



COMMODITIES DEMYSTIFIED

A GUIDE TO TRADING AND THE GLOBAL SUPPLY CHAIN
SECOND EDITION



Commodities trading – supply of the basic staples that are converted into the food we eat, the industrial goods we use, and the energy that fuels our transport and heats and lights our lives – is one of the oldest forms of economic activity, yet it is also one of the most widely misunderstood.

At no time has this been truer than in the last 25 years, with the emergence of a group of specialist commodities trading and logistics firms operating in a wide range of complex markets, from metals and minerals to energy products.

I am pleased to present the second edition of “Commodities Demystified”. The first edition of this guide, published in 2016, was enthusiastically received by a wide range of audiences including business partners, financial institutions as well as those wishing to familiarise themselves with our industry.

This updated guide builds on our attempt to explain the functions and modus operandi of these firms, and the way they help organise the supply chains that underpin today’s globalised world. Drawing on the expertise and experience of Trafigura, one of the leading independent trading firms, it describes operating principles and techniques that are common to the sector as a whole.

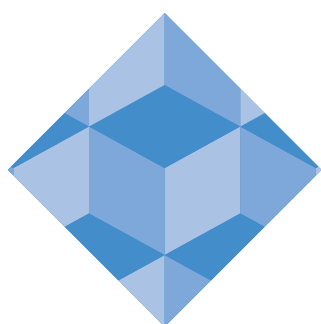
We hope you will find it interesting and informative, and that it sheds some additional light on a critical global industry that deserves to be better understood.

*Jeremy Weir, CEO
Trafigura*

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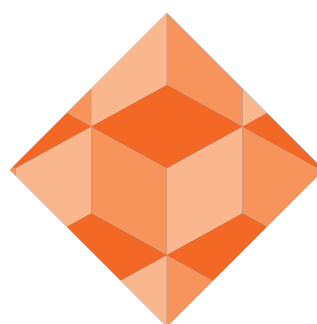
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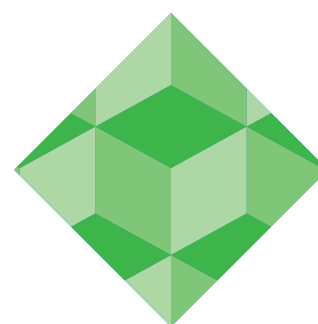
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Credits. *Commodities Demystified* was commissioned by Trafigura Group from a team of writers and designers, comprising: **David Buchan** (Lead Writer), Senior Research Fellow, Oxford Institute for Energy Studies; former Energy Editor, Financial Times; author, with Malcolm Keay, of "Europe's long energy journey: towards an Energy Union?"; **Charlie Errington** (Writer/Editor), Owner, Go Tell Communications; **Group Charlescannon Sarl** (Design and Production); and **eBoy** (cover illustration). This report is the property of Trafigura. You are not permitted to copy, adapt, reproduce or use the content of this report for any purpose whatsoever without the prior written permission of Trafigura. E-mail: CorporateAffairs@trafigura.com

INTRODUCTION

The story of the modern commodities trading industry is part of the history of our time. The vast expansion of international trading in fuels, minerals and food in recent decades is one of the vital building blocks and enablers of globalisation.

Independent commodity traders have been at the centre of key economic events, such as the upheaval of global oil markets, since the 1970s. A business once controlled by the integrated oil majors is now largely open to the forces of supply and demand. Traders have harnessed the development of modern capital markets to finance trade and of futures markets to offset risk. They have helped the world cope with seismic and sometimes disruptive shifts in production and consumption, and reversals in the economic cycle.

In particular, they have provided logistical and risk management services that have enabled the dramatic rise of new centres of economic growth - and especially the emergence in this millennium of China as the world's premier manufacturing hub. Moving the huge volumes of basic materials needed to fuel and feed this modern industrial revolution requires the services of specialist firms with the appropriate logistical and financial capabilities, global scale and scope, and expertise in and appetite for risk.

Industry estimates suggest that around \$10 trillion of commodities are produced and consumed each year around the world. However, commodities are rarely produced and consumed in the same place at the same time. Production occurs in locations that are often far away from the principal consumption centres. Commodities traders provide vital support for this global model of production and consumption in a complex value chain that includes refining, processing, storage and shipping.

This guide sets out to present a thumbnail portrait of commodities trading. Taking the dramatic integration of the global economy over recent decades as a backdrop, it describes the functions and practices of modern commodities trading firms: their basic economic purpose; the different ways in which they provide service to their customers and add value; their approach to managing the individual components of the supply chain and to mastering the many and various risks involved.

It aims to inform readers about the specialist nature of the business and the services it provides, and to dispel some of the myths that have grown up around trading over the years. It makes clear that, at its core, this is a physical and logistical business, and not the dematerialised, speculative activity that is

sometimes portrayed. It presents a business focused on moving commodities from where they are produced to where they are needed with efficiency and at the lowest possible cost; thus serving the interests of both producers and consumers.

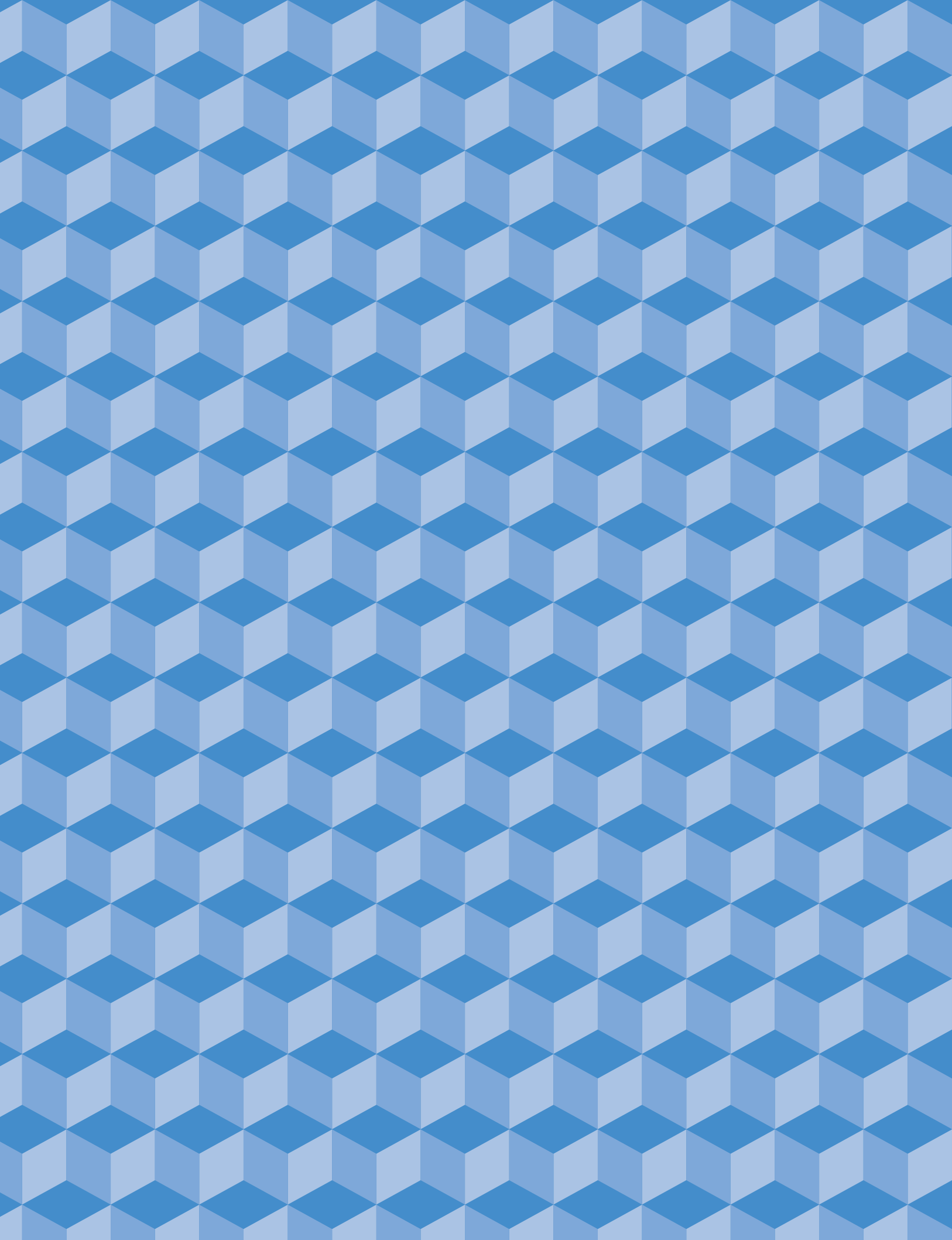
Trafigura Group, one of the world's largest independent commodity traders, with a focus on oil and petroleum products and metals and minerals, is at the centre of the narrative. The company focus allows us to provide concrete case studies and illustrations. But it also imposes some limitations. We do not claim that this is a definitive guide to all facets of the industry. Other firms will have their own unique characteristics which are not reflected here. Deliberately and inevitably, we have focused on energy, metals and minerals trading, and have made only passing reference to trading agricultural products.

But we have tried as far as possible to capture factors that are generic to commodity trading firms and their basic functions and techniques.

The document is divided into three sections. Part A establishes some basic definitions and parameters of commodities, the recent history of energy and metals markets, and the firms that trade them. Part B explores the nuts and bolts of the trading

business and the links in the supply chain, from sourcing the commodities from producers, transporting them by land and sea, and storing them in terminals, tanks and warehouses, to blending them to meet ever varying customer specifications, and delivering them to the right places at the right time. Part C drills into the more challenging details of risk management, price hedging and finance.

The available literature on this topic elsewhere is surprisingly sparse. Its complexities deserve to be properly explored by anyone with a serious interest in the functioning of the contemporary global economy. It is our hope that, however, imperfectly, this study adds to the sum of knowledge on the subject.





Section A

FUNDAMENTALS OF COMMODITIES

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Chapter 1

WHAT ARE PHYSICAL COMMODITIES?

Physical commodities underpin the global economy. They are traded in vast quantities across the globe. We depend on them for the basics of everyday life – for the electricity we use, the food we eat, the clothes we wear, the homes we live in and the transport we rely on.

The trade in physical commodities underpins the global economy. These are the fundamental raw materials from which we build and power our cities, run our transport systems and feed ourselves – the basic stuff of life.

But ask the average person what they think of when they hear the word 'commodity' and they are more likely to talk about financial markets, Wall Street and speculation.

While it is true that commodity markets can be volatile, and a certain breed of financial trader will always be attracted by that, this conception is a world away from the complex, intensely practical business of getting resources out of the ground, moving them across the globe and turning them into the raw materials we use every day.

This guide tells the story of how physical commodities get transformed into things we actually need and use, and traders' role in that. But before

we can examine how commodities work, we have to be clear about what they are.

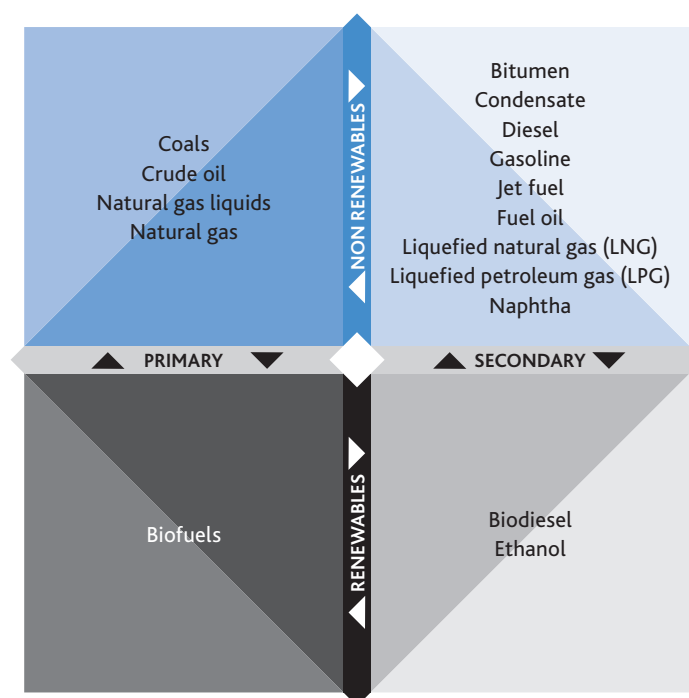
Commodities are basic products, but not every basic product is a commodity.

So what makes them different? It is important to stress their physical nature. Ultimately, one way or another, all commodities come out of the ground. Fundamentally, these are products created by natural forces.

Physical commodities are created by natural forces

That has certain implications. The first is that every shipment is unique – its chemical form depends on exactly when and where it originated. There is no such thing as a standard physical commodity. To be saleable, commodities have to be put into a usable form and moved to where they can be used, at the time they are needed. These transformations – in space, time and form – are key drivers for this business; discussed in detail in later chapters.

COMMODITIES FOR HEAT, TRANSPORT, CHEMICAL MANUFACTURING AND ELECTRICITY



Key characteristics

Physical commodities come in all shapes and sizes, but they also have certain characteristics in common:

- They are delivered globally, including by sea, usually in bulk.
- Economies of scale favour bulk delivery. The cost of transportation makes location a significant pricing factor.
- Commodities with similar physical characteristics are exchangeable, but these are not standard items. Exchanging them may have an effect on price and quality.
- There is no premium for branded goods. Pricing is determined by product quality and availability.
- They can be stored for long, in some cases unlimited, periods.

It is these characteristics that make commodities suitable for trading in global markets.

Main types

Broadly speaking, physical commodities come in two forms:

Primary commodities are either extracted or captured directly from natural resources. They come from farms, mines and wells. As natural products that come out of the ground, primary commodities are non-standard – their quality and characteristics vary widely.

Secondary commodities are produced from primary commodities to satisfy specific market needs. Crude oil is refined to make gasoline and other fuels; concentrates are smelted to produce metals. There may be minor variations in quality depending on how a secondary commodity is produced.

Agricultural

Commodity trading dates back to agrarian societies. Trading agricultural commodities got underway in an organised way in the US when the Chicago Board of Trade (CBOT) was established in 1848.

There was an exponential growth in agricultural commodities trading in the 1970s

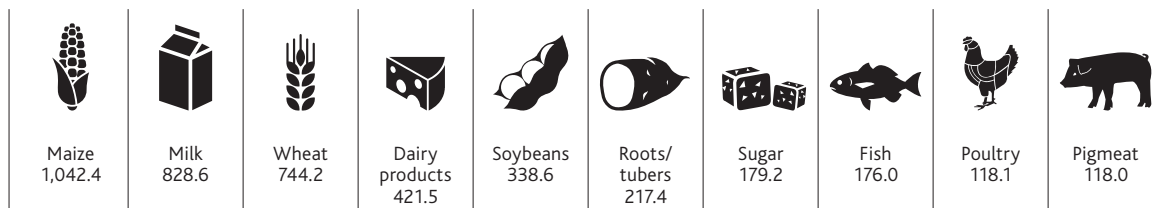
It continued to expand over the following century, and then took a leap forward in the early 1970s when the Soviet Union started to buy massive amounts of foreign grain to compensate for its failing harvests. At one stage, Moscow was buying a quarter of US grain crops, a level of demand almost comparable to the impact of China on oil and metals markets today. By the

mid-1970s the global grain trade was five times its size in the 1930s, and it continues to increase.

It is significant, in terms of the way the world economy is moving, that most of the traditional agricultural commodity trading houses such as Cargill or Louis Dreyfus have over the years added energy, metals and minerals to their portfolios.

The main categories of agricultural commodity include grains and oilseeds (corn, soybean, oats, rice, wheat), livestock (cattle, pigs, poultry), dairy (milk, butter, whey), lumber, textiles (cotton, wool) and softs (cocoa, coffee, sugar).

Global agricultural commodity production in 2017 (Million tonnes – mt)



Source: OECD-FAO Agricultural Outlook (Edition 2017)

BASIC SUPPLY CHAIN PROCESS FOR WHEAT



Energy

After crude oil's discovery in economic quantities in Pennsylvania in 1859, it burst onto the scene as a cheap alternative to whale oil in lamps. Petroleum products facilitated new possibilities for transportation and mechanisation. The trade in primary and secondary energy commodities has propelled industrialisation and global growth ever since.

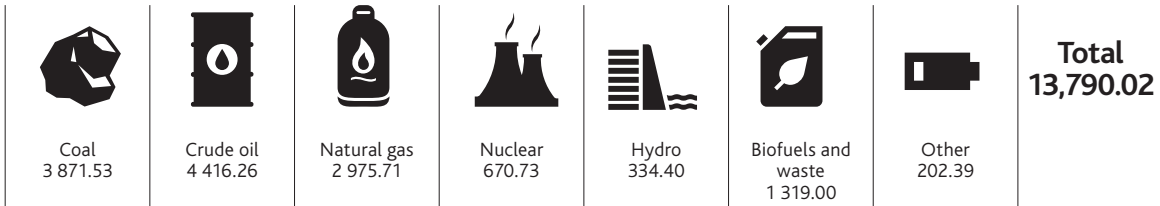
Energy commodities have been pivotal in the development of globalised markets

In recent decades, global trading firms have emerged that specialise in primary and secondary energy commodities. They have played a central part in globalising the oil trade. They have ridden the wave of resource

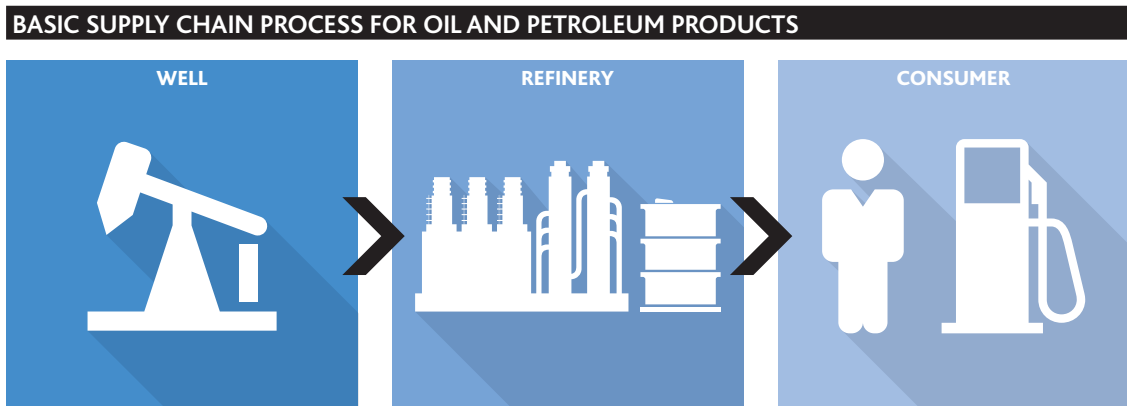
nationalism to help producing countries' national oil companies sell their output, and they have used capital markets to finance trade and futures markets to offset risk. They are helping to export the US shale revolution by bringing its oil, gas and petrochemical feedstock to world markets, and are engaged in the pivot of energy markets towards the faster growing Asian economies.

Primary energy commodities such as crude, natural gas, natural gas liquids, coal and renewables are refined and processed into many different petroleum products and fuels, from bitumen to gasoline, biodiesel and LNG (liquefied natural gas).

World energy production 2015 (Million metric tonnes – mmt)



Source: IEA Key world energy statistics report, 2017



Metals and minerals

Metallurgy goes back to the bronze age. Trading metals originated with the Phoenicians and continued with the Romans. Modern metal trading can be traced back to the mid-19th century, when Britain, the first industrialised nation, turned from being a net exporter of metals to a net importer as it sought to feed its manufacturing base.

Merchants and financiers in London organised and financed the metals trade. This early history has left its mark. The three-month contract, the main daily-traded futures contract on the London Metal Exchange (established in 1877), reflects the time it took for ships to transport copper from Chile to the UK.

The pattern of metals and mineral trading remained relatively unchanged throughout the 20th century. Successive attempts by producers to control prices by restricting supply, along OPEC lines, proved largely ineffective. Base metals –

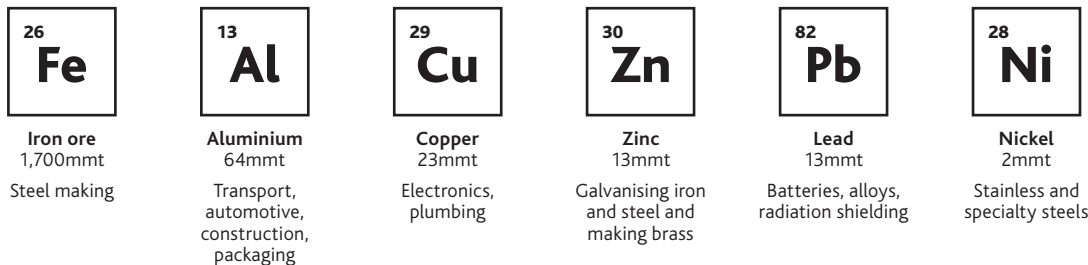
chiefly copper, nickel, zinc, lead and iron ore for steel-making – though essential for industry and manufacturing, cannot command the rigid, inelastic demand enjoyed by oil and other energy suppliers.

The spectacular industrial rise of China in the 21st century transformed the trade in minerals and metals. Rapid growth in Chinese demand created supply bottlenecks, developed new sources of production and trade routes, and led to unprecedented market volatility.

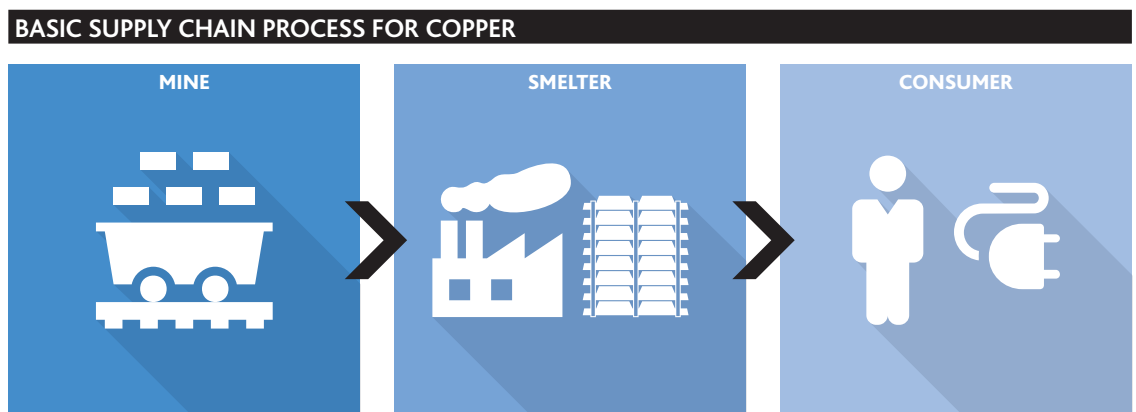
Rapid growth in Chinese demand changed the structure of metals and minerals trading

Initial processing for most metals generally takes place at or near the mine to reduce transportation costs. Iron ore is left untreated, but mined copper, lead, nickel and zinc ores are turned into concentrates, while bauxite is turned into alumina. Iron ore, concentrates and alumina are traded as primary commodities. Smelters process these into refined metals and useful alloys such as steel.

Global major metal production in 2017



Source: *Trafigura research 2018*



Commodity futures

Commodity futures have evolved alongside commodity trading to support price risk management. Physical traders use futures to hedge against the risk of adverse price movements while they are transporting commodities from the producer to the consumer.

Rudimentary futures markets existed in Mesopotamia and Japan several thousand years ago. Farmers needed to protect themselves from the vagaries of the weather. They managed that by fixing a future price for their crops. This gave them the confidence to start sowing the next year's crop before they received any money from the current year's crop.

A commodity future is a contractual agreement to trade a defined commodity on a listed exchange. The quantity, quality, delivery location and delivery date are all specified. Under the terms of the contract the seller is required to deliver the specified physical commodity on the delivery date.

Commodity futures prices converge with physical commodities

The possibility of physical delivery imposes an important price discipline on futures markets. It ensures that the price of the commodity future and that of the underlying physical commodity converge as the delivery date approaches. However, physical delivery against futures contracts almost never happens in practice. Instead, sellers close out their positions by buying back the equivalent number of contracts at the exchange on or before the delivery date.

A futures trade occurs when a buyer and seller agree on a price. The exchange acts as the counterparty for both buyer and seller so every futures trade generates two transactions, a long position for the buyer and a short position for the seller.

Futures traders maintain a cash buffer, or margin, for each contract they own. This protects the exchange against the risk of a credit default. Profits and losses are recalculated daily and the margin account is adjusted accordingly. Traders must ensure they have sufficient margin in their account at the start of each trading session.

A COMMODITY FUTURE IS A CONTRACTUAL AGREEMENT TO TRADE A DEFINED COMMODITY ON A LISTED EXCHANGE. THE QUANTITY, QUALITY, DELIVERY LOCATION AND DELIVERY DATE ARE ALL SPECIFIED. UNDER THE TERMS OF THE CONTRACT THE SELLER IS REQUIRED TO DELIVER THE SPECIFIED PHYSICAL COMMODITY ON THE DELIVERY DATE.

Where, when and what – the fundamentals of commodity pricing

End-users buy physical commodities to meet staple needs. The commodity has to be fit for purpose and it needs to be available. These requirements determine the three pillars for pricing:

- Where: delivery location
- When: delivery timing
- What: the product quality or grade

Commodity trading firms bridge gaps between producers and consumers based on these three pillars, through transformations in space, time and form.

- Space: transport the commodity to alter its location;
- Time: store the commodity to change the timing of delivery;
- Form: blend the commodity to affect its quality or grade.

Commoditisation

The term 'commoditisation' conveys the sense of total standardisation. This is misleading when applied to commodity trading.

Metals may end up pretty much the same once they have been through the homogenising process of smelting but raw materials and minerals can be very diverse, not only in location but also in physical characteristics. Even oil from the same well, or indeed coal extracted from the same pit, will alter over time as different levels of the deposits are exploited.

Both smelters and refineries are optimised to process specific grades of a commodity. With over 150 different grades of crude oil and oil products, searching out and matching sellers' products with buyers' preferences is a core competence for commodity traders.

Chapter 2

DEVELOPMENT OF COMMODITIES TRADING

In both the metals and minerals and the energy sectors, institutionally agreed approaches to commodity pricing have been superseded by the increased efficiency of market-led mechanisms.

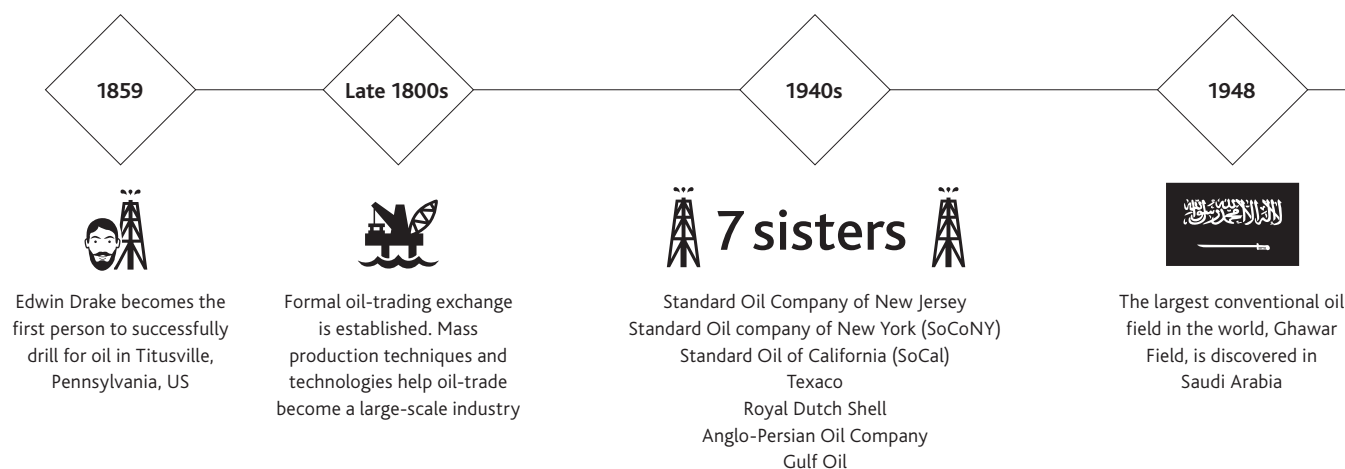
Oil and petroleum products

OPEC's (The Organisation of the Petroleum Exporting Countries) decision to flex the collective muscles of its member nations wrested monopolistic control from the oil majors – a trend that continues to the present day.

