**Executive Summary**

The commodity markets are significantly smaller and more fragmented than other major asset markets such as equities and bonds. Hence, available benchmarks differ greatly in the composition and the calculation methodologies and give varying pictures about volatility and returns over different time periods. Nonetheless, these benchmarks demonstrate a high degree of homogeneity in terms of their long term price behaviour and the correlation with other asset markets.

Commodities exposure through diversified collateralised futures should be considered in investors’ strategic allocation for the following reasons:

- Historically, diversified collateralised commodity indices have produced a variable risk premium due to a strong cyclical pattern. **Over the long term, returns from these indices have been of similar size and similar volatility to most equity indices.**

- Low correlation to equities and bonds as well as other asset classes. In particular, **commodities tend to generate higher returns in “down” markets for stocks and bonds.** This means that the addition of commodities in portfolios reduces overall portfolio volatility and improves the risk/return trade off over most time frames considered.

- As a real asset, commodities offer inflation protection. Specifically, **commodities provide a good hedge against unexpected inflation** as anticipated trends in inflation are already priced into the value of financial assets.

- Commodities, in particular **energy related and gold, can provide a degree of “event risk” protection.** Historically, they have shown strong returns when geopolitical or macro-economic shocks have taken place.

In spite of the strong performance of commodity markets over the last 4 years, the fundamental picture for commodities remains strong. This is because consumption of commodities is compounding on a daily basis, while supply is growing at a slower rate.

For example, crude oil import gap is widening:

<table>
<thead>
<tr>
<th></th>
<th>’99-’04 Demand Change</th>
<th>’98-’04 Dom Supply Change</th>
<th>Dom Demand &gt; Supply Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>North America</td>
<td>+ 1.4mbpd</td>
<td>+ 0.6mbpd</td>
<td>+ 0.8mbpd</td>
</tr>
<tr>
<td>China</td>
<td>+ 1.9mbpd</td>
<td>0.4mbpd</td>
<td>1.5 mbpd</td>
</tr>
<tr>
<td>Europe</td>
<td>+ 0.5mbpd</td>
<td>-0.7mbpd</td>
<td>+ 1.2mbpd</td>
</tr>
</tbody>
</table>

Source: EIA (Provided by Morgan Stanley)

There are significant supply bottlenecks in the oil market and some metal commodities. This is happening at the same time when China and India are moving away from a developing, agrarian based economy to a manufacturing/service driven economy. We also highlight that energy and metals are finite resources, yields from crop based commodities are limited due to acreage and weather conditions and that rising environmental awareness is constraining/adding to the cost of new exploration.

In spite of this generally positive picture supportive of commodity returns, structural changes based on demand from developing countries and new/more entrants to the commodity markets may impact future risk premiums. Roll yields, which have been a significant contributor to the overall collateralised commodity index return, may be affected as price expectations change along the term structure curve since this growth attracts an increased number of speculators to the market.
This may cause a reduction to future roll yields thus impacting the risk return profile of a passive commodity investment. While such structural change is unlikely to destroy the correlation advantages a passive commodity exposure provides to diversified portfolios, we believe a more active approach to commodities will mitigate many of the risks to commodity returns. **Active commodity managers can better manage the overall volatility of commodity exposure and they may add alpha to complement or replace the contribution that roll yield has to overall commodity performance.**

Choice of commodity indices/vehicles is increasing (ETFs, structured products, pooled funds are now available) and consequently there is greater flexibility in obtaining commodity exposures. Investor should decide on the selection of a particular strategy/product on the basis of their **tolerance for risk and the desired role they believe commodities should play in their portfolio.** Investors who can tolerate higher volatility may be rewarded by extra returns by choosing a more concentrated index with a heavy bias towards energy. Conversely, investors who are risk averse are probably more likely to opt for a more diversified commodity index. In both cases adding commodities will reduce the portfolio risk over most time horizons.

### 1. Background

Commodities have long been regarded as a non-traditional asset class. Direct commodity investments are seldom included in portfolios and where they exist they represent a very small part of investors’ asset allocations. Investors generally prefer to get exposure to commodities through ownership of equity in commodity producers.

This seems to be changing with strong inflows into commodities recorded during 2004 and 2005. In the past three years we have witnessed one of the greatest resource booms in the last 60 years with broad based commodity prices rising more than 20% on an annualised basis. Major futures commodity exchanges have enjoyed record trading volumes and the price of a seat of the New York Mercantile Exchange, where oil trades, has surpassed the cost of membership on the New York Stock Exchange. This may suggest that a bubble is developing in the commodity markets, similar to the technology sector in 2000.

