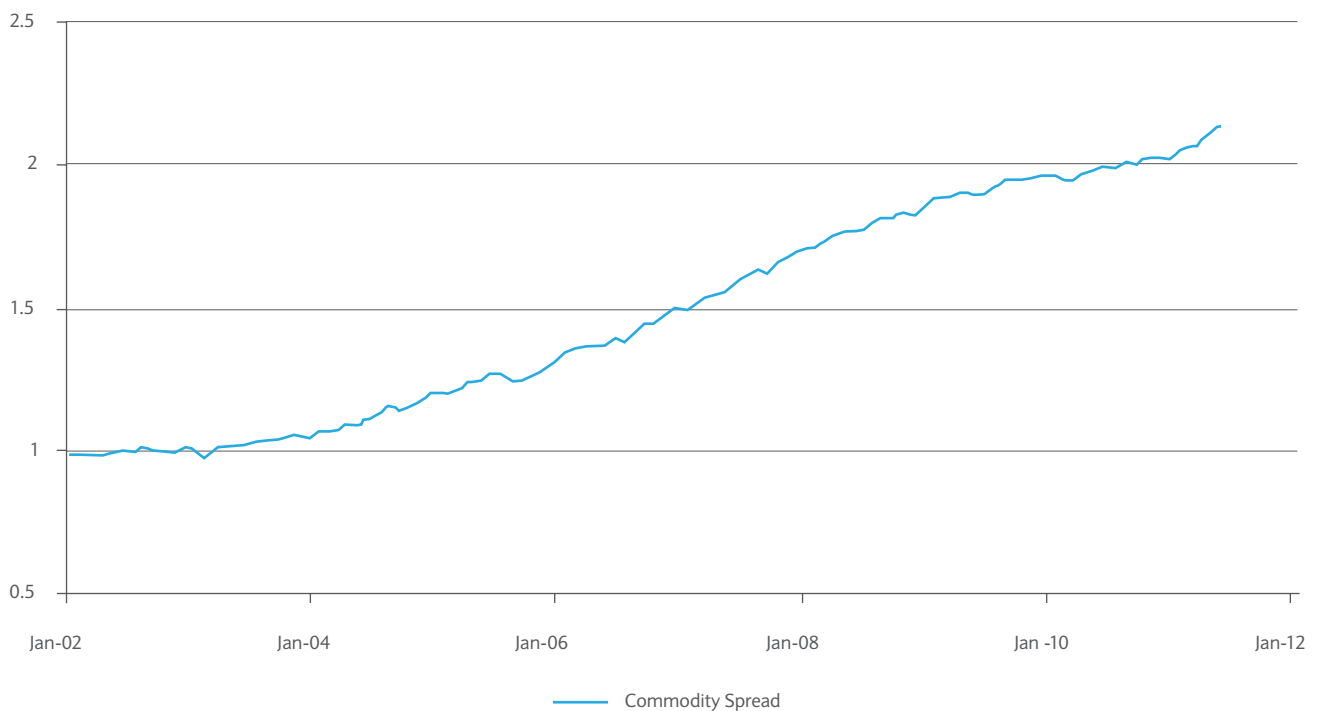
In a bull market, the momentum strategy performs poorly as prices revert to the trend growth line. However, in a bear market, the strategy is more successful. The table shows that a trend following strategy barely gains value until late 2007; most of the gains were made during the bear market in 2008. An asset manager can therefore successfully use a momentum strategy to model returns; however he or she must know when this is effective and when it isn't. The key is to know when momentum strategies give the best results and being able to predict and act upon the next downside trend. As we can see from the table, in the long run, using past month returns as an indicator for the next month's returns is no better than tossing a coin.

*What effect do roll yield and seasonality have on commodity prices?*

The term structure of commodity futures prices can vary. Often 'backwardation', where the future price of the commodity declines as the time horizon increases, is common. This means investors must have not only a view on commodity prices but

also a view on which contract to select. A number of theories have tried to explain the reason for this unique feature or 'convenience yield'. Fama-French (1987)<sup>18</sup>, and Keynes (1930)<sup>19</sup> theorised that futures prices should be less than future spot prices as producers use commodity futures to hedge commodity price risk. Some have used the roll yield (the yield that an investor captures when their commodities futures contract converges to the spot price) to form a view on the asset class. For example Fuertes-Miffre-Rallis (2010)<sup>20</sup> suggest overweighting upward trending commodities whereas others like Erb-Harvey (2005)<sup>21</sup> have concluded that the term structure of commodity prices provide great opportunities for tactical allocations in commodities, as illustrated by the below example.

