II. THE RISKS OF COMMODITY TRADING

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II. THE RISKS OF COMMODITY TRADING

SUMMARY
CTFs face several overlapping categories of risk.

They have little exposure to commodity prices (flat price risk). They normally hedge physical commodity transactions with derivatives.

Hedging exchanges flat price risk for basis risk. The basis is the differential between the price of a physical commodity and its hedging instrument. Basis risk is the risk of a change in this differential.

CTFs accept and manage basis risk in financial markets. They may also take on spread risk, which arises out of timing mismatches between a commodity and a hedging instrument.

Margin and volume risk. CTFs have limited exposure to commodity price risk. Their profit is largely based on volumes traded and the margin between purchase and sale prices. Margins and volumes are positively correlated.

CTFs have various kinds of liquidity risk:

• Hedging liquidity. CTFs use futures exchanges to hedge commodities. Loss-making hedges incur costs daily before offsetting profits on physical commodities are realized.

• Market liquidity. In some commodities markets it may be difficult to realize value from a trading position at short notice.

• Funding liquidity. With high commodity prices, CTFs need substantial capital to trade effectively.

CTFs are exposed to a wide range of operational risks. They manage these through a combination of approaches, including insurance, IT, and health and safety audits.

Other risks include political risk, legal/reputational risk, contract performance risk, and currency risk.

CTFs can reduce risk:

• Through diversification. There is little correlation between basis risks in different commodity markets. A CTF can reduce its overall exposure by trading in multiple commodity markets. Most large CTFs are widely diversified and are therefore less susceptible to market shocks.

• Through integration. Owning assets across the value chain provides opportunities to self-hedge. When there is a market shock, cushioning effects generally occur elsewhere along the value chain.

A. RISK CATEGORIES

Commodity trading involves myriad risks. What follows is a relatively high level overview of these risks. Note that some risks could fall into more than one category. As will be seen, a crucial function of commodity traders is to manage these risks. This risk management essentially involves transferring risks that commodity traders do not have a comparative advantage in bearing to entities that do: this allows them to generate value by concentrating on their core transformation activities.

Flat price risk. Traditional commodity trading involves little exposure to “flat price” risk.\(^1\)

In the traditional commodity trading model, a firm purchases (or sells) a commodity to be transformed (e.g., transported or stored), and hedges the resulting commodity position via a derivatives transaction (e.g., the sale of futures contracts to hedge inventory in transit) until the physical position is unwound by the sale (or purchase) of the original position. The hedge

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\(^1\) The “flat price” is the absolute price level of the commodity. For instance, when oil is selling for $100/barrel, $100 is the flat price. Flat price is to be distinguished between various price differences (relative prices), such as a “time spread” (e.g., the difference between the price of Brent for delivery in July and the price of Brent for delivery the following December), or a “quality spread” (e.g., the difference between the price of a light and a heavy crude).
transforms the exposure to the commodity’s flat price into an exposure to the basis between the price of the commodity and the price of the hedging instrument. (I discuss basis risk in more detail below).

Of course, hedging is a discretionary activity, and a firm may choose not to hedge, or hedge incompletely, in order to profit from an anticipated move in the flat price, or because the cost of hedging is prohibitively high. Moreover, particularly as some commodity firms have moved upstream into mining, or into commodities with less developed derivatives markets (e.g., iron ore or coal), they typically must accept higher exposure to flat price risks.

Commodity prices can be very volatile, and indeed, can be subject to bouts of extreme volatility. Therefore, firms with flat price exposure can suffer large losses. This does not mean that flat price exposure is a necessary condition for a firm to suffer large losses: as an example, trading firm Cook Industries was forced to downsize dramatically as a result of large losses incurred on soybean calendar spreads in 1977. Indeed, many (and arguably most) of the instances in which commodity trading firms went into distress were the not the result of flat price risk exposures, but basis or other spread risks: a spread or basis position that is big enough relative to a firm’s capital can create a material risk of financial distress.

