Commodities

Speculators, Index Investors, and Commodity Prices

Addressing the questions...

As WTI crude oil prices push on toward $140/bbl, questions have been raised regarding the role that the speculators and index investors are playing in the continuing rise in commodity prices. In addressing these questions, we stress the common theme that the speculators and index investors perform different economic roles in the commodity futures markets, and that these differences in economic roles imply different influences on commodity prices.

The role of speculators is to bring to the market informed views on the future supply and demand fundamentals. Consequently, speculative buying and selling can move commodity prices to the extent that other market participants believe that it is conveying relevant information on forward supply and demand fundamentals.

The role of index investors is to hold the commodity price risk that the producers wish to hedge. Because they buy and sell mechanically and consequently do not bring information to the market, index investors do not move commodity prices in the same way as speculators.

By lowering the cost of capital to commodity producers, however, the participation of index investors in the commodity futures markets can help lower commodity prices over the long run.
Table of contents

Speculators, Index Investors, and Commodity Prices 2

Questions addressed:

1. Who are the financial participants in the commodity futures markets? 4
2. Why does each of the above participate in the commodity futures markets? 4
3. What type of commodity futures positions do these participants hold? 4
4. What share of the commodity futures markets does each of the participants comprise? 5
5. Are the commodity futures purchases of speculators and index investors a form of physical demand? 6
6. Has the buying from the index investors in the commodity futures markets rivaled in size the physical oil demand growth of China? 7
7. Are the commodity futures positions of speculators and index investors a form of physical inventory? 8
8. If speculators and index investors do not produce, consume, or hold inventory, what is their role in the market? 9
9. What impact do speculators and index investors have on commodity prices? 12
10. What is the evidence that prices move with changes in speculative positions, but not with changes in index investment? 14
11. If speculators can move prices, wouldn’t removing them from the commodity futures markets allow for less volatile and perhaps lower prices? 18
12. How do we know if fundamentals support prices at these levels, or how do we know this isn’t a speculative bubble? 18

Appendix A: Description of the use of CFTC data 20
Appendix B: An economic analysis of influence of speculative buying and selling on commodity prices 21

Disclosures 23
Speculators, Index Investors, and Commodity Prices

By May of 2004 as WTI crude oil prices pushed toward $40/bbl, the role that the financial participants, specifically the speculators, were playing in the rise in commodity prices had become a subject of increasing concern. At the time, our research reached two conclusions. First, WTI crude oil prices do move with the speculative positions. Second, the speculative positions move with expectations of the future supply and demand fundamentals, or as we stated at the time, “economic indicators explain the broad movements in net speculative length as these speculative fund flows represent a natural response to economic forces and is how the market anticipates potential price pressures, which is the role of speculative money in all markets.”

Four years later as WTI crude oil prices push on toward $140/bbl, the role that the financial participants are playing in the rise in commodity prices has once again become a subject of increasing concern. This time, in addition to the role of speculators, the role of index investors in the commodity futures markets has been called into question.

Consequently, we think it useful to address many of the questions that have been raised regarding the financial participants in the commodity futures markets. A common theme running through our answers to these questions is that speculators and index investors perform very different economic roles in the commodity futures markets, and that these differences in economic roles imply very different influences on commodity prices. The economic roles are so different, in fact, as to make the increasingly prevalent label of “index speculator” a contradiction in terms.

The role of speculators is to bring new information to the market on forward supply and demand fundamentals. Consequently, speculative buying and selling moves commodity prices to the extent that other market participants believe it is revealing new information on forward fundamentals. However, it is important to note that the empirical evidence shows that the size of the implied commodity price changes due to speculative buying and selling are well below those sometimes suggested by market commentators.

For example, when we first wrote about the impact of speculators on oil prices in May 2004, the level of net speculative length was a relatively high 195 million barrels. Since then, however, net speculative length has increased by only 11 million barrels while WTI crude oil prices have increased by $100/bbl. Thus, since the last time speculators faced such intense scrutiny, the increase in speculative positions explains almost none of the rise in WTI crude oil prices. Even if we take a more neutral starting point in the recent run up in prices, regression analysis would indicate that the increase in net speculative long positions since January 2007 accounts for only $12.60/bbl of the $70/bbl increase in WTI crude oil prices since then (see Question 10). This strongly suggests that it has been the failure of the oil market to find adequate new supplies and/or sufficiently slow global demand growth that has been the key driver of price action.

The role of index investors is to supply a pool of stable, passive, unleveraged capital to bear commodity price risk. Unlike speculators who buy and sell on new information, the index investors buy and sell mechanically. Consequently, the buying and selling of index investors does not “move the market” in the same manner that the buying and selling of speculators does. Instead, by allowing commodity producers to transfer their inherent commodity price risk exposure to long-term investors who are better-suited to bear it, the participation of the index investors in the commodity futures markets lowers the cost of capital to commodity producers, and by lowering costs helps to lower commodity prices over the long run.

With this theme in mind, we now turn to answering many of the specific questions that have been raised, hoping that by addressing these specific questions that we can more fully address the broader question of the potential influence of speculators and index investors on commodity prices.

Q1: Who are the financial participants in the commodity futures markets?
A: The financial participants are divided into two broad categories: speculators and index investors, or more accurately, active and passive investors.

The commodity futures markets are comprised of physical and financial participants. The physical participants are commonly called commercial participants, or hedgers. They are the producers and consumers of the physical commodities, and they are part of both the commodity futures markets and the underlying physical markets for the commodities.

The financial participants generally participate in only the commodity futures markets, not the underlying physical commodities markets. The financial participants are comprised of both speculators who actively trade the commodity futures markets and commodity index investors who passively hold a commodity futures position in their portfolio as part of their overall asset allocation strategy.

Q2: Why does each of the above participate in the commodity futures markets?
A: Commercials participate in order to hedge their inherent commodity price risk exposure, speculators to profit by anticipating commodity price movements, and index investors to earn a return for bearing commodity price risk.

The commercials participate in the commodity futures markets in order to reduce their natural exposure to commodity price risk. This is why they are also known as hedgers, as they seek to hedge through commodity futures their exposure to commodity prices due to their role as producers and consumers of the physical commodities.

The speculators, or active investors, trade in the commodity futures markets because they believe that they can profit by successfully anticipating movements in commodity prices.

The index investors, or passive investors, hold a commodity futures position as a part of their asset allocation strategy. Index investors seek to earn returns on these positions as a payment for bearing the commodity price risk that the physical participants want to hedge. Index investors also seek diversification and to protect their portfolios against inflation and adverse movements in equity and bond prices.

Q3: What type of commodity futures positions do these participants hold?
A: Commercials tend to be net short commodity futures, index investors are long only, and speculators can be long or short depending on their view of the market.