**The key goal of this research is to evaluate commodities as a separate asset class and the benefits of their inclusion into a diversified portfolio.** Hence, we focus on the general characteristics that define commodities as an asset class (“beta”) rather than opportunities presented in trading of specific commodities (“alpha”).

We note that the driver behind this analysis has been the need to look for an uncorrelated asset class that warrants consideration in a balanced portfolio with the aim of improving the risk return trade-off.

The analysis is done from a global perspective using $US dollars and is a proxy for currency hedged returns for non US domiciled investors.

### 2. General Information/Characteristics of Commodities

Commodities are real assets that have intrinsic value because they are consumed on a daily basis. They are a large and important part of the world economy with 2003 world production of some key commodities estimated at above $1.5tn USD.

There are around 100 commodities, generally classified into Energy, Grains, Metals, Food and Fibre and Livestock that are traded around the world. Commodity futures trading started in the US in the 1800s and dramatically reduced the price risk for primary producers. “Investable” commodity futures indices are a relatively recent creation, dating back to the early ’90s. Today, commodities are traded on a number of exchanges (New York Mercantile Exchange, Inc., (NYMEX), the Chicago Board of Trade (CBOT), the Chicago Mercantile Exchange (CME), the London Metal Exchange (LME), etc with each of these specialising in particular commodities.

Some general characteristics for commodities are as follows:

- There is no value adding process performed on commodity items. **Commodities are produced “naturally” which means that each commodity is subject to unique supply factors.** For example, the production of coffee is affected by the weather, while that of copper is affected by availability of ore.
Further, because commodities are inputs to manufacturing processes of the final product used by consumers, they are subject to the cycles in demand by both the intermediate players and the end user.

As they are affected by a different set of factors, commodities from different groups can often exhibit negative correlation at any point of time.

Commodity prices are positively correlated with growth measures, although there may be a significant lag between a pick up in industrial production and commodity prices.

As a real asset, commodities generally exhibit positive correlation with a wide variety of inflation indicators, both actual and unexpected.

Negatively correlated to most other financial assets.

It is evident that commodity prices are influenced by a unique set of factors that do not directly impact on equities and bonds. Unlike a business which has a value based on earnings growth, commodity performance is highly cyclical with prices oscillating within wide bands that are themselves subject to trends. Over the long term commodity prices have declined in real terms mainly due to two factors:

A shift in economic output from manufacturing to service industries and information technology, meaning that any given increase in GDP produces a smaller increase in demand for raw materials.

Technology advances which have both increased the supply of commodities, through higher rates of mineral extraction and crop yields and reduced demand, (through substitution) as plastic has replaced metal, or fibre optics have replaced copper wire.

Commodities exposure is obtained in a variety of ways; from physical inventory held by the producer, long futures positions, over-the-counter investments, long-term fixed-price purchasing contracts, etc. This makes a complete accounting of capital dedicated to holding commodities, from the time they are produced to the time they are consumed, unfeasible.

3. Fundamentals of Risk Premium

The cyclical nature of commodity prices means that simply buying and holding a commodity can result in substantial losses and high volatility during periods of commodity price declines.

Futures markets have long been used by producers and consumers to negate variations in the prices of the commodities that are large part of the end products that they buy or sell. Producers are, in general, prepared to sell their commodities into the futures markets at a lower price compared to the spot price thus avoiding storage and financing costs that tend to be high for commodities. This action separates out their business risk (the ability to supply the market with products of suitable quality and at an acceptable price) from their commodity price risk (the impact on the cost of their end product from the changing economic value of their primary input). This ability to hedge is crucial to stabilising profit margins and earnings for both producers and users. On the other hand, users who value the immediate accessibility of commodities, place an upward pressure on nearby spot or futures prices.

The value of price certainty to hedgers is greater the closer the futures contract gets to expiry because as time passes the futures price increases towards the spot price. This often creates an “inverted forward price curve”, the so called backwardation effect, whereby the near term futures contracts are trading at higher prices than the far term futures contracts. This is the opposite to “contango” (the far term futures contracts are higher than the near term futures contract) which is evident in pricing of other financial futures contracts.