At one time, the international oil majors (often described as "the Seven Sisters") exerted almost total

control over the oil industry. They prospected for oil, extracted, transported and priced it, controlled refineries and sold oil products to end-users. This vertical integration from upstream to downstream meant they dominated the market. The Seven Sisters' dominance fed concerns that they were operating as a cartel. There were calls for increased competition from both producers and consumers.

By the 1970s, this monopolistic position eroded. Oil-producing nations, especially in the Middle East, were asserting national sovereignty over their natural resources.



Initially, OPEC members emulated the oil majors and set prices directly, but they soon switched to market-based methods, affecting price by varying production. The 1973 oil embargo was a vivid demonstration of the oil producers' ability to exert pressure by constraining supply. At the time of the embargo, OPEC controlled half of global crude production and 80 percent of proven reserves. In a market with very low demand elasticity, this allowed them to exert a high degree of control.

Producing nations took back control of their oil assets

Over the course of the 1970s and 1980s many oil majors' upstream concessions were nationalised. Producing countries established national oil companies (NOCs) to market production. Starved of crude to fuel their refineries and petrol stations, the majors set up trading operations that could source crude from other producers. In time, they developed new sources of supply, but the old model of vertical integration was gone forever.

As markets developed, oil futures contracts were increasingly used to enable trading along the supply chain between producers and consumers.

Active futures markets gave traders effective risk management tools

Standardised contracts equipped the industry with price benchmarks and effective tools for hedging price risk. This provided an opening for commodity traders. They could act as middlemen and insure themselves against the financial risk of carrying large, valuable cargoes around the world.

As time went on, oil majors reduced their trading operations. Mega-mergers at the turn of the century consolidated trading operations. ExxonMobil for instance now only markets its own oil, but in the late 1990s Mobil was a very active trading firm.

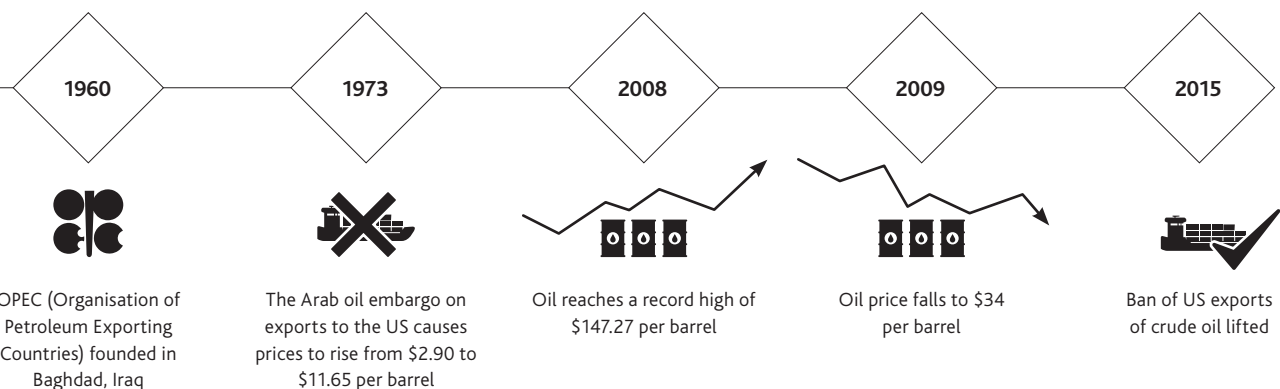
Vertical disintegration has continued. Higher oil prices encouraged the majors to sell off refineries and non-core downstream distribution to focus more on highly capital-intensive and specialised upstream exploration and production. Some commodity trading houses seized the opportunity to buy refineries, around which to build their trading business. Others, like Trafigura, were less interested in outright ownership of refining. They saw independent refineries as important new customers.

Independent, specialist operators became increasingly influential with the collapse of the old, vertically integrated supply chain model. A diffuse, actively traded market created more openings for independent commodity traders and shippers.

Before OPEC, the majors owned a third of all tankers and chartered another third on long-term time charters. The rise of the oil spot market, particularly in Rotterdam, in the early 1970s brought in more independent charterers of tankers.

By 2015, the majors owned just 9.4 percent of global tanker tonnage. The world's biggest tanker owner, the National Iranian Tanker Company has a 2.8 percent market share, but sanctions have made it very hard for it to put its tonnage to use in recent years. BP, Kuwait Oil Tanker Company, Chevron, Sonangol, Petrobras, Pertamina and PDVSA retain small market shares, but most of the oil industry now relies on chartering other people's tankers.

In today's markets, around a third of the world's crude oil – some 30m barrels a day – is traded through intermediaries. Trafigura, the second largest independent trader, has a five percent share of the traded market – that is, volumes that are not handled directly between producers and consumers.



Top ten oil producers and consumers in 2016*(thousand barrels / day)***Producers**

United States: 12,539
Saudi Arabia: 12,408
Russia: 11,341
Iraq: 4,503
Canada: 4,450
Iran: 4,395
China: 4,032
UAE: 3,865
Kuwait: 3,194
Brazil: 2,613

**Consumers**

United States: 19,901
China: 11,903
India: 4,276
Japan: 4,006
Russia: 3,637
Saudi Arabia: 3,220
Brazil: 3,076
South Korea: 2,566
Germany: 2,422
Canada: 2,418



Metals and minerals

China's explosive economic growth has expanded trade routes, opened new sources of production and enabled the emergence of a globalised, competitive marketplace.

The pattern of the global metals trade has been transformed since the start of the millennium. The major destination countries for metals have shifted from West to East; primarily to China. China's share of metal imports rose from less than 10 percent in 2002 to 46 percent in 2014. The major source countries, meanwhile, have moved from North to South. By 2014 almost half of metal exports to China came from Australia, Brazil and Chile. Peru is also emerging as a significant supplier.

Before China's rise, Japan had been the last big economy to industrialise with fast growth. During the 1970s and 1980s Japanese steel makers prioritised predictability over price. They preferred to agree prices annually with the iron ore producers rather than rely on market forces. During this period annual contract prices set the price benchmark for the whole sector.

The sheer volume of Chinese demand transformed pricing models. The iron ore market is a case in point. Chinese steel makers had never cultivated the iron ore producers in the way their Japanese counterparts had, and they were less precise about

projected consumption requirements. Faced with a shortage of iron ore under the annual contract system, the Chinese went to the spot market and to India (which had never been among the suppliers negotiating with the Japanese) for extra tonnage.

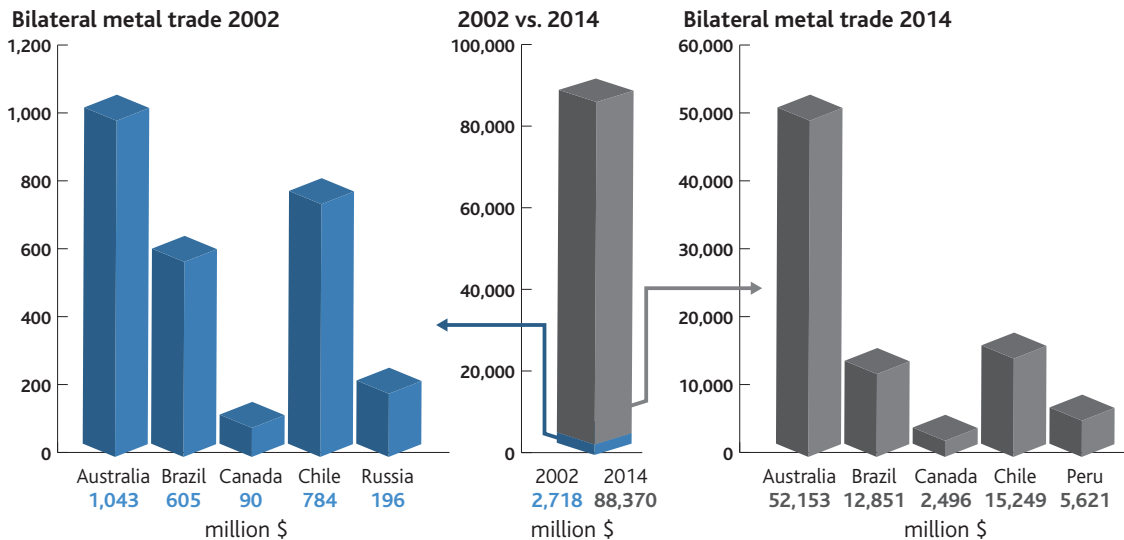
Fast growth in Chinese demand encouraged new producers and short-term pricing

In the boom years before the global financial crisis of 2008-9, the spot price rose to twice the contract price. Some Chinese companies took this opportunity to buy contract ore and sell at spot prices to their fellow steel makers. As the global financial crisis affected output, the spot price rapidly sank below the contract price and some of these firms reneged on contracts. In the post-crisis period, with China leading global growth, the spot-contract price relationship reversed again.

This see-sawing, volatile environment spurred the quest for more responsive pricing. And this is what the market has provided. Today's benchmark, The Steel Index (TSI) iron ore reference price prepared by the Platts price-reporting agency is based on reported spot market prices for iron ore at a north China port.

Increased price volatility has benefited commodity trading firms. Producers and consumers face greater risks in volatile conditions and are less willing to hold stocks. They can manage this by forging closer relationships with commodity traders, who have developed the expertise and resources to manage price risks.

EXPONENTIAL GROWTH IN CHINA'S BILATERAL METAL TRADE IMPORTS



Source: IMF World Economic Outlook, October 2015, p.47

*The metals included are aluminium, copper, iron ore, lead, nickel, tin, zinc and uranium

The changing nature, as well as the increased volume, of China's imports of copper – the second most important base metal by value – had favourable implications for commodity traders.

China used to import vastly more refined copper than copper concentrate, but in recent years that relationship has changed. In 2015, the proportion between the two types was about equal, with the proportion of concentrate continuing to increase.

Importing the raw material and processing copper at home is more cost-effective for the Chinese. As the country has grown its smelting capacity there has been a corresponding increase in investment around the world in concentrate production.

More Chinese smelting capacity fuels demand for concentrates

Global consumption of aluminium and of steel have grown significantly in the past two decades. China is playing a dual role here too, as both producer and importer. It is now the world's largest producer of steel and primary aluminium. Its adoption of a cheaper technique for producing nickel pig iron is disrupting the global stainless steel market, where it has gone from being a substantial importer to a major exporter.

The increasing focus on importing concentrates plays to the strengths of commodity traders.

Feeding China's growing demand has put a strain on world mining resources. In the pursuit of more and more quantity, quality has suffered. For instance, in the 2000s the copper content in raw ore would typically have been around 2-3 percent; the average now is less than 1.5 percent.

With lower quality ore, more is needed and it takes more energy to crush and mill it into concentrate with 20-30 percent pure copper content. Lower quality ore frequently has more impurities in it, such as arsenic, but variable quality also opens up more trading opportunities.

With fewer big mineral finds, more smaller mines are operating. But a small mine producing copper with a high arsenic content may find it hard to market itself as a sole supplier to a smelter.

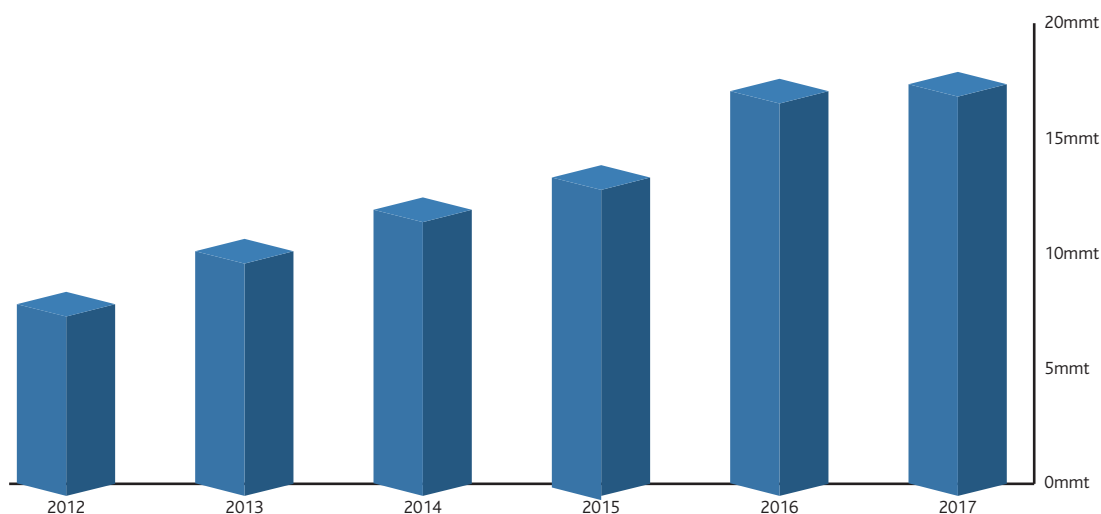
Traders can assist smaller mines by providing marketing know-how and working capital. They often combine concentrate from different sources. From the smelter's perspective, trading firms play a number of useful roles. They aggregate smaller mines' output into larger, more cost-effective shipments. Traders with blending capacity can also combine output from different sources to meet specific smelters' quality requirements.

Traders help producers access global markets

Traders also work with the leading players. Large mines want to develop relationships with trading firms, as back-up for long-term, institutional sales. Buyers of refined metals beyond the smelting stage cultivate a range of suppliers in case of a shortage.

The extraordinary recent surge in China's appetite for metals and minerals created openings for commodity traders. One might therefore imagine that the current slowdown in China's economic growth would squeeze some traders out of the market. This is unlikely. A key legacy of the commodity supercycle is the arrival of spot trading in metals and minerals. If an actively traded spot market is here to stay, so are commodity traders.

CHINA COPPER ORE AND CONCENTRATE IMPORTS (MILLION METRIC TONNES)



Source: *Trafigura research, 2016*

Changing patterns in global trade

Global markets are replacing vertically integrated providers and specialist trading firms are stepping into the breach.

China has been the engine for growth in commodity trade among its fellow BRIC countries (Brazil, Russia, India and China) – drawing iron ore from Brazil and to a lesser extent from India, and oil and gas from Russia. Chinese demand has accelerated development in resource-rich, emerging economies in Africa and Latin America.

Global trade in commodities is changing the axes on which the world economy turns. Just as commodity demand is shifting from west to east, so commodity supply is shifting from north to south. The rise of China, and now India, is fuelling growth in 'South-South' trade. The high prices generated by the commodity supercycle has shifted the terms of trade between manufacturers and commodity producers decisively, at least for a time, in favour of commodity producers. The emerging commodity producers of Latin America, Africa and south-east Asia are forging trade links with Chinese and Indian markets.

The same pivot towards Asia is evident for energy commodities. Oil demand is in gradual decline in

OECD (Organisation of Economic Cooperation and Development) countries. Non-OECD oil demand now outstrips that in OECD countries and the gap will grow. The developing world is consuming two more barrels for every one saved in OECD countries.

Asia already imports as much crude as the Middle East is able to export, and its import requirements are growing. Some of this can be met by pipelines from Russia and Kazakhstan and some from Russia's Pacific ports, but it will also have to import additional crude from more distant destinations.

THE VOLUME OF GLOBAL INTER-REGIONAL TRADE IN CRUDE OIL WILL GROW BY SOME 7 MILLION BARRELS A DAY (MB/D), REACHING JUST OVER 44 MB/D IN 2040, OF WHICH TWO-THIRDS, AROUND 29 MB/D, WILL BE FLOWING TO ASIAN PORTS (COMPARED WITH LESS THAN HALF TODAY).

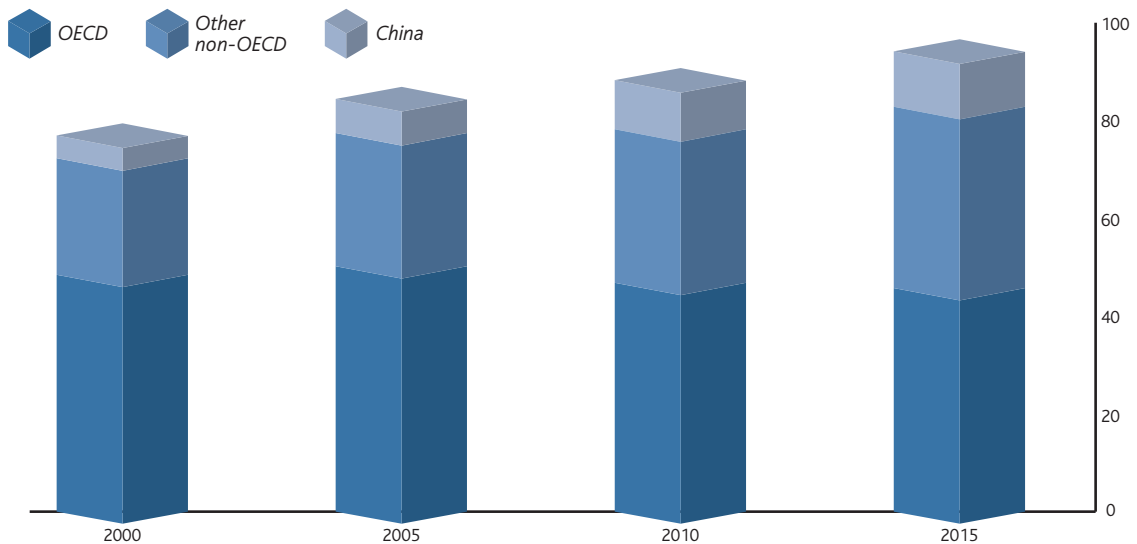
International Energy Agency

The volume of oil products being shipped around the world has already risen, as super refineries in the Middle East and India that focus on export markets have replaced smaller refineries in Europe and elsewhere near centres of consumption.

As shipping distances lengthen, the International Energy Agency (IEA) forecasts that the percentage increase in tanker trade (the volume of oil-on-water) will be almost twice the increase in the volume of crude oil actually traded.

Commodity trading is shifting the focus of global trade from north to south and from west to east

GLOBAL OIL DEMAND GROWTH IS DRIVEN BY NON-OECD ECONOMIES (MB/D)



Source: *Trafigura research, 2016*

The same regional pattern exists for gas, where consumption in non-OECD countries now exceeds that in OECD countries. Again, Asia is exerting its magnetic pull on the market. China is now the third largest gas consumer behind the US and Russia.

Because of its low density compared to other fossil fuels, gas is expensive and difficult to transport. Only around 30 percent of global gas is traded between major regions of the world, and this is unlikely to alter. But what is changing, and in a manner very relevant to commodity traders, is the

method of transport, with relatively less being delivered directly by pipeline to geographically tied customers, and more in individual LNG cargoes that can be shipped and traded between many destinations.

The biggest gas import markets in the world today are buying more LNG. Europe is expected to take more LNG from all points to balance pipeline gas from Russia, Norway and Algeria, while Japan and Korea will remain very substantial LNG importers. Although China imports pipeline gas from Russia and Turkmenistan, its LNG imports will also rise. ■

FROM THEN TO NOW: THE CHANGING DYNAMICS OF THE GLOBAL SUPPLY CHAIN

VERTICALLY INTEGRATED INSTITUTIONS



NETWORKED SPECIALIST OPERATORS

Oil majors and miners divested trading, processing and downstream units during the 2000s commodities super-cycle. There has been a partial return to vertical integration in the years since, but specialist operators, having built capacity, now compete for global volume.

FEWER PRODUCERS / FIXED GEOGRAPHIES



MANY PRODUCERS / MULTIPLE GEOGRAPHIES

Rapid growth in Chinese demand, new technologies, geopolitical factors and diverse market participants have spurred new sources of production.

LIMITED TRADING



ACTIVELY TRADED

More transparency and market liquidity have increased efficiency and reduced arbitrage opportunities.

LONG-TERM PRICING



SPOT MARKETS

The shift from institutionally-based to market-led trading has fuelled demand for benchmark-based spot market pricing.

STABLE / INFLEXIBLE



VOLATILE / FLEXIBLE

With markets becoming more active there is more speculative activity. Speculation adds to short-term price volatility, but liquid markets are also easier to hedge.

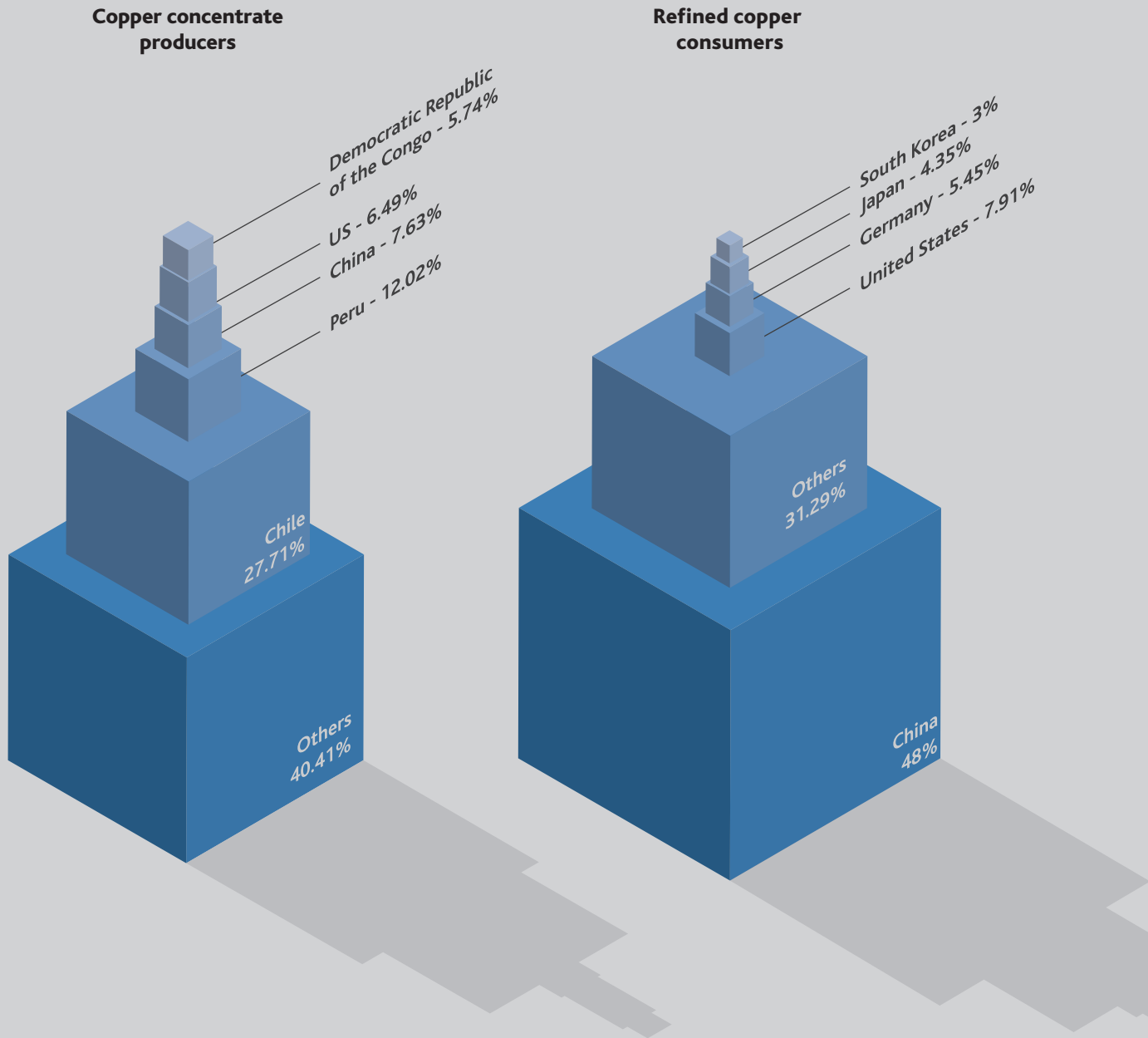
PRICE RISKS NOT MANAGED



ACTIVE RISK MANAGEMENT

Market participants have become more adept at managing price risk on futures and options exchanges and through OTC transactions.

Top copper producers and consumers in 2017



Source: WoodMackenzie 2018

Chapter 3

THE STRUCTURE OF THE GLOBAL SUPPLY CHAIN

An efficient supply chain promotes prosperity by ensuring smooth transmission of the energy and raw materials that underpin our civilisation. The market-based mechanism aligns supply and demand highly effectively.

The physical supply chain – upstream, midstream and on the water

The physical supply chain is the beating heart of the commodity trading business. Global trading firms manage transportation and complex logistics to source, store, blend and deliver commodities for their customers around the globe.

Trafigura's traded volumes give a sense of the scale of the business. In 2015, it traded 146 million metric tonnes of crude, gasoline, fuel oil, middle distillates (jet fuel, diesel), naphtha, condensates, LPG, LNG and biodiesel. In the same year it traded 52 million metric tonnes of metal concentrates, refined metals, coal and iron ore. Its shipping operations transported 95 million metric tonnes of oil and petroleum products, and 32 million metric tonnes of minerals and metals on 2,744 individual ship voyages.

As a leading independent trading firm, its involvement in the supply chain runs from the point of production through storage and blending to shipment and final delivery. The aim is to provide a complete service for clients.

Connected markets

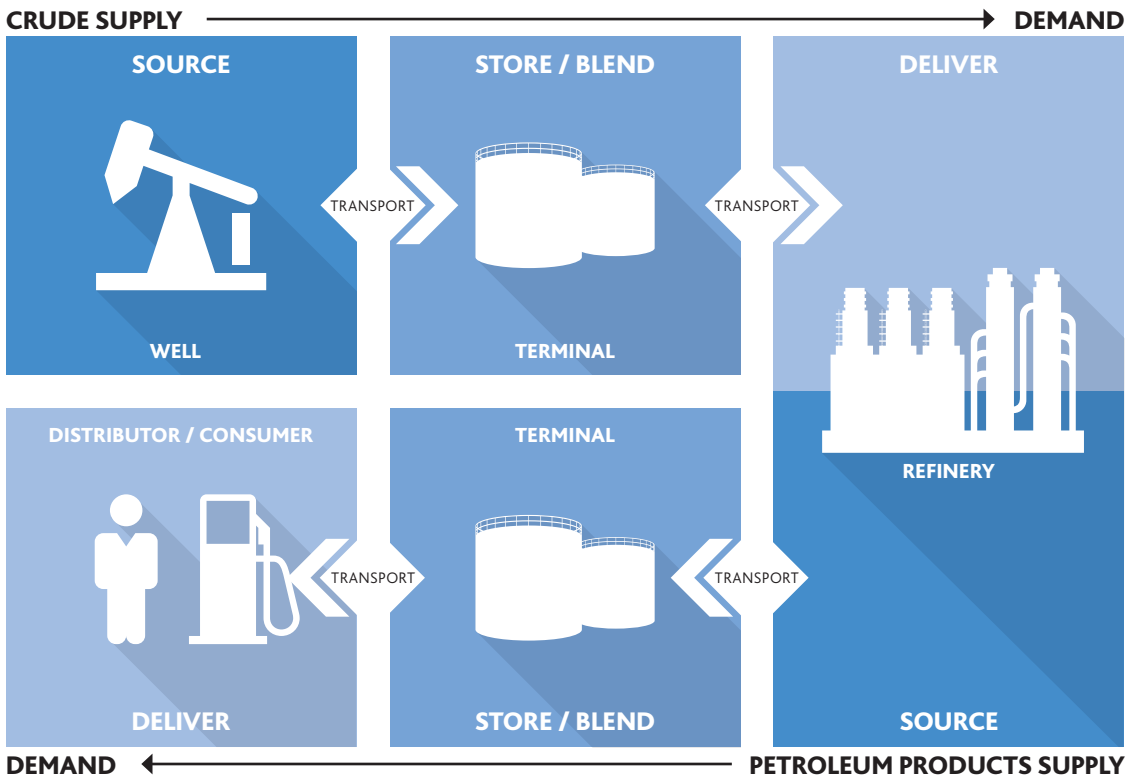
Within the global supply chain are numerous, interconnected supply chains.

There is, for instance, no homogeneous, global market for crude. Instead, linked regional markets co-exist for its many different varieties and grades priced off regionally based benchmarks.