In the commodity futures markets the desire of commodity producers to hedge generally exceeds that of commodity consumers. This is because commodity production is typically concentrated among far fewer participants than is consumption, leaving each commodity producer exposed to far greater commodity price risk than each consumer. For example, a relatively small number of petroleum refiners supply all of the motor gasoline to hundreds of millions of drivers. This leaves these refiners far more inclined to hedge motor gasoline sales than drivers are to hedge purchases. Because of this underlying mismatch between the willingness of producers and consumers to hedge, commercials as a whole tend to be sellers of commodity futures.

Commodity indices were designed to be long-only investment vehicles in order to create a stable supply of passive buyers to balance the commercial selling. Put simply, the index
investors are the buyers of the commodity futures positions that the commercials want to sell in order to hedge their natural exposure to commodity price risk.

Speculators will be either long or short, buyers or sellers, depending on the direction they anticipate commodity prices will move.

Q4: What share of the commodity futures markets does each of the participants comprise?

A: Commercials and speculators tend to be the largest participants, with index investors typically comprising about 12 percent of the market.

Although one would have to estimate market share for each commodity futures market separately, we have calculated market shares for the WTI crude oil market and the corn market as the energy and food markets have been the ones raising the most questions regarding the role of speculators and index investors. As shown in Exhibits 1 and 2, commercial participants and speculators are roughly equally represented in these two commodity futures markets, with the index investors holding around 12 percent of all futures positions.2

![Exhibit 1: NYMEX crude oil: composition of futures and options positions (May 2008)](source: CFTC and Goldman Sachs Commodities Research)

![Exhibit 2: CBOT Corn: composition of future and options positions (May 2008)](source: CFTC and Goldman Sachs Commodities Research)

Furthermore, these index investor positions are almost entirely long positions, which are balancing the surplus of commercial short positions relative to commercial long positions (see Exhibit 3). For example, commercials hold 56.6 percent of all the short positions in the corn market, but only 27.0 percent of all long positions. Because index investors hold 24.6 percent of the long positions and only 2.0 percent of all the short positions, speculators are able to remain more balanced, with 48.4 percent of the long positions and 41.3 percent of the short positions.

Finally, while the growth in index investor positions has been a subject of concern, these positions have actually been growing at a slower rate than the overall market since 2006. As shown in Exhibit 4, the index investors’ share of the total positions in the corn market has declined to 12.1 percent in May 2008 from 14.7 percent in January 2006, while their

2 We describe the CFTC data and assumptions on which our estimates of index investor positions in the petroleum markets are based in Appendix A.
share in the oil market increased slightly from 9.7 percent to 11.4 percent over the same period. Interestingly, while index investment in crude oil increased by 383 million barrels from January 2006 to May 2008, commercial short positions in crude oil increased by 867 million barrels. This implies that the growth in gross commercial selling over this period was far greater than the growth in index buying.

Exhibit 3: Index investor long positions offset natural short position of the commercials
percent of positions (which is twice open interest)

Exhibit 4: The share of total positions held by index investors has been generally declining since 2006
percent of total positions (which is twice open interest)

One potential driver of this change is the fact that the number of barrels (or bushels or tons, etc.) tied to notional index positions declines as prices increase, all else equal. For example, a notional $100 million dollar investment in oil will buy 10 million barrels of oil at $10/bbl but only 1 million barrels of oil at $100/bbl. Consequently, index investors’ positions in the market can diminish relative to commercial participants during rising price environments. To see this, consider an airline with 100 million barrels of exposure and an index investor that plans to invest $100 million dollars in oil. The airline will hedge that same volume whether oil is at $10/bbl or $100/bbl while an index investor will generally invest the same notional amount regardless of price so that at $100/bbl the number of “barrels” they are buying is far less.

Q5: Are the commodity futures purchases of speculators and index investors a form of physical demand?
A: No, speculators rarely and index investors never take physical delivery of the actual commodity.

Because the financial participants are net buyers of commodity futures from producers, it is easy to view speculators and index investors as another type of consumer and to view their commodity futures purchases as another form of demand. The logical implication of this view is that purchases of commodity futures by speculators and index investors drive up commodity prices as any other form of demand would (see Exhibit 5).

However, this view fails to recognize that speculators rarely and index investors never take physical delivery of the actual commodity, let alone actually consume it. Instead, all of the commodity futures contracts that speculators and index investors buy from producers (on net), are sold back to producers (on net) before supply ever meets demand in the physical market.
In the case of index investors, this selling back of all commodity futures purchased before the time of delivery is built into the mechanical structure of the commodity index itself. For example, as of June 12, 2008 the S&P GSCI™ index holds WTI crude oil futures for delivery in August of 2008. During the 5th-9th business days of July, the index will sell those August futures contracts and purchase contracts for delivery in September of 2008. This process is called “rolling” the futures positions, and as shown in Exhibit 6 involves selling futures as their delivery time approaches and then buying new futures farther out the forward curve. In this manner the index investor maintains their investment in WTI crude oil futures at a fixed point on the forward curve, much like a bond investor seeking to maintain a constant maturity in their bond portfolio. By “rolling” their commodity futures positions in this way index investors never take physical delivery of the commodity and so cannot be adding to physical demand.

**Q6: Has the buying from the index investors in the commodity futures markets rivaled in size the physical oil demand growth of China?**

**A:** No, over the past 5 years the petroleum “futures demand” from index investors has averaged less than 20 percent of the increase in Chinese physical oil demand and only 7.3 percent of overall Chinese physical oil demand. Further, the “futures demand” from index investors has been declining, and is now more comparable in size to the increase in physical oil demand from Singapore.

A recent argument asserting the view that commodity futures purchases are a form of demand states that the petroleum futures “demand” from commodity index investors over the past 5 years has been as large as the increase in physical petroleum demand from China, with the implication that commodity index investment is having a similar impact on crude oil prices. This argument illustrates the two logical failures of the view of commodity purchases as a form of demand.

1. It implies that index investors are consuming actual petroleum when they are never even taking delivery of a single barrel. Chinese consumers, on the other hand, are actually burning the oil.

2. The argument also confuses the concepts of stocks and flows in arriving at its conclusion that the “demands” are of comparable size.
For example, according to the International Energy Agency (IEA), Chinese oil demand has increased from 1.83 billion barrels per year in 2002 to 2.75 billion barrels per year in 2007, an increase of 920 million barrels per year of physical oil demand. At the end of 2007, the total stock of petroleum futures positions held by index investors was 855 million barrels. However, 855 million barrels is a stock of futures positions. The annual “futures demand” required to build up to that stock position would be the stock divided by the number of years over which the position was built. Even assuming that these futures positions were built entirely over the 5 year period from 2002-2007, the annual flow of index investor buying would average 171 million barrels per year, or less than one-fifth the increase in Chinese physical oil demand. In comparison to the average level of Chinese oil demand over the period, the index investor “futures demand” averaged only 7.3 percent.

Further, while the increased level of Chinese physical oil demand will persist and, in fact, increase as the Chinese economy continues to grow, there are already indications that the so-called “futures demand” from index investors has already declined sharply. The 855 million barrels of petroleum futures positions held by index investors at the end of 2007 was only 83 million barrels higher than at the end of 2006, less than one-half the average annual “futures demand” of the past 5 years. At this level, petroleum “futures demand” from index investors is more comparable in size to the increase in physical oil demand from Singapore, where physical oil demand in 2007 was 85 million barrels per year higher than in 2002.