Backwardation is more typical for some commodities than for others. While the mix of commodities that are in backwardation changes over time, backwardation tends to be greater for commodities where commodities are subject to supply disruptions causing prices to be volatile, where producers are very sensitive to price fluctuations, and when it is costly or hard to have large holdings of inventories (oil, hogs, soybean meal; and cattle). However, when inventories are large in relation to usage, forward prices have to be at premium to spot prices by enough to compensate people for storing them (contango). Its worthwhile remembering that backwardation is theoretically unlimited as compared to a contango that is capped at “full carry”.
Energy commodities exhibit a high level of backwardation as energy is prone to supply disruptions; as a result, there is a frequently a premium in the spot price for physical possession. From the inception of NYMEX WTI Crude Oil futures, to 31 Dec 2003, WTI has been in backwardation 65% of the time. However, other commodities are also subject to this phenomenon. The chart below is produced using Goldman Sachs research calculations based on daily observations of backwardation. It represents the percentage of backwardation or contango between the 1st and 2nd month futures contracts on the GSCI (Goldman Sachs Commodity Index). From 1992 to 2004, more than 50% of the time Live Cattle has been in backwardation while backwardation for Copper is 35%. Note, that gold, which is not perishable and is in abundant supply has been in contango all the time.

1(WTI) West Texas Intermediate, a grade of crude oil

4. Commodity Exposure – Available Indices

In this report we are focused on collateralised diversified commodity indices because diversification dampens the cyclical and the high volatility of individual commodities. The index exposure can be achieved in a number of ways.

- **Total Return Swap**: these are quite flexible and can provide a guaranteed return of the chosen index (less the cost). Issues to consider are the swap structure, the ability of the counterparty to access deal flow especially between rolls, counterparty risk and administration.

- **Diversified Commodities Indices**: Index futures are useful as portfolio tools but are not ideal for large investments because liquidity is significantly lower than individual commodity futures. This tends to widen bid ask spreads particularly under volatile market conditions. However the advantage in obtaining commodity exposure through commodity index futures lies in its simple administration.

- **Index Replication via Basket**: Individual futures contracts are used heavily by producers and consumers for hedging purposes and as such offer investors profit opportunities. An index (investable or customised) can be replicated using individual commodity futures. This is more efficient as these contracts are characterised by high liquidity (open interest of $US60bn compared to just $US1bn for index futures) in all market conditions and significantly lower trading costs.

There are four main investable commodity indices: Goldman Sachs Total Return Commodity Index (GSCI), Dow Jones–AIG Commodity Index (DJ-AIG), Reuters-Commodity Research Bureau Index (CRB) and Standard and Poor’s Commodity Index (SPCI). They differ in the number of commodities they include (17 for CRB to 25 for GSCI), the weight each commodity is given, the manner in which futures prices are calculated (geometric or average weighting) and the way in which weights are maintained. However, two main criteria governing the inclusion and the weight of a particular commodity are production and liquidity characteristics.

GSCI has an extremely high weighting in Energy (70%), CRB, has a relatively high weighting in Agricultural commodities and DJAIG has a balanced weighting to four major commodity groups (Energy, Metals, Grains, Other Agriculturals).
Commodity Indices: Composition

Importantly, our analysis show there is a high level of correlation between these indices (0.75 – 0.90) with exception of the correlation between the GSCI and CRB (0.50 – 0.75).

5. Components of Returns for Collateralised Futures Index

The return from a passive investment in collateralised futures benchmarked to one of the main commodity indices can be broken down into three components:

Spot Yield. This represents the percentage movement in the spot prices of the underlying commodities; it is driven by fundamental factors such as disruptions to supply, demand fluctuations and unexpected price changes. Since fundamental "surprises" are more likely to happen on the supply side (events like droughts, floods, war, and cartel action) than on the demand side, this generally creates a positive skew to commodity returns. Historically, spot yields have generally been the largest contributor to collateralised futures returns irrespective of the commodity subclass, but it is worthy to note that over time spot prices can result in positive or negative returns.

Roll Yield or Risk Premium. This is the cost (negative) or benefit (positive) from rolling the futures positions forward as they expire. Whether this return is negative or positive depends on whether the price for the contract being rolled over into is lower or higher than the contract rolled out of. Roll yield is the second largest contributor to the total return structure of commodity futures and is also affected by supply, demand and sentiment in the physical commodity market. As the chart following chart shows, there is a strong linear relationship between the size of backwardation and the overall total return, with the commodities for which backwardation has been the most pronounced, (Oil (Brent and Crude), Gasoline, Live Cattle and Copper) delivering the highest total return.