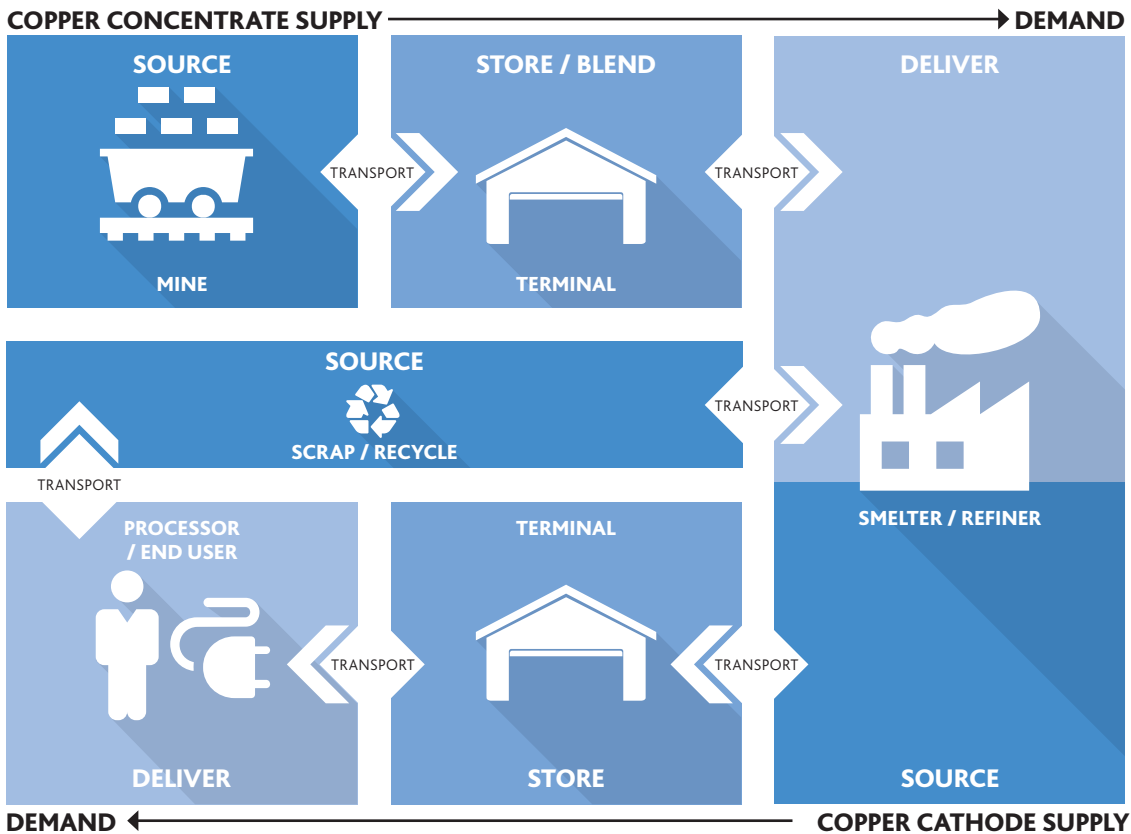
Hundreds of types of crude are traded worldwide. They are priced off three main benchmarks: West Texas Intermediate (WTI), Brent blend and Dubai crude. But the extent of pricing differentials between these markets is limited. If the differentials get too great, it is profitable for traders to blend and transport crudes priced in the cheaper markets and market them in more expensive markets. And when they do this supply and demand pressures reduce differentials again.

The global supply chain comprises numerous interconnected supply chains.

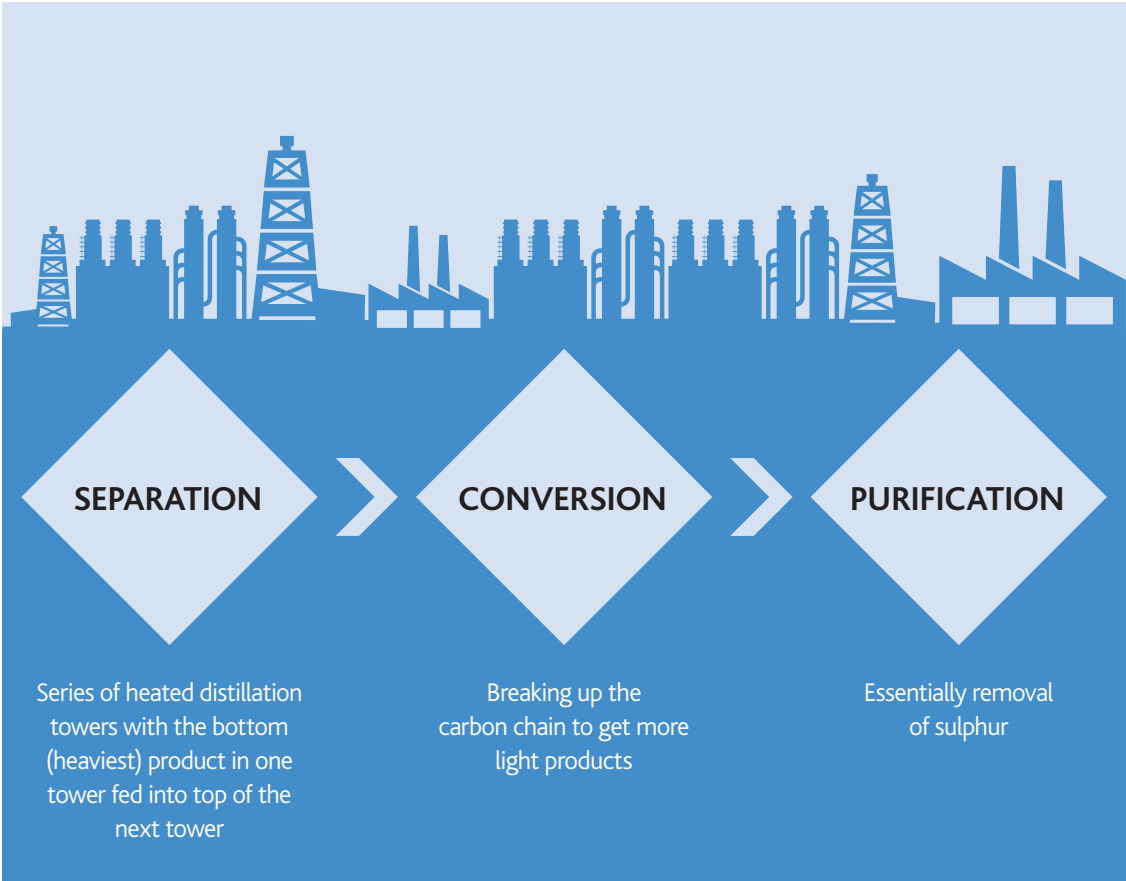
SUPPLY CHAIN FOR CRUDE OIL & PETROLEUM PRODUCTS



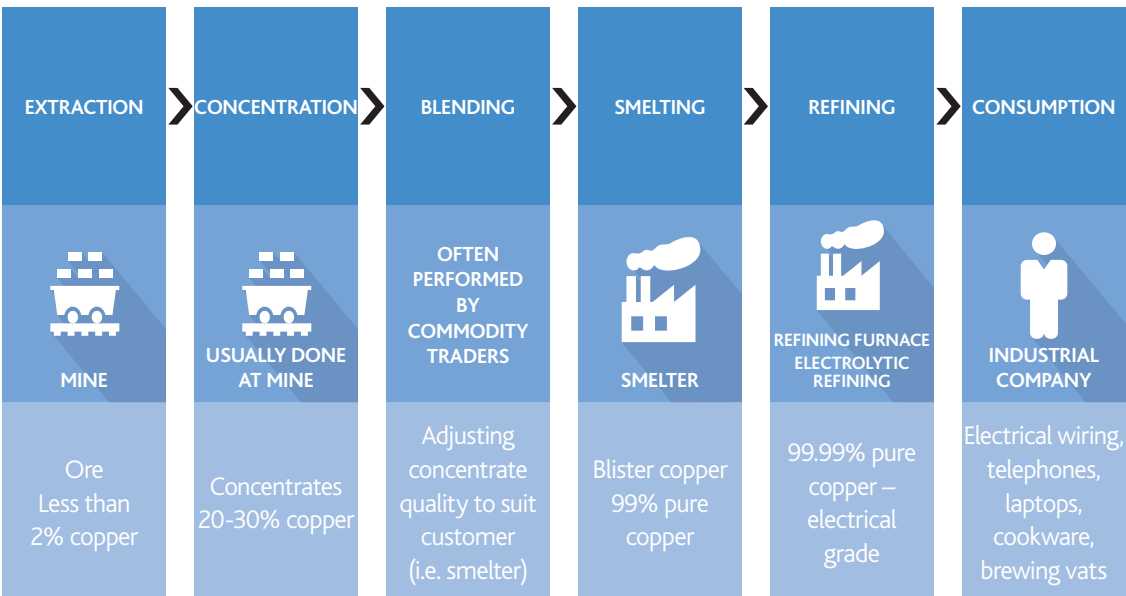
SUPPLY CHAIN FOR COPPER



REFINING CRUDE OIL INTO PRODUCTS



COPPER FROM MINE TO MARKET



Primary and secondary commodities

Supply chain connectivity is most direct between primary and secondary commodity markets.

Primary commodities, such as crude oil and copper concentrate, are extracted from wells and mines. They are prepared for transportation at the production site. Heavy crude may be blended with distillates or a lighter crude to reduce its viscosity and improve pipeline flow. Copper ore is crushed and milled into concentrate.

The end-users for primary commodities use them as feedstock for processing into secondary commodities that can then be sold on to manufacturers, utilities and energy users.

Refineries and smelters act as both consumers and producers of commodities. Refineries take crude and produce gasoline, distillates, fuel oil, etc. Copper smelters acquire concentrate and fuel for their furnaces to produce the refined metal. Both require precisely specified products.

Traders act as conduits between producers and consumers in both primary and secondary commodity markets. They transform and transport commodities to meet customers' timing, delivery and quality requirements.

Links between markets

Economic fundamentals link markets and affect key trade routes. For instance, the US shale revolution has had a big impact on the pattern of global energy trade. It has reduced US net oil imports, increased the export of US refined products and required traditional US suppliers, like Nigeria, to find alternative markets. It has not only made the US self-sufficient in gas but transformed it into an exporter of LNG; and as US shale gas pushed US coal out of the domestic power market, it has created further negative repercussions for the international coal market. The multi-dimensional consequences illustrate the interconnectedness of markets.

Storage promotes market stability

Inelasticity in the supply and demand for commodities increases the potential for market volatility. Shutting down a mine is very expensive. Once a mine has closed it is very difficult to start it up again. Miners will therefore often prefer to go on producing, even at a loss. In the medium term, this may mean that a reduction in demand results in persistent, excess supply. Without any kind of circuit breaker prices would fall even faster.

Storage plays a key role in the global supply chain. It acts as a shock absorber, reducing overall price volatility. When supply is outstripping demand, inventories rise. When demand exceeds supply inventories can be drawn upon to meet consumers' requirements.

Trading firms manage global storage inventories that help keep markets in equilibrium. They use futures markets as a hedge against changes in commodity prices. Typically, they build up inventory in buyers' markets and reduce inventory in sellers' markets. In doing this, they both profit from market volatility and help to reduce it by smoothing underlying supply-demand imbalances.

Storage acts as a market shock absorber; rising when there is excess supply and falling when there is excess demand

"VOLATILE ECONOMIC CONDITIONS INCREASE VALUE CREATION OPPORTUNITIES. SUPPLY AND DEMAND SHOCKS CAN CAUSE GEOGRAPHIC IMBALANCES THAT CREATE SPATIAL ARBITRAGE OPPORTUNITIES FOR TRADERS. GREATER VOLATILITY ALSO MAKES STORAGE MORE VALUABLE, THEREBY CREATING INTER-TEMPORAL ARBITRAGE OPPORTUNITIES. GREATER ECONOMIC VOLATILITY IS ALSO ASSOCIATED WITH GREATER VOLATILITY IN RELATIVE PRICES, AND IN PARTICULAR TEMPORARY MISPRICINGS THAT CREATE TRADING OPPORTUNITIES".¹

Professor Craig Pirrong, University of Houston

Traders and volatility

Markets function most effectively when there is deep and consistent liquidity. Traders help create liquid commodity markets and thereby lower transaction costs. They are especially active in volatile markets.

Traders thrive on volatility and commodity markets are often highly volatile. But in the same way that traders profit from bottlenecks in the logistical supply chain, but do not cause them, it does not necessarily follow that they encourage volatility.

Traders thrive in volatile conditions, but their actions don't make markets more volatile

Take world oil markets. Oil is a staple in economic life. In the short-to-medium term, price movements will have relatively little effect on consumption - we all need fuel for our cars, so small supply changes can lead to big price movements. There are also geopolitical forces at play, with some oil producing nations subject to sanctions and others riven by internal conflicts. Seasonality, government fiscal policy and the management of strategic oil stockpiles for countries like the US and China all have a big impact.

Commodity traders do not create these general conditions; they do not promote volatility. Traders are not speculators - their job is to match buyers with sellers. They do that through physical arbitrage and, from making markets more volatile, arbitrage actually helps to re-establish balance and improve efficiency and transparency in physical markets. ■

¹ *The Economics of Commodity Trading Firms, Craig Pirrong, 2014*

Chapter 4

WHO ARE COMMODITY TRADERS AND WHAT DO THEY DO?

Commodity trading firms play a pivotal role in the global supply chain by bridging gaps between producers and consumers, and by balancing supply and demand both within and between connected markets.

The leading firms

The principal traders in agricultural products have a long lineage; Cargill for example started grain trading at the end of the American Civil War. In recent years, they have also begun to trade in energy and 'hard' commodities as a subsidiary activity.

Vitol, Trafigura, Mercuria, Gunvor and Noble are leading firms that specialise in energy, metals and minerals trading. Glencore started up as a pure trader, but is now a major mining company. Several major oil and mining companies are also active traders, as a sideline to their industrial activity.

"COMMODITY TRADERS ARE THE
VISIBLE MANIFESTATION OF ADAM SMITH'S
'INVISIBLE HAND', DIRECTING RESOURCES
TO THEIR HIGHEST VALUE IN RESPONSE TO
PRICE SIGNALS".²

Professor Craig Pirrong, University of Houston





Physical trading

Commodity trading is a bilateral business bringing buyers and sellers together in over-the-counter (OTC) deals. This cannot be done through centralised exchanges, electronic or otherwise, such as the oil futures market, because physical commodities vary widely in grade, quality and location, and the needs of those who use them are very diverse.

To see why, just look at the Nymex's WTI contract. Like all futures contracts, all the features of the WTI contract are standardised, including the notional delivery point at Cushing, Oklahoma, except the price. Futures are ideal for price discovery. In terms of physically allocating oil, futures contracts are hopeless; very few people want to take delivery of oil in a small town in Oklahoma; but standardisation is vital. Standardised futures contracts provide the market with benchmarks – such as Brent, WTI and Dubai – around which actual physical oil can be priced, at a premium or discount, according to quality, transport and location. They also allow buyers, sellers and traders of physical oil shipments to hedge the risks and exposures on OTC contracts.

² *The Economics of Commodity Trading Firms, Craig Pirrong, 2014*

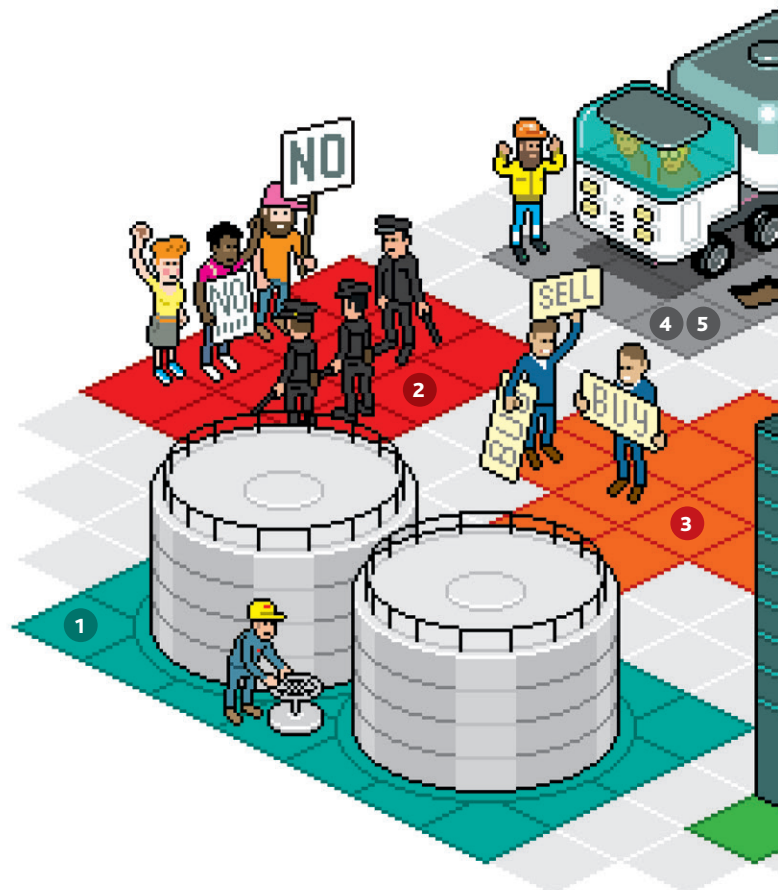
Top commodity trading houses by revenue in 2016

Company	Founding date	Revenues 2016 (\$)	Commodities traded	Corporate status
ENERGY, METALS AND MINERALS				
 Glencore <i>Founded as Marc Rich and Co AG</i>	1974	153 billion	Copper, zinc, lead, nickel, ferroalloys, alumina, aluminium, iron ore, cobalt, coal, oil, oil products, wheat, corn, canola, barley, rice, oil seeds, meals, edible oils, biofuels, cotton, sugar.	Public limited
 Vitol	1966	152 billion	Crude oil, fuel oil, gasoline, middle distillates, naphtha, methanol, ethanol, chemicals, LPG, natural gas, LNG, carbon emissions, coal, iron ore, power, alumina, base oils, bitumen.	Private
 Trafigura	1993	98.1 billion	Crude oil, fuel oil, middle distillates, gasoline, naphtha, LPG, LNG, biodiesel, condensates chemicals, coal, iron ore, concentrates and ores (copper, lead, zinc, alumina, nickel, tin, cobalt) refined metals (copper, aluminium, zinc, blister, nickel, tin, cobalt).	Private
 Mercuria	2004	91 billion	Crude oil, fuel oil, middle distillates, gasoline, naphtha, biofuels, petrochemicals, natural gas, LNG, power, coal, iron ore, manganese, chrome, carbon emissions, base metals, food and feed grains, oil seeds, vegetable oils.	Private
 Gunvor	2000	47 billion	Crude oil, heavy fuel and feedstock's, middle distillates, gasoline, naphtha, LPG, biofuels, natural gas, LNG, carbon emissions, copper, aluminium, zinc, lead, tin, nickel, manganese, steel, coal, coking coal, iron ore, timber.	Private
 Noble Group	1986	45.5 billion	Crude oil, LNG, distillates, gasoline, fuels, coal gas, aluminium, alumina, bauxite, copper, iron ore, chrome, manganese ore, zinc, lead, nickel, metallurgical coal, metallurgical coke.	Public
AGRICULTURAL PRODUCTS (MAINLY OR WHOLLY)				
 Cargill	1865	107.2 billion	Crude oil, bunker fuel, fuel oil, distillates, naphtha Gasoline, LPG, power, natural gas, cotton, grain and oilseeds, sugar, ethanol, palm oil.	Private
 Archer Daniels Midland	1902	62.4 billion	Food (acidulates, beverage alcohol, edible beans, fiber, tree nuts, lecithin, vitamin e, oils, plant sterols, polyols and gums, proteins, rice, soy isoflavones, starches, sweeteners) animal feed, corn, oilseed, ethanol, biodiesel, industrials.	Public
 Louis Dreyfus Company	1851	49.8 billion	Oilseeds, grains, rice, freight, coffee, cotton, sugar, juice, dairy, fertiliser, metals.	Private
 Bunge	1818	42.7 billion	Oilseeds, sugar, bioenergy, edible oils, wheat, corn, rice, fertiliser.	Public
 Wilmar International	1991	41.4 billion	Palm oil, oilseed, edible oils, sugar, specialty fats, oleo chemicals, biodiesel, fertiliser, flour, rice.	Public
 Olam International	1989	20.5 billion	Cocoa, coffee, edible nuts (cashew, almonds, hazelnuts, peanuts, sesame), rice dairy, grains, palm oil, fertiliser, rubber, wood, cotton.	Public

Source: public materials including company websites and annual reports

Oil trading: a multidimensional discipline

Commodity traders need excellent peripheral vision to understand the interconnected nature of the global economy. Conditions in commodity markets can change rapidly and traders have to remain alert to many micro and macro factors. Economic cycles, geopolitical developments and technical factors all have an impact.



1 Availability of tankage

Supply of oil and petroleum products does not come solely from wells and refiners. Traders, producers, consumers and countries all maintain large inventory stocks in oil tanks located strategically around the globe. Traders keep tabs on tankage to know what capacity is available to them should they need to store stocks at particular locations. They also monitor tankage to identify potential sources of supply.

2 Geopolitical developments

Conflict in oil-rich areas and international sanctions can have a major impact on supply. Both fiscal and security policy can affect supply and demand for oil. The US 700-million-barrel Strategic Petroleum Reserve (SPR) is the

world's largest emergency supply. On several occasions, the US government has bought and released stocks to and from the SPR to reduce and supplement supply. Traders need to be aware of changes in policy.

3 Benchmarks

The spot market (for immediate delivery or receipt) in oil is a small fraction of the world oil market, but it sets prices for a much larger volume of trade. Every shipment has specific qualities and each is priced individually. Almost always this price is expressed as premium or discount to a benchmark price. Traders monitor the key benchmarks to gain insight into both absolute and relative price movements.

4 Bottlenecks, peaks and troughs

Traders monitor the impact of natural cycles, economic trends and global events on supply and consumption levels in different parts of the world. They also need to know about a range of technical factors; these might include a lack of local infrastructure constraining supply or seasonal variations in demand.

5 Locations and logistics

Product can come from multiple sources. In a competitive industry, many transactions are only doable with narrow margins. Traders can secure competitive advantage through a combination of keen pricing and efficient logistics. They need to assess the real cost of the product at the point of delivery. For instance, acquiring oil inland and

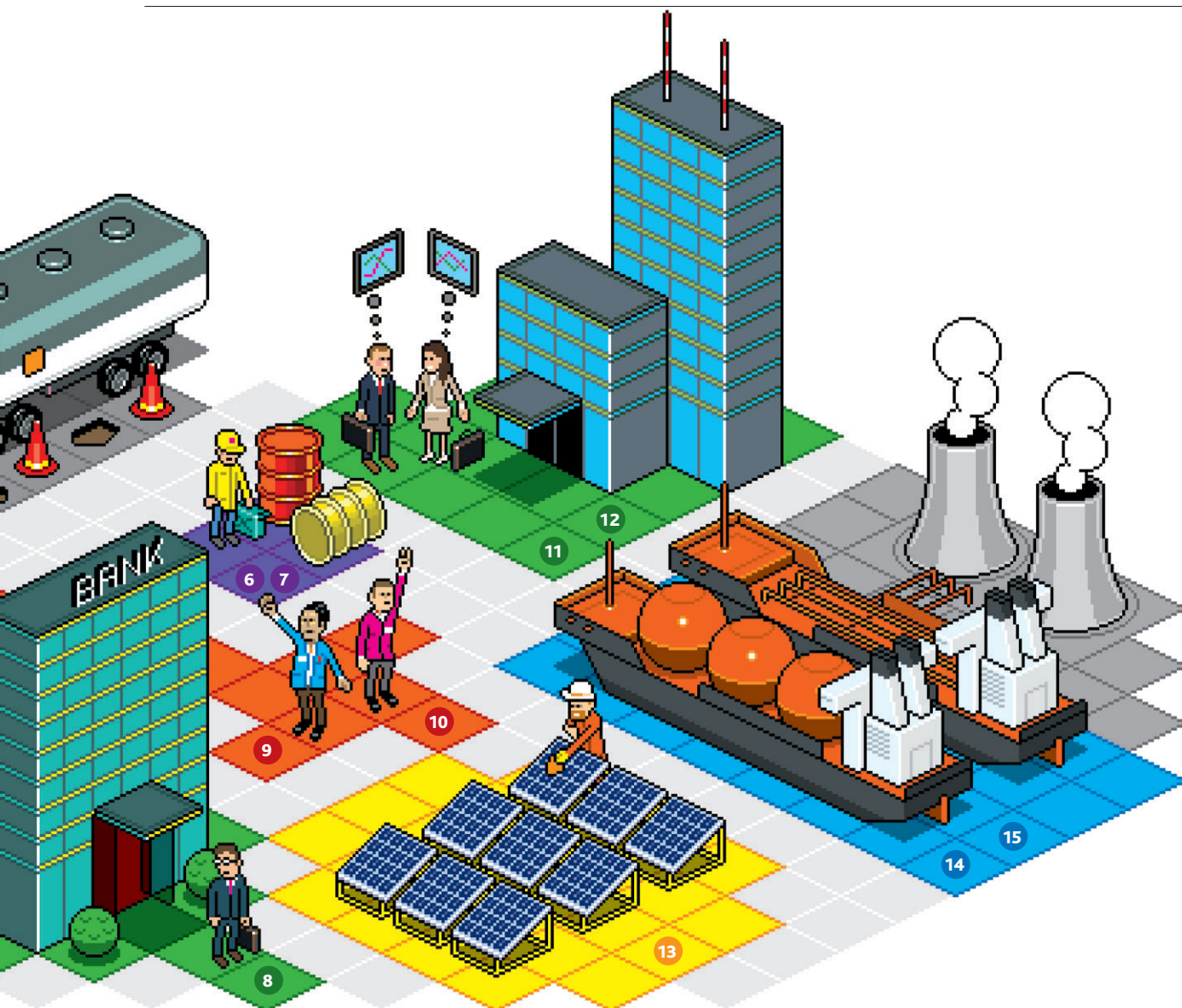
transporting it by barge may be more cost-effective than bringing the same shipment to port using the road network.

6 Product specifications

Generally, commodity traders are less directly interested in the absolute level of commodity prices than in geographic or quality price differentials between different grades of the commodity. They aim to identify a price differential that makes it profitable to move commodities around the world and transform them. To do that, they need a solid working knowledge of the chemical constituents of the commodity.

7 Blending opportunities

Traders may decide to acquire commodities with a view to blending multiple commodities. They must



assess the cost and effectiveness of combining commodities to create a synthetic blend. They also need to identify when and where blending can take place and know where other blending ingredients can be acquired.

8 Cost of financing

Trading firms attract short-term secured finance to bridge the time lag between buying and selling commodities. Finance is more expensive when commodity prices and interest rates are higher. This is an unavoidable cost of doing business, which the trader must factor in to determine the profitability of a transaction.

9 Futures markets

Futures markets provide valuable information about expected future supply and demand on which producers, consumers and traders

can act today. As the most actively traded market, futures provide the most accurate, timely indication of changing market sentiment.

10 Contango and backwardation

Traders monitor whether futures are trading at a premium (contango) or a discount (backwardation) to the spot price. This gives an indication of whether inventories are rising or falling. When markets are in contango there may be an opportunity to conduct a cash-and-carry arbitrage (see page 46).

11 Risk management

Trading teams use futures and options to minimise exposure to market volatility. Many trading desks include specialist risk management teams that manage the traders' overall exposure to absolute price risk.

12 Counterparty and political risk

Commodity trades are large-scale transactions. Traders try to limit credit risk by partnering with financial institutions, but they also need to calibrate their exposure to specific counterparties and be aware of sovereign risk.

13 Cost / availability of substitute products

The price and availability of substitute products can affect the supply and demand for a physical commodity. Close substitutes, including different grades of the same commodity, impact on price by changing the economics for traders who are blending commodities. More indirect substitutes affect prices in linked markets by affecting the demand for related energy products.

14 Existing trade flows

Understanding trade flow fundamentals is critical. Traders are continually assessing relative and absolute pricing levels. Spreads between prices often relate to the direction of trades. When trade flows shift, price differentials change.

15 Cost / availability of freight

The cost of freight varies according to the availability of shipping. Dealers in physical commodities factor in transportation cost when assessing the profitability of a trade. They often sit alongside freight traders who can fix prices for particular journeys in the wholesale markets.

▶ Play the video online

www.downloads.commoditiesdemystified.info

Trading and transformation

Commodity traders are essentially logistics companies that use financial markets to fund their operations and hedge or limit the price risk involved. They transport and, in several ways, transform, commodities across the world. This notion of transformation is key. It can involve:

Traders add value by transforming commodities in space, time and form

Transformation in space.

Transporting commodities from where they are produced to where they are consumed is the most visible aspect of the commodity trading business. Oilfields and mineral deposits are rarely near urban centres of consumption. Commodities are often transported across continents. Shipping therefore plays a vital part in commodity trading.