**Basis Risk.** Hedging involves the exchange of flat price risk for basis risk, i.e., the risk of changes in the difference of the price between the commodity being hedged and the hedging instrument. Such price differences exist because the characteristics of the hedging instrument are seldom identical to the characteristics of the physical commodity being hedged. For instance, a firm may hedge a cargo of heavy Middle Eastern crude with a Brent futures contract. Although the prices of these tend to move broadly together, changes in the demand for refined products or outages at refineries or changes in tanker rates or myriad other factors can cause changes in the differential between the two.

Liquidity considerations lead firms to accept basis risk. In theory, it is possible to find a counterparty who would be willing, at some price, to enter into a contract that more closely matches the exposure a firm wants to hedge. However, it can be time consuming and expensive to find such a counterparty: the firm has to accept flat price risk until a counterparty has been found. Moreover, it can be time consuming and expensive to exit such a contract once the hedge is no longer needed (as when a firm hedging a cargo of crude oil finds a buyer for it), in part because the time and expense of finding a new counterparty gives the original counterparty considerable bargaining power. By trading in standardized liquid derivatives contracts (e.g., Brent oil futures, CBOT corn futures), a hedger must accept basis risk (because the standardized contract almost never matches the characteristics of the exposure being hedged), but can enter and exit a position rapidly and at low cost because there are many other traders (other hedgers, speculators, market makers) continuously present in a heavily traded, liquid market. The speed, flexibility, and liquidity of trading in a market for a heavily traded standardized instrument reduce the transactions costs and execution risks of hedging, and for most hedgers the savings in transactions costs and execution risks more than offset the costs associated with basis risk.

Indeed, there is a positive feedback mechanism that creates a virtuous cycle that leads to the dominance of a small number—often just one—of standardized hedging instruments for a commodity, and induces market participants to trade these standardized contracts rather than customized contracts with less basis risk but higher transactions costs. The more firms that trade a particular standardized contract, the cheaper it is to trade that contract. Thus, more trading activity in a standardized contract reduces transactions costs, which attracts more trading activity to that contract. This commonly results in trading activity “tipping” to one contract (or at most two) for a given commodity. For instance, there is only one heavily traded corn futures contract. Oil is exceptional in that two liquid contracts exist side-by-side. Thus, basis risk is ubiquitous because firms prefer to accept such risk in order to achieve the transactions cost savings of trading in liquid markets for standardized instruments.

Although the basis tends to be less variable than the flat price (which is why firms hedge in the first place), the basis can be volatile and subject to large movements, thereby potentially imposing large losses on hedging firms. And as noted above, it is possible to take a position in the basis (or spreads generally) that is sufficiently risky relative to a firm’s capital that an adverse basis (spread) change can threaten the firm with financial distress.

Basis risks generally arise from changes in the economics of transformation during the life of a hedge. Changes in transportation, storage, and processing costs affect relative prices across locations, time, and form. Sometimes these basis changes can be extreme when...
there are large shocks to the economics of transformation: for example, the explosion of a natural gas pipeline that dramatically reduced transportation capacity into California in late-2000 caused a massive change in the basis between the price of gas at the California border and at the Henry Hub in Louisiana (the delivery point for the most liquid hedging instrument). As another example, in the past three to four years, the basis between West Texas Intermediate crude oil and internationally traded crude oils has become larger, and substantially more variable, due to the dramatic increase in US oil production and to infrastructure constraints.

Basis risk can also vary by commodity. The basis for refined industrial metals tends to be less volatile than the basis for metal concentrates hedged using futures contracts on refined metals.

Local, idiosyncratic demand and supply shocks are ubiquitous in commodity markets. A drought in one region, or an unexpected refinery outage, or a strike at a port affect supply and/or demand, and cause changes in price relationships—changes in the basis—that should induce changes in transformation patterns; commodity trading firms play an essential role in identifying and responding to these shocks.

Basis risks can also arise from the opportunistic behavior of market participants. In particular, the exercise of market power in a derivatives market—a corner or a squeeze—tends to cause distortions in the basis that can inflict harm on hedgers. For instance, it was reported that Glencore lost approximately $300 million in the cotton market in May-July, 2011 due to extreme movements in the basis that were likely caused by a corner of the ICE cotton futures contract. Basis and calendar spread movements are consistent with another squeeze occurring in cotton in July, 2012. Squeezes and corners have occurred with some regularity in virtually all commodity markets. In the last three years alone, there have been reports (credibly supported by the data) of squeezes/corners in cocoa, coffee, copper, and oil.