We have tested these theories by creating a spread based strategy that takes equal positions in 11 liquid commodities, going long on the contract with the highest roll yield and short the nearest front month contract (excluding the precious metals sector). The goal of this strategy is to produce a spread with the highest roll yield for each commodity (chart below).

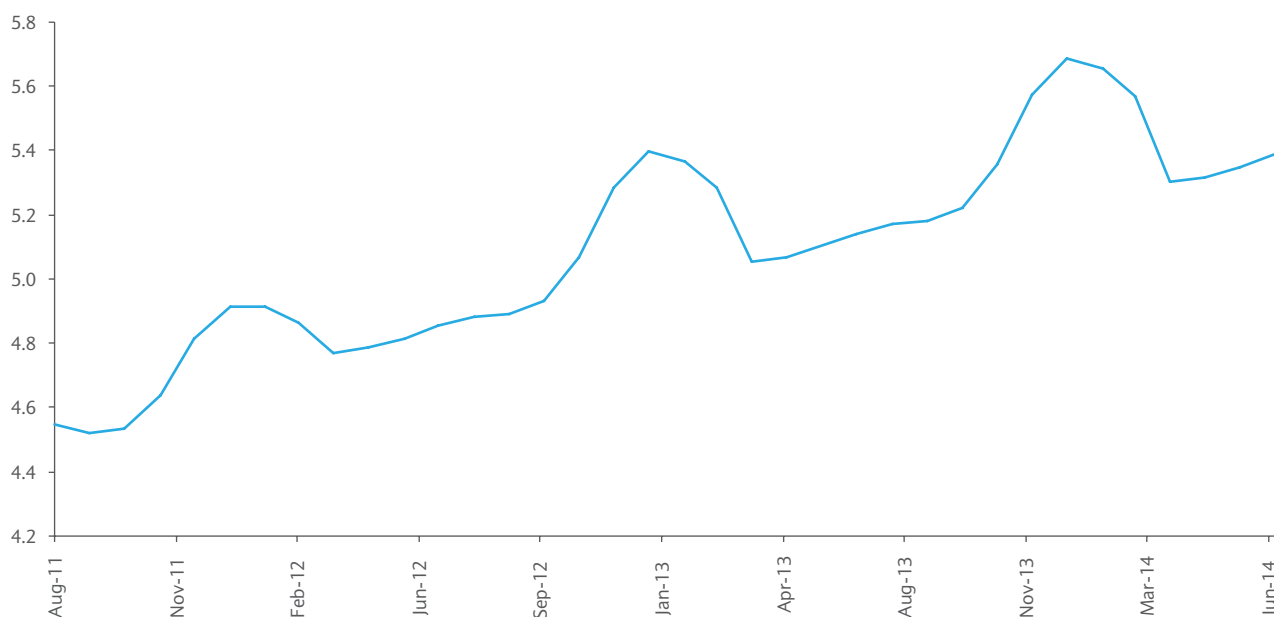


Performance Indicators (Dec 2000-Mar 2009)	Jan 2002- May 2011
Annualised monthly return	8.55%
Annualised monthly volatility	3.61%

Thus a strategy that takes positions based on the shape of the roll yield curve has in the past produced attractive risk return characteristics; however these strategies now tend to be crowded out (as there are a large number of similar strategies available in the market) and may suffer the same fate as the currency carry did during the credit crisis. This should not however dissuade investors from picking more appropriate futures on the curve and allocating to a roll yield based strategy.

It is crucial, however, to note that many commodities' prices exhibit seasonal patterns as the demand and/or supply of the commodity varies throughout the year. Natural gas and heating oil experience seasonal demand in the winter. Many crops prices are impacted by their harvest seasons. In this paper we will use natural gas as an example. Natural gas's forward curve, as the chart depicts below, exhibits a general contango pattern with the curve steepening from October to January as the demand for heating picks up and inverting from January to April as the demands for heating falls.