Transformation in time. Commodity supply and demand are not always in sync. The demand for energy products fluctuates with the seasons. Supply can be disrupted in the short term by industrial action, geopolitical conditions or extreme

weather. Oversupply or excess demand can persist over the medium term, because of the time it takes for productive capacity to adjust to changing demand conditions.

Firms deal with mismatches in supply and demand through temporal transformation. They store commodities while supply is unusually high and draw down inventories when demand is unusually high. Storage reduces volatility by smoothing fluctuations in the prices and availability of commodities. To do this effectively, commodity traders need access to strategically located storage facilities and financial credit.

Transformation in form. With the exception of those consumed directly in a power station, all commodities undergo some transformation before they can be consumed. While commodity traders do not usually involve themselves in industrial processes, they often blend or mix different grades of refined oil or metal products to suit their customers.

THE TRINITY OF ARBITRAGE OPPORTUNITIES



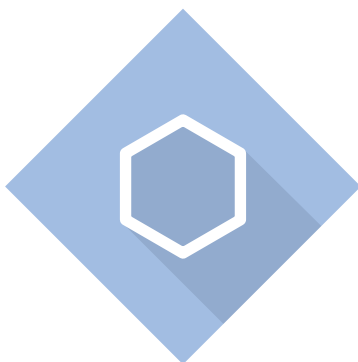
Space
transport

Unlike financial markets, where pricing relationships are relatively stable because products are basically interchangeable, in the physical trading world there is a lot more disjunction in prices. If there is a refinery accident or bad weather and there is a sudden need for a product, there might be a perfect substitute, but not if the substitute is 500 miles away.
 See Chapter 6, p.38



Time
storage

Forward prices reflect the market's expectations about tomorrow given the reality of today. When today's oil price is lower than prices on the forward curve, the oil market is said to be in contango. This is when oil storage comes into its own, and oil traders have profited.
 See Chapter 7, p.44



Form
blending and processing

Most blending-based arbitrage is about optimising grades to satisfy pools of demand, but arbitrage opportunities can also arise out of government regulation. Until the end of 2015, US regulators prohibited exports of unrefined oil products. This created a profitable trade in the export of lightly refined US oil.
 See Chapter 8, p.48

Physical arbitrage

What is in this for the commodity traders themselves? Their business model is based on identifying and acting on market inefficiencies which present themselves as excess price differentials between untransformed and transformed commodities. They act on these pricing signals to direct commodities to where they are most valued, reducing market mispricing. By doing this, they make markets more competitive and in exchange earn profit.

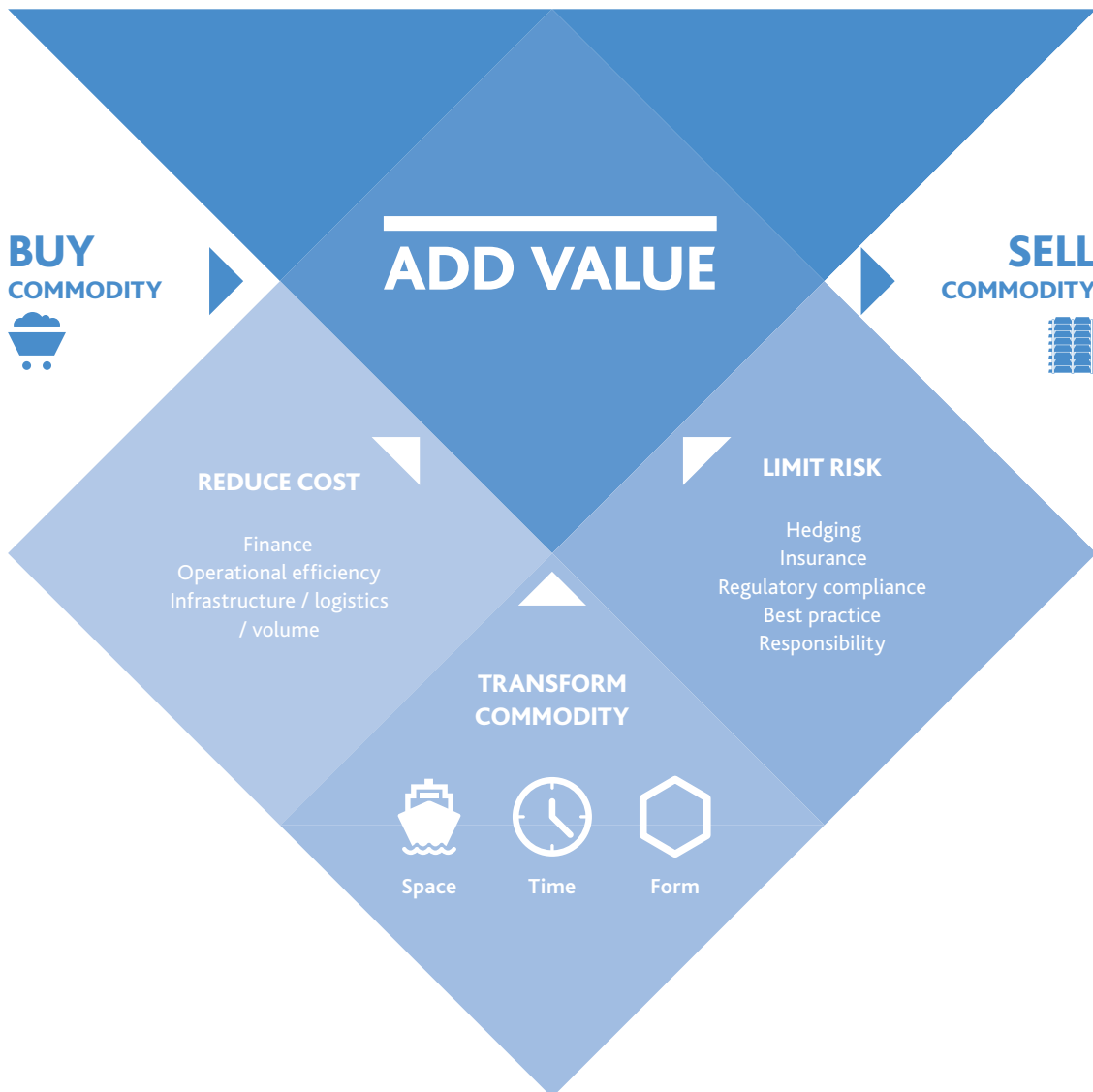
Traders focus on spotting any gaps in the market, mispricing or dislocation in distribution. They monitor relative prices for different grades of a commodity (the quality spread), for the same commodity with different delivery locations (the geographic spread) and for different delivery dates (the forward spread). Where they identify a mismatch, they can lock in

profit by buying in the cheaper market and selling in the more expensive market.

An arbitrage opportunity opens up when the value of transformation – the difference between the prices of the transformed and untransformed commodity – is more than the cost of making that transformation. For instance, in a contango market the forward price is higher than the spot price. Traders can buy and store the commodity today and simultaneously sell it at a higher price on the future date (see page 46).

Arbitrage depends on careful execution of a large volume of transactions with generally very thin margins. The trader must be able to identify worst-case revenues and costs from the outset. They can only undertake these large-scale, low-margin transactions if they have reliable access to funding and the expertise to manage risk effectively.

HOW TRADERS ADD VALUE TO COMMODITIES



Arbitrage: how it works

In practice, a commodity trading firm will often employ more than one arbitrage technique in a single transaction. The following example shows how arbitrage techniques may be combined to optimise copper concentrate trading flows.

Existing trade flows

Prior to this transaction, Trafigura had arranged to source copper concentrates via an offtake agreement with a Peruvian mine (1). It had also agreed to deliver copper concentrates to a Finnish smelter (2).



Transformation in space: geographic arbitrage
Trafigura subsequently identifies a geographic arbitrage opportunity. It switches its supply source for the Finnish smelter and finds a different buyer for the Peruvian concentrates.

Trafigura sources concentrates for the Finnish market at a Spanish mine (3). It delivers the Peruvian concentrates to a US smelter (4). These two transactions result in much shorter delivery journeys and yield a significant reduction in overall freight costs compared with the original Peru to Finland route.



Transformation in time: time arbitrage
Trafigura ships concentrates to the Finnish smelter according to the originally agreed schedule, but the US smelter wants delivery in six months' time.

With the copper market in contango, Trafigura now identifies a time arbitrage.

The US smelter is prepared to pay a premium for forward delivery in six months. Trafigura stores the Peruvian concentrate safely and securely at an Impala Terminals warehouse (5).



Transformation in form: technical arbitrage
The US smelter requests a particular specification for its concentrate. Trafigura can meet this requirement cost-effectively by blending the Peruvian concentrate in its warehouse to create the required grade synthetically (6). This technical arbitrage earns it additional margin.

The blended concentrates are shipped to the US smelter, arriving six months later as agreed. The combination of arbitrage techniques has increased Trafigura's profitability and price competitiveness.



How arbitrage destroys arbitrage

Physical arbitrage depends on identifying and exploiting pricing anomalies, but paradoxically the arbitrage transaction itself will cause the anomalies to disappear. The mechanism is as follows:

Arbitrage can occur when traders identify relative mispricing in connected markets. They buy the commodity where it is underpriced, and sell it – following transformation in the connected market – where it is overpriced.

This increases demand in the first market, which exerts upward pressure on the price. In the second market, the increase in supply pushes prices down. The net result is to reduce the price differential between these two markets.

Over time, the effect of the arbitrage on supply and demand moves the two markets into balance and the anomalies disappear. In their pursuit of physical arbitrage opportunities, commodity traders create increasingly efficient and competitive markets. Both producers and end-users are the beneficiaries.

More transparency and increased competition

The price anomalies that lead to arbitrage often stem from poor information or limited competition. In increasingly efficient markets, pricing differentials are getting smaller, more transient and harder to identify.

More arbitrage and increasing transparency limit anomalies and make markets more efficient

Commodity traders can still generate sustained profitable opportunities wherever they can develop a competitive advantage. Many firms are building alliances and developing efficient logistics to execute transformations more cost-effectively than their competitors.

Increased transparency encourages commodity traders to exert control across the whole logistics chain, including storage. As markets have become more competitive and information has improved, the emphasis has shifted towards cost reduction.

Reducing costs with improved logistics

Trafigura's approach has been to acquire interests in industrial assets where it identifies opportunities to strengthen its supply chain. These may include terminals, storage and transportation facilities. It sometimes acquires assets to address transport bottlenecks and sells them on once it has resolved them.

Patterns of asset ownership by commodity traders are diverse, complex and dynamic, which makes generalisation difficult. Commodity traders' involvement in industrial assets should also be seen as part of a wider trend of 'backward integration'. Many other players in

the commodities sector – smelters, refiners, even manufacturers – are backing into extractive industries with investments that assure security of supply; Arcelor Mittal's acquisition of iron ore mines is just one example.

Price differentials

Generally, commodity traders are not interested in the absolute level of commodity prices, high or low, but in the geographic or technical price differentials of commodities that make moving them around the world and transforming them profitable.

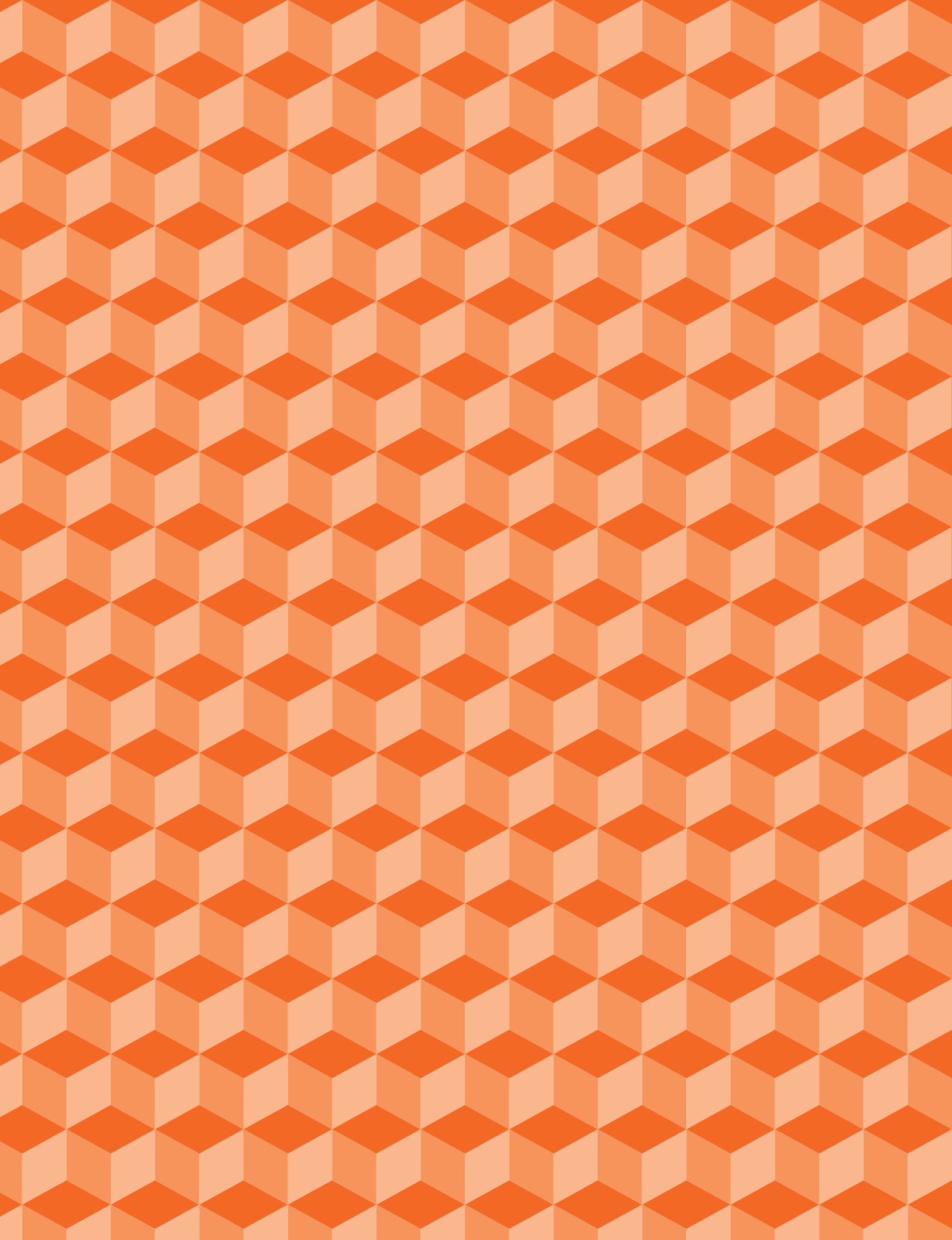
Commodity traders might trade the difference in value between one grade of gasoline and another grade of gasoline, or the difference in value between gasoline in New York and the same grade of gasoline in Rotterdam, or the difference between one concentrate of copper with a high content of gold and another with a high content of cyanide.

The concept of price differential sets commodity traders apart from many other intermediaries in business. Most middlemen take a fixed percentage of a financial transaction, and therefore have a self-interest in the value of the transaction being as high as possible. In contrast, commodity traders – like any trader who buys and sells – are less interested in the absolute level of commodity prices than in the price differential between purchase and sale, and in the degree to which this spread can be increased by transforming commodities to suit the varying needs of their customers. ■

Physical traders care less about market prices. They want to maximise price differentials between buyers and sellers

"TRAFIGURA'S ABILITY TO INVEST IN THE SUPPLY CHAIN HAS GROWN, BUT THE MODEL HAS BEEN CONSISTENT OVER TIME. WE ARE AGNOSTIC ON THE PRICE OF COMMODITIES. WE WANT TO DELIVER A SERVICE IN ORDER TO ADD VALUE. IF YOU ARE JUST BUYING AND SELLING THERE IS A LIMIT, AND TO BE A LONG-TERM SUCCESS YOU NEED TO PROVIDE REAL VALUE-ADDED TO YOUR CUSTOMERS. FOR INSTANCE, WE CAN HELP A MINE IN THE CONGO WITH ITS ENERGY INPUT, MAKE ITS TRUCKING OPERATIONS MORE EFFICIENT, ENSURE BETTER RELIABILITY, AND THEN SHIP ITS PRODUCTS TO ONE OF OUR IMPALA TERMINALS, AND HANDLE ALL THE RISK INVOLVED ON A VOYAGE THAT WILL TAKE WEEKS ALL THE WAY TO CHINA. SO WE ARE NOT JUST AN ARMS-LENGTH BUYER AND SELLER".

Pierre Lorinet, Director and former Chief Financial Officer, Trafigura





Section B

HOW COMMODITY TRADING WORKS

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Chapter 5

SOURCING COMMODITIES: WORKING WITH PRODUCERS

Trading firms aim to maximise the price differential between the price they pay for (untransformed) commodities and the revenue they earn by selling (transformed) commodities. Minimising the overall cost of acquiring commodities is therefore a priority. They work with producers to secure long-term, cost-effective supply.

Reducing overall cost

Despite changed market dynamics, the majors* still control a sizeable proportion of commodity supply chains. They operate many of the largest mines and oilfields. They have long-term customers with processes optimised to meet their output. They use tried-and-tested trade routes and invest in specialist logistics. It all helps to minimise the total cost of delivery.

Most independent traders do not own their own sources of production. They search far and wide to identify and acquire low-cost, marketable product.

Trading firms need to factor in shipment, processing and scaling costs

To do that, they need boots on the ground – people who understand the local culture, who are able to adapt to its priorities.

Independent traders can incur significant costs when they bring new producers to market. It is not just about the headline price. Lower cost producers may be smaller operations with limited access to global markets. The trader has the task of making their products globally competitive.

Trading firms have to deliver shipments at their customer's preferred location and they have to meet grading criteria and quality thresholds. If they buy from producers in remote, inaccessible locations, transportation costs are likely to be high. If they buy from smaller mines, it is harder to achieve economies of scale. Traders often work with producers to optimise or scale up production.

Focusing on quality

The pace of growth in Chinese demand has forced traders to look further afield for supplies and quality has suffered. The average copper content in ores has fallen from 2 percent to less than 0.6 percent over the last two decades. With low-quality raw materials, smelters require more concentrate to produce the same amount of copper. The concentrate may include impurities, arsenic for instance, which need to be managed. It all adds to delivery costs.

Process quality is equally important. There are high-quality deposits in Africa's copperbelt, but trading firms need to be careful where they source these. Some mines, especially in conflict areas, do not conform to international health and safety standards.

*Mining majors: BHP Billiton, Glencore, Rio Tinto. Oil majors: BP, Chevron, Exxon Mobil, Shell, Total

This matters for the trading firm. In a world that is moving towards increased transparency, suppliers that source from mines with poor social, environmental and production performance run a significant reputational risk.

Improving competitiveness and marketability

Many trading firms develop specialist logistics to support multiple, smaller producers. Trafigura is investing heavily in Colombian transport infrastructure. In Brazil, its state-of-the-art multimodal cargo terminal, a joint venture with Mubadala, has direct rail links to miners in the country's iron ore quadrangle.

Traders can gain a sustained competitive advantage by developing advanced logistics in countries where there are no viable alternatives. Their logistics networks can transform and transport commodities at lower cost than their competitors. But these are long-term investments and they need to work in partnership with local communities.

Firms will also provide technical or financial resources to help producers modernise and extend production. These are often linked to long-term purchase arrangements, known as offtake agreements, where the trader agrees in advance to buy a minimum percentage of the mine's output over several years.

Securing supply

There are many ways of securing supply, one of which is ownership of oil and gas fields and mines. Common ownership of the raw material and of all the means to process, transport and market it can make sense.

There are several examples of upstream integration. Glencore, after its merger with Xstrata, has effectively become an integrated mining company. Mercuria has upstream oil and coal assets, and Vitol owns upstream oil assets. Trafigura owns mines in Spain and Peru.

Offtake agreements and upstream integration secure long-term supply

However, a more usual way to secure supply is through long-term offtake agreements with producers. Sometimes such agreements follow on from a spell of asset ownership by the commodity trading firm. Trafigura, for example, bought a Peruvian mine in 1997 and spent the following 16 years improving efficiency and extending its life. When it sold the mine in 2013 it signed an agreement to take 100 percent of its output.

Commodity trading firms sometimes combine an initial investment (perhaps in the form of a joint venture) with offtake agreements to get supply flowing.

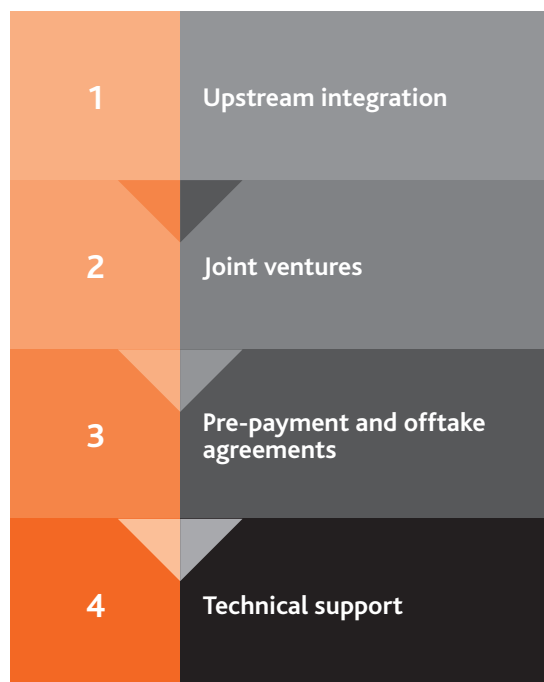
Pre-payment agreements

More typically the commodity trading firm makes a pre-payment for future supply. This arrangement is popular in many resource-rich but cash-poor developing countries that might resist outright foreign ownership of their natural resources.

Commodity pre-payments are a useful substitute for the loans that emerging economies find increasingly hard to get from international banks. For commodity traders making the pre-payment there is a risk that the commodity to be delivered will fall in value. However, there are mechanisms to deal with this. The producer can for instance agree to make up any fall in commodity value with a cash payment or extra supply of the commodity.

Offtake agreements give producers security of demand and commodity traders security of supply. Commodity traders are unlikely, in every case, to tie a specific volume of crude to a specific agreement to supply one particular refinery, or dedicate copper concentrate to serve a particular smelter. They wouldn't be traders if they were to forego the opportunity of getting the best price for their offtake volumes. But the existence of some steady long-term supply coming into their commodity portfolios does allow traders to sign longer-term supply agreements with refiners, smelters and processors. ■

WAYS COMMODITY TRADING FIRMS SECURE RELIABLE LOW-COST SUPPLIES



Chapter 6

TRANSPORTING COMMODITIES: TRANSFORMATION IN SPACE

Many producers are found in remote locations, often in emerging economies. Traders need to deliver commodities to consumption centres on the other side of the world. They can increase their profitability and generate more physical arbitrage opportunities by lowering transportation costs.

Developing infrastructure

Commodity trading firms rely on efficient logistics to transport commodities cost-effectively. Where the existing infrastructure is sub-optimal, there are strong commercial grounds for investing in midstream assets – road, rail or river transportation linked to modern ports and terminals – that increase the efficiency of their supply chains.

Multimodal logistics

Trading firms design multimodal logistics systems to optimise economies of scale and reduce shipment costs. They select the most efficient transportation for each stage along the supply chain to reduce the overall cost of the delivered commodity. Multimodal terminals optimise the transfer of shipments between different modes of

transport. These may be situated inland or at the coast and will usually take advantage of automated processes that streamline transferral. For instance, small-scale miners in Brazil's iron ore quadrangle transport their cargo on trucks to a local collection terminal at an inland railway station. The product is transferred directly onto rail freight carriages. It then travels by rail to an Atlantic terminal, where it is automatically unloaded onto a conveyor belt. This conveys the product to a feeder system for a bulk dry freight tanker, which is berthed and ready for export.

Multimodal logistics networks optimise transportation and minimise transferral costs at each stage of the supply chain

Trafigura reinvents logistics in Colombia

Following the collapse of the state-owned railway company in 1990, Colombia's rail network disintegrated. It put immense strain on the road system as the only viable means for transporting cargo.

It led to a situation where transporting freight 500km overland by road from Bogotá to the country's main Pacific port at Buenaventura was more expensive than shipping that same load the 15,500 kilometres by sea to China.

Trafigura has invested over \$1 billion to help to develop the country's strategic infrastructure and reduce its reliance on an overloaded, inefficient road network.

Its ambitious plan is revolutionising Colombia's logistics. Trafigura subsidiary Impala Terminals is coordinating an operation to connect the Caribbean Sea to the country's hinterland by opening the 1,500-kilometre Magdalena River to freighty traffic.

With its multimodal logistics network in Colombia, the trading firm can move product to and from Colombia's interior. A giant oil terminal at Barrancabermeja on the Magdalena river is exporting and importing crude and naphtha using motorised pushers and barges.

Trafigura's river transport system is helping Colombia to unblock the logjam that has constrained its economic development. In return, the company gets access to a sizeable new market.

Inland transportation

Getting product from one part of the world to another brings many different modes of transport into play. The main inland modes of transportation include:



Trucks

Delivery by road is probably the most flexible mechanism, but individual shipments are not easily scalable. Trucks are best deployed to manage complex routes and difficult terrain.

Rail

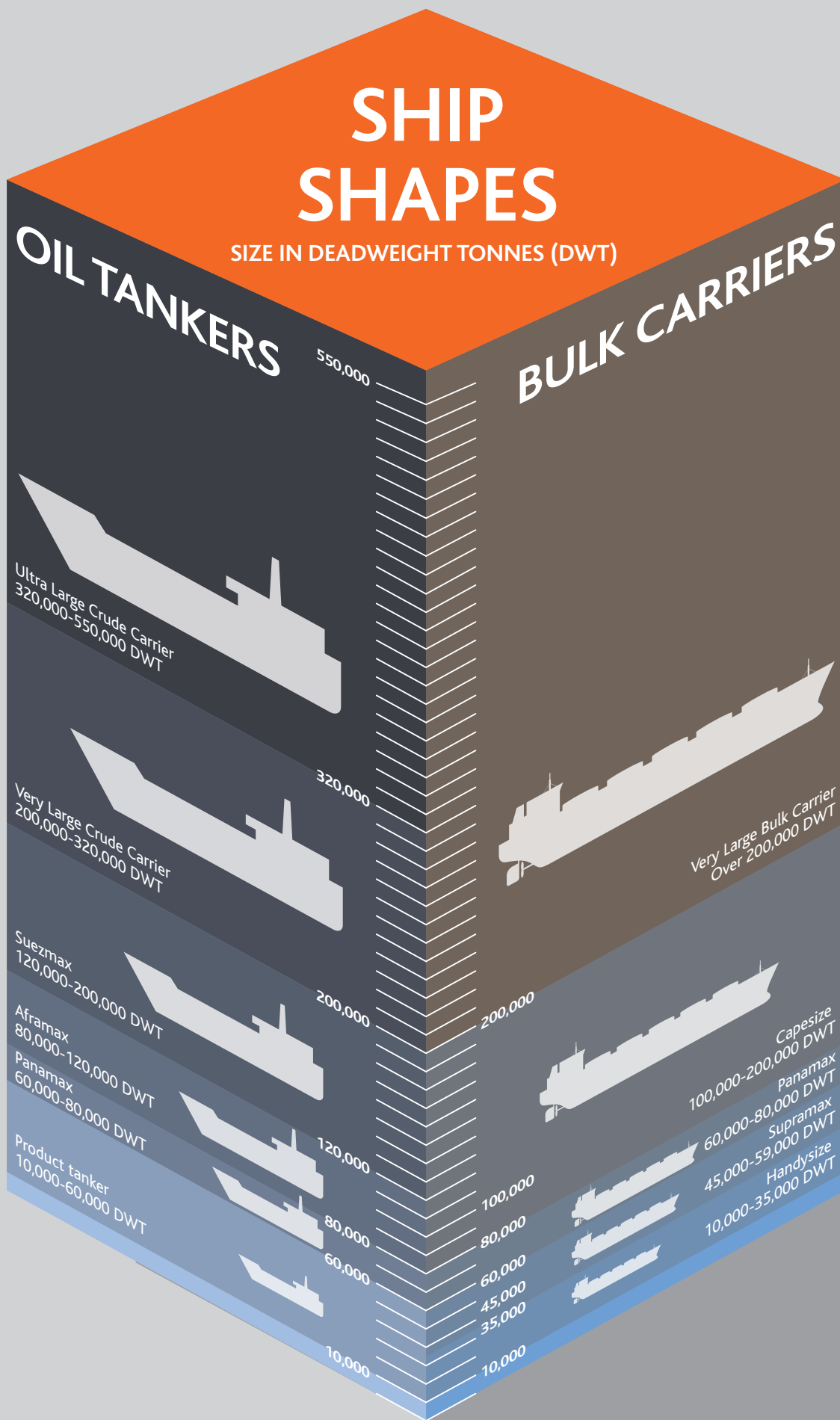
Low unit cost, large-scale shipments. Rail also offers high-speed delivery and the ability to build direct rail links between producer and ports. It may require a high initial investment.