Q7: Are the commodity futures positions of speculators and index investors a form of physical inventory?

A: No, if these positions were equivalent to the hoarding of physical inventory, we would observe an enormous backwardation in commodity forward curves, which we do not.

While we have established that commodity futures positions are not equivalent to physical demand, it is also easy to view the commodity futures positions held by speculators and index investors as another form of physical inventory. The logical implication of this view is that the holding of commodity futures by speculators and index investors is equivalent to the hoarding of physical inventories, resulting in a shortage that drives up commodity prices.

However, this view fails to recognize that in the physical markets inventories play a central role in protecting producers and consumers from near-term physical shortages, a risk that commodity futures cannot hedge. Because holding physical inventory provides benefits to the physical producers and consumers that commodity futures do not provide, producers and consumers are willing to pay a premium to obtain the physical commodity now relative to commodity futures contracts, which would deliver the physical commodity at a later date, in order to have the physical inventories on hand when inventories are low. Conversely, because storing physical inventory incurs costs to the physical producers and consumers that commodity futures do not, producers and consumers are willing to pay a premium for commodity futures contracts relative to the physical commodity in order to avoid these storage costs when inventories are high (see Exhibit 7).
Further, if the commodity futures positions held by the index investors were “squeezing” the oil market in the same way that a real physical inventory shortage would, we would expect to see a premium for prompt delivery of the physical commodity that would literally be off the chart in Exhibit 7. More specifically, in May 2008 we estimate that commodity index investors held futures contracts on 1114 million barrels of petroleum. If these futures positions were the economic equivalent of removing physical inventories from the market, the relationships in Exhibit 7 implies that front month WTI crude oil would have traded at a $50.00/bbl premium to second month WTI crude oil in May 2008 rather than the $0.50/bbl discount that it actually traded at in May.

The fact that financial participants are holding commodity futures positions, but these positions are not equivalent to holding physical inventory begs the question of what exactly are these financial participants holding? What they are holding is risk.

Q8: If speculators and index investors do not produce, consume, or hold inventory, what is their role in the market?

A: Index investors bear commodity price risk while speculators bring information to the market about future supply and demand fundamentals.

Index investors bear commodity price risk

One of the exceptional achievements of the commodity futures markets is the separation of the ownership of commodity price risk from the ownership of the physical commodity. That is, these markets allow participants to buy and sell the commodity price risk without requiring the exchange of the physical commodity. This separation can create economic benefits as the producer who by nature must hold the physical commodity is no longer required to bear all the risk of fluctuations in commodity prices. Instead of the producer holding this commodity price risk, against which it would need to hold expensive equity capital, the producer can shift this risk off of its balance sheet. This frees the producer to devote its expensive equity capital as well as its managerial energies to focus on its core competency of operating its business, not managing commodity price risk.
Because index investors are simply bearing the commodity price risk that would otherwise sit on the commodity producers’ balance sheets, the relevant comparison for assessing the level of index investment is not demand or inventories but the amount of commodity price risk held by the commodity producers. In the oil markets, the more relevant comparison for the level of index investment would be the level of the total crude oil reserves held by the oil producers plus the level of physical inventory. In other words, because the index investors are simply holding commodity price risk, their size is best viewed in the context of the size of the primary holders of commodity price risk, the commodity producers.

Viewing the level of index investment in the context of the level of total proven reserves held by the oil companies, index investors remain relatively small. At 855 million barrels as of the end of 2007, they held in petroleum futures only 7.7 percent of the amount of oil that ExxonMobil held in the form of proven reserves (see Exhibit 8). In relative size, the index investors are closer to oil companies such as Hess Corporation or Nexen.

**Exhibit 8: Relative to the barrels of oil that oil companies could hedge, index investors are holding a relatively small amount of oil price risk**

<table>
<thead>
<tr>
<th>Company</th>
<th>Proven Reserves (million barrels)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exxon Mobil</td>
<td>11,075</td>
</tr>
<tr>
<td>Petrobras</td>
<td>9,613</td>
</tr>
<tr>
<td>Chevron</td>
<td>7,087</td>
</tr>
<tr>
<td>ConocoPhillips</td>
<td>6,320</td>
</tr>
<tr>
<td>Suncor Energy</td>
<td>2,515</td>
</tr>
<tr>
<td>Occidental Petroleum</td>
<td>2,224</td>
</tr>
<tr>
<td>Canadian Natural Resources</td>
<td>1,358</td>
</tr>
<tr>
<td>Apache Corporation</td>
<td>1,134</td>
</tr>
<tr>
<td>Marathon Oil</td>
<td>1,071</td>
</tr>
<tr>
<td>Hess Corporation</td>
<td>885</td>
</tr>
<tr>
<td><strong>Index Investors</strong></td>
<td><strong>855</strong></td>
</tr>
<tr>
<td>Nexen</td>
<td>835</td>
</tr>
<tr>
<td>Talisman Energy</td>
<td>648</td>
</tr>
<tr>
<td>Petro-Canada</td>
<td>597</td>
</tr>
<tr>
<td>Murphy Oil</td>
<td>307</td>
</tr>
</tbody>
</table>

Source: Goldman Sachs Equity Research and Goldman Sachs Commodity Research.

As shown in Exhibit 8, index investors hold an extremely low percentage of the total oil price risk that sits on oil company balance sheets. Further, the comparison raises the important point that whether or not the oil prices risk sits on oil company balance sheets, where it is held by the oil company’s equity and bond investors, or resides in commodity futures held by index investors, this risk is always being held by investors of one form or another. Consequently, the important question is whether or not the commodity price risk is being held by the investors best-suited to hold it.

Index investors are remarkably well-suited to bear the commodity price risk that producers wish to shed. Index investors are typically long-term investors with diversified portfolios of equities and bonds, such as pension funds and endowments, for whom commodity futures investments offer an asset with an equity-like rate of return that is uncorrelated with equity and bond returns and so can be an important source of portfolio diversification. Further, the commodity index investments provide greater protection from inflation at the cost of more exposure to the impact of economic recessions. Being long-term investors, however, they are much better-suited to bear this macroeconomic risk than are other investors.

By facilitating the transfer of commodity price risk from commodity producers, who would have to hold expensive equity capital against it, to long-term investors who are better able
to hold that risk within their diversified portfolios, the participation of the commodity index investors lower the cost of commodity price risk.

**Speculators bring information to the commodity futures markets on the future supply and demand fundamentals, supporting more efficient price discovery**

While index investors passively earn returns as payment for bearing the risk of commodity price fluctuations, speculators actively seek to earn profit by anticipating the fluctuations in commodity prices. Speculators believe they can anticipate price fluctuations because they believe that their analysis and understanding of the market has provided them with a more informed view of future fundamentals and prices. That is, they buy commodity futures when they believe the market has underestimated the tightness in forward fundamentals and sell when they believe the market has overestimated them.