## Natural Gas forward curve<sup>23</sup>



Given the S&P GSCI index uses the nearby month contract, (ie the index in January invests in February's contract), not surprisingly, we find that the roll yields are the worst in September, October and November for the S&P GSCI Natural Gas Index, as set out in the table below:

### Roll Yield S&P GSCI Natural Gas Index<sup>24</sup>

Roll Yield	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2000	(1.9%)	1.0%	(1.2%)	(0.7%)	(1.0%)	0.5%	0.1%	0.3%	(2.4%)	(1.6%)	(1.0%)	4.0%
2001	3.7%	3.3%	(1.0%)	(0.9%)	(1.4%)	(1.8%)	(2.3%)	(0.9%)	(11.8%)	(19.0%)	(5.0%)	(2.7%)
2002	(0.1%)	(3.2%)	(6.9%)	(1.4%)	(1.1%)	(2.1%)	(1.3%)	(1.6%)	(12.7%)	(5.7%)	(3.2%)	1.0%
2003	1.5%	6.0%	2.3%	(1.3%)	(1.5%)	(1.2%)	(0.7%)	(1.1%)	(5.0%)	(5.7%)	(4.7%)	(0.1%)
2004	0.1%	1.4%	(1.6%)	(1.4%)	(1.3%)	(1.0%)	(0.8%)	(2.0%)	(21.5%)	(18.1%)	(6.1%)	(1.6%)
2005	(1.0%)	(1.1%)	(1.9%)	(1.3%)	(1.3%)	(0.9%)	(0.7%)	(0.6%)	(6.1%)	(3.3%)	(5.4%)	(0.5%)
2006	(1.2%)	(1.8%)	(3.1%)	(2.6%)	(3.5%)	(4.1%)	(5.2%)	(2.0%)	(22.0%)	(25.9%)	(6.6%)	(1.1%)
2007	(2.1%)	(0.4%)	(2.0%)	(1.9%)	(2.0%)	(1.5%)	(1.6%)	(2.9%)	(14.8%)	(12.1%)	(4.1%)	(1.5%)
2008	0.4%	(0.5%)	(0.7%)	(0.9%)	(1.2%)	(0.7%)	(0.5%)	(0.8%)	(3.7%)	(4.4%)	(2.4%)	(0.7%)
2009	0.3%	(0.9%)	(1.5%)	(3.2%)	(2.9%)	(4.9%)	(3.5%)	(6.1%)	(41.8%)	(15.2%)	(7.5%)	(1.5%)
2010	0.5%	0.4%	(1.1%)	(2.4%)	(2.6%)	(1.2%)	(0.4%)	(0.3%)	(5.9%)	(9.8%)	(4.8%)	(0.5%)
<b>Average</b>	<b>0.0%</b>	<b>0.4%</b>	<b>(1.7%)</b>	<b>(1.6%)</b>	<b>(1.8%)</b>	<b>(1.7%)</b>	<b>(1.5%)</b>	<b>(1.6%)</b>	<b>(13.4%)</b>	<b>(11.0%)</b>	<b>(4.6%)</b>	<b>0.5%</b>

However, as the winter approaches, the spot price of natural gas is buoyed by increasing demand. The three contracts mentioned above have the best spot returns, as shown in the table on next page:

18 Fama, Eugene F., and Kenneth R. French. 1987. 'Commodity Futures Prices: Some Evidence on Forecast Power, Premiums, and the Theory of Storage', Journal of Business, vol. 60, no. 1:55-73

19 Keynes, John M.. 1930. A Treatise on Money, volume 2, London: Macmillan

20 Fuentès, Ana-Maria, Miffre, Joëlle., Rallis, Georgio., Strategic and Tactical Roles of Enhanced-Commodity Indices, EDHEC-Risk Institute