Barge

Like rail, this is a low unit cost transportation alternative where there is a suitable river. This will also require substantial initial investment. Terminals and barge fleets are needed. The ability to arrange direct river-to-ship transfers at seaports can be advantageous.

Fixed pipeline

Low unit cost, but high capital costs. Pipelines ensure continuous supply and are most suitable for traders with a steady flow of consumer orders and control of substantial terminal capacity.



Overseas transportation

Just as commodity trading firms need onshore facilities to load, offload, store and blend cargoes, so they need ships to carry their cargoes across the oceans. However, unlike terminals, commodity trading firms do not need to own their own vessels. Ships are interchangeable and port facilities are not.

They may charter wet freight tankers to transport oil and petroleum products. Metals and minerals – dry freight – are transported in bulk carriers.

There are two main ways of doing this:

- **A time charter** is like renting a car: you pay for the daily hire, fuel and any parking fees, while the cost of maintenance, insurance and licensing is paid by the rental company.

- **With a voyage charter**, the charterer pays a metric tonne freight rate for the cargo to be carried from point A to point B. The ship's owner or time charterer pays fuel and port charges.

Time chartering is extremely flexible.

Time chartering a ship – for a month, a year or more – gives the charterer full commercial control. He pays for fuel and port charges. At any time during that

period he can put it out for re-hire for individual voyages or indeed for another time charter. The owner retains the technical responsibilities of crewing, insuring and maintaining the ship.

Most trading firms supplement time charters with voyage charters to maximise their ability to take advantage of short-term and spot market trading opportunities.

Shipping and chartering desks

Commodity trading firms normally operate shipping or freight desks.

They act as service providers to the company's traders, getting them competitive freight rates and hedging freight rate risk.

They will often also trade a portfolio of shipping services for third-party customers, booking voyage and time charter clients when they have unused capacity, and pursuing freight arbitrage opportunities for the company.

Wet and gas freight

In certain markets there is a need for specialist carriers and here it can sometimes make sense for traders to own their own shipping. LNG, LPG, propane and butane are transported in refrigerated carriers to keep the gas as a supercooled liquid. Bitumen carriers are specially adapted to allow the cargo to be heated so it doesn't solidify. Having its own fleet of special purpose carriers helps a firm to avoid the risk of chartering vessels in a narrow, illiquid market and means it is better able to keep commercially sensitive transactions confidential.

Freight market dynamics

Freight specialists aim to minimise transportation costs, but supply and demand factors can greatly affect operational expenses for particular vessel types. With voyage charters, they need to locate a vessel with the ability to load their cargo and berth at the required locations at the agreed times.

Time chartering provides more flexibility, but to be cost-effective, these vessels need to be fully utilised across the chartering period. Trading firms often have freight desks that make idle time-chartered vessels available to third parties. Freight traders aim to mitigate freight risk by hedging their future freight obligations using swaps or forward freight agreements (FFAs). Bunker fuel, another major cost of chartering, is also subject to market volatility. Traders use bunker derivatives to hedge their future fuel costs.

Chartering terms are set out in Contracts of Affreightment (COAs). These include Incoterms, which specify rights and responsibilities. They also specify penalties, such as the demurrage fee payable to the owner if the vessel takes longer than agreed to load and unload.

Newer, cleaner and more efficient vessels are progressively replacing older ships in the current global fleet. Many regulators have reduced the maximum permissible sulphur content in bunker fuel in recent years in response to environmental concerns. In the medium term, these dynamics may lead to a shortfall in the supply of suitably located and equipped vessels, with a consequent increase in chartering costs.

Trading firms use time charters and voyage charters for overseas transportation as needed

Liquefied Natural Gas (LNG) markets

Gas, the greenest of the fossil fuels, is difficult to transport globally and that restricts its tradability. Russia, the most landlocked of major energy producers, delivers most of its gas by pipeline. Pipeline gas generally goes straight from the producer to the consumer, with no real role for intermediaries.

But pipelines are impractical where producers and consumers are separated by sea. LNG transportation provides an effective solution.

LNG works by cooling natural gas to minus 162 degrees centigrade. This liquefies the gas and shrinks it to 1/600th of its gaseous volume. The liquid concentrate is transportable in purpose-built refrigerated tankers.

The technology was developed several decades ago and began to be used commercially in the mid-1960s. Liquefaction and re-gasification capacity developed rapidly until the 1980s, then stagnated until the mid-1990s, but has picked up since.

Qatar is the global industry leader, but is now being joined by new exporters, chiefly Australia but also the US and countries in east Africa.

Early LNG contracts were long-term arrangements, locking producer and consumer into a virtual pipeline that did not allow any intermediary trading.

Commercial arrangements limited sales to a defined set of buyers (who in turn would often have monopolistic franchise areas).

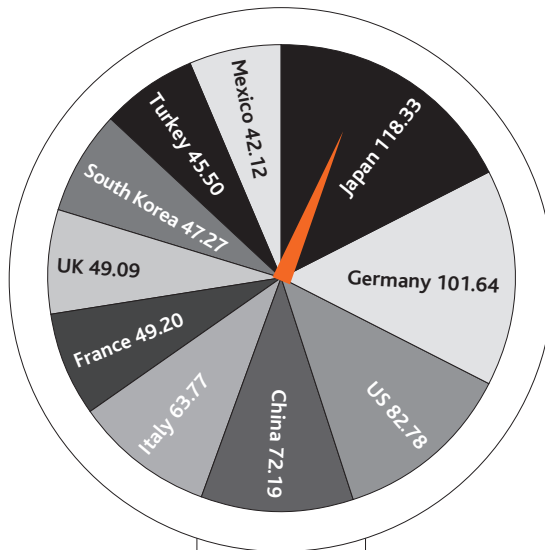
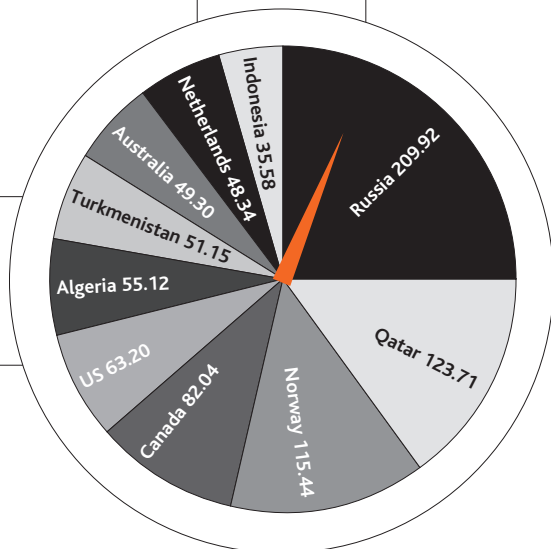
As more re-gasification capacity has come on-stream, particularly on floating barges, international LNG trading is opening up, taking on more of the characteristics of a standard commodity market. A small but growing share of international LNG trade is taken by trading firms selling gas from a global portfolio and benefiting from arbitrage opportunities between the various regional import prices.

An estimated 20 percent of LNG volumes is now traded on the spot market (though in this long-term business, spot contracts can last up to four years) through aggregators and traders.

The evolution of LNG markets demonstrates that a requirement for significant investment in long-term capital projects technology is no bar to the development of effective traded markets. Craig Pirrong has observed that "expensive, durable investments in specialised capital [projects] are completely compatible with spot market pricing complemented by market risk transfer mechanisms. In essence, liquid markets create security of supply and security of demand³".

³ *Fifty Years of Global LNG, Craig Pirrong, 2014*

Top ten exporters of gas (pipeline and LNG combined) in 2016 (billion cubic metres)
 Source: World Oil and Gas Review 2017, ENI



Top ten importers of gas (pipeline and LNG combined) in 2016 (billion cubic metres)
 Source: World Oil and Gas Review 2017, ENI

< TRANSPORTING GAS

Bitumen markets

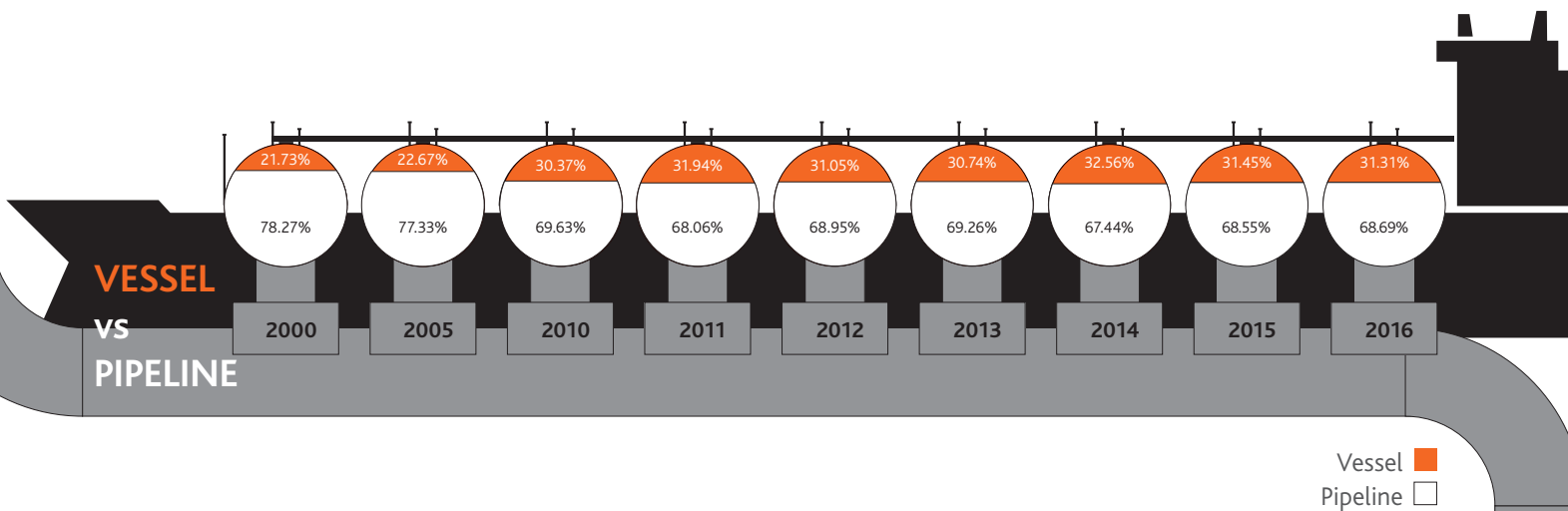
Not too long ago, the bitumen trade was regarded as a regional business. The specialised ships required to transport the product tended to be relatively small, making it difficult to achieve the economies of scale needed to make global trade worthwhile. In recent years, however, this has started to change.

Bitumen shipping and trading go hand in hand, because the ship is needed to make the trade. And bitumen carriers are highly specialised, built with containers that continually heat the bitumen at 150°C so it does not solidify.

Puma Energy’s bitumen carriers are some of the largest in the world. Weighing in at 30,000 tonnes each and 40 percent more fuel-efficient than their traditional counterparts, these kinds of ships are helping to globalise the market. They can transport bitumen from the US Gulf to Australia and back again without having to stop to refuel.

Budgets for road construction and maintenance – which account for about 85 percent of bitumen use globally – are largely tied to government spending. Public investment has been lacking since the 2008 financial crisis in the developed world, but China and countries in Africa are major growth markets. ■

GLOBAL LNG SHARE OF TRADED GAS



Source: World Oil and Gas Review 2017, ENI

Chapter 7

STORING COMMODITIES: TRANSFORMATION IN TIME

With inelastic supply and demand in commodity markets, supply and demand shocks have the potential to create volatile market conditions. Trading firms store commodities to help bridge this gap and keep markets in balance. They own and control midstream infrastructure and maintain large inventories at strategic locations around the globe.

Traders earn profits over time by reducing stocks when there is excess demand and building up inventory when there is excess supply.

Why trading firms invest in midstream infrastructure

Commodity traders consider the full control of midstream facilities that comes with outright ownership vital to their trading business. All major commodity traders own midstream infrastructure, including loading and offloading terminals at ports, and storage and blending facilities, which are also usually at ports.

There are considerable positive synergies between their core trading function and ownership of this kind of logistical infrastructure.

Temporal specificity

The economic concept of temporal specificity helps to explain why midstream infrastructure is strategically important.

A strike at a mine, political unrest, unseasonal temperatures – supply and demand shocks in commodity markets can have many different causes, and they can occur at any time. What is more, both supply and demand are price inelastic. Producers cannot easily open or close mines or wells; for consumers, commodities are typically seen as necessities.

These conditions can make for highly volatile markets. Commodity storage plays a vital economic role by helping to dampen volatility and bring markets back into balance. Market participants can offset the effect of market shocks by adjusting inventory levels. When demand exceeds supply they reduce storage levels. In oversupplied markets they can bolster underlying demand by increasing inventories.

Traders want to control fixed assets to be able to move commodities swiftly when market conditions dictate

Trading firms facilitate the process. They earn arbitrage profits by releasing or increasing inventories while simultaneously creating offsetting positions in futures markets.

Trading firms gain a competitive advantage by maintaining inventories their own facilities. Arbitrage opportunities are, by definition, transient. The cost of even a short delay in obtaining goods can be considerable. Firms that store their commodities in a facility they do not own or control risk not being able to exploit such opportunities.

To execute arbitrage successfully, traders need instant access to their assets. Knowing this, facility owners may try to charge premium rates by, for example instituting delivery delays and enforcing an artificially high price for an 'express' service. Such hold-ups don't occur if the firm executing the arbitrage also owns the storage facility.

As markets become more transparent, arbitrage opportunities are increasingly transient. The more acute this temporal specificity becomes the greater the incentive to invest in midstream infrastructure.

Traders do not face the same risks with floating storage facilities. Most commodity traders own terminals and storage facilities, but very few have their own bulk carriers or tanker fleets. The owners of fixed logistic assets face little competition. There is little to stop them holding up delivery. However, bulk ships and tankers are mobile. If a ship owner tried to delay delivery the charterer would simply take their business to a competitor.

Adding value though logistics

As commodity producers have got better access to price information and become more sophisticated at marketing their products, the profit margin on pure trading activities has declined. Trading firms increasingly need to add value by offering integrated logistical services for their customers. They are better equipped to do that if they invest in infrastructure.

Global trading firms with substantial throughput are best placed. Trading firms that control a substantial fraction of the assets at a particular midstream facility benefit from the advantages of scale. Being able to deliver more efficiently gives them a competitive edge in the region.

Trading firms benefit more from investing in midstream assets where they have substantial throughput

Security and optionality

Control of midstream infrastructure also gives traders security of supply. This enhances their strategic flexibility and improves their ability to deliver globally at times that suit their customers.

Partnerships and trading relationships

Infrastructure to make exports more competitive is welcome in many economies, especially in those that do not have the resources or the expertise to do this themselves. This kind of investment unlocks new markets and opens doors to new suppliers.

Trafigura subsidiary Impala Terminals' investment, along with Mubadala, at Porto Sudeste in Brazil offers smaller independent iron ore miners an export outlet. It is also a platform for the company to develop new relationships in the region. Its river infrastructure programme is strategically vital for Colombia. Its involvement is generating goodwill in the country and helping it forge crucial long-term partnerships with private and public sector concerns.

Ownership and control

All of these factors help to explain the increased asset intensity of trading firms in recent years. It also raises a question: if midstream infrastructure assets are so valuable, why do commodity trading firms sometimes choose to sell them?

It partly comes down to culture. Trading firms exist to service the need of producers and consumers as such they buy and sell opportunistically. That extends to fixed assets, especially when there is a capital gain that outweighs the trading advantage of holding onto the asset.

It is also strategic. Unlike Glencore and Noble, the four big private commodity trading firms, Vitol, Gunvor, Mercuria and Trafigura, cannot raise equity finance on stock markets. They need regular capital infusions to build up their balance sheets or make further infrastructure investments. Asset sales can be an important cash-raising tool.

And it is important to remember too that control does not necessarily require ownership. A good illustration is Trafigura's construction, then partial sale, of an oil storage and export facility at Corpus Christi, Texas (see page 54). The company sold a majority stake to a specialist operator in 2015, but before doing so it made sure it retained the rights to all future production.

Contango and backwardation

A trader can buy a commodity for delivery on a date in the future in one of two ways. He could either borrow money now to buy the commodity today, and store it until the desired delivery date (at which point he repays the borrowing) or he could buy a commodity futures contract.

Since these are different ways of achieving the same objective, their relative costs are connected. Prices in commodity spot and futures markets are linked by arbitrage. When one purchase method becomes relatively cheap, traders can arbitrage the price differential. They buy in the cheaper market while simultaneously selling in the more expensive market. This adjusts supply and demand, and therefore relative pricing, in the two markets.

But there are also times when, for technical reasons, the markets can move apart. When futures prices drift higher than spot prices, markets move into contango. The opposite situation, when futures

fall below the current spot price, is known as backwardation.

The period starting in mid-2014 was one of extreme volatility in crude. The oil price collapsed from over \$100 per barrel in June to less than \$50 at the end of the year. And the market moved into a contango pricing structure.

Traders were incentivised to buy physical oil in the spot market and increase storage levels. In doing this, they were also helping to balance supply and demand.

All the leading traders sought to make the most of the situation by taking on additional storage capacity. As most of the world's available on-land storage tanks filled up, some fixed long leases on supertankers to store surplus oil on the high seas for periods of up to 15 months. This practice was last seen when oil demand collapsed during the 2008 financial crisis. ■

Impala Terminals

Trafigura's wholly owned logistics and infrastructure industrial investment Impala Terminals manages the group's metals and minerals infrastructure assets. It designs, builds, owns and creates multimodal logistics chains that link inland ports and deep sea terminals across many countries globally.

It has three main areas of operation – South America, Africa and the US.

In Peru, it has expanded a warehousing and blending facility at Callao, the country's main commercial port, into one of the country's largest sites for copper, zinc and lead concentrates. In Colombia, it is helping to create multimodal (barge, truck and rail) transportation across the country.

The Magdalena river project, once completed, will handle 1.5m tonnes of cargo a year. In Brazil, Impala's \$2bn joint venture investment with Mubadala, the UAE sovereign wealth fund, to operate a new port facility at Porto Sudeste is giving smaller independent miners a cheaper and more convenient outlet to world markets.

In Africa, Impala is getting copper concentrates out of the central copper belt of the DRC and Zambia by road and rail to the key southern African ports for export.

In Louisiana, US, Impala has bought and expanded the Burnside terminal. It is now the only terminal on the Mississippi big enough to load coal, bauxite and aluminium between barges and ocean-going vessels, and in the future, directly to and from rail cars.

Global storage for oil and petroleum products

Trafigura stores petroleum products on land and in floating storage at strategic facilities around the globe at third-party owned terminals, and with its midstream and distribution partner Puma Energy.

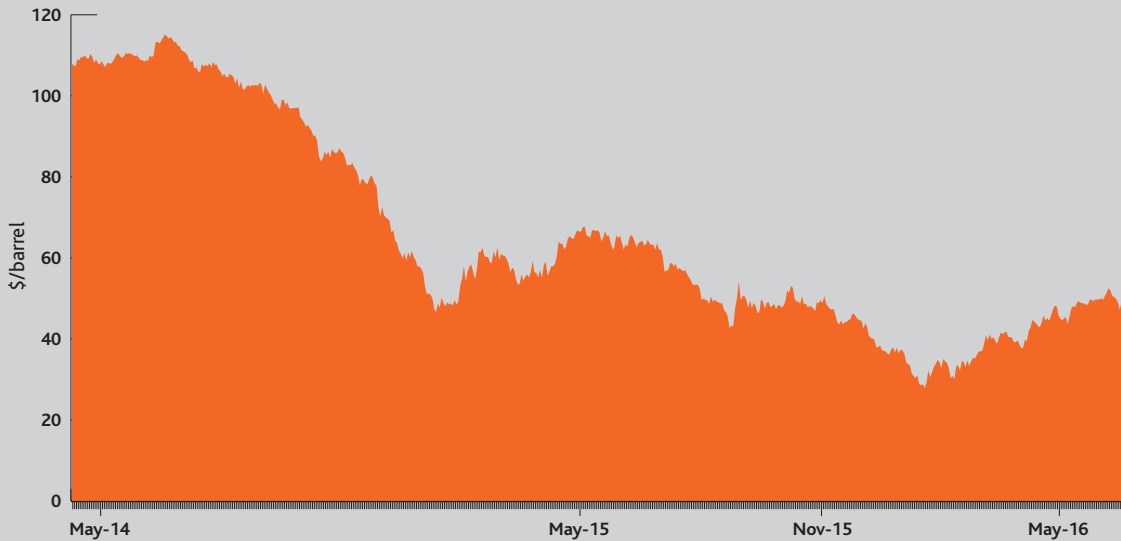
Independent audits and regular due diligence ensure that all storage facilities meet international best practice standards.

Puma Energy manages close to 8 million m3 of storage at modern facilities at over 45 countries across the Americas, Europe, Africa, the Middle East and Asia-Pacific. These are strategically placed at global energy hubs and locations with strong multimodal transport links.

Puma Energy handles many different products, including crude, fuel oil, clean refined products, bitumen, LPG and petrochemicals. Its high-volume bulk-building and bulk-breaking services allow traders to split or combine products for resale. It also provides access to infrastructure with rail, truck, pipeline and discharging services.

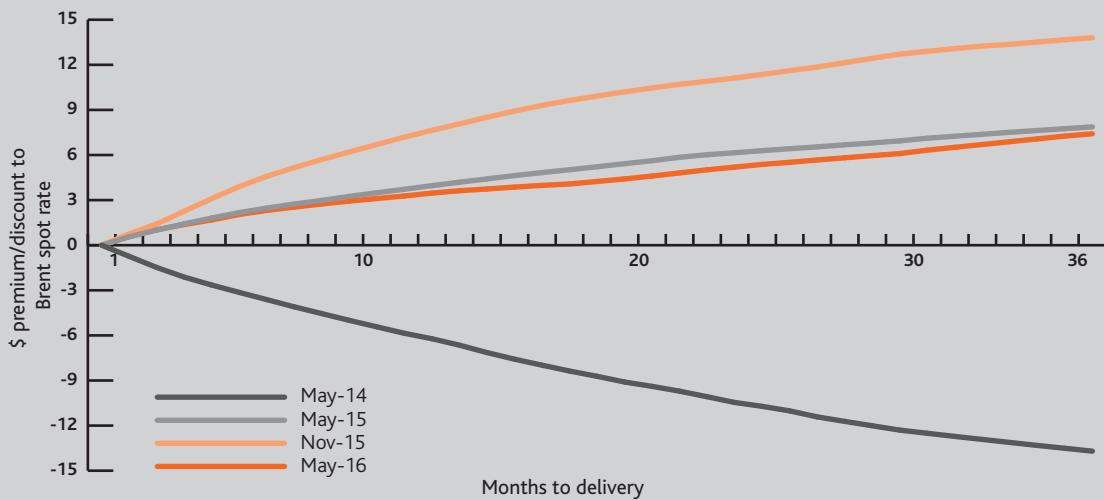
The Brent futures curve moved from backwardation in May 2014 to contango in May 2015 to super-contango in November 2015 and back to contango in May 2016

BRENT CRUDE OIL SPOT PRICE: MAY 2014 - MAY 2016



Source: <http://www.tradingeconomics.com/commodity/brent-crude-oil>

BRENT FUTURES CURVES: MAY 2014 - MAY 2016



Source: *Trafigura research, 2016*

Chapter 8

BLENDING COMMODITIES: TRANSFORMATION IN FORM

Since commodity producers derive their product from the ground, its quality and characteristics are variable. To be fit for purpose, physical commodities need to be matched to customer specifications.

Traders and intermediaries bridge the quality gap by blending commodities from multiple sources to make products that match customer requirements. They earn profits by identifying and exploiting market inefficiencies in the price / quality relationships between different shipments of a physical commodity.

Suppliers provide products that at least meet the customer specification, but the complexity of the refining process is such that to do this they will sometimes present an over-specified product. Traders and intermediaries use blending to optimise shipments so they can meet customer specifications at a competitive price.

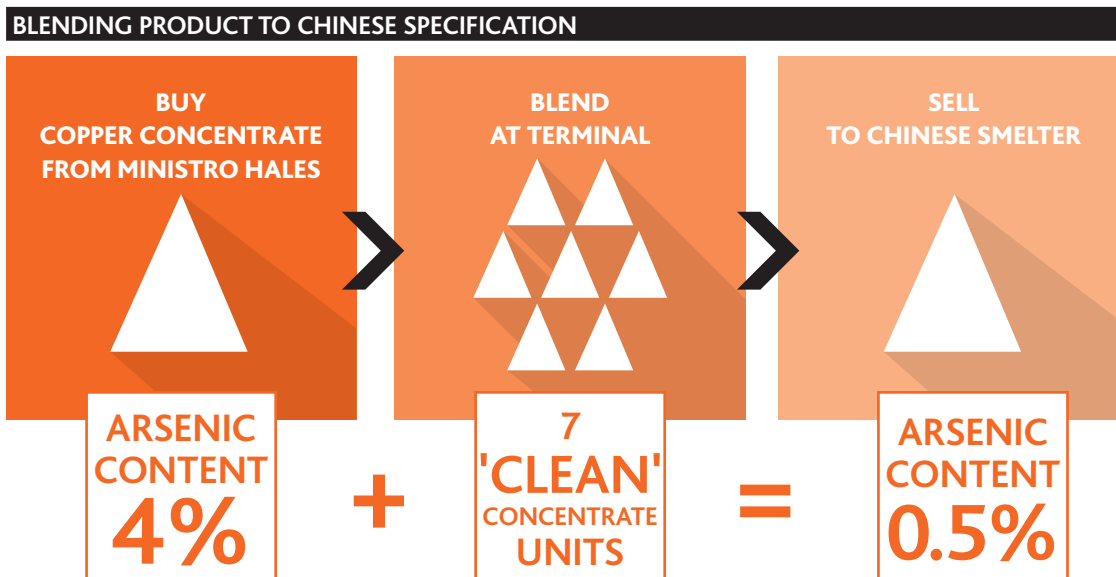
Strategic infrastructure

In metals and minerals markets, traders often combine materials from two or more mines to create commodities with the desired qualities synthetically. In concentrates markets – copper in particular but also zinc, lead and other metals – they use blending

techniques to reduce the levels of arsenic, phosphorous and other unwanted materials in shipments in return for a higher price. In iron ore and coal markets, blending is primarily a mechanism for enhancing profitability.

Traders need to be able to store products from multiple sources at a strategic location where there is the capability to blend at scale. They could in theory rent such facilities from third parties, but most prefer to control or own their own infrastructure. Transaction economics and the concept of temporal specificity shed light on the reason for this.

Arbitrage opportunities are fleeting. If a change in relative pricing between two grades of a commodity creates a blending opportunity the trader must be able to react swiftly to exploit that. If its product is held in a third-party owned facility the trader's interests may not be prioritised. There is a risk that the third party may even use the situation to extract premium rates.



Blending in copper markets

Chinese copper consumption has grown markedly since 2000. In 2002, China had already overtaken the US to become the world's largest copper consumer. By 2014, it was consuming 8.7 million metric tonnes of refined copper products, 40 percent of global demand.

China processes increasing amounts of its copper domestically; it accounts for over a third of global smelter production. But with few exploitable reserves domestically, it has to source most of its copper overseas.

The quality of concentrate available has suffered with the growth in demand. As existing mines get depleted, smelters are more reliant on new, sometimes arsenic-rich, sites for their concentrate. The Toromocho mine in Peru, which came on stream in 2014, and Codelco's Ministro Hales project in northern Chile, which began production in 2015, are significant new sources of copper supply. Both produce concentrate with high arsenic content: 1 percent at Toromocho and around 4 percent at Ministro Hales.

These new flows of arsenic-rich copper concentrate present fresh challenges for the industry. Concentrate containing arsenic poses health and safety risks for smelters and China insists on a maximum 0.5 percent arsenic content for imports. Although processing

techniques such as oxidisation can reduce arsenic content, these are costly and they also affect copper levels. For instance, processing at Toromocho which reduces arsenic from 1 percent to 0.7 percent, also cuts the copper grade in the concentrate from 26 percent to around 22 percent.