Contributors to Index Roll Yields: 1983 - 2005

Source S&P and Morgan Stanley Commodities data

Collateral Yield. Collateral is typically provided in the form of cash or T-Bills and ensures that the futures position is not leveraged. Interest earned on this collateral forms a component of the total return of the commodity index. Of the three return sources, collateral yield is always positive and is the most stable component of the total return structure, reflecting prevailing interest rates.

Due to the combination of the positive roll yield and the positive return from collateral, future positions can make money when spot markets are falling. For example, from 1983 to 1993 (source: DJ-AIG) the spot price of oil declined at an annual rate of 5.04%. Over the same time period a collateralized long position in oil futures earned an annualized return of 9.85%.

Essentially, exposure through futures has shown a superior risk return profile compared to spot prices. While the correlation between the two indices is high, the return profile is very different ($100 exposed to spot commodity prices would have increased just over threefold over the last 34 years, while the same amount of money invested in collateralised commodities would have grown to more than 6 times over the same time period).

80%
70%
60%
50%
40%
30%
20%
10%
0%

5.0% 10.0% 15.0% -5.0% -10.0% -15.0% 20.0% 25.0%

Average Annual Backwardation (since 4/83, as % of price)

Source S&P and Morgan Stanley Commodities data
6. Performance of Commodity Indices

In this section we have shown the performance of different commodity indices over different time and inflation periods.

Returns ending December 2004

<table>
<thead>
<tr>
<th></th>
<th>3 Years Ret</th>
<th>3 Years vol</th>
<th>5 Years Ret</th>
<th>5 Years vol</th>
<th>10 Year Ret</th>
<th>10 Year vol</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSCI</td>
<td>27.0</td>
<td>20.8</td>
<td>17.1</td>
<td>21.5</td>
<td>10.6</td>
<td>19.9</td>
</tr>
<tr>
<td>DJ AIG</td>
<td>20.5</td>
<td>12.8</td>
<td>14.3</td>
<td>13.6</td>
<td>9.2</td>
<td>13.1</td>
</tr>
<tr>
<td>SPCI</td>
<td>20.9</td>
<td>14.9</td>
<td>12.3</td>
<td>16.2</td>
<td>7.0</td>
<td>14.6</td>
</tr>
<tr>
<td>CRB</td>
<td>14.1</td>
<td>8.9</td>
<td>7.5</td>
<td>9.2</td>
<td>4.3</td>
<td>8.9</td>
</tr>
</tbody>
</table>

As a general observation different commodity indices have produced similar returns (except for the CRB index, due to high allocation to agricultural commodities) over the long term. We conclude that DJ-AIG index has shown the best median performance results over all time frames and the GSCI is the most volatile followed by the SPCI and the DJ-AIG.

Over the very long term based on the research done by professors Gary Gorton and Geert Rouwenhorts\(^2\), collateralised commodity futures have delivered returns similar to equities, with lower volatility and better return distribution characteristics (note positive skewness of returns and higher kurtosis – less fat tails).

Risk Premium of Commodity Futures, Stock and Bonds Annualised Monthly Returns 1959/7 – 2004/12

<table>
<thead>
<tr>
<th></th>
<th>Commodity Fixtures</th>
<th>Stocks</th>
<th>Bonds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Ret</td>
<td>5.23</td>
<td>5.6</td>
<td>2.22</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>12.10</td>
<td>14.85</td>
<td>8.47</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.71</td>
<td>-0.34</td>
<td>0.37</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>4.53</td>
<td>1.81</td>
<td>3.56</td>
</tr>
<tr>
<td>T-Stats</td>
<td>2.92</td>
<td>2.57</td>
<td>1.77</td>
</tr>
<tr>
<td>Sharpe Ratio</td>
<td>0.43</td>
<td>0.38</td>
<td>0.26</td>
</tr>
</tbody>
</table>

Dispersion of Return By Inflationary Period Rolling 5 Year Periods. USD $

- During the inflationary years gold and commodities (as measured by the GSCI) delivered returns that often far exceeded those from equities. While this meant that volatility was extreme, it was mainly concentrated on the upside. The lowest returns from equities were more negative than those from gold and commodities.

- During dis-inflationary years, reduced volatility saw the range of gold and commodity returns shrink below those from equities. While gold returns were often lower compared to equities, returns from commodities were comparable to those from equities. The low inflation years saw a similar pattern of returns between gold, commodities and equities.

- As a group commodities have shown little correlation to Bonds (close to zero). Here, the dispersion between the indices is significantly smaller although at times the GSCI and the other three indices have shown an opposite pattern in the correlation. Over the last three years the correlation with bonds has been trending up but it still remains at low levels.