Unlike the investor who seeks to reduce their risk through diversification and earn returns for holding the risk that remains, if a speculative trader is to profit on their well-informed views, they must instead manage a concentrated risk exposure in the market where their views are most informed. The speculative trader will be willing to hold a larger position, and a greater concentration of risk, the greater they perceive the expected profit to be and the greater their confidence in their views.

Consequently, the more a speculator perceives the market’s pricing to be out of line with supply and demand fundamentals, the larger the position they are willing to hold. While the rest of the market does not, at first, know the view of the speculative traders, they can observe the speculators’ positions in the market. When they see the speculators buy or sell, they may infer the speculators view on fundamentals. Simply by seeking to profit on the information they have gathered and assessed through their own research and analysis, the speculators reveal it to the rest of the market.

In the corn market the connection between speculative buying and expectations of forward fundamentals is readily observed, as the USDA publishes its own expectations for forward fundamentals in the form of their estimates for end-of-harvest inventory levels. As seen in Exhibit 9, the lower the USDA expectations for end of harvest inventory levels, the larger the speculative long positions tend to be. A similar relationship is seen in the petroleum markets where net speculative length move with the leading indicators of economic growth indicators (see Exhibit 10).

---

**Exhibit 9: Net speculative long positions in corn move with expectations of end of harvest inventory levels**

<table>
<thead>
<tr>
<th>Million bushels (left and right axes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>USDA end-of-harvest inventory expectations (right axis, inverted)</td>
</tr>
<tr>
<td>Net speculative length (left axis)</td>
</tr>
</tbody>
</table>

Source: CFTC, USDA and Goldman Sachs Commodities Research.

**Exhibit 10: Net speculative long positions in petroleum move with leading economic indicators**

<table>
<thead>
<tr>
<th>Million barrels (left axis); % year over year (right axis)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goldman Sachs Global Leading Indicator (GLI) (right axis)</td>
</tr>
<tr>
<td>Net speculative length (left axis)</td>
</tr>
</tbody>
</table>

Source: CFTC and Goldman Sachs Commodities Research.
Q9: What impact do speculators and index investors have on commodity prices?

A: Speculators move prices by bringing information to the market on the forward supply and demand fundamentals. Index investors do not trade based on such information, and so do not influence commodity prices in the same manner as the speculators.

Speculators impact prices by bringing to the market views on forward supply and demand fundamentals that change the price at which the rest of the market is willing to trade. They are a part of the market’s price discovery mechanism.

As previously discussed, the more a speculator perceives the market’s pricing to be out of line with supply and demand fundamentals, the larger the position they are willing to hold. For example, the lower the futures price is relative to the speculator’s expectation of future physical prices, the larger the speculative long position. While the rest of the market has not done the same research or analysis as the speculative trader, they can observe the speculators positions in the commodity futures market. When they see the speculators buy or sell, they can infer that the speculators may have a more accurate view on forward fundamentals. Consequently, when the other market participants see the speculators buy, they are likely to infer that future physical prices will be higher and will raise the futures price at which they are willing to trade. Conversely, when other market participants see the speculators sell, they are likely to infer that future physical prices will be lower and will lower the futures price at which they are willing to trade. In short, the impact of the speculators on commodity futures prices is dependent upon how other market participants react to the information that the speculators are revealing.3

The role of information in moving commodity futures price may be better understood in an example from today’s corn market. The severe rainstorms and resultant flooding in the US Midwest is widely known to all market participants. Consequently, we would expect that all the market participants would have revised up their expectations for future physical corn prices. Further, as they revised up their expectations for future physical corn prices, they raised their willingness to pay for corn futures contracts, increasing the futures price at which corn futures can be traded.

Now suppose that the speculators do more research to assess the impact of the rainstorms on the US corn crop than the broader market would endeavor to do. If the speculators determine that the impact of the rainstorms on the corn crop is likely to be greater than is commonly thought, they would buy corn futures in order to profit by selling them when the extent of the damage to the crop is realized by the market. The size of the long corn futures position they would be willing to hold would be larger the more that their research suggests that the market is under-pricing the extent of the damage. Of course, the rest of the market knows this. Consequently, the greater the level of speculative positions they observe, the more they will revise up both their estimate of the likely impact of the rainstorms to the US corn crop and the future physical price of corn. Once again, the futures price at which corn futures could be traded will rise.

Whether the rise in the futures price of corn is driven by information that is widely available or information that requires more detailed research to obtain, the higher futures price will trigger a number of reactions in the physical corn market. As the corn futures price rises relative to physical corn prices, physical producers and consumers will be motivated to hold larger physical inventories. As more physical inventory goes into storage, it reduces the supply available to meet current demand, dragging up corn prices in the physical markets. If the information on forward supply and demand fundamentals that raised corn futures prices turns out to be right, the physical corn market will have

---

3 For a more detailed economic analysis, see Appendix B.
shifted supply from today into a tomorrow with a diminished US corn crop. It will have accomplished this by raising physical prices today, thereby reducing demand today and carrying more supply into tomorrow. If instead the information turns out to be wrong, the resulting excess of physical corn inventory will need to be drawn down tomorrow through lower prices.

In general, however, the information brought to the market by the speculators allows the physical market to more efficiently use physical inventories to reduce the overall volatility in commodity prices while balancing supply and demand across an evolving and uncertain fundamental landscape. Furthermore, it is only through the response of commodity futures prices to speculative buying and selling that the speculators’ well-informed views can be used to guide the market, and commodity futures prices will only respond to speculative buying and selling to the extent that the other market participants believe it is revealing relevant information to them.

**Unlike speculators, index investors do not bring information on supply and demand fundamentals to the market, and so do not influence commodity prices in the same manner as speculators.**

Unlike speculators who are actively trading on their views of commodity prices and the supply and demand fundamentals, index investors passively hold commodity price risk. The buying and selling of index investors is driven by asset allocation decisions, portfolio rebalancing, and the shape of the commodity forward curve during the “roll” period, not views on the supply and demand fundamentals. Consequently, they do not influence commodity prices in the same manner as speculators.

The argument has been made, however, that the size of the index investors relative to the commodity futures markets has, in and of itself, been distortive. The fact that the index investors hold only around 12 percent of all positions in commodity futures markets such as crude oil and corn suggests that this is highly unlikely. Further, because the speculators, whose role is to maintain the balance between prices and fundamentals, continue to hold nearly 50 percent of the positions in the market, it becomes difficult for another participant to distort the market as the speculators can adjust their positions to compensate.

Further, the economic role of index investors in the commodity futures market is to supply a stable pool of passive, unleveraged capital to bear commodity price risk. By moving the commodity price risk from the physical producers to an investor better-suited to bear it, the participation of index investors in the commodity futures markets lowers the cost of capital to commodity producers by allowing them to hedge with a counterparty that is willing to bear the risk at a lower expected return. By lowering the cost of capital to these commodity producers, the participation of commodity index investors allows the producers to supply the physical commodity at a lower price over the long term.