Blending concentrates reduces toxicity

Another solution is to blend the concentrate. Mines producing arsenic-rich concentrate sell at a discount to trading firms, like Trafigura, which also have access to cleaner stocks. The traders then blend the material with cleaner concentrates before selling on to smelters.

Low-quality concentrate requires larger inventories and more extensive processing. This is reflected in the price. The premiums payable on cleaner concentrates vary according to market conditions.

Blending coal for power plants

The rationale for blending coal is purely economic. Trading firms source products from multiple locations and blend to meet customer specifications in the most cost-effective way possible. Utilities running coal-fired power plants are important customers.

Japanese and Korean plants have more exacting quality requirements. They typically negotiate long-term contracts, often direct with producers, to secure consistent quality product.

Power plants in China, which face less exacting environmental standards and stretching demand conditions, are often more flexible about the grades of coal they use. They are also active in spot markets and prepared to deal with multiple suppliers. Global trading firms sell direct or via intermediaries. They blend coal from different sources to supply the right quality product as cost-effectively as possible.

Iron ore and steel mills

The steel industry is a major source of demand for coal and iron ore. Its market dynamics differ from the utility business in one key respect: demand is much more volatile.

Historically, steel mills maintained large iron ore inventories, allowing them to respond rapidly to shifting demand conditions. But in recent years, as it has become more difficult for the steel mills to obtain credit, inventories have shrunk from 40 to 10

days. The mills increasingly rely on steel sales to generate cashflow and have outsourced storage to trading firms.

Their lack of inventory contributes to a see-sawing iron ore price. Rather than consuming iron ore and coal at a constant rate, the mills ramp up production when pricing is advantageous and slow it down as steel demand falls.

Trading firms maintain large stocks and supply the mills according to need. They buy ore with different purity levels from various suppliers and blend it according to customer demand.

Iron ore can be supplied as lumps or in a fine-ground powder (fines) at various grades of purity. Mills pay a premium for high-quality lump ore as it can be charged directly into the blast furnace. Fines first have to be agglomerated into lumps, in a process known as sintering, to prevent it smothering the furnace. Lower grade ores must go through a series of processes before they can be used to make pig iron and ultimately steel.

Market forces dictate spreads between lumps and fines and for the different grades. Trading firms blend accordingly to maximise their margins, aiming to source the most economic and supply the most popular grades by adjusting combinations of lumps and fines. This is a scale business, which is most profitable for firms with access to blending terminals and multiple sources of supply.

Most traders have cornerstone contracts with key customers for the bulk of the ore they supply. They build up inventories comprising different grades and types of ore to meet their requirements and will supplement this by trading on spot markets with intermediaries and other steel mills.

Crude oil benchmarks and characteristics

In its natural, unrefined state, crude oil ranges in density and consistency, from a very thin, lightweight fluid to a thick, semi-solid oil. There is tremendous variation in colour, from golden yellow to very dark black. The viscosity, toxicity and volatility (i.e. tendency to evaporate) of oils determine how they can be used and transported.

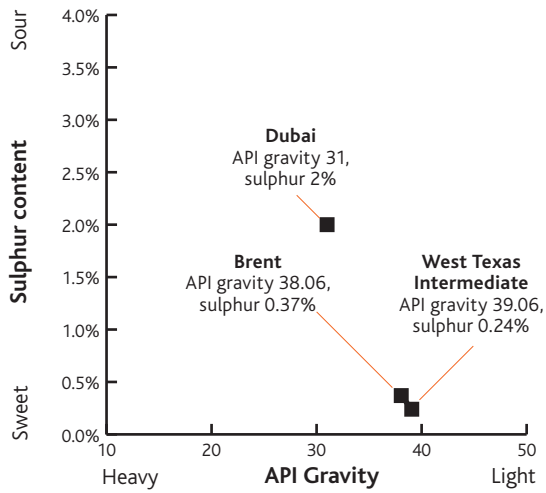
Key measurements for crude include American Petroleum Institute (API) gravity (inversely related to density) and sulphur content (low sulphur grades, known as sweet, are less toxic).

Grades are described by location and specified in detail. Benchmark grades are used as pricing indices and for hedging.

With over 160 tradeable crude oil products, many different refined products and numerous end-users with highly specific requirements, blending opportunities abound in oil markets.

Steel mills have outsourced storage to trading firms

THREE BENCHMARK CRUDES

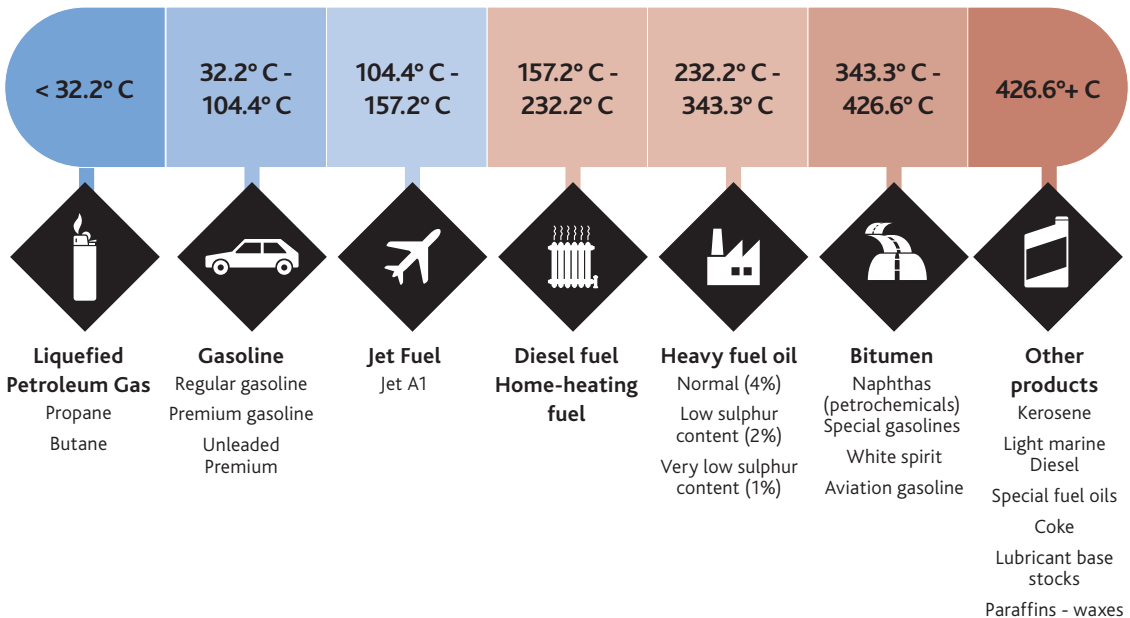


Source: Industry reports

CRUDE OIL BENCHMARKS AND CHARACTERISTICS

CHARACTERISTICS	UNITS	VALUES
Gravity	°API	>31.1 = light 22.3-31.1 = medium 10-22.3 = heavy <10 = extra-heavy
Sulphur	WT %	<.5% of mass = sweet >1% of mass = sour
Kinematic viscosity at 40° C	CST	Varies from light-liquid to tar-like, nearly solid
Vanadium	ppm	Useful for classification
Neutralisation number	Mg KOH/gr	Measure of acidity
Pour point	°C	Temperature at which a liquid becomes semi-solid and loses its flow characteristics

MAIN PETROLEUM PRODUCTS BY DISTILLATION TEMPERATURE



Source: US Energy Information Administration and IFP

Blending oil products

There is no set mechanism for blending. Traders own or lease storage or pipeline capacity. They work with partners, including the refiners themselves, to modify the gasoline blend so that it corresponds closely to pockets of demand. They may sell components for the fuel to the end-user themselves.

Traders blend crudes to make synthetic grades for their customers

Traders often make synthetic grades of crude by blending sourced grades. In the Mediterranean, the segregation of Basrah crude into light and heavy blends has resulted in traders blending heavy Basrah with light crude oils to arrive at a proxy for the Urals grade. In Louisiana, with precious little virgin Light Louisiana Sweet (LLS) crude remaining, but with many local plants set up to take it, traders have been blending crudes sourced elsewhere to make cocktails for the refiners. While most blending takes place at energy hubs that enjoy strong connectivity with energy transportation routes – a typical hub would be near leasable tankage and have ocean trade routes accessible – blending happens at every stage in the supply chain. It occurs at the refiner, at terminals near the plant, at terminals near points of consumption and at various points along the way.

Sometimes traders do the blending themselves. For example, the trader may be able to buy discounted barrels from a refiner who is producing too much summer-grade gasoline as winter approaches. By adding in butane he can create a more cost-effective fuel that meets the winter-grade specification.

On other occasions, knowledge of blending requirements informs trading opportunities. Heavy and extra-heavy crudes need to be blended with light crudes to reduce viscosity and improve pipeline transmission. This is typically done at source by the producer.

This happens in Canada and also in Colombia and in Venezuela, where state-run producer PDVSA is keen to export its diluted crude oil (DCO). To do that it needs to obtain naphtha and light crude that can serve as diluent. This is a costly and logistically complex exercise, but it is willing to engage in this trading to get its supplies to major market centres. Traders and intermediaries get to participate in the supply of the diluent.

Similarly, downstream, with ethanol and biodiesel, two mandatory fuel mix products for US gasoline and diesel products, distributors do the blending. Traders get to participate by selling them the required renewables.

Refiners and optimisation

Plants are constantly optimising their throughput processes based on feedstock costs, most profitable yields, operational issues and availability. In the US, it is common for plants to blend shale oil with heavy crude barrels. In the Far East, plants optimise their inputs by blending fuel oils with crude when fuel oil gets very cheap. Traders are continually looking to identify shortages in particular components at specific locations so they can source and sell these to the refiners.

Blending is widely used to transform residual fuel streams that come out of refinery units into products for end-users. Supplies coming from refineries vary in quality due to differences in refining unit configuration and feedstock choices. Fuels have to meet different regulatory standards depending on the use of the product (the quality requirements for fuel used for vessels, for instance, differ from those at power plants) and they vary across regions. Blending is often the cheapest way to bridge the gap between demand and supply.

They blend residual fuel streams to make viable products for end-users

The rise of the super refineries

The rise of the super refinery is changing the dynamics of international oil trading.

Refinery operations are increasingly consolidating into regional mega-hubs. The world's twenty largest (often newly-built) super refineries today are located in Asia (nine), the US (five), the Middle East (four), Latin America (one) and Europe (one).

Super refineries benefit from economies of scale. They have the capacity to meet growing demand needs and the flexibility to handle up to 50 types of crude oil.

Smaller refineries across the developed world – which historically refined its crude locally – are closing in many countries, including in Australia, Canada and the UK. Former refineries are being repurposed. Puma Energy, for example, recently acquired a refinery in the UK, which it has converted into a terminal and storage facility for refined products.

Modern refineries are better equipped to produce a wider range of refined products as well as meeting more stringent environmental requirements, for instance on sulphur. Local oil markets today need to be connected to these global super refineries. But with fewer refineries available they can be thousands of miles away from the ultimate market for the refined product.

Super refineries have more throughput, accept more types of feedstock and make more diverse products

Products need to be shipped reliably and safely over large distances. Efficient hub-and-spoke refinery network and global operations offer great flexibility, and are highly responsive to changes in demand, supply shocks and other market adjustments.

Transportation and storage are increasingly pivotal in today's global oil market, but blending still plays an important role. With the emergence of the super refineries, more blending opportunities have opened up as plants gain the ability to accept a wider range of input.

The great gasoline giveaway

Refiners try to manipulate ingredients to meet market specifications, but they cannot always achieve this precisely. Depending on the ingredients available and the processes they employ they may arrive at an over- or under-specified blend. For the refiner, it may make economic sense to deliver an over-specified blend. It could be that there is a shortage of raw materials or perhaps the complexity of optimisation outweighs its economic benefits.

Even so, these are market inefficiencies and they create profitable opportunities for traders and other intermediaries. In oil trading parlance these sub-optimal blends are known as "giveaways". By modifying such blends with other ingredients traders are able to supply products that meet market specifications more precisely and more cost-effectively.

Gasoline giveaways are profitable for traders

Giveaways erode refiner margins. A 150,000 barrels-per-day refinery may forego anything up to \$30 million annually in giveaways on gasoline, distillate and heavy oil sales. For gasoline blending, refiners often focus on minimising octane giveaways. Other dimensions of giveaways can be more complex to manage.

Volatility in fuel fluctuates according to altitude and ambient temperature. Far more than in, say, Europe, the US caters for these fluctuations by allowing states or regions to specify particular blends to reflect climatic differences; not only seasonal, but also geographic, such as between the low-lying sub-tropical Gulf, the high plains near the Rockies, and California's Meditterean-type climate. A refiner producing gasoline for multiple US states may have to make blends with several different volatilities and change the volatility from month to month.

Not surprisingly, given the amount of capital involved, optimisation is going on all the time. It is not always a case of the traders physically combining elements themselves but the aim is always the same:

to develop a product that meets the specification more precisely and therefore more cost-effectively.

Balkanisation and US gasoline markets

Most of us don't think twice about the fuel we put into our cars, but the convenience of the local service station and the ubiquity of this seemingly simple product belie the complexity of the markets and processes required to deliver it.

It is a common misconception to think of gasoline simply as an oil product derived from crude oil through the refining process. While straight-run gasoline, also called naphtha, is distilled directly from crude, gasoline as a product is far more complex.

The product specification varies according to where it is consumed, by whom and for what purpose. At the top level, refiners make at least two versions. Regular gasoline is blended for standard vehicles. Premium grade gasoline is blended for high-performance vehicles with high-compression engines that require high-octane fuel to operate at peak efficiency.

In the US there is a proliferation of standards. Several states have regional regulatory requirements. The Environmental Protection Agency (EPA) enforces strict environmental controls. Unique fuel regulations have created gasoline zones across the country where only certain fuels can be sold. This balkanisation of the US fuel supply has made it more expensive to produce and deliver fuel, but it also creates trading opportunities.

There are different fuels in different US states at different times of the year

Gasoline is a blend of 15 to 20 different components. The aim is to produce a clean-burning, energy-efficient, cost-effective grade with low toxicity levels. Achieving the right combination is a complex process. Often, adding one ingredient strengthens one attribute at the expense of other desired characteristics.

Butane for instance is a relatively cheap fuel with good burning properties. Gasoline with more butane is cheaper to produce and has higher octane levels, but butane's high Reid vapour pressure (RVP) makes it prone to rapid evaporation. That limits the extent to which it can be incorporated into blends.

Volatility – a gasoline's tendency to vaporise – is the key gasoline characteristic for good driveability. Liquids and solids don't burn; vapours do. Gasoline has to vaporise before it can ignite in an engine's combustion chamber. In cold conditions, gasoline that vaporises easily helps a cold engine start quickly and warm up smoothly. Warm-weather gasoline is blended to vaporise less easily to prevent fuel

handling problems and control evaporative emissions that contribute to air pollution.

Refiners therefore produce blends with lower RVPs for use in warmer regions. Gasolines with higher RVPs are more suitable for colder climates. The US maintains different RVP standards for summer and winter to reflect temperature-related changes in performance.

Summer-grade gasoline typically contains just 2 percent butane. It costs refiners several cents more per gallon to produce than the winter-grade gasoline, which may contain up to 3.5 percent butane.

As the science has developed, new environmental standards have emerged. In the 1980s, scientists discovered that adding certain oxygenate compounds, including methyl tertiary butyl ether (MTBE) and ethanol, made gasoline an easier-to-burn product with reduced polluting output. MTBE has since been withdrawn, because of other polluting effects, but ethanol is widely used. This oxygenated blend is known as reformulated gasoline (RFG).

Environmental legislation in the US requires all gasoline to be blended with ethanol or some other non-fossil component before it can be sold to customers. The Environmental Protection Agency (EPA) has set a 5.9 percent legal minimum level of ethanol. Some states have imposed a 10 percent legal minimum. Reformulated gasoline is now mandatory in many parts of the US, particularly in urban areas prone to smog.

But ethanol has a problem: it attracts water. When gasoline mixed with ethanol is pushed through steel pipelines or plumbing at oil refineries they become much more prone to corrosion. For this reason, ethanol blending normally happens at or near the point of consumption.

Refiners make BOBs that are ready for blending

US refiners therefore produce a type of gasoline ready for blending with ethanol on delivery. CBOB (Conventional blendstock for oxygenated blending) and RBOB (reformulated blendstock) are the two base gasoline stocks. On the adjacent map, all of the colour-coded areas require different formulations based on RBOB. The white areas use CBOB as the base stock. Other BOBs include EuroBOB (refined in Europe for use on the US east coast) and CARBOB (a special RBOB formula mandated by the state of California).

The complex nature of the US market creates many opportunities for gasoline traders. Operating profitably in these markets requires a multi-disciplinary approach. A successful gasoline trader is part-chemist, part-distributor, part-salesperson and part-logistics expert. ■

Opportunity and optionality at Corpus Christi

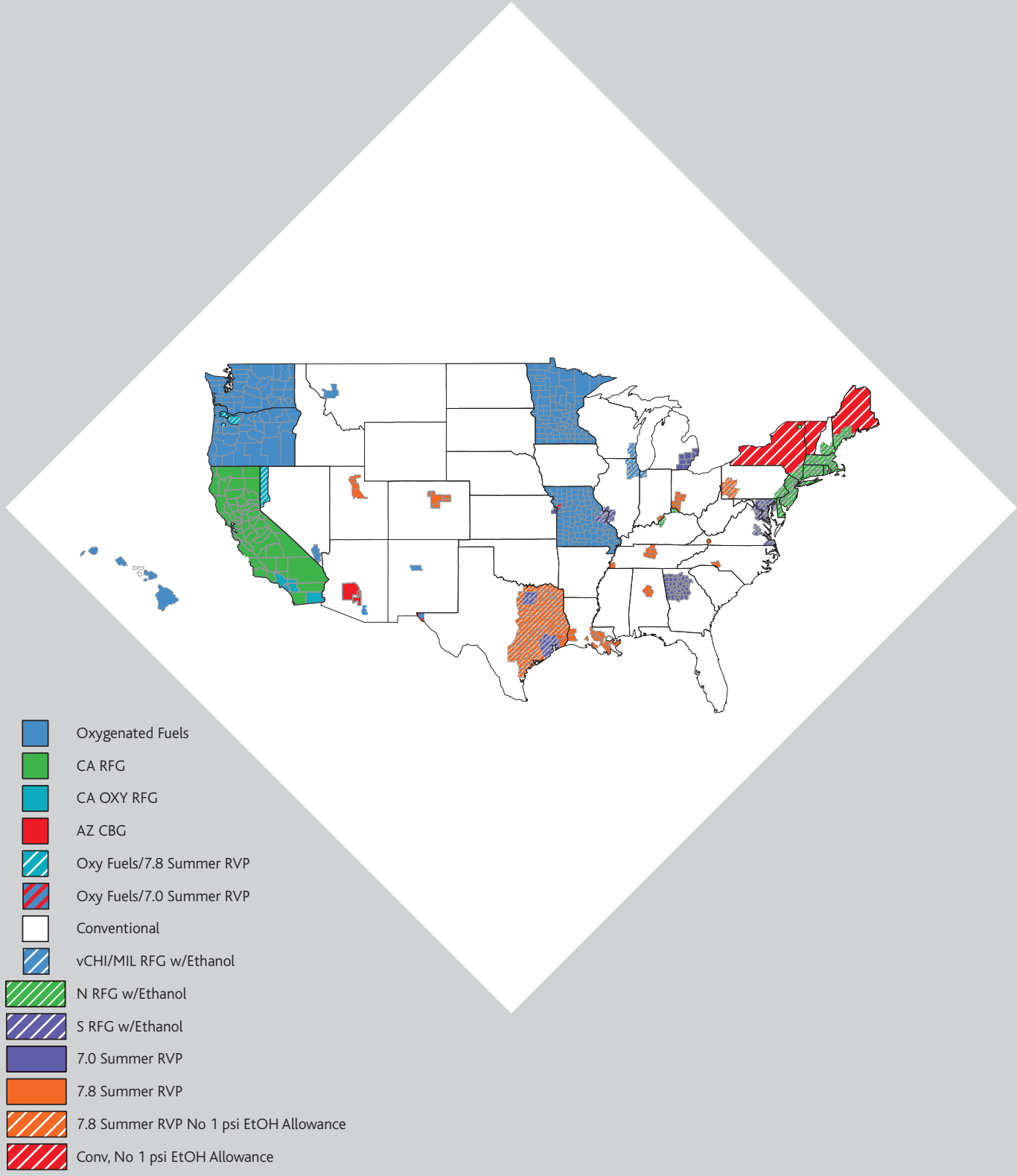
In 2011, Trafigura identified an opportunity at Corpus Christi in Texas to provide a faster, cheaper outlet than the often congested port of Houston for the output of the Eagle Ford shale formation. In seizing the opportunity, Trafigura transformed its role in the US energy markets from importing African crude to handling sizeable quantities of domestic crude and exporting naphtha and LPG.

Trafigura bought out Texas Dock and Rail which had a ready-made deep water dock that could accommodate big tankers as well as a tank farm. The latter particularly needed expanding as the highly variable output of Eagle Ford called for a terminal with blending facilities. Over the next three years, Trafigura invested in a pipeline system from Eagle Ford to Corpus Christi, and planned two 'splitter' mini-refineries, producing refined product for export.

Control of this infrastructure gives Trafigura a lot of optionality. It can choose to send crude to its splitters and then export the product. It can sell crude into foreign markets. It can also sell it regionally to be blended with Light Louisiana Sweet. And it can export naphtha to Asia, Latin America and Europe where this is a popular feedstock.

This optionality – beloved of commodity traders because it enables them to make opportunistic arbitrage trades – was preserved in 2014 when Trafigura sold 80 percent of its Corpus Christi operation to Buckeye Partners for \$860 million. Trafigura retained a 20 percent stake and commercial rights to 100 percent of the throughput.

US GASOLINE REQUIREMENTS VARY BOTH REGIONALLY AND SEASONALLY



Source: ExxonMobil, June, 2015.
This map is not intended to provide legal advice or to be used as guidance for state and / or federal fuel requirements, including but not limited to oxy fuel or RFG compliance requirements. ExxonMobil makes no representations or warranties, express or otherwise, as to the accuracy or completeness of this map.

Chapter 9

DELIVERING COMMODITIES: MEETING CUSTOMER SPECIFICATIONS

As markets become more efficient, commodity trading is evolving into a low-margin service business. Increasingly, traders make their living by providing a solidly reliable logistics service between producer and consumer.

There is growing emphasis on service in the commodity industry. With more intense competition and better information, markets are more transparent, margins thinner and arbitrage opportunities more fleeting. The most successful trading firms are focusing on producer and end-user priorities.

In an industry governed by economies of scale and close trading relationships, there is space for niche players that cater to specialist markets and regions, and for larger global trading firms that can afford to invest in logistics and infrastructure that benefit their customers. Market conditions are much more challenging for medium-sized trading firms.

The customers for commodity trading firms are often strategic organisations in their respective economies, such as government agencies, energy-intensive manufacturers and utilities. Any disruption in their supply chains can have far-reaching consequences.

Reliability is fundamental. If a trading firm wants to forge strong trading relationships, it has to be able to deliver commodities on spec and on time, every time. If it is supplying coal to a power generating

company, for instance, it needs to deliver its cargo in the right volumes, at the right quality, at the agreed time and at the agreed place. Should it fail to deliver, there is a high price for the end-user, with the risk of power outages and even popular unrest.

This is a low-margin business. Trading firms typically earn 3 percent or less on a given transaction. Given the cost of transportation, insurance and the operational risks they take on, this is by no means excessive. The trading firms that deliver service most efficiently will gain a competitive advantage.

The trading firm's role is far broader than that of a mere broker. It justifies its involvement by the high level of service it provides to commodity producer and consumer alike. Ensuring execution progresses smoothly and within budgeted parameters is therefore critical to business profitability.

Like any other multinational business, commodity traders may be operating in places that are blighted by geopolitical division, subject to international political sanctions, and prone to corruption and money laundering.

Key tenets for successful delivery

Trading firms rely on high-quality operations to execute transactions profitably

While most commodity consumers are in industrialised nations and emerging economies, mines and wells are scattered across the globe. They are usually located away from major urban areas, often in developing economies. Trading firms may need to create, supplement or enhance local infrastructure to make transportation affordable.

Commodity trades span the globe. They can involve counterparties that may not know each other, let alone trust each other. One way that trading firms add value is by building up trusting relationships with their counterparties. They set up detailed protocols for trading and delivery to minimise risk and maximise certainty. These need to be followed to the letter.

Large trading firms manage significant numbers of transactions. They must consider all aspects of operational risk, put systems in place, take out insurance and audit the delivery process. A company like Trafigura takes on more than 2,000 ship voyages a year. The sheer volume of activity makes it hard to monitor each and every risk on a given flow of business without a clear system and well-understood, carefully thought through procedures.

They appoint specialists and independent inspectors to manage processes on the ground

Commodity trading firms employ a relatively small number of people to handle numerous high-volume, high-value transactions. They put protocols in place to supervise and monitor processes so they can identify and pre-empt any problems or issues that may arise.

Once the trader concludes the deal, he hands the execution to an operator. The operator coordinates logistics to make sure all the right resources are in place for the right dates. That means working with the contracts department and the shipping department, appointing inspectors to measure the quantity and quality of what's in the tanker, appointing vessel brokers and agents, dealing with those responsible for loading and discharge, the terminal operator and, of course, maintaining relations with the customer. The operator also has to keep the deals desk up to date with any information that could affect hedging strategy or the profitability of the trade.

Operations teams focus in depth on cargo certification. They assess whether the quantity and quality of the cargo needs to be certified by an independent inspector. This may be specified as a requirement in an accompanying letter of credit. Trading firms will normally appoint agents to act as their representatives, certify cargo and manage delivery of shipments.

All documentation needs to be accurate and up to date. The firm's trade finance department ensures that the documents accompanying a letter of credit are in order. Before the ship carrying its cargo can embark its master needs to sign a bill of lading, a standard form document that confirms the title holder of a cargo shipment and obliges the carrier to release it to them on arrival at the destination port. Insurance provision needs to be in place.

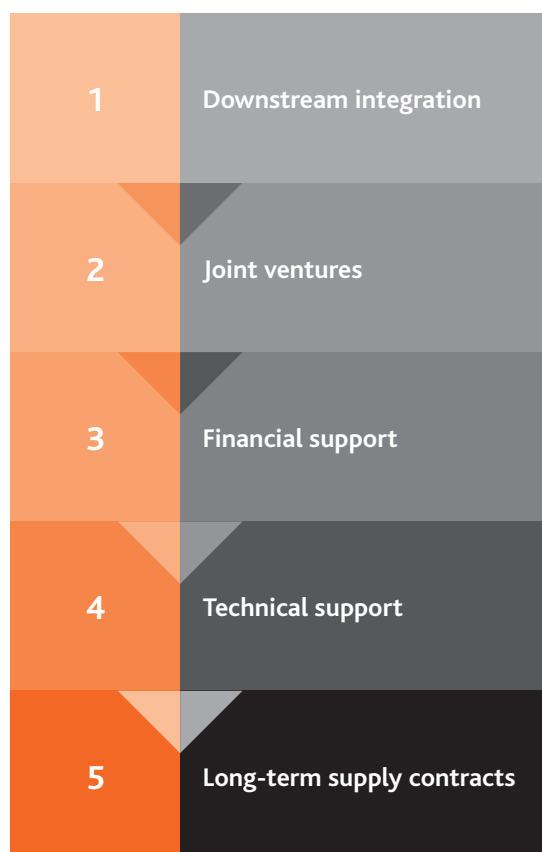
It takes great care and skill to execute deals precisely, managing continuing operational risks while preserving corporate reputations. Companies not disciplined enough to fulfil their various obligations and responsibilities may find themselves taking on large risk exposures quite unintentionally.

As competition has intensified, alliances between trading firms and other market participants – based on shared interests, complementary capabilities and mutual benefit – have become increasingly common.

They strengthen supply chains by supporting their customers

For consumers, long-term arrangements increase certainty and reduce volatility. The trading firms gain from having consistency of supply.