**Spread risk.** From time to time commodity trading firms engage in other kinds of "spread" transactions that expose them to risk of loss. A common trade is a calendar (or time) spread trade in which the same commodity is bought and sold simultaneously, for different delivery dates. Many commodity hedges involve a mismatch in timing that gives rise to spread risk. For instance, a firm may hedge inventory of corn in October using a futures contract that expires in December.

Calendar spreads are volatile, and move in response to changes in fundamental market conditions. The volatility of spreads also depends on fundamental conditions. For instance, time spreads tend to be more volatile when inventories are low than when they are high. Spreads can also change due to manipulative trading of the type that distorts the basis.

**Margin and Volume Risk.** The profitability of traditional commodity merchandising depends primarily on margins between purchase and sale prices, and the volume of transactions. These variables tend to be positively correlated: margins tend to be high when volumes are high, because both are increasing in the (derived) demand for the transformation services that commodity merchants provide.

The demand for merchandising is derived from the demand and supply of the underlying commodity. For instance, the derived demand for commodity transportation and logistics services provided by trading firms depends on the demand for the commodity in importing regions and the supply of the commodity in exporting regions.

This derived demand changes in response to changes in the demand and the supply for the commodity. A decline in demand for the commodity in the importing region will reduce the derived demand for logistical services. The magnitude of the derived demand decline depends on the elasticity of supply in the exporting region. The less elastic the supply, the less the

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2 The subject of cornering (a form of manipulative conduct) is obviously hugely sensitive and controversial, but it is has been a matter of contention since modern commodity trading began in the mid-19th century. Rigorous economic analysis can be used to distinguish unusual price movements and price relationships resulting from unusual fundamental conditions, and those caused by the exercise of market power. Craig Pirrong, Detecting Manipulation in Futures Markets: The Ferruzzi Soybean Episode, 6 American Law and Economics Review (2004) 72. Stephen Craig Pirrong, Manipulation of the Commodity Futures Market Delivery Process, 66 Journal of Business (1993) 335. Stephen Craig Pirrong, The Economics, Law, and Public Policy of Market Power Manipulation (1996). Craig Pirrong, Energy Market Manipulation: Definition, Diagnosis, and Deterrence, 31 Energy Law Journal (2010) 1. Using the rigorous theoretical and empirical methods set out in these publications it is possible to identify several recent episodes in which it was extremely highly likely that prices and basis relationships were distorted by the exercise of market power. It is important to emphasize that these methods can be used-and have been—to reject allegations of manipulation.

3 Jack Farchy, Cotton trading costs Glencore $330m, Financial Times, 7 February, 2012.

4 For instance, an unexpected increase in demand or decrease in supply tends to lead to a rise in prices for delivery near in the future, relative to the rise in prices for later delivery dates.
underlying demand shock reduces the derived demand for logistical services. This occurs because
the bulk of the impact of the demand decline is borne by the price in the exporting region
rather than the quantity traded, leaving the margin between purchase and sales prices and
the quantity of the commodity shipped only slightly affected.

This means that variations in the quantity of commodity shipments, as opposed to variations
in commodity flat prices, are better measures of the riskiness of traditional commodity
merchandising operations. (Similar analyses apply to the effects of supply shocks, or shocks
to different kinds of transformation such as storage or processing.)

The amount of financial risk incurred by a commodity trading firm due to variations in
margins and volumes depends on the kinds of transformations it undertakes, and the assets
it utilizes in those transformations. Transformations involving large investments in fixed
assets (notably many processing and refining activities) entail high fixed costs and operational
leverage. The financial performance of a firm with higher operational leverage will vary more
due to fluctuations in margins.