Consequently, if the increase in index investment is because investors have become more comfortable with commodities as an asset class, perceive commodities as less risky than they did before, and are willing to hold commodity price risk at a lower expected return, the impact would be to drive physical commodity prices down, not up, over the long run.
Q10: What is the evidence that prices move with changes in speculative positions, but not with changes in index investment?  

A: Commodity price changes are highly correlated historically with changes in net speculative positions but not with changes in index investment.

Commodity index investments have risen remarkably, by some measures from $13 billion to $215 billion over the past 5 years, the same time period in which commodity prices have increased more than 3-fold (see Exhibit 11). While Exhibit 11 appears to demonstrate a strong connection between index investments and prices, it suffers from the well-known effect that any two series that trend over time will often tend to look connected, even when they are not. The common prescription to avoid this potential illusion is to ask whether there is a connection between the changes in two series. That is, the right question is not whether high levels of speculative positions or index investment is correlated with high prices, but whether increases in speculative positions or increases in index investment are correlated with rising prices. Quite simply, when they buy does the price go up, and when they sell does the price go down.

Exhibit 11: Commodity prices and the notional value of commodity index investments have both risen substantially over the past 5 years
Index: Dec 31,1969=100 (left axis), billion US dollars (right axis)

Unfortunately, the estimates used in charts like Exhibit 11 were not historically collected in a manner suitable to addressing this question. However, since January 2006 the CFTC has collected weekly estimates on the positions of index investors in 12 commodity markets as part of its weekly Commitments of Traders report. Using this data, we can use a statistical regression analysis to address the question of “when they buy does the price go up, and when they sell does the price go down?” for speculators and index investors. While the data available for such an analysis is limited, the answer we obtain is a “yes” for the speculators and a “no” for the index investors.

4 In the academic statistical and econometric literature this is known as the “spurious regression” problem and is a staple of econometric text books.
Exhibit 12 reports the results of four simple regressions of the percentage change in corn, soybean, wheat, and crude oil prices on the changes in net speculative length, and index investment, measured in millions of bushels for the grains and millions of barrels for oil. The regressions are run using monthly average data over the period from January 2006-May 2008. Because the CFTC does not report the index investor positions in the energy markets, we use an estimate of index investor positions obtained from the CFTC data using the methodology described in Appendix A.

As shown in Exhibit 12 and illustrated in Exhibits 13-20, monthly changes in agricultural commodity prices are significantly correlated with changes in net speculative length, but exhibit little correlation with changes in index investment, as we would expect given their economic roles in the commodity futures markets. The same is true in the WTI crude oil market.

### Exhibit 12: Empirical evidence supports conclusion that commodity prices move with speculative positions, but not with index investor positions

<table>
<thead>
<tr>
<th>Regression Coefficients</th>
<th>R-square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speculators Estimate</td>
<td>Indices Estimate</td>
</tr>
<tr>
<td>Corn</td>
<td>Soybeans</td>
</tr>
<tr>
<td>0.0228 (7.47)</td>
<td>-0.0047 (-0.58)</td>
</tr>
</tbody>
</table>

Source: CBOT, NYMEX, CFTC, and Goldman Sachs Commodities Research.

In Exhibit 12, the regression coefficient estimate on speculators represents the percentage monthly change in commodity prices given a 1 million bushel (or barrel) change in net speculative length. For example, a 1 million bushel increase in net speculative length increases the price of corn by 0.0228%, or at $7.50/bu corn, 0.17 cents/bu. The t-statistic is a measure of the statistical significance of the estimate. A t-statistic larger than 2.00 in absolute value is commonly accepted as indicating the estimate is significantly different from zero. In other words, if the t-statistic is less than 2.00 in absolute value, the impact is not statistically significant. As can be seen in Exhibit 12, changes in speculative positions are positively correlated with price changes for every commodity while changes in index investment are not significantly correlated with price changes for any commodity. The R² describes the percentage of variation in price changes explained by changes in speculative positions and index investments.

It is also important to note that while we find that speculators play an important role in bringing forward economic information to the market, the size of the implied price changes according to our analysis (see regressions reported in Exhibit 12) are well below those sometimes suggested by market commentators. For example, if we ask how much of the $70/bbl increase in WTI crude oil prices from their recent low of $55/bbl in January 2007 to $125/bbl in May 2008 was due to speculative buying, our regressions indicate that only $12.60/bbl of that increase was due to an increase in net speculative positions, as
speculative positions over that time only increased by 182 million barrels. This strongly suggests that it has been the failure of the market to find adequate new supplies and/or sufficiently slowing global demand growth that has been the key driver of price action.

This result is even more dramatic if we examine the cumulative impact since we first wrote about the impact of speculators on oil prices in May 2004. At that time, the relatively high level of net speculative length of 195 million barrels had similarly led commentators to suggest that it was speculation that had driven WTI crude oil prices to the then extreme price of $40/bbl. Since then, net speculative length has only risen by 11 million barrels while WTI crude oil prices have increased by $85/bbl. Thus, since the last time speculators faced such intense scrutiny the increase in speculative positions explains almost none of the rise in WTI crude oil prices.\(^5\)

Although we argue that speculators have a direct causal impact on commodity prices due to the information they convey to the market, it is important to note that the regressions above can only show correlation, not causality. It could be the case that speculators are not driving price changes but are instead responding to them as momentum traders would, or it could be that both prices and speculators are responding to new information in the market separately, but concurrently. In these cases, speculators would have no direct impact on prices at all.

Exhibits 13-20 illustrate the regression results that are reported in Exhibit 12 by showing the correlation between price changes and changes in net speculative length, controlling for index investment changes (Exhibits 13, 15, 17, and 19) and between the price changes and changes in index investment, controlling for net speculative length changes (Exhibits 14, 16, 18, and 20).

In addition to finding no significant impact of changes in index investment on changes in commodity prices in each of the individual commodities, the similarity of the results across the commodity markets provides additional support for the view that speculators and the index investors affect commodity price in substantially different ways, with index investors having little ability to “move the market.”

---

5 Using the regression estimates in Exhibit 12, the increase in net speculative length would have increased WTI crude oil prices by 56 cents/bbl.
Exhibit 15: Soybean prices move with speculators... percentage (vertical axis), million bushels (horizontal axis)

Exhibit 16: ... but not with index investors percentage (vertical axis), million bushels (horizontal axis)

Exhibit 17: Wheat prices move with speculators... percentage (vertical axis), million bushels (horizontal axis)

Exhibit 18: ... but not with index investors percentage (vertical axis), million bushels (horizontal axis)

Exhibit 19: Crude oil prices move with speculators... percentage (vertical axis), million barrels (horizontal axis)

Exhibit 20: ... but not with index investors percentage (vertical axis), million barrels (horizontal axis)
While the answers obtained from the statistical analysis are consistent with the differing economic roles of speculators and index investors as discussed above, it is important to remember the twin caveats of all statistical analysis, “correlation is not causation” and “the absence of evidence is not evidence of an absence.”