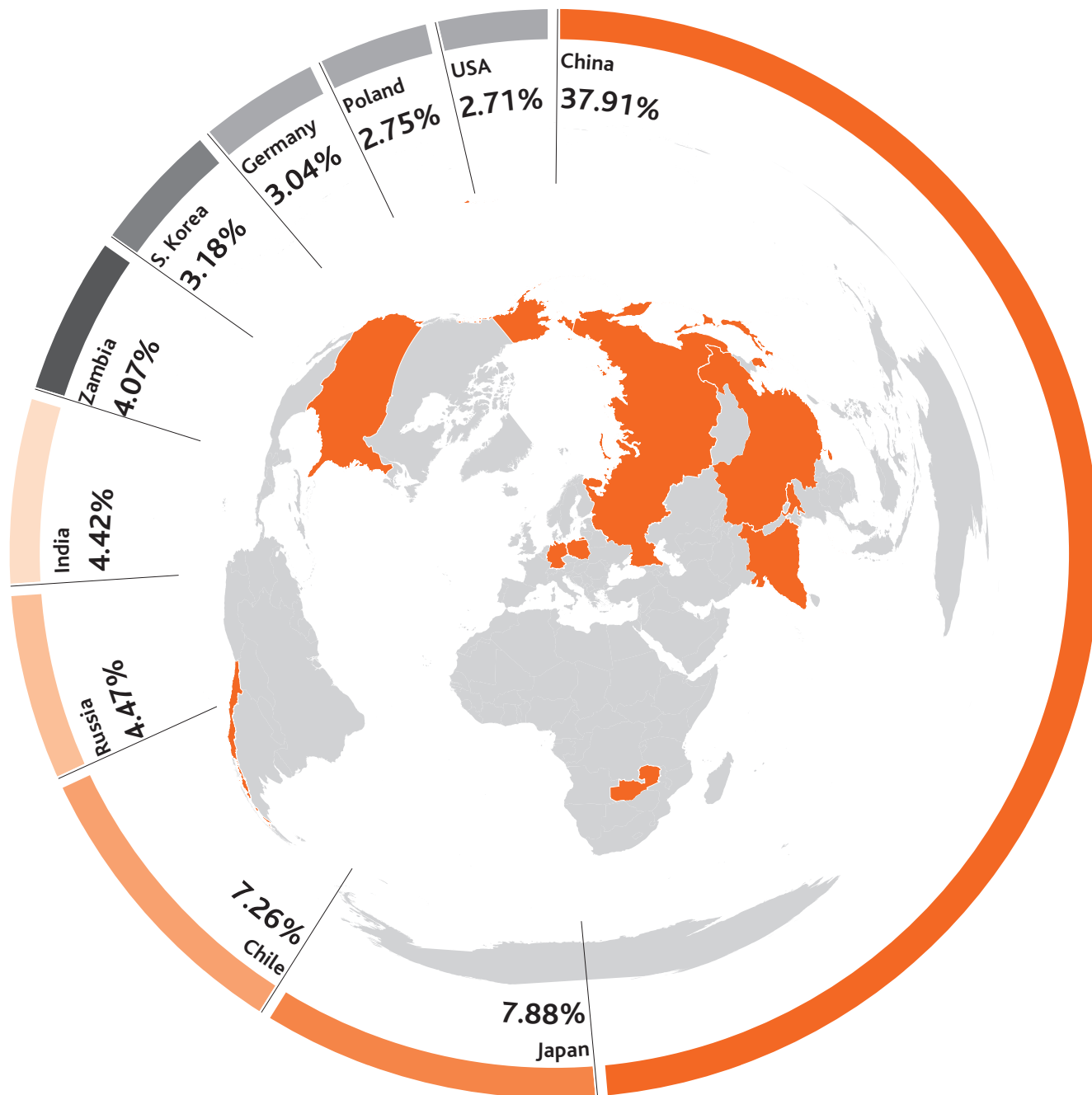
WAYS COMMODITY TRADING FIRMS SECURE RELIABLE CONSUMPTION OUTLETS



Top ten copper smelter producers in 2017

In 2017, world copper smelter production reached over 19 million tonnes. Asia's share of world copper smelter output more than doubled from 27 percent in 1990 to 56 percent

in 2017 as smelter production in China expanded rapidly. Primary smelters use mine concentrates as their main source of feed. Secondary copper smelters use copper scrap as their feed.



Trading is a volume business. By locking in long-term trading patterns they are better able to invest in infrastructure, improve economies of scale and gain competitive advantage.

But they cannot achieve this simply by providing goods at the lowest price. They have to engage with customer problems and demonstrate how they add value.

As arbitrage becomes more fleeting, there are greater incentives to acquire assets and integrate downstream.

Developing new marketing outlets is a core part of the trading firm's business model. They pursue various strategies to strengthen consistency of supply.

They provide technical expertise and infrastructure support. For instance, where utility companies are migrating from coal to cleaner fuels, trading firms work with them to adapt their facilities to new fuel types. In LNG markets, trading firms are working with consumers to internationalise the gas business by encouraging take-up of FSRUs (floating storage and re-gasification units).

In other cases, financial support can help forge closer links. In 2015, Trafigura took a minority stake in Nyrstar, Europe's largest zinc mine and smelter group. The two companies announced that Trafigura would market its zinc concentrate to Nyrstar's smelting business. Trafigura also acquired rights to Nyrstar's zinc output via a \$150 million prepayment deal.

They extend supply chains by acquiring downstream assets

A notable development in energy markets in recent years is the integration of some large trading firms into downstream distribution in emerging markets.

There is a strong economic case for the integration of midstream and downstream functions in emerging markets. These markets are typically relatively small with underdeveloped infrastructure requiring additional investment. In many cases they were previously controlled by vertically integrated oil majors. When the majors exited these markets to focus on their upstream activities, trading firms, which can supply downstream markets in emerging economies very efficiently, were natural buyers.

Puma Energy, originally a wholly owned subsidiary of Trafigura, has acquired significant midstream and downstream capacity. It owns and operates fuel storage and marketing businesses over 45 countries. Trafigura retains a substantial minority interest in the business and remains its most important fuel supplier, as it is in turn Trafigura's largest customer (see adjacent box). ■

Puma Energy

Puma Energy is Trafigura's industrial go-between in the oil sector. Founded in 1997, it has grown from modest roots retailing petrol in Argentina into one of the largest independent global downstream companies, operating over 48 countries.

Trafigura took majority control in 2000 and made it the vehicle for acquiring fixed assets in the oil sector. In order to assist Puma Energy's growth, Trafigura has subsequently opened up the capital to outside investors, and in 2017 held 49.6 percent of the company's shares.

Puma Energy provides logistics and services to third parties as well as Trafigura from its midstream assets, such as bulk storage depots and offshore mooring systems.

In its downstream business supplying petrol stations, mining companies, airlines, shipping companies and so on, Trafigura is Puma Energy's preferred source of supply.

It has storage facilities in the major hubs of Singapore and Rotterdam-Antwerp. But it has focused its growth in countries from where the oil majors have retreated, where markets are opening up and where oil demand remains strong.

It invests in territories where there is a logistical bottleneck in the market. In Namibia, for example, it bought up BP's downstream business then rebuilt its outdated storage facility. In Australia, it has bought a large network of retail service stations and is building new terminals to accommodate big ships from international hub ports.

Executing the trade: operations in action

Structuring and maintaining an efficient operating model is at the heart of profitable commodity trading. The operations team of any commodity trader has an important role in helping to define and refine protocols that allow the trading firm minimise risk and reduce costs.



Managing efficient execution

In commodity trading firms, the trading operation is at the hub of the company. It controls the commodity inventory and has overall responsibility for managing the supply chain activities required to transform transactions into profit for the company and value for its customers. From the moment the deal is closed until ultimate delivery, the operations team is responsible for execution of the myriad processes required to achieve this objective.

1 Loading and discharge

Every day a vessel remains in dock or at sea waiting to load or discharge results in both opportunity costs and actual costs for the trading firm. The contract between the charterer and the shipowner specifies agreed time for loading and unloading (laytime). The operations team needs to coordinate chartering dates, arrival and loading, and destination and discharge schedules to minimise lost time.

2 Demurrage

Trading in the physical world doesn't always go according to plan. Ships develop faults, and

weather systems affect shipping speeds, fuel consumption and trade routes. Charterers that exceed the agreed rental period must pay a demurrage fee. The operations team monitors demurrage risks and notifies trading teams when schedules come under pressure.

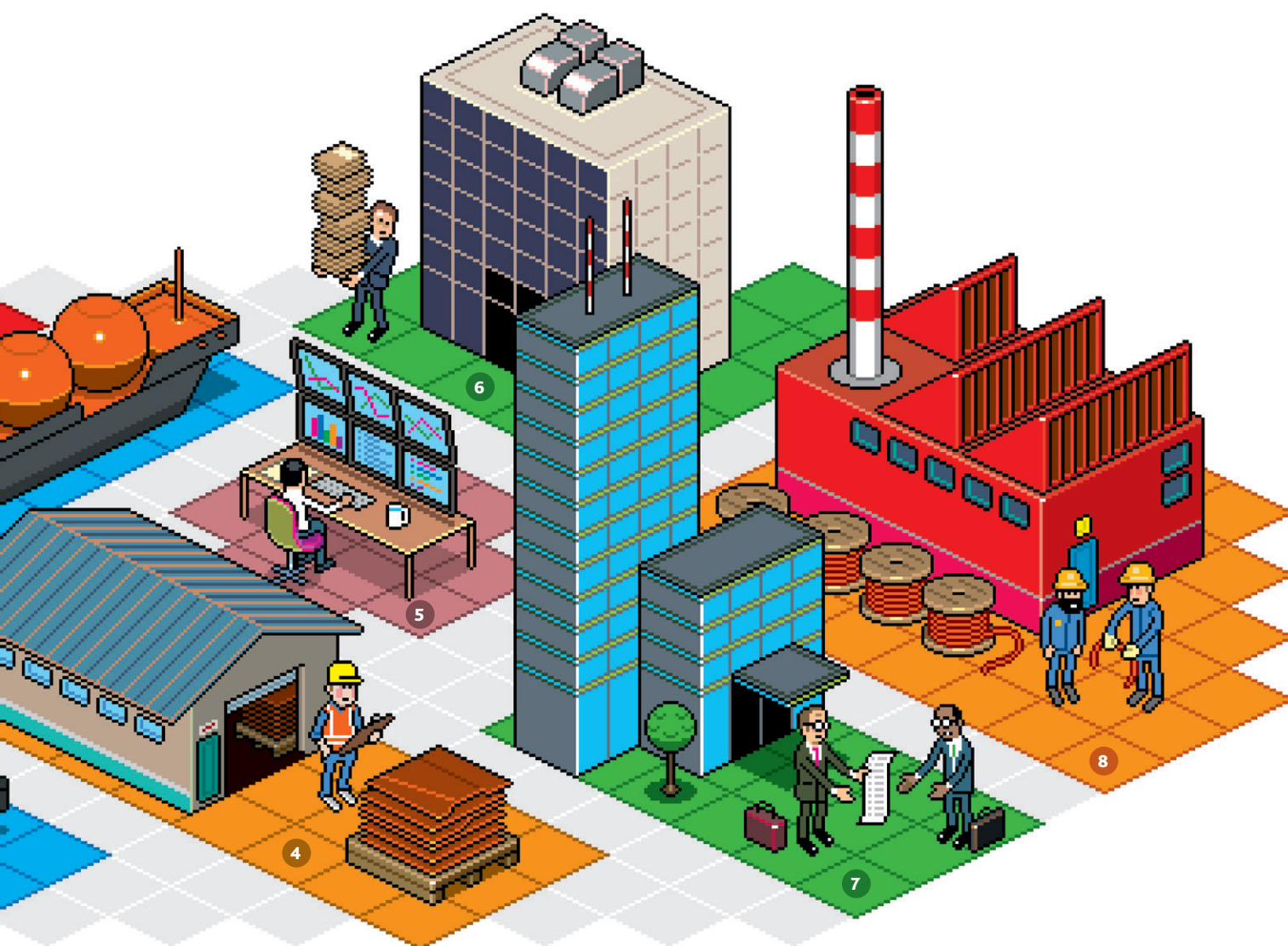
3 Vessel brokers and agents

Global trading firms undertake numerous high-volume, high-value transactions involving thousands of journeys each year. They liaise with brokers to charter vessels. They use agents to manage logistics and represent their interests while their ships are in port. They oversee administrative

tasks, supervise loading and unloading of cargo, and are responsible for arranging pilot and tug-boat services.

4 Appointing inspectors

Both the volume and the quality of commodity shipments can change while in transit. Sometimes, this is anticipated – with crude oil shipments for instance, there is always some residue left in the tanker. In other cases, the cargo may have been stored incorrectly, its chemical properties may have changed, or there is a discrepancy in volumes loaded and unloaded at various stages. To prevent the expense and disruption of disagreements



between buyers, sellers and logistics providers, trading firms appoint independent inspectors to certify the quality and the quantity of cargo.

5 Accounting for physical flows

Profit and loss (P&L) can be affected by many known or unknown factors. Effective and vigilant contract management is mandatory. The operations team will keep the trading back office up to date with the latest news while monitoring the life cycle of the trade. This includes tracking payments and receipts for known costs such as port fees, agency fees, inspection costs,

warehousing rental and chartering costs as well as for the material itself via suppliers and receivers. Financing arrangements are put in place (e.g. letter of credit) and if applicable an operator tracks and controls the pricings of cargo and allocates them to shipments for invoicing purposes, while monitoring exposures. There will also be unknown or unpredictable factors, such as force majeure by a supplier, bad weather or engine failure, which may result in P&L impact.

6 Insurance

The operations team checks that insurance provides adequate coverage. Trading firms maintain

separate insurance programmes for property, liability, political risk and trade credit general insurance. The shipper may cover a specific cargo with its own policy. If not, the trading firm may take out special marine policies to cover shipment.

7 Troubleshooting

Most transactions work like clockwork, but when things get more complex the operations team has to negotiate the best remedial action. Who is at fault if a correctly loaded cargo arrives off-spec or the quantities can't be reconciled? Does the trader sue the inspector, claim insurance or accept the loss? And what is the

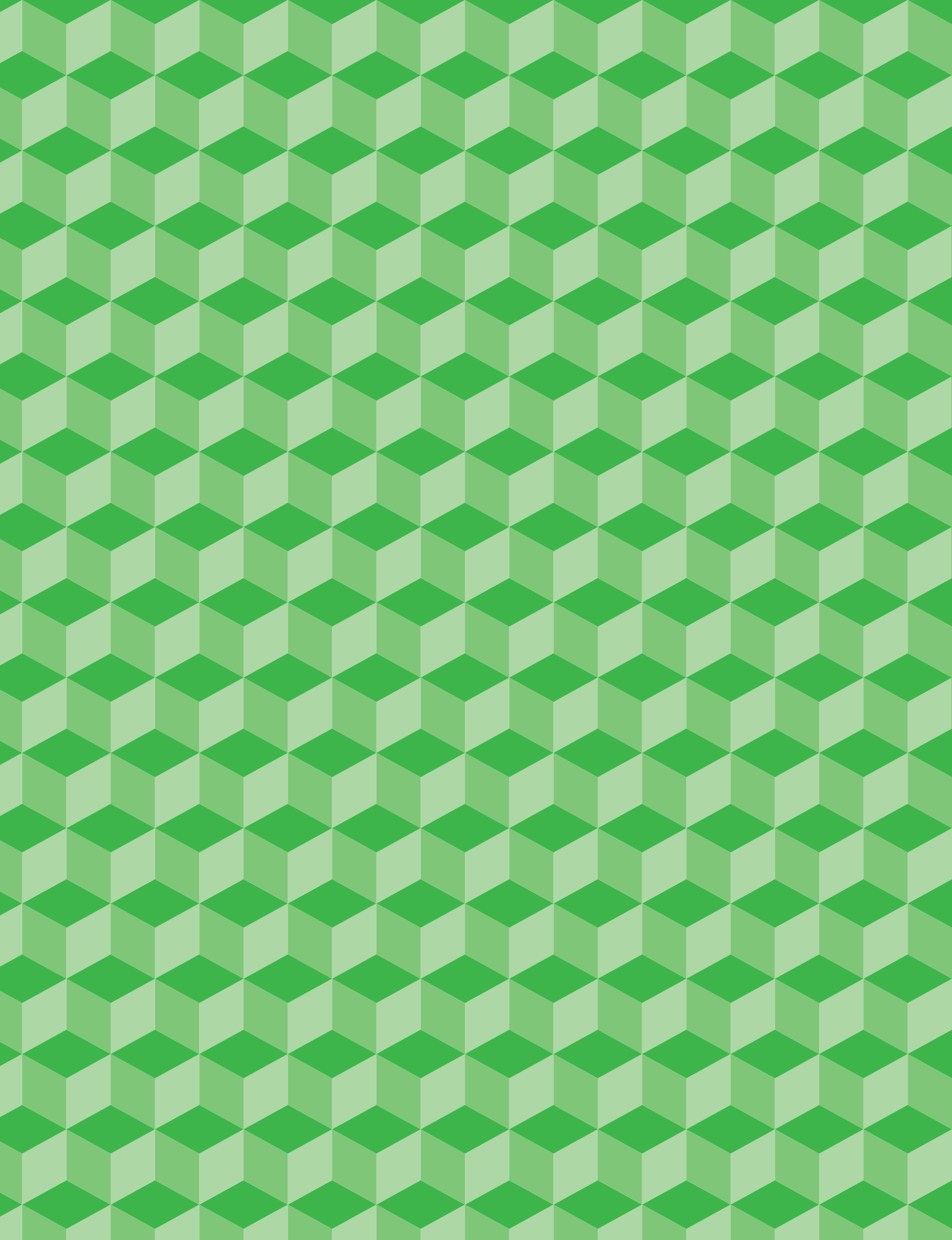
best strategy to recover value on distressed cargo?

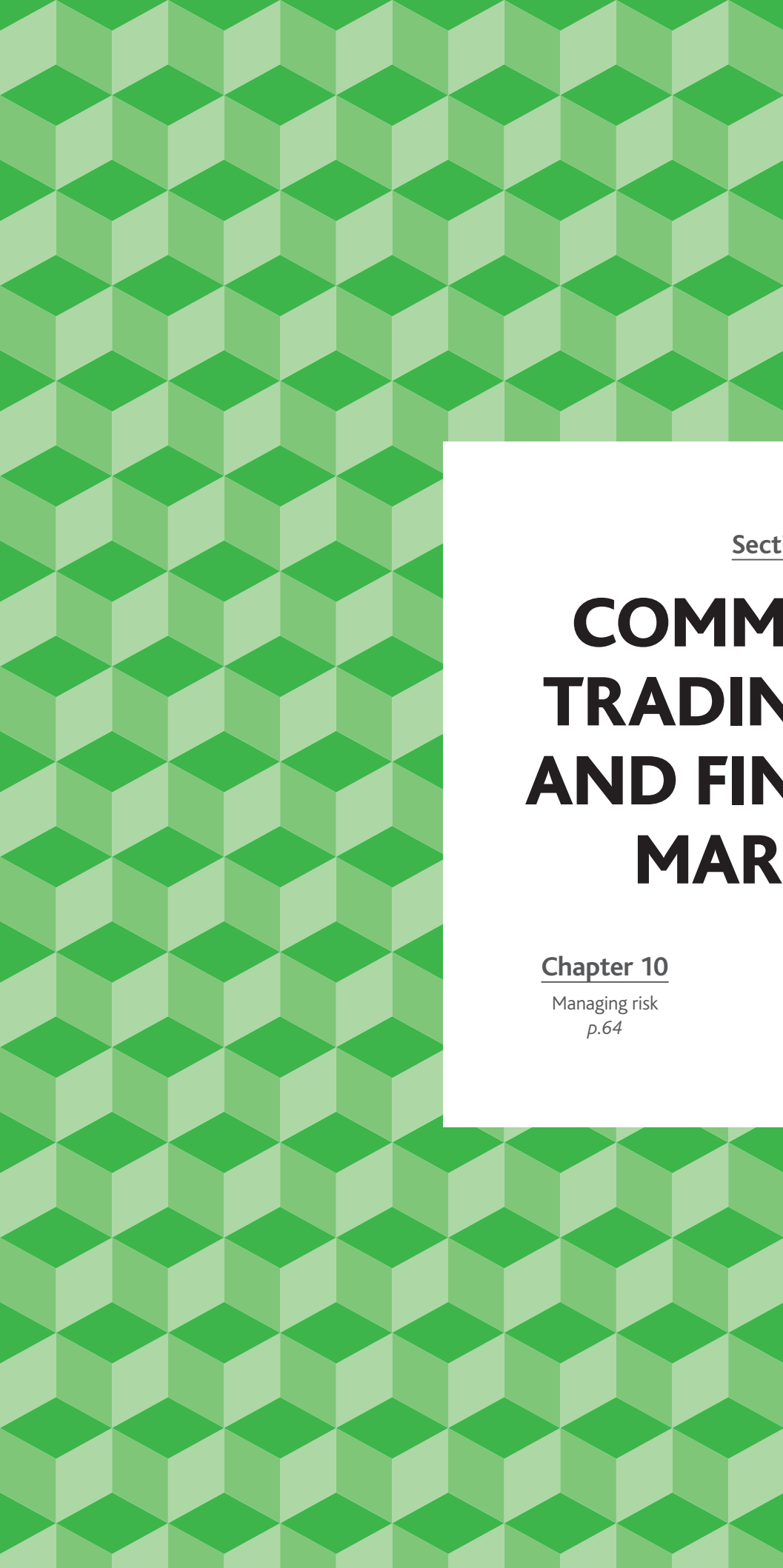
8 Auditing

Most operations go to plan but where this does not happen it is the job of the operations team to work out who is at fault and establish how best to recoup money for the firm. With a complex supply chain, issues can arise during storage, blending and transportation. The operations team will reconcile volumes and qualities at every stage in the process to pinpoint discrepancies.

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Section C

COMMODITY TRADING, RISK AND FINANCIAL MARKETS

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Chapter 10

MANAGING RISK

Risk management is a core competence for trading firms. They store and transport physical assets across the globe and earn slim margins on high-value, high-volume transactions. They use sophisticated risk management techniques to link revenues to costs and operate effectively in volatile markets.

Trading firms can only stay in business as competitive, low-risk operations

Major traders have annual turnover that dwarfs their own capital resources and puts them firmly in the ranks of the world's largest companies. They rely on sizeable infusions of short-term capital to buy the commodities they need to trade. This would not be available to them were they not able to demonstrate to financial institutions the sustainability of their business models.

Managing financial risk effectively is therefore an absolute priority for trading firms. They use derivative markets to hedge against absolute price (also known as flat price) risk. They also take out commercial credit risk and political risk policies in the insurance market.

Diversification and integration reduce risk

Global trading firms handle a variety of commodities and manage processes across the supply chain.

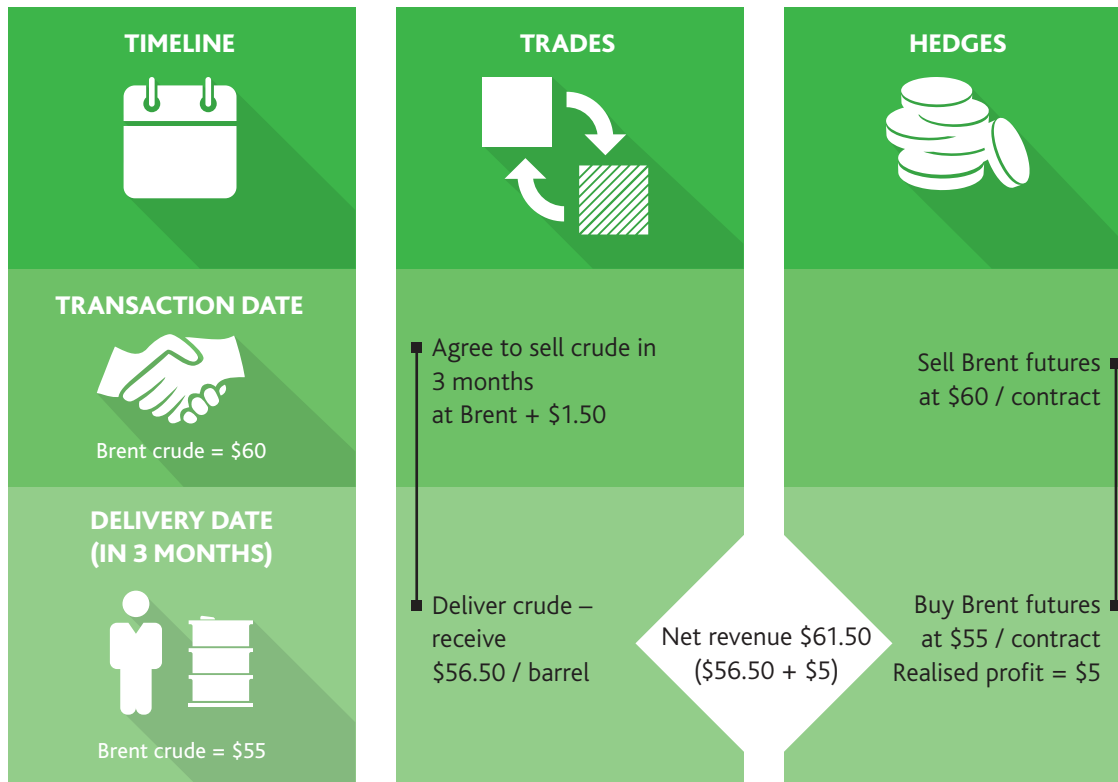
As diversified operations they enjoy limited natural protection from commodity price changes. Different price pressures in various commodity markets will be offset by the breadth of their activities. Most are trading both primary and secondary commodities and will usually have their own storage facilities.

The integrated nature of their operations provides another natural hedge within the overall business. In the copper market, for instance, a decline in end-demand for the refined metal may or may not lead to reduced smelter production and lower demand for concentrate. It all depends on market dynamics. Either way, the demand for storage (either of concentrates or refined copper) is likely to increase.

In an integrated trading operation, lower demand for shipping a commodity is offset by increased demand for storing it.

But diversification and integration provide little protection in the event of a systemic change in market sentiment. Both the global financial crisis and the economic slowdown in China would have been catastrophic for any trading company that took no additional steps to hedge its activities.

HEDGING AGAINST FLAT PRICE RISK FROM THE SALE OF CRUDE



Managing flat price risk

The practice of hedging is fundamental to commodity trading. Trading firms like Trafigura systematically eliminate their flat price exposure – the risk of a change in the benchmark price for a barrel of oil or a tonne of copper concentrate.

In a typical transaction, a trader will agree purchase and sale prices with two different counterparties to lock in a profit margin. The transaction is agreed before shipment and the convention is that final prices are not fixed until the commodity is delivered. So on the transaction date, the parties agree both trades at fixed margins against a benchmark index price. For crude, for instance, the purchase price might be set in advance at 50 basis points over the Brent index on the day the trader takes delivery and the sale price at 150 basis points over Brent when the shipment is delivered.

Left like this the transaction leaves the trading firm exposed to fluctuations in the actual price of Brent crude. It clearly has to take delivery of the crude before it can ship it, so if the Brent price is higher on the earlier date it could make a substantial loss.

It can avoid this by simultaneously taking out futures contracts against both parts of the transaction. It fixes the purchase price in advance by buying futures on the transaction date and selling them back when it collects the shipment. At the same time, it fixes the sale price by selling futures on the transaction date and buying them back when the crude has shipped. The simplified example above illustrates how traders use futures to remove flat price risk when selling a physical commodity.

Hedging flat price risk does not eliminate price risk altogether because physical price and futures prices don't stay completely aligned, but it does leave the trading firm with a smaller, much more manageable market risk. This is known as basis risk.

Managing basis risk

Basis describes the difference in the price behaviour of the physical commodity and its underlying hedging instrument. Managing basis risk is core to the trader's skill set. Understanding the dynamics of basis behaviour is the source of profitable trading opportunities.

There is no such thing as the perfect hedge

Basis risk arises because, in practice, the price behaviour of a hedging instrument will never exactly correspond to that of the physical commodity.

Traders typically use futures contracts to hedge physical transactions. These are notional, standardised commodities with specific delivery dates, delivery locations and quality characteristics. Standardisation makes futures much more tradeable, which reduces transaction costs and execution risks associated with hedging, but also differentiates them from physical commodities.

When trading firms buy and sell physical commodities they are acquiring specific assets at particular locations on precise dates. The physical nature of the asset makes it unique. A Brent futures contract, based on a notional specification of light North Sea oil delivered at a precise location, will never be an exact match for, say, a cargo of heavy Middle East crude. Both prices move roughly in tandem so basis risk is considerably lower than flat price risk. But because they are priced in linked but distinct markets, technical factors and supply and demand differences result in fluctuations in the differential between their prices.

In global commodities markets, basis relationships provide profitable trading opportunities

Global trading firms take advantage of these fluctuations to maximise their profit margins. With around half of all international crude priced off the Brent benchmark contract, there is ample opportunity to take advantage of these changing differentials. The global nature of the crude oil market makes global arbitrage, with oil cargoes circling the world seeking the best price, a profitable activity for traders.