21 Erb, Claude B., Harvey, Campbell R., The Tactical and Strategic Value of Commodity Futures

22 Source: Bloomberg as at 7 July 2011, Barclays

23 Source: Bloomberg as at 7 July 2011

24 Source: Bloomberg as at 7 July 2011

## Spot Price of natural gas<sup>25</sup>

Spot Return	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2000	14.3%	3.7%	6.7%	6.7%	38.7%	2.8%	(15.7%)	26.7%	8.4%	(13.4%)	46.7%	48.4%
2001	(41.6%)	(8.3%)	(4.0%)	(6.6%)	(16.6%)	(20.9%)	6.5%	(27.8%)	(5.7%)	46.7%	(17.9%)	(4.8%)
2002	(16.8%)	10.2%	53.6%	15.6%	(15.2%)	0.9%	(9.0%)	11.6%	25.5%	0.4%	1.1%	14.0%
2003	(17.0%)	44.5%	(37.5%)	6.4%	16.1%	(13.4%)	12.8%	0.3%	2.1%	1.3%	0.7%	25.7%
2004	(12.8%)	0.4%	9.5%	(1.2%)	9.9%	(4.5%)	(0.7%)	(17.0%)	33.9%	28.4%	(12.7%)	(19.3%)
2005	2.8%	6.5%	13.7%	(14.0%)	(3.1%)	9.4%	12.9%	45.5%	21.3%	(12.3%)	3.1%	(10.8%)
2006	(17.0%)	(27.9%)	7.4%	(9.1%)	(2.6%)	(4.4%)	34.5%	(26.3%)	(7.1%)	34.1%	17.4%	(28.8%)
2007	21.7%	(4.8%)	5.9%	1.7%	0.9%	(14.6%)	(8.6%)	(11.7%)	25.6%	21.3%	(12.3%)	2.5%
2008	7.9%	16.0%	7.8%	7.3%	7.9%	14.1%	(31.7%)	(12.9%)	(6.4%)	(8.8%)	(4.0%)	(13.6%)
2009	(21.4%)	(5.0%)	(10.1%)	(10.7%)	13.7%	0.0%	(4.7%)	(18.5%)	62.6%	4.2%	(3.9%)	14.9%
2010	(7.9%)	(6.2%)	(19.6%)	1.3%	10.7%	6.3%	6.6%	(22.5%)	1.5%	4.3%	3.5%	5.4%
Average	(4.9%)	2.7%	3.0%	(0.2%)	5.5%	(2.2%)	(2.1%)	(4.8%)	14.7%	9.6%	2.0%	3.0%

Given the excess return of a commodity equals the spot price return plus the roll yield, it is important that asset managers consider both factors when investing into seasonal commodities. Seasonality and the shape of the curve have a significant impact on the prices of the commodities but it is still only a single factor.