The first caveat warns that while changes in commodity prices and speculative positions occur at the same time, this does not mean that speculative buying and selling is causing the change. Instead, it could be that both commodity prices and speculators are reacting independently to new public information that is entering the market. It could also be that the speculators are really momentum traders that are buying in response to rising prices.

The second caveat warns that the absence of a significant correlation can be the result of limitations or inadequacies in the data applied to the question as well as the absence of an underlying relationship. Given that the data on index investor positions is available from only January 2006 onward, it could be that we simply don’t have enough data to find a significant correlation between changes in prices and changes in index investments. The fact that the correlation between changes in speculative positions and changes in prices is evident, even in this small sample, however, suggests there is likely not a relationship between changes in index investment and changes in commodity prices to be found.

Q11: If speculators can move prices, wouldn’t removing them from the commodity futures markets allow for less volatile and perhaps lower prices?

A: No, because it is not the speculators moving the market, it is the information on forward supply and demand fundamentals that they are conveying.

Speculators drive prices only to the extent that the market believes that informed views on the forward supply and demand fundamentals drive the speculators. Consequently, if one were to remove speculators from the commodity futures markets, one would simply force the market to function with less informed views, degrading the price discovery mechanism. The fact is, a well-functioning physical commodity market needs to bring a view of future supply and demand fundamentals to its inventory management. Restricting the market participants that inform that view or eliminating the markets in which information on the future is assembled does not eliminate the need for a view on the future. The decisions would simply have to be based on a less informed view, with the risk falling squarely on the physical producers and consumers who may not be best equipped to manage that risk.

Q12: How do we know if fundamentals support prices at these levels, or how do we know this isn’t a speculative bubble?

A: If commodity futures price were too high relative to the underlying supply and demand fundamentals, we would expect to observe large inventory builds, which we do not observe.

The simplest way to address the question of whether the underlying supply and demand fundamentals support prices at these high levels is to ask what would happen if they did not. Suppose commodity prices were too high, then we would expect to see those high commodity prices curbing demand too much, bringing too much supply to the physical market and the resulting excess of supply over demand generating a large build in the physical commodity inventories. Consequently, increasing physical commodity inventories would be the main indicator that current prices are not supported by current fundamentals. The fact that across the commodity markets, we are not observing anything approaching
sustained growth in physical inventory indicates that current prices are supported by supply and demand fundamentals.

Therefore, we find the concerns that commodity markets are in the midst of a speculative bubble unwarranted. Physical commodity inventories are not growing, and in fact remain near the bottom of the historical range for many commodities. Net speculative length in the petroleum futures markets has not increased significantly since 2004, even as WTI crude oil prices have risen from $40/bbl to near $140/bbl. In sum, the commodity markets are not behaving in a way that a speculative bubble would suggest.

Further, there are two characteristics of the commodity futures markets that make them much less vulnerable to the formation of speculative bubbles. First, commodity futures contracts are simple to short, and the restricted ability to sell an asset short is a common feature of markets that have undergone periods of excessive speculation. For example, comparisons have been drawn between rising commodity prices and the speculative bubble that formed in technology stocks in the late 1990s. A common characteristic of the technology stocks that were influenced by “excessive speculation,” however, was a limited float of stock that created a difficulty in selling the stock short. When it is difficult to sell an asset short, those speculators who think the price is too high are unable to express that view in the market and have difficulty influencing prices. Unlike the new technology stocks, however, commodity futures are derivative assets, with longs and shorts not restricted by the number of shares outstanding. Therefore, if market participants truly believed that the forward supply and demand fundamentals do not support commodity prices, they could easily sell commodity futures.

Second, an investor can be led to buy shares of a technology stock even when they believe the shares are fundamentally over-priced on the expectation that the shares can be resold at a higher price to another investor (i.e. the “greater fool” theory). In the equity markets the passing of shares from investor to investor continues indefinitely. In the commodity futures markets, however, the long futures contracts must be passed (on net) to physical consumers. The physical consumer is not interested in finding a “greater fool” but on consuming the physical commodity. Consequently, the price of the commodity futures contract is forced back to a level consistent with physical market fundamentals.

The only way for a similar bubble to develop in the commodity markets would be for the physical market participants to begin focusing on finding the “greater fool” by putting the physical commodities into inventory. Once again, a speculative bubble would require the building of physical inventory, this time as physical market participants begin hoarding the physical commodities. However, as we have seen neither physical inventory builds nor the hoarding of physical commodities, the concerns of a speculative bubble seem unfounded.

---

Appendix A: Description of use of CFTC data

Beginning in January 2006, the CFTC has reported the positions of index investors for 12 commodities in a supplement to its weekly Commitments of Traders report. From this report, we have followed a common procedure for estimating the total level of index investment and the positions of index investors for commodities that are not reported by the CFTC. The main assumption underlying this estimation procedure is that all index investors hold either a standard S&P GSCI™ index or a standard DJ-AIG index, the two most common commodity indices. Because Kansas wheat (KW) is included in the S&P GSCI™ index but not in the DJ-AIG index and soybean oil (SO) is included in the DJ-AIG index but not the S&P GSCI™ index, using the assumption above one can infer the total investment in the S&P GSCI™ from the Kansas Wheat index positions reported by the CFTC and one can infer the total investment in the DJ-AIG from the soybean oil index positions reported by the CFTC as follows.

\[
\text{S & P GSCI}^\text{TM investment} = \text{KW index positions} \times \frac{\text{Price of KW contract}}{\text{Dollar weight of KW in index}}
\]

\[
\text{DJ - AIG investment} = \text{SO index positions} \times \frac{\text{Price of SO contract}}{\text{Dollar weight of SO in index}}
\]

Given this estimate of the total dollars invested in each commodity index, we can estimate the index investor positions in the non-reported commodities, using the dollar weights for the particular commodity in each commodity index, which are published daily.

It should be noted, however, that this procedure likely overstates the total value of index investment in general and the index positions in the energy markets in particular. This is because many index investors invest in versions of the S&P GSCI™ and the DJ-AIG that contain much lower weightings on energy than the standard indices. Consequently, by assuming all investment is in the standard indices, we overstate the total dollars invested because we divide by a dollar weight for Kansas wheat and soybean oil that is too low and then we compound the problem in estimating the energy index positions by multiplying by an energy dollar weight that is too high. However, we use these numbers despite the fact that they overstate the index investment levels for the sake of transparency of method and compatibility with other studies.
Appendix B: An economic analysis of influence of speculative buying and selling on commodity prices

Although the relationship between the changes in speculative positions and the changes in commodity prices could simply be a correlation as both react to a changing outlook for the forward supply and demand fundamentals, there is also the possibility that the changes in speculative positions cause changes in commodity prices as the changes in speculative positions reveal well-informed views on the changing outlook for forward supply and demand fundamentals. In this Appendix, we provide a brief economic sketch of such a relationship. For more detail, one could consult the growing academic literature on the price discovery mechanism.7

Unlike that of consumers in the physical commodity markets whose willingness to pay for the physical commodity depends on the marginal benefit it provides them, the willingness to pay of the participants in the commodity futures markets depends on the price at which they expect to be able to sell the commodity futures contract in the future and the payment they require for bearing commodity price risk in the interim (see Exhibit 21). Consequently, to the extent that the other market participants view the speculative positions as signaling information on future physical prices, more speculative buying will lead them to raise their expectations for future physical commodity prices and to raise their willingness to pay for commodity futures. This is represented by the upward sloping line in Exhibit 21.