It should be noted further that many commodity firms benefit from self-hedges. For instance,
a decline in the demand for a commodity (e.g., the decline in the demand for oil and copper
during the 2008-2009 financial crisis) reduces the demand for logistical services provided
by commodity trading firms, but simultaneously increases the demand for storage services.
A firm that supplies logistical services and operates storage facilities therefore benefits
from an internal hedge between its storage and logistics businesses; the decline in demand
in one is offset by a rise in demand in the other.

These considerations highlight the danger of confusing the riskiness of commodity prices
with the riskiness of commodity trading, i.e., the provision of commodity transformation
services. Although changes to underlying supply and demand for commodities affect
demand for transformation services, the latter tend to be less volatile (especially when
underlying demand and supply are highly inelastic), and because there are frequently
negative correlations (and hence self-hedges) between the demands for different types
of transformations.

Operational Risk. Commodity firms are subject to a variety of risks that are best
categorized as “operational”, in the sense that they result from the failure of some
operational process, rather than from variations in prices or quantities. The list of potential
operational risks is large, but a few examples should suffice to illustrate. A firm that
transports a commodity by sea is at risk to a breakdown of a ship or a storm that delays
completion of a shipment, which often results in financial penalties.

A particularly serious operational risk is rogue trader risk, in which a trader enters into
positions in excess of risk limits, without the knowledge or approval of his firm. The firm can
suffer large losses if prices move against these positions. A rogue trader caused the demise
of one commodity trading company, Andre & Cie. The copper trading operation of Sumitomo
suffered a loss in excess of $2 billion due to rogue trading that lasted nearly a decade.

Contract Performance Risk. A firm that enters into contracts to purchase or sell a
commodity is at risk to the failure of its counterparty to perform. For instance, a firm that
has entered into contracts to buy a commodity from suppliers and contracts to sell the
commodity to consumers can suffer losses when the sellers default. In particular, sellers have
an incentive to default when prices rise subsequent to their contracting for a sales price,
leaving the commodity trading firm to obtain the supplies necessary to meet its contractual
commitments at the now higher price, even though they are obligated to deliver at the
(lower) previously contracted price.

This is a chronic problem in the cotton market, and this problem became particularly acute
beginning in late-2010. Initially, many cotton producers reneged on contracts to sell cotton
when prices rose dramatically. Subsequently, cotton consumers reneged on contracts when
prices fell substantially. As a result, several commodity trading firms suffered large losses in
cotton that had materially adverse effects on their overall financial performance. Contract
performance has also been an issue in sales of iron ore and coal to Chinese and Indian buyers:
this has tended to result in traders dealing with such buyers only on a spot basis.

Market Liquidity Risk. Commodity trading (including specifically hedging) frequently
requires firms to enter and exit positions quickly. Trading risks are lower, to the extent that
it is possible to enter and exit without having a large, adverse impact on prices. That is,
trading is less risky, and cheaper, in liquid markets.
Liquidity can vary across commodities; e.g., oil derivative markets are substantially more liquid than coal or power derivatives markets. Moreover, liquidity can vary randomly—and substantially—over time. Liquidity can decline precipitously, particularly during stressed market periods. Since market stresses can also necessitate firms to change positions (e.g., to sell off inventory and liquidate the associated hedges), firms can suffer large losses in attempting to implement these changes when markets are illiquid and hence their purchases tend to drive prices up and their sales tend to drive prices down.

As frequent traders, commodity trading firms are highly sensitive to variations in market liquidity. Declines in liquidity are particularly costly to trading firms. Moreover, firms that engage in dynamic trading strategies (such as strategies to hedge financial or real options positions) are especially vulnerable to declines in market liquidity. Furthermore, to the extent that declines in liquidity are associated with (or caused by) market developments that can threaten commodity traders with financial distress, as can occur during financial crises, for instance, liquidity is a form of “wrong way” risk: under these conditions, firms may have to adjust trading positions substantially precisely when the costs of doing so are high.

**Funding Liquidity Risk.** Traditional commodity merchandising is highly dependent on access to financing. Many transformations (e.g., shipping a cargo of oil on a very large cruise carrier are heavily leveraged (often 100%) against the security of the value of the commodity. A commodity trading firm deprived of the ability to finance the acquisition of commodities to transport, store, or process cannot continue to operate.