- All commodity indices have moved in a fairly tight correlation band against the MSCI expressed in A$, with the correlation ranging between a -0.20 to +0.30 range. This is important as its shows that commodities are a significant diversifying asset class within an overseas equity portfolio. The correlation of the GSCI with the MSCI appears to be the most unstable.

Source: Mercer Investment Consulting

\(^2\)Facts and Fantasies about Commodity Futures, June 2004
As for international shares, commodities show a similar correlation pattern with the ASX 300. In particular the correlation between Australian shares and the GSCI has been low and negative at times. Over the last four years there has been a downtrend in the correlation with the indices such as CRB, SPC and DJ-AIG and a rising trend in the correlation with the GSCI.

While the returns from commodities were not as high as those from gold during the period of high inflation, commodities offered high returns during other inflationary periods. These observations suggest that gold’s role as a hedge against inflation is essentially a tactical one. Long term gold holdings are more likely to depress overall portfolio returns during non-inflationary periods due to gold’s lacklustre performance during these periods. Commodities, however, because of their diversification characteristics and solid returns can be considered a strategic inflation hedge while delivering high returns under all inflationary periods.

7. Correlation

One of the main attractions of commodities is their low correlation with other asset classes. Correlations are unstable over time so conclusions drawn from any analysis over a static timeframe are bound to differ markedly to actual results. Our analysis of correlations has been undertaken dynamically over rolling three year timeframes as this is a standard medium term timeframe for most investors.

As a group commodities have shown little correlation to Bonds (close to zero). Here, the dispersion between the indices is significantly smaller although at times the GSCI and the other three indices have shown an opposite pattern in the correlation. Over the last three years the correlation with bonds has been trending up but it still remains at low levels.

All commodity indices have moved in a fairly tight correlation band against the MSCI expressed in A$, with the correlation ranging between a −0.20 - +0.30 range. This is important as its shows that commodities are a significant diversifying asset class within an overseas equity portfolio. The correlation of the GSCI with the MSCI appears to be the most unstable.

As for international shares, commodities show a similar correlation pattern with the ASX 300. In particular the correlation between Australian shares and the GSCI has been low and negative at times. Over the last four years there has been a downtrend in the correlation with the indices such as CRB, SPC and DJ-AIG and a rising trend in the correlation with the GSCI.

Commodities offer a different exposure relative to gold: as a group, commodity indices have a correlation below 0.50 with gold, with correlation ranging between −0.40 to +0.50. GSCI has recorded the lowest correlation with gold as these two indices show a different pattern in returns for most of the time.

Returns of commodities are also relatively independent of the listed resources index as measured by the HSBC Mining index. While CRB, DJ-AIG and SPC have recorded a correlation around 0.50 with the listed mining index, the correlation of the GSCI has been markedly lower ranging from +0.10 to +0.40.

Commodities are positively correlated with unexpected inflation as anticipated trends in inflation are already priced into the value of financial assets. Of the individual commodities WTI (Western Texas) and heating oil stand as the most strongly correlated with unanticipated inflation. Commodity producer stocks did not exhibit significant positive correlation also with unexpected inflation.

Quarterly Correlation of Assets with Components of Inflation

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Inflation</th>
<th>Change: Expected Inflation</th>
<th>Unexpected Inflation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stocks</td>
<td>5.23</td>
<td>5.6</td>
<td>2.22</td>
</tr>
<tr>
<td>Bonds</td>
<td>12.10</td>
<td>14.85</td>
<td>8.47</td>
</tr>
<tr>
<td>Commodity Futures</td>
<td>0.14</td>
<td>0.22</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Source: Facts and Fantasies about Commodity Futures, June 2004
Dragana Timotijevic

Dragana joined Mercer Investment Consulting in October 2004 as Principal, Alternatives Research Manager. She is primarily responsible for alternatives research and development and also provides some retail consulting advice.

Dragana was previously Head of Manager Research at vanEyk Research for 5 years. Before joining vanEyk in 1999, she spent 11 years with State Super Investment Management Corporation, Axiom Funds Management and Deutsche Bank Asset Management as an economist and asset allocation analyst.

She holds a Bachelor of Economics and Masters in Statistical Economic Analysis from University of Belgrade and a Graduate Diploma in Applied Finance and Investment from the Securities Institute of Australia. Dragana also qualified as a CFA in 1998.

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This discussion paper reflects Dragana Timotijevic’s unique insights and observations on commodities. The views expressed do not necessarily reflect the views and policies of Mercer Human Resource Consulting, Inc.

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