Unlike the physical commodity markets where the equilibrium is achieved at the price at which supply and demand are balanced, in the commodity futures market the equilibrium is achieved at the commodity futures price at which two conditions are met. One, the other market participants are willing to trade given the views on fundamentals revealed by the level of net speculative length. Two, speculators are willing to hold that level of net speculative length given their views on the forward supply and demand fundamentals. This equilibrium is represented by the intersection of the upward and downward sloping curves in Exhibit 21.

As illustrated in Exhibit 21, when the speculators change their view on forward supply and demand fundamentals in such a way that they raise their expectations for future physical prices, it raises the level of net speculative length that they are willing to hold at a given futures price. The increased speculative buying leads other market participants to raise their own expectations for future physical prices, which raises the futures price at which participants are willing to trade commodity futures.

---

Comparing Exhibits 21 and 22 illustrates how information that is widely available or information that required more detailed research impacts the price of commodity futures. Both change the commodity futures price at which the market participants are willing to transact by changing their outlook on the future physical prices and forward market supply and demand fundamentals. With widely available information, however, the change is reflected in market commodity futures prices almost instantly. With more detailed information that requires research, however, the commodity futures price changes only when the buying and selling of speculators reveals it to the market.
Reg AC

We, David Greely and Jeffrey Currie, hereby certify that all of the views expressed in this report accurately reflect our personal views, which have not been influenced by considerations of the firm’s business or client relationships.

Disclosures

Distribution of ratings/investment banking relationships

Goldman Sachs Investment Research global coverage universe

<table>
<thead>
<tr>
<th>Rating Distribution</th>
<th>Investment Banking Relationships</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Buy</strong></td>
<td><strong>Hold</strong></td>
</tr>
<tr>
<td>Global</td>
<td>28%</td>
</tr>
</tbody>
</table>

As of Apr 1, 2008, Goldman Sachs Global Investment Research had investment ratings on 2,975 equity securities. Goldman Sachs assigns stocks as Buys and Sells on various regional Investment Lists; stocks not so assigned are deemed Neutral. Such assignments equate to Buy, Hold and Sell for the purposes of the above disclosure required by NASD/NYSE rules. See ‘Ratings, Coverage groups and views and related definitions’ below.

Disclosures required by United States laws and regulations

See company-specific regulatory disclosures above for any of the following disclosures required as to companies referred to in this report: manager or co-manager in a pending transaction; 1% or other ownership; compensation for certain services; types of client relationships; managed/co-managed public offerings in prior periods; directorships; market making and/or specialist role.

The following are additional required disclosures: Ownership and material conflicts of interest: Goldman Sachs policy prohibits its analysts, professionals reporting to analysts and members of their households from owning securities of any company in the analyst’s area of coverage. Analyst compensation: Analysts are paid in part based on the profitability of Goldman Sachs, which includes investment banking revenues. Analyst as officer or director: Goldman Sachs policy prohibits its analysts, persons reporting to analysts or members of their households from serving as an officer, director, advisory board member or employee of any company in the analyst’s area of coverage. Distribution of ratings: See the distribution of ratings disclosure above. Price chart: See the price chart, with changes of ratings and price targets in prior periods, above, or, if electronic format or if with respect to multiple companies which are the subject of this report, on the Goldman Sachs website at http://www.gs.com/research/hedge.html. Goldman, Sachs & Co. is a member of SIPC (http://www.sipc.org).

Additional disclosures required under the laws and regulations of jurisdictions other than the United States

The following disclosures are those required by the jurisdiction indicated, except to the extent already made above pursuant to United States laws and regulations. Australia: This research, and any access to it, is intended only for “wholesale clients” within the meaning of the Australian Corporations Act. Canada: Goldman Sachs Canada Inc. has approved of, and agreed to take responsibility for, this research in Canada if and to the extent it relates to equity securities of Canadian issuers. Analysts may conduct site visits but are prohibited from accepting payment or reimbursement by the company of travel expenses for such visits. Hong Kong: Further information on the securities of covered companies referred to in this research may be obtained on request from Goldman Sachs (Asia) L.L.C. India: Further information on the subject company or companies referred to in this research may be obtained from Goldman Sachs (India) Securities Private Limited. Japan: See below. Korea: Further information on the subject company or companies referred to in this research may be obtained from Goldman Sachs (Asia) L.L.C., Seoul Branch. Russia: Research reports distributed in the Russian Federation are not advertising as defined in Russian law, but are information and analysis not having product promotion as their main purpose and do not provide appraisal within the meaning of the Russian Law on Appraisal. Singapore: Further information on the covered companies referred to in this research may be obtained from Goldman Sachs (Singapore) Pte. (Company Number: 198602165W). Taiwan: This material is for reference only and must not be reprinted without permission. Investors should carefully consider their own investment risk. Investment results are the responsibility of the individual investor. United Kingdom: Persons who would be categorized as retail clients in the United Kingdom, as such term is defined in the rules of the Financial Services Authority, should read this research in conjunction with prior Goldman Sachs research on the covered companies referred to herein and should refer to the risk warnings that have been sent to them by Goldman Sachs International. A copy of these risks warnings, and a glossary of certain financial terms used in this report, are available from Goldman Sachs International on request.


Japan: Goldman Sachs Japan Co., Ltd. Is a Financial Instrument Dealer under the Financial Instrument and Exchange Law, registered with the Kanto Financial Bureau (Registration No. 69), and is a member of Japan Securities Dealers Association (JSDA) and Financial Futures Association of Japan (FFAJ). Sales and purchase of equities are subject to commission pre-determined with clients plus consumption tax. See company-specific disclosures as to any applicable disclosures required by Japanese stock exchanges, the Japanese Securities Dealers Association or the Japanese Securities Finance Company.

Ratings, coverage groups and views and related definitions

Buy (B), Neutral (N), Sell (S) - Analysts recommend stocks as Buys or Sells for inclusion on various regional Investment Lists. Being assigned a Buy or Sell on an Investment List is determined by a stock’s return potential relative to its coverage group as described below. Any stock not assigned as a Buy or a Sell on an Investment List is deemed Neutral. Each regional Investment Review Committee manages various regional Investment Lists to a global guideline of 25%-35% of stocks as Buy and 10%-15% of stocks as Sell; however, the distribution of Buys and Sells in any particular coverage...
Return potential represents the price differential between the current share price and the price target expected during the time horizon associated with the price target. Price targets are required for all covered stocks. The return potential, price target and associated time horizon are stated in each report adding or reiterating an Investment List membership.

Coverage groups and views: A list of all stocks in each coverage group is available by primary analyst, stock and coverage group at http://www.gs.com/research/hedge.html. The analyst assigns one of the following coverage views which represents the analyst’s investment outlook on the coverage group relative to the group’s historical fundamentals and/or valuation. Attractive (A). The investment outlook over the following 12 months is favorable relative to the coverage group’s historical fundamentals and/or valuation. Neutral (N). The investment outlook over the following 12 months is neutral relative to the coverage group’s historical fundamentals and/or valuation. Cautious (C). The investment outlook over the following 12 months is unfavorable relative to the coverage group’s historical fundamentals and/or valuation.

Not Rated (NR). The investment rating and target price, if any, have been removed pursuant to Goldman Sachs policy when Goldman Sachs is acting in an advisory capacity in a merger or strategic transaction involving this company and in certain other circumstances. Rating Suspended (RS). Goldman Sachs Research has suspended the investment rating and price target, if any, for this stock, because there is not a sufficient fundamental basis for determining an investment rating or target. The previous investment rating and price target, if any, are no longer in effect for this stock and should not be relied upon. Coverage Suspended (CS). Goldman Sachs has suspended coverage of this company. Not Covered (NC). Goldman Sachs does not cover this company. Not Available or Not Applicable (NA). The information is not available for display or is not applicable. Not Meaningful (NM). The information is not meaningful and is therefore excluded.

Ratings, coverage views and related definitions prior to June 26, 2006

Our rating system requires that analysts rank order the stocks in their coverage groups and assign one of three investment ratings (see definitions below) within a ratings distribution guideline of no more than 25% of the stocks should be rated Outperform and no fewer than 10% rated Underperform. The analyst assigns one of three coverage views (see definitions below), which represents the analyst’s investment outlook on the coverage group relative to the group’s historical fundamentals and valuation. Each coverage group, listing all stocks covered in that group, is available by primary analyst, stock and coverage group at http://www.gs.com/research/hedge.html.

Definitions

Outperform (OP). We expect this stock to outperform the median total return for the analyst’s coverage universe over the next 12 months. In-Line (IL). We expect this stock to perform in line with the median total return for the analyst’s coverage universe over the next 12 months. Underperform (U). We expect this stock to underperform the median total return for the analyst’s coverage universe over the next 12 months.

Coverage views: Attractive (A). The investment outlook over the following 12 months is favorable relative to the coverage group’s historical fundamentals and/or valuation. Neutral (N). The investment outlook over the following 12 months is neutral relative to the coverage group’s historical fundamentals and/or valuation. Cautious (C). The investment outlook over the following 12 months is unfavorable relative to the coverage group’s historical fundamentals and/or valuation.

Current Investment List (CIL). We expect stocks on this list to provide an absolute total return of approximately 15%-20% over the next 12 months. We only assign this designation to stocks rated Outperform. We require a 12-month price target for stocks with this designation. Each stock on the CIL will automatically come off the list after 90 days unless renewed by the covering analyst and the relevant Regional Investment Review Committee.

Global product; distributing entities

The Global Investment Research Division of Goldman Sachs produces and distributes research products for clients of Goldman Sachs, and pursuant to certain contractual arrangements, on a global basis. Analysts based in Goldman Sachs offices around the world produce equity research on industries and companies, and research on macroeconomics, currencies, commodities and portfolio strategy.

This research is disseminated in Australia by Goldman Sachs JBWere Pty Ltd (ABN 21 006 797 897) on behalf of Goldman Sachs; in Canada by Goldman Sachs Canada Inc. regarding Canadian equities and by Goldman Sachs & Co. (all other research); in Germany by Goldman Sachs & Co. oHG; in Hong Kong by Goldman Sachs (Asia) L.L.C.; in India by Goldman Sachs (India) Securities Private Ltd.; in Japan by Goldman Sachs Japan Co., Ltd.; in the Republic of Korea by Goldman Sachs (Asia) L.L.C., Seoul Branch; in New Zealand by Goldman Sachs JBWere (NZ) Limited on behalf of Goldman Sachs; in Singapore by Goldman Sachs (Singapore) Pte. (Company Number: 198602165W); and in the United States of America by Goldman, Sachs & Co. Goldman Sachs International has approved this research in connection with its distribution in the United Kingdom and European Union.

European Union: Goldman Sachs International, authorised and regulated by the Financial Services Authority, has approved this research in connection with its distribution in the European Union and United Kingdom; Goldman, Sachs & Co. oHG, regulated by the Bundesanstalt für Finanzdienstleistungsaufsicht, may also be distributing research in Germany.

General disclosures in addition to specific disclosures required by certain jurisdictions

This research is for our clients only. Other than disclosures relating to Goldman Sachs, this research is based on current public information that we consider reliable, but we do not represent it is accurate or complete, and it should not be relied on as such. We seek to update our research as appropriate, but various regulations may prevent us from doing so. Other than certain industry reports published on a periodic basis, the large majority of reports are published at irregular intervals as appropriate in the analyst’s judgment.

Goldman Sachs conducts a global full-service, integrated investment banking, investment management, and brokerage business. We have investment banking and other business relationships with a substantial percentage of the companies covered by our Global Investment Research Division.

Our salespeople, traders, and other professionals may provide oral or written market commentary or trading strategies to our clients and our proprietary trading desks that reflect opinions that are contrary to the opinions expressed in this research. Our asset management area, our proprietary trading desks and investing businesses may make investment decisions that are inconsistent with the recommendations or views expressed in this research.
We and our affiliates, officers, directors, and employees, excluding equity analysts, will from time to time have long or short positions in, act as principal in, and buy or sell, the securities or derivatives (including options and warrants) thereof of covered companies referred to in this research. This research is not an offer to sell or the solicitation of an offer to buy any security in any jurisdiction where such an offer or solicitation would be illegal. It does not constitute a personal recommendation or take into account the particular investment objectives, financial situations, or needs of individual clients. Clients should consider whether any advice or recommendation in this research is suitable for their particular circumstances and, if appropriate, seek professional advice, including tax advice. The price and value of the investments referred to in this research and the income from them may fluctuate. Past performance is not a guide to future performance, future returns are not guaranteed, and a loss of original capital may occur. Certain transactions, including those involving futures, options, and other derivatives, give rise to substantial risk and are not suitable for all investors.

Current options disclosure documents are available from Goldman Sachs sales representatives or at http://www.theocc.com/publications/risks/riskchap1.jsp. Fluctuations in exchange rates could have adverse effects on the value or price of, or income derived from, certain investments.

Our research is disseminated primarily electronically, and, in some cases, in printed form. Electronic research is simultaneously available to all clients.

Disclosure information is also available at http://www.gs.com/research/hedge.html or from Research Compliance, One New York Plaza, New York, NY 10004.

Copyright 2008 The Goldman Sachs Group, Inc.

No part of this material may be (i) copied, photocopied or duplicated in any form by any means or (ii) redistributed without the prior written consent of The Goldman Sachs Group, Inc.