### What effect do inventory levels have on short-term prices?

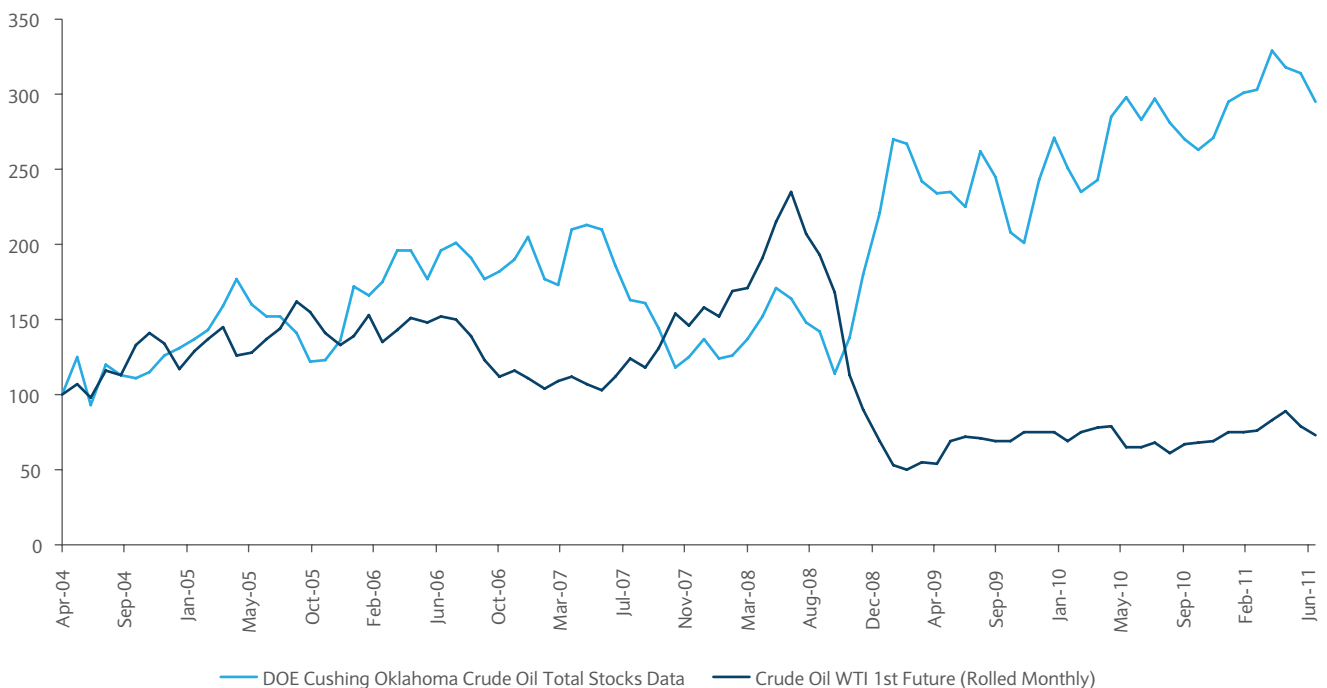
Inventory levels are a key fundamental driver of commodity futures prices in the short-term. The link between inventory levels and commodity futures was first analysed by Kaldor (1939), who developed the concept of the Theory of Storage<sup>26</sup>. This theory states that in order to ensure commodities are stored and not simply bought and sold on the spot market, futures prices and expected spot prices of commodities have to rise sufficiently over time to compensate inventory holders for the costs associated with storage. Although the Theory of Storage does not play out in all circumstances, it allows us to intuitively

understand why futures prices of commodities are mostly higher than spot prices.

Gorton-Hayashi-Rouwenhorst (2007)<sup>27</sup> argues that inventory expectations explain the roll yield movement in the commodities curve. Inventories serve as buffers against sharp movements in supply, therefore when inventories are low, spot prices become more volatile. Positive demand shocks and negative supply shocks both lead to drops in the level of inventories. This results in increasing spot prices, which signals that the commodity in question is becoming scarcer in the market. Future prices also increase and decrease as they are heavily affected by spot prices.

An example of the effect of inventory levels on both spot and forward WTI oil prices is demonstrated in the below graph, which charts capacity at the Cushing, Oklahoma storage facility against WTI prices.

## Crude oil prices have an inverse relationship with inventories<sup>28</sup>



It is clear from the above graph that WTI crude prices are heavily negatively correlated with inventory levels in Cushing. The only major divergence occurred during September 2007 – September 2008 when the GFC upset market fundamentals.

If a fund invests in commodities using a strategic asset allocation strategy involving little regular trading, the fund manager will not need to pay particular attention to inventory levels. However they will need to wear the volatility that this strategy entails. If, on the other hand, the fund manager employs a tactical asset allocation strategy, ensuring that the fund pays close attention to key inventory data, and trades accordingly, is important.

## Conclusion

Throughout this paper we have looked at the diversification benefits that commodities add to an investment portfolio and also touched on the real volatility of the asset class, which is not significantly different from that of equities.

Commodities are a complex asset class and a number of factors need to be considered simultaneously in order to reduce the downside risks similar to that of 2008 credit crisis. Both long-term fundamentals such as business cycles and shorter term factors such as inflation expectations, inventories and the shape of the commodities curve, are important considerations while investing into commodities. As with credit, fixed income and emerging market equities, the commodities asset class needs specialist knowledge and a constantly evolving dynamic investment process to generate consistent returns for investors.

25 Source: Bloomberg as at 7 July 2011

26 The Fundamentals of Commodity Futures Returns, Gary B. Gorton, Fumio Hayashi, K.Geert Rouwenhorst, 2007, p1

27 Gorton, Gary B., Hayashi, Fumio, Rouwenhorst, Geert K., 'The Fundamentals of Commodity Futures Returns', Yale ICF Working Paper No. 07-08

28 Source: Bloomberg as at 7 July 2011

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