Risk management activities can also require access to funding liquidity. A firm that hedges a cargo of oil it has purchased by selling oil futures experiences fluctuating needs for (and availability of) cash due to the margining process in futures. If prices rise, the cargo rises in value but that additional value is not immediately realized in cash. The short futures position suffers a loss as a result of that price increase, and the firm must immediately cover that loss of value by making a variation margin payment. Thus, even if the mark-to-market values of the hedge and the cargo move together in lockstep, the cash flows on the positions are mismatched. Maintaining the hedge requires the firm to have access to funding to bridge this gap.

Firms can suffer funding liquidity problems due to idiosyncratic factors or market-wide developments. As an example of the first, a firm that suffers an adverse shock to its balance sheet (due to a speculative loss, for instance) may lose access to funding due to fears that it may be insolvent. As an example of the second, a shock to the balance sheets of traditional sources of funding (e.g., a financial crisis that impairs the ability of banks to extend credit) can reduce the financing available to commodity firms.

Funding liquidity is often correlated with market liquidity, and these types of liquidity can interact. Stressed conditions in financial markets typically result in declines of both market liquidity and funding liquidity. Relatedly, stresses in funding markets are often associated with large price movements that lead to greater variation margin payments that increase financing needs. Moreover, declines in market liquidity make it more costly for firms to exit positions, leading them to hold positions longer; this increases funding needs, or requires the termination of other positions (perhaps in more liquid markets) to reduce funding demands.

**Currency Risk.** Most commodity trading takes place in US dollars, but traders buy and/or sell some commodities in local currency. This exposes them to exchange rate fluctuations.

**Political Risk.** Commodities are produced, and to some degree consumed, in countries with political and legal systems characterized by a weak rule of law. Commodity trading firms that operate in these jurisdictions are exposed to various risks not present in OECD countries. These include *inter alia*, the risk of expropriation of assets; the risk of arbitrary changes in contract terms at which the firms have agreed to purchase or sell commodities; and outright bans on exports.

Such risks exist in OECD economies as well, though to a lesser degree. For instance, OECD countries sometimes intervene in commodity markets in attempts to influence prices. Thus, there is a continuum of political risks, and although some countries pose very high levels of such risk, it is not absent in any jurisdiction.

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5 Inventories financed with traditional transactional bank credit are typically marked to market on a weekly basis. If the price rises over a week, the funding bank increases the amount loaned, whereas if the price falls, the inventory owner/borrower pays down some of the loan.
Legal/Reputational Risk. Various aspects of commodity trading give rise to legal and reputational risks for commodity trading firms. Many commodities are potential environmental hazards, and firms are subject to legal sanctions (including criminal ones) if their mishandling of a commodity leads to environmental damage. These risks can be very large, particularly in oil transportation. Note the 200 million euro fine imposed on Total arising from the Erika incident, or Exxon’s massive liability in the Exxon Valdez spill; although these are not commodity trading firms, firms that engage in oil transportation are exposed to such risks. One commodity trading firm, Trafigura, paid a large monetary settlement and suffered substantial reputational damage when “slops” produced when cleaning a tanker that it had chartered, the Probo Koala, were disposed of improperly by an independent contractor, causing some people exposed to the slops to fall ill.

Furthermore, commodity trading firms frequently operate in countries in which corruption is rife, making the firms vulnerable to running afoul of anti-corruption laws in the United States, Europe, and elsewhere. Moreover, commodities are sometimes the subject of trade sanctions. Since these sanctions create price disparities of the type that commodity firms routinely profit from they create an enticement for trading firms to attempt to evade the sanctions. As a final example, commodity trading firms may have opportunities to exercise market power in commodity markets; indeed, their expertise regarding the economic frictions in transformation processes that make such kinds of activities profitable and their size make them almost uniquely positioned to do so. The exercise of market power in this way is sometimes referred to as manipulation, or cornering: such actions cause prices to diverge from their fundamental values and leads to distortions in commodity flows.