But not every market enjoys the global pricing, internationally agreed benchmarks and active derivative sector used by crude oil traders. Gas markets, for instance, are still linked to regional pricing factors. In East Asia, gas prices are indexed to oil or oil products. In Europe, Russian pipeline gas is still nominally linked to the oil price, although this link is rapidly weakening as gas-on-gas competition increases in fast-developing trading hubs in the European Union. And in North America, it is simply the interaction between the supply and demand for gas that determines prices.

As LNG develops, gas may be traded internationally in sufficient volumes to offset regional price differences, but a global gas price has not happened yet. For now, LNG traders have more limited arbitrage opportunities. In practice, they must decide on the final destination for their LNG on the transaction date and establish the relevant regional hedge.

Physical markets and financial markets

The futures market provides valuable information about expected future supply and demand on which producers, consumers and traders can act today. The market is reflecting today's environment, with a futures contract priced according to the opportunity cost of storing the physical commodity until its delivery date.

Events change perceptions, so futures should not be seen as an accurate guide to changes in the physical market. However, over time the price of a futures contract will always converge with the physical market price. This is because on the day the future contract expires it becomes physically deliverable. Physical delivery almost never happens in practice, but the fact that it is possible imposes a price discipline on futures contracts.

So, for example, the closing price for a monthly futures contract for Brent crude for delivery in June is the same as the spot Brent price in the physical market in June. If the prices differed, traders would buy in the cheaper market and sell in the market with the higher price. Supply and demand would quickly eliminate this arbitrage opening.

The possibility of delivery or receipt is an essential feature of almost all futures contracts, and most stipulate a specific geographic delivery point. For WTI crude, the delivery point is a small town in Oklahoma (Cushing), for US natural gas it is Henry Hub which is, notionally at least, at a small town in Louisiana (Erath). Brent crude is deliverable at various locations around the North Sea (amalgamated in what is called the Brent-Forties-Oseberg-Ekofisk or BFOE basket). Metals contracts at the London Metal Exchange (LME) are deliverable at any of the 650 LME-accredited warehouses around the world.

The possibility of physical delivery imposes a price discipline on financial markets because of the threat of arbitrage

Where physical delivery is not practical, a cash alternative is specified. Steel is not easily deliverable, because delivery involves storage, and steel, unlike other base metals, rusts over time. It therefore cannot be stored for extended periods. Shipping freight is also cash deliverable as this is a service not a physically deliverable good.

FUTURES CONTRACTS, SPOT PRICES AND THE LINK BETWEEN THEM

Crude oil futures	Size	Density	Sulphur content
WTI	1,000 barrels	Light	Low
Brent	1,000 barrels	Light	Low
Dubai	1,000 barrels	Medium	Medium
Shanghai (planned)	1,000 barrels	Medium	Medium
Physical spot market prices	Daily assessments of spot markets by Price Reporting Agencies – chiefly Platts and Argus.		
Relationship between futures and physical prices	Oil contracts can be priced according to a premium / discount to either Platts or Argus spot prices or to the futures benchmark prices. But hedging can usually only be done by taking out one of the futures contracts. Futures and spot prices will tend to move up or down together, and will converge when futures contracts become deliverable.		

This raises the question of how the market determines reference prices in the physical markets for energy and metals. In the main, the market relies on prices published by two Price Reporting Agencies. Platts and Argus are private companies that perform a vital public role. They report daily on a vast array of markets trading different physical commodities as well as some specially tailored derivative contracts.

The development of oil spot markets, in parallel with that of the futures markets, created a need for price assessments, first as a contribution to transparency but gradually for use in trade. The spot market in oil is still a small fraction of the world oil market, but it sets prices for a much larger volume of trade. Most energy trade is still conducted on a long-term basis, but often at prices in contracts that are set at an agreed differential to a Platts or Argus benchmark. This in turn is based on the prevailing spot market price.

Hedging an aluminium transaction on the LME

Trading firms use futures to protect themselves against the risk of adverse market movements. To hedge aluminium sales, they will often use LME futures.

By way of example, take a physical transaction where a trader contracts to sell 10,000 tonnes of aluminium a month to a manufacturing counterparty. The two parties agree to trade at the prevailing LME Official Settlement Price at the end of each month. At the time the physical transaction is agreed, the price of aluminium is \$1,500 a tonne. The trader hedges his exposure with an LME 'monthly average'

futures contract. He places an order with his broker to open futures contracts to sell 10,000 tonnes of aluminium a month at \$1,500 a tonne.

The LME requires margin payments on all futures contracts to minimise its risk in the event of default. On opening the futures contract, the broker lodges initial margin, underwriting the trader's ability and willingness to honour the contract. In normal trading times on the LME, this initial margin is around 5-8 percent of the underlying physical transaction (higher at times of high volatility). This is usually funded with a credit line from a bank.

Variation margin payments are also required to reflect the daily fluctuations of the aluminium price. At the end of each trading day the futures position is marked to market, with profits posted to the broker's account and losses met with additional funds. For instance, if the price drops by \$50 to \$1,450, the trader, as the party that is short on aluminium, would post a variation margin of \$50 a tonne.

The trader can now make physical deliveries of aluminium each month, with changes in the market price having no effect on its net cash flow. If prices go above \$1,500 a tonne its gains in the physical market are offset by equal losses on the financial transaction. If prices fall, the opposite occurs.

Hedging freight

Traders cannot just look at their gross margin on trades (the difference between the sale price and the purchase price of the commodity). They must also consider the cost of sourcing, transforming and transporting the commodity to meet the purchaser's specifications. Where commodities need to be shipped overseas, the cost of chartering a suitable vessel is a key contributor in determining trade profitability. The lower the gross margin, the more material this becomes.

The price of freight varies according to the supply and demand for shipping. Traders use FFAs to fix their costs in advance

Charterers pay freight rates according to supply and demand conditions at the time. Depending on the commodity being shipped, the quantity, timings and locations, freight prices can vary markedly. Traders will generally fix chartering costs in advance to protect against the risk of a rise in freight costs.

This is normally done through freight forward agreements (FFAs). Commodity trading firms are charterers and are therefore natural buyers of FFAs. They use FFAs to protect themselves against rising future freight rates. Ship owners are natural sellers. They seek to protect themselves against lower freight rates in the future.

If a commodity trader who wants to charter a tanker in 15 days to carry his cargo of crude for 30 days to a certain destination fears that shipping rates will rise, he buys an FFA locking in the current freight rate of \$19,000 a day.

Suppose his fears prove justified and the average rate over that following month is \$22,000 a day, then this is what he pays the ship owner. However, the FFA comes to his rescue. In this example, the FFA contract settles above the agreed price and the FFA buyer is paid the price difference, multiplied by the length of the contract. The FFA buyer receives:
 $\$22,000 - \$19,000 = \$3,000 \times 30 \text{ days} = \$90,000.$

For the charterer, the FFA has offset the rise in the freight rate he had to pay. For the counterparty on this contract, probably a ship owner, the exact opposite has occurred – a gain on the physical freight rate is negated by a loss on the FFA. But neither party is worse (or better) off. The derivative stabilises the cash flow of both parties. Changes in the other main cost of shipping – that of the price of bunker ship fuel – can also be hedged.

Assessing risk and evaluating trade profitability

Hedging allows traders to fix flat price risk in advance, mainly through futures contracts. They can also control the cost of transporting the commodity, using FFAs to fix the chartering cost. The cost of financing the purchase of the commodity and of any variation margin on their futures positions can be estimated in advance. However, any trade will involve taking on basis risk as well as credit, political and operational risks.

They must also consider the opportunity cost of any trade. Ultimately, trading firms' logistical resources and access to capital are limited. They will also have global risk management rules in place that limit their exposure to particular markets and regions as well as overall restrictions imposed by the size of the balance sheet.

There has to be enough profit in a trade to justify the risks and the capital it employs

By using hedging tools, they can determine which trades are likely to be most profitable no matter what happens to price, and lock into that profitability.

Hedging a crude oil transaction priced off different benchmarks

There are hundreds of grades of crude oil. The physical characteristics and the location of each shipment will determine its pricing. Prices are set against three main benchmarks, depending in part on the location of the shipment and in part on the type of crude being traded. WTI is used in North America; Brent is the benchmark for Europe and the Dubai benchmark is popular in the Middle East and Asia. This can mean that traders buy and sell crude against different benchmark prices depending on where the product is acquired and shipped. The trading firm can still hedge the transaction so long as there are financial instruments for each benchmark.

In the example on the next page, Trafigura is analysing whether to buy two million barrels of Ghanaian oil for sale to a customer in China. It estimates its delivery costs, including freight, ship-to-ship transfer cost and losses due to water and sediment in the cargo, will be \$1 per barrel. It estimates its hedge financing costs, covering hedge finance, insurance and trade credit, will be 35 cents per barrel.

This transaction earns Trafigura a gross profit of \$3 million, which equates to a gross margin of \$1.50 per barrel. But after taking in to account its financing and transportation costs, its net margin is 15 cents per barrel ($\$1.50 - \$1 - \$0.35$), a net profit of \$300,000. It will undertake the transaction if it decides that the projected profit outweighs the associated operational and financial risks, in particular basis and demurrage risk.

MANAGING PRICE RISK

TIMELINE



DAY 1
Brent crude = \$60
Dubai crude = \$57.50



DAY 30
Brent crude = \$70



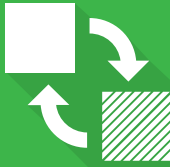
DAY 75
Dubai crude = \$75



PROFIT / LOSS



TRADES



Trafigura buys 2m barrels of Ghanaian crude for delivery in Europe in 30 days' time at a \$2/barrel discount to the price of Brent crude.


Trafigura sells 2m barrels of Ghanaian crude for delivery in China in 75 days' time at a \$2/barrel premium to the price of Dubai crude.

Trafigura pays \$136m to buy crude (\$68 x 2m)

Trafigura earns \$154m from the sale of crude (\$77 x 2m)

Trafigura realises a gross profit of \$9 per barrel on the physical trades (\$77 - \$68)

HEDGES



Trafigura buys 2,000 Brent futures at \$60 per barrel

Trafigura sells 2,000 Dubai futures at \$57.50 per barrel

Selling back Brent futures realises a \$20m profit $[(\$70 - \$60) \times 2m]$ Equivalent to \$10 per barrel.

Buying back Dubai futures realises a \$35m loss $[(\$57.50 - \$75) \times 2m]$ Equivalent to \$17.50 per barrel.

Trafigura realises a loss of \$7.50 per barrel on its hedges (\$10 - \$17.50)

Total cost \$116m
(\$136m - \$20m)

Total revenue \$119m
(\$154m - \$35m)

Gross profit \$3m
(\$119m - \$116m)

Volumes and trading profitability

Commodity traders are largely indifferent as to whether markets go up or down. Successful hedging removes most of the risk and reward of changes in absolute prices. What they do care about is the margin between their purchase and sale prices. A trade is only profitable when this margin is greater than the unit cost of doing the business. Net margin is the critical metric for profitability.

Traders focus on margins not market prices

For trading firms, volumes, not prices, are the key factor for profitability. Professor Craig Pirrong highlights "the danger of confusing the riskiness of commodity prices with the riskiness of commodity trading". He points out that the metric to judge riskiness in commodity trading operations should be the level of commodity shipments, not commodity prices.

While it is the case that large trading firms have more at stake by virtue of the large volumes they ship, they also have more opportunities to reduce risk through flexible management of their trading system. Larger businesses tend to be more diversified and therefore their risks are less concentrated.

It is true too that margins and volumes tend to rise and fall together, because both reflect demand for the transformation services that commodity merchants provide. Net margins also increase as volumes increase, because this is an industry with substantial economies of scale. The unit cost of delivery can fall dramatically as volumes grow, because of logistics savings.

The link between margins, volumes and prices is more indirect. There is a correlation between margins and price volatility. Managing price risk is not a core competence for producers and consumers. In volatile markets, the value added by traders is more evident and their services are in demand. This is reflected in the higher margins that are generally available in more volatile market conditions.

As it happens, the surge in oil and metals prices until 2014 was also good for margins and volumes. But when prices collapse, margins and volumes do not always follow. The sharp fall in oil prices between 2014 and 2016 did not stem from a fall in oil demand. It was simply that more was being produced than being consumed. Price rather than demand took the hit from an excess of production over consumption and unused supply was placed in storage. Inventories cannot rise forever though. As the saying goes, 'the cure for low oil prices is low oil prices'. This proved the case in 2016. OPEC reintroduced quotas and shale suppliers pared back production; this helped to set a floor on prices.

Managing operational risk

Global trading firms encounter many different kinds of risk. They are active around the world. They operate in multiple jurisdictions. Their counterparties include governments, state agencies, banks, and private and public limited companies.

One liability that looms large for any company transporting, loading and offloading big volumes of oil and petroleum products is the danger of an oil spill. Oil, by definition, is a hazardous chemical. There is the potential for injuries, fatalities and extensive environmental damage; and rightly, as Exxon, Total and BP have all discovered in recent decades, that brings massive financial penalties and huge reputational damage. Trading firms mitigate this risk through best practice operations in their own procedures and by ensuring their commercial partners comply with similarly high standards. For instance, when chartering ships, most insist on double-hulled, certified tankers. Many also impose an age limit on the ships they charter.

Trading firms apply best practice and invest in modern equipment to manage operational risk

More generally, operational effectiveness is a critical business attribute – and not just to avoid the potentially calamitous liability incurred through an industrial accident.

Global traders depend on forging strong, sustainable trading relationships. They themselves are under scrutiny as many of their commercial partners have their own reporting and regulatory requirements. To do business with these organisations, they need, as a minimum, to be meeting internationally accepted health, safety and environmental standards.

Responsibility and reputational risk

Minimising harm to people and the environment is a basic tenet for any responsible business. For commodity traders, this is a critical area of focus. The reputational fallout should anything go wrong would be very damaging. They store toxic, flammable and hazardous materials and transport them by land and sea across large distances. They are active in remote parts of the world with widely varying levels of governance.

Responsibility is a commercial imperative for commodity trading firms in their day-to-day activities, not least because of their reliance on strong banking relationships. Trading firms typically earn slim margins on high-volume transactions. Their profitability relies on continuing access to low-cost capital. Banks provide much of this in the form of short-term, collateralised facilities.

Society and stakeholder activists monitor international banks' activities closely. Their lending and investing decisions have to meet high ethical standards. Accordingly, banks' due-diligence teams assess counterparties against responsibility as well as commercial criteria. Trading firms have to meet their responsibility thresholds to retain access to funding.

Trading responsibly is not just about avoiding accidents. Firms need to make a positive socio-economic contribution to maintain their social licence to operate. This is especially true in remote regions and underdeveloped economies.

There is continuing debate about the scope of a trading firm's responsibility. Traders collaborate with many partners in a highly complex supply chain. This necessarily restricts their ability to control systems and influence behaviour. Yet they are still expected to mitigate the negative consequences of all of their activities, even when these arise indirectly. They must tread a fine line.

Credit risk and political risk

Trading firms take numerous steps to protect themselves from credit risk (i.e. non-payment by companies) and political or country risk (i.e. action by governments to block payment or seize assets). But not every risk can be managed directly.

Insurance is a critical business enabler.

Traders cannot afford not to insure their operations. The loss of a single cargo, quite apart from the social and / or environmental cost, could cost tens or even hundreds of millions of dollars. Having insurance allows trading firms to deal with a range of counterparties, operate in challenging environments and compete more effectively worldwide.

If trading firms cannot satisfy themselves, through their own internal checking process, of the creditworthiness of a counterparty, then they can usually take out a guarantee or insurance on the counterparty from a bank. This transfers the credit risk to the bank, though this comes at a cost to the trading firm.

Insurance against political risk, as well as credit risk, can be taken out on the Lloyds market in London. One widely used policy known as CEND provides cover against confiscation, expropriation, nationalisation and deprivation.

Some commodity traders, notably those with global operations, spend a lot of money on political and credit risk insurance. For the largest firms, self-insuring most of their operations through a captive insurer is a viable alternative. A captive insurance company takes on the risk of each transaction, but just like an external insurer it spreads the cost across multiple transactions. The largest traders have sufficient volume to make this possible internally, with the captive insurer using the reinsurance market to protect the business against worst-case outcomes. ■

They take out insurance to cover business risks they cannot manage internally

Chapter 11

FUNDING COMMODITY TRADING

Trading firms buy and sell commodities with an aggregate value that far exceeds their own capital resources. They achieve this by attracting funding from financial institutions. Banks are willing to lend because their loans are secured against commodities.

Financial institutions are critically important stakeholders for commodity trading firms. Trading firms are significant short-term borrowers; they depend on substantial and continuing financial support to sustain and grow their businesses.

Traders' activities require substantial capital resources. They source, store, blend and deliver commodities around the globe. They may invest in terminals, logistics and physical infrastructure to improve the operational efficiency of their trading operations.

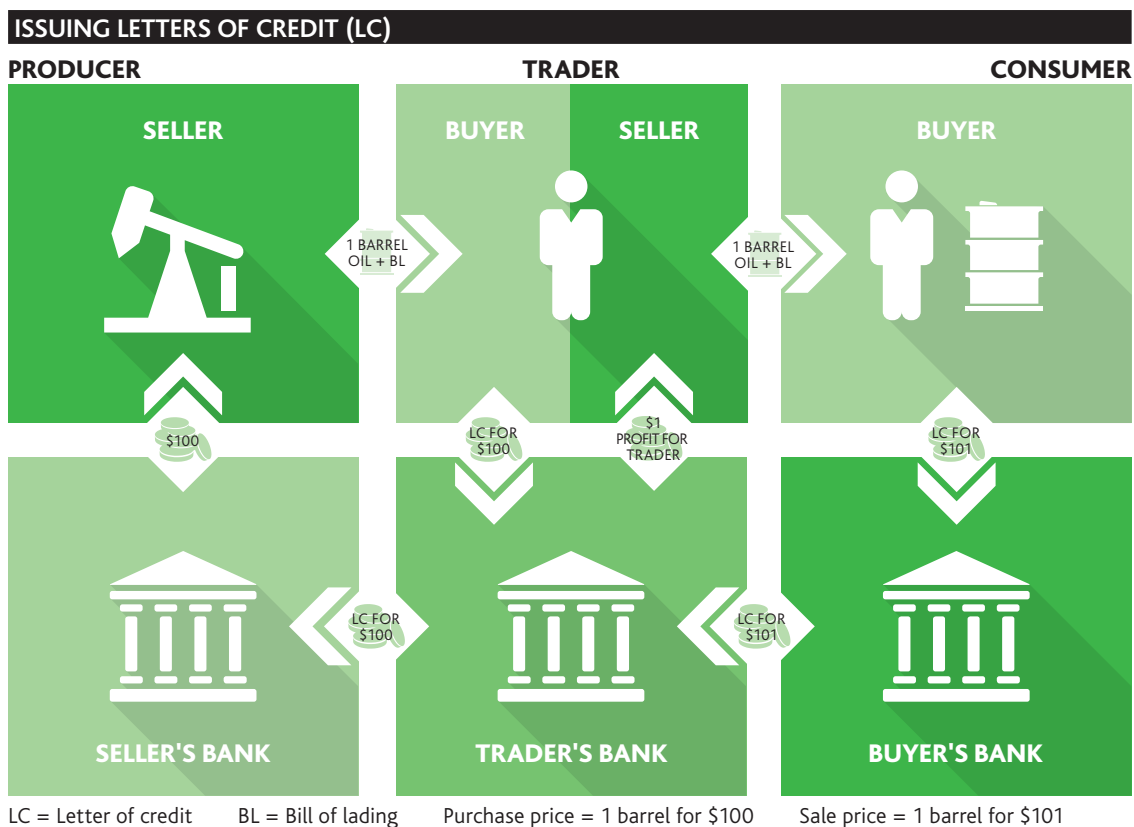
They need funding models that will help them to operate effectively in all market conditions. Larger trading firms, like Trafigura, typically diversify both the sources and the structure of their financing, raising capital in different regions with a range of repayment schedules.

Financing trade

Traders rely on short-term secured lending facilities to support their commodity purchasing activities. Commodity traders are heavy users of traditional trade finance tied to specific commodity transactions.

Banks provide short-term credit facilities secured by the commodity in the form of letters of credit, which are made available to the seller. These facilities are self-liquidating in the sense that debt is repaid immediately from the proceeds of the sale of the commodity being financed.

Repayment of the debt comes from the transaction itself, and is therefore not dependent on the creditworthiness or cash flow of the trading firm as intermediary or that of the final buyer of the commodity. Banks providing trade finance know that in the event of any default, they can use the underlying commodity as collateral to ensure they get repaid. The size of the facility is marked to market at least weekly to keep it aligned with the value of the underlying commodity.



Traditional trade finance uses letters of credit (LCs) with bills of lading as collateral

Banks facilitate a trade by providing a letter of credit (LC) to the seller on the buyer's behalf. This document is a bank-backed guarantee that the seller will receive payment in full so long as certain delivery conditions are met. The seller has the assurance that should the buyer be unable to make payment on the purchase, the bank will cover the outstanding amount. In some emerging markets, sellers are legally required to demand letters of credit from buyers to register sales and make transactions more transparent.

One of the conditions that must be satisfied for the LC to be honoured, and payment made, is presentation of a bill of lading (BL). The BL is a formal document that confers title of ownership to goods in transit to the holder. It acts as receipt that the goods have been loaded on board and delivered to the buyer.

Bilateral trade finance

- **Step One.** The trader or trader's bank issues an LC to the seller via the seller's bank. The precise sequence of events is that the seller puts the goods on a ship. When these have been checked

by the carrier, the seller receives a BL, which he then presents to his bank to get paid. So the seller does not rely for payment on the creditworthiness of the trader, but on that of his own bank, which in turn relies on the creditworthiness of the trader's bank.

- **Step Two.** A copy of the BL passes to the trader, giving him title to the cargo in question.
- **Step Three.** The buyer issues a LC to the trader. This gives the trader the security that the buyer is able and willing to pay. The trader presents the BL to the buyer's bank and gets paid.

This system works well. It suits the seller. He knows he will get paid once the BL is presented and he does not have to depend on the creditworthiness of either the trading firm or the importer. It also allows commodity trading firms to hold far more bank debt on their balance sheet than a normal company could, because this trade finance debt is dependent on another counterparty. But arranging this kind of bilateral finance for individual cargoes with LCs and BLs is very labour-intensive. So trading firms also use other techniques to fund commodity trades.

Pooled collateral

In regions where they do sizeable and regular trades, some trading firms, including Trafigura, have established a borrowing base. At regular intervals, the trading firm provides a bank or banks with an overview of all its inventory and receivables, against which it negotiates a line of credit. Trafigura has one such arrangement with a number of banks in Mexico, where it buys and stores a lot of copper, lead and zinc concentrates, and operates similar borrowing bases in other parts of the world.

Trading firms use a range of techniques to finance commodity trades

Repurchase agreements

Repurchase agreements involve the trading firm selling a commodity to a bank, and simultaneously agreeing to buy it back a week later. The operation, usually involving LME-grade metals, is repeated week after week, because the banks find it more attractive (in terms of the return on equity) to own the material rather than to finance it. This is because banks' regulatory capital requirement for asset ownership is lower than that for lending activities.

Syndicated pre-payment deals

Once trading firms have negotiated pre-payment deals, they will often go to the wholesale market and offer this as security to negotiate a syndicated lending agreement with a group of international banks. There has been a general retrenchment in the wake of the 2008 global financial crisis. Many banks have ceased direct lending to emerging market countries, but they remain comfortable to do so indirectly, with a commodity trading firm acting as intermediary.

Financing hedging costs

Since the global financial crisis, regulators have become much more alert to the credit risk associated with derivatives. They have introduced stricter capital requirements to guard against systemic breakdown led by derivatives trading. This has increased the cost of over-the-counter (OTC) derivatives.

This has helped to fuel a global trend in favour of trading on regulated exchanges.

As a result, hedging, even of freight derivatives, is increasingly conducted on cleared markets. With this kind of hedge, a clearing house stands between the counterparties to every trade on the market. This ensures that even if one party to a transaction defaults, the transaction will go through.

Hedging via the big electronic exchanges with heavily-traded futures contracts is an efficient, low-risk mechanism for managing flat price risk, but it comes at a cost.

Clearing houses need to ensure they have sufficient collateral to protect themselves against the cost of default. They manage this by requiring anyone with an open position to post margin, which can be drawn on in the event of a default.

Clearing houses require traders to post daily margin on loss-making futures positions

Traders are required to post an initial margin on opening the trade. At the end of each trading session all positions are marked to market and profits and losses from that day's trading are transferred between counterparties. Those with loss-making positions must place additional funds, known as variation margin, before the start of the next trading session to avoid an automatic default.

Commodity trading firms must maintain variation margins to prevent their accounts being closed, and their physical transactions becoming unhedged. In volatile market conditions, these variation payments can run into hundreds of millions of dollars.

Trading firms may need to borrow funds to cover timing mismatches on hedged positions

Since these are hedging profits and losses, they are ultimately offset by payments and receipts from their associated physical transactions. But there can be a mismatch in the timing of cash flows from the physical and financial positions, which may have to be financed.

Ironically, this mismatch is most acute when the value of their underlying physical assets are increasing.

For example, if a trader buys an oil shipment and the oil price rises, the cargo rises in value, but that additional value is not realised until the end of the voyage. The trader will have already hedged his position by selling oil at a fixed price using the futures market. This futures position incurs daily losses as the oil price rises. Every day the futures position suffers a loss, the trading firm must make a variation margin payment.

To cover these sudden liquidity needs, trading firms maintain sizeable credit lines from their bankers. Many of the largest traders negotiate short-term syndicated facilities to meet this requirement.

It is vital that these facilities include substantial headroom. The greatest potential hedging costs will be incurred at times of greatest volatility. Traders must be able to operate successfully in all market conditions if they are to maintain the confidence of their financial backers.

Corporate finance

Transactional trade finance provides commodity traders with the financial fuel for their daily bread-and-butter business of buying, shipping and selling commodities around the world. But this is short-term credit and it does not put banks under any ongoing obligation to continue to lend.

Trading firms are capital-intensive operations; they need the assurance that they will have access to capital across the longer term. They want the flexibility to cope with sudden liquidity crunches so they can keep trading in difficult market conditions. They may also want the financial headroom to expand their logistics base by, say, buying or building a new port facility.

For those commodity trading companies that have gone public or are prepared to do so, long-term finance can come in the form of equity. But most of the big trading firms prefer to remain private partnerships. They therefore have to consider other ways of attracting longer-term financial support.

Access to long-term finance supports investment in infrastructure and provides protection in case of a liquidity crunch

UTILISING SPECIAL PURPOSE VEHICLES FOR SECURITISATION FINANCE



1 Trader purchases oil from producer, payment terms = 30 days after bill of lading

2 Bank issues letter of credit to producer and makes payments as per agreed payment terms

3 Once the bank makes payment on letter of credit, a bilateral loan is created

4 Trader agrees to sell oil to customer and issues an invoice on 30-day payment terms creating a trade receivable

5 Trader sells encumbered trade receivable to SPV

6 SPV repays bilateral loan

7 Customer pays the invoice directly to an SPV account

Securitisation

Several trading firms have set up special purpose vehicles (SPVs) that issue long-term bond facilities backed by trade receivables. Institutional investors acquire these asset-backed securities. This in a sense is a hybrid between a capital market operation and trade finance. It works in the following way.

When a trading firm sells a cargo, it gets an invoice promising to pay it in, say, 30-60 days. Instead of waiting that long for payment, the trading firm sells the invoice immediately to its securitisation vehicle. The special purpose company uses the funds raised from its bond facility to acquire these receivables. In turn, these receivables support a revolving bond facility giving the trading firm longer term credit. The mechanism shortens the trading firm's liquidity cycle, enabling it to trade more.

Some trading firms have become active in the corporate syndicated bank market and in the capital markets, and have issued bonds of up to five years. However, the price for soliciting investors in the bond market is the regulatory requirement for greater transparency of private commodity trading firms' finances. Trafigura passed a milestone in 2013 when it issued a perpetual bond, which has no repayment date and is classed under generally accepted accounting rules as equity. The company was only allowed to issue this type of bond after a binding commitment to issue financial statements twice a year.

Asset sales

In today's more competitive landscape, the profitability of arbitrage-led transactions has declined. Commodity trading firms depend increasingly on strategic assets that lower their overall cost of delivery, reduce storage