There are recent examples in which commodity traders have been accused of each of the foregoing legal transgressions. This has exposed these firms to legal sanctions and reputational damage. These risks can be substantial. For instance in late-June, 2012 a class action was filed in the United States accusing one major commodity merchant, Louis Dreyfus (and its Allenberg subsidiary), with cornering cotton futures contracts in May and June 2011. Although the accused firm has vigorously denied the allegation, the potential exposure is large (in the hundreds of million dollars) and is therefore a material risk that illustrates the potential for contingent liabilities arising from manipulation claims.

Given the current environment in which manipulation generally, and commodity manipulation specifically, is the subject of considerable political and regulatory attention, this is a real risk attendant to commodity trading, and likely a growing one. Note specifically recent allegations of manipulation involving LME metal warehousing and Brent crude oil. Even though manipulation is difficult to prove in legal proceedings, allegations are increasingly common, costly for the accused to defend, and can result in serious reputational damage even if the allegations are not proven in court.

B. RISK MANAGEMENT

Commodity trading firms universally emphasize their expertise in risk management, and the importance that they place on managing risks (price risks in particular). They utilize a variety of tools to achieve risk control objectives. Most notable among these are hedging using derivatives (e.g., selling crude oil futures or a crude oil swap to hedge a cargo of crude oil) and diversification across commodities and integration of different links in the value chain.

As noted above, hedging transforms the nature of a firm’s risk exposure from flat price risk to basis risk. These basis risks can be material, also as noted above.

Diversification across commodities makes firm financial performance less dependent on idiosyncratic events in any particular commodity. Given the nature of commodities, particular markets or submarkets are prone to large shocks that can seriously impair the profitability of operating in those markets. Diversification is a way of reducing the overall riskiness of a commodity trading firm. This is particularly important for privately-held firms that have limited ability to pass idiosyncratic risks onto diversified shareholders.

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6 For instance, ADM recently agreed to pay a fine of $54 million to settle charges that it bribed Ukrainian government officials. Gregory Meyer, ADM to pay $54 million to settle bribery charges, Financial Times, 20 December, 2013.
7 In re Term Commodities Cotton Futures Litigation 12-cv-5126 (ALC) (KNF) (SDNY). Term Commodities is a subsidiary of Louis Dreyfus. Louis Dreyfus BV and Allenberg Cotton (another Louis Dreyfus subsidiary) are also named defendants.
8 There are examples of commodity trading firms paying large sums to settle claims of market manipulation. These include Ferruzzi (in soybeans) and Sumitomo (in copper).
Most large trading firms are widely diversified. Many smaller firms are more specialized, and less diversified. The latter are obviously more vulnerable to adverse developments in a particular market.

To quantify the potential benefits of diversification, I have evaluated data on world trade flows by commodity code. Specifically, I have collected data on world imports and exports of 28 major commodities for the 2001-2011 period from the International Trade Centre UNCTAD/WTO. Using this data, I calculate correlations in annual world imports and exports across these 28 commodities. I calculate two sets of correlations between percentage changes in trade flows across commodities. The first set is based on nominal trade flows, measured in US dollars. The second set is based on deflated trade flows. To calculate deflated traded flows, I divide the nominal trade flow in a given year by the nominal price of the commodity in question, scaled so that the 2001 value is 1.00. The deflated trade flow is a measure of the quantity (e.g., barrels of oil or tons of coal) of each commodity traded in a given year.

Correlations of nominal trade flows across commodities are generally positive. The median nominal import and export correlation is close to 50%. However, deflated trade flow percentage changes exhibit much lower correlations. The median correlation for deflated import percentage changes is 0.065, and the median correlation for deflated export percentage changes is 0.031. Approximately 40% of the correlations based on the deflated flows are negative.

As noted elsewhere, the derived demand for the services of commodity trading firms, and their profitability, is dependent on the quantities of commodities traded, rather than prices. Therefore, the correlations based on deflated data are more relevant for evaluating the potential benefits to the firms of diversification across commodities. The lack of correlation generally, and the prevalence of negative correlations indicate the potential benefits of diversification across commodities in reducing the variability of trading firm risk.

Diversification can also reduce a trading firm’s exposure to basis risk. Dealing in multiple commodities diversifies away basis risk to the extent that basis movements exhibit little correlation across commodities.

Integration in the value chain also tends to reduce risk. As noted earlier, there can be self-hedges in the value chain, as in the case of storage on the one hand and throughput-driven segments on the other. Moreover, shocks at one level of the value chain often have offsetting effects (or at least, cushioning effects) at others. For instance, a supply shock upstream that raises prices of raw materials tends to depress processing margins. Integrating upstream and processing assets can stabilize overall margins, thereby reducing risk. Again, this is particularly useful for privately held firms that cannot readily pass on risks through the equity market, or for firms subject to other financing frictions. Moreover, it is more valuable across segments of the marketing chain where markets are not available to manage price risk at these stages of the chain, or these markets are relatively illiquid (e.g., iron ore, alumina and bauxite, or coal).

Diversification and integration are primarily useful in managing risks idiosyncratic to particular commodities or commodity submarkets, e.g., a drought that affects wheat production and hence prices. They are less effective at mitigating systematic shocks that affect all commodity markets, e.g., a global financial crisis, or a decline in Chinese growth (because China is a major importer of all important commodities). There are some exceptions. As noted previously, some commodity trading activities like storage are profitable when commodity demand is low even though such demand shocks tend to reduce the profitability of other trading company operations.

Risk measurement is a crucial component of risk management. Most commodity trading firms utilize Value-at-Risk as a risk measurement tool. The limitations of this measure are well known. In particular, commodity trading firms incur model risk (including risks

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10 The commodities included are listed in Appendix A. The data was accessed using the ITC’s Trade Map system.
11 The nominal price for each commodity is based on data provided in the World Bank Commodity Price Data (Pink Sheet) annual average commodity prices. For commodities (such as oil, coal, or wheat) where there are multiple varieties or grades reported (e.g., Brent and WTI; Australian, Columbian, and South African coal), I utilize the simple average of the 2001=1.00 deflators.
12 There are some exceptions. As noted previously, some commodity trading activities like storage are profitable when commodity demand is low even though such demand shocks tend to reduce the profitability of other trading company operations.
associated with the estimation of parameter inputs). Such model risks have been implicated in large losses in virtually every market and type of trading firm (e.g., banks, hedge funds), and they must be considered a serious concern for trading firms as well, especially given the fact that these firms have extensive involvement in commodities and markets for which pricing, volatility, and correlation information is particularly scarce (especially in comparison to financial markets).

Given the importance of the subject, I now turn from this more general discussion of risk management to a more detailed analysis that focuses on risk management at Trafigura.
### Table 1

**Source Data for International Trade Flow in Commodities**

<table>
<thead>
<tr>
<th>Commodity</th>
<th>UNCTAD/WTO Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal or Vegetable Fats or Oils*</td>
<td>15</td>
</tr>
<tr>
<td>Cane or beet sugar*</td>
<td>1701</td>
</tr>
<tr>
<td>Corn*</td>
<td>1005</td>
</tr>
<tr>
<td>Cocoa beans*</td>
<td>1801</td>
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<td>Coffee*</td>
<td>901</td>
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<tr>
<td>Cotton*</td>
<td>52</td>
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<tr>
<td>Cotton neither carded or combed*</td>
<td>5201</td>
</tr>
<tr>
<td>Palm Oil*</td>
<td>1511</td>
</tr>
<tr>
<td>Rice*</td>
<td>1006</td>
</tr>
<tr>
<td>Soyabean*</td>
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<tr>
<td>Soyabean oil</td>
<td>1507</td>
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<tr>
<td>Wheat*</td>
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<tr>
<td>Coal*</td>
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<td>Petroleum oils (crude)*</td>
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<td>Iron and steel*</td>
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<td>Zinc*</td>
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<td>Zinc ores and concentrates</td>
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</table>

Annual nominal export volumes for 28 commodities between 2001 and 2011 can be found on the International Trade Centre’s Trade Map statistical database. These data were used to calculate correlations between commodities.

A subset of these commodities (asterisked) is represented graphically in Figures 2, 3, 4 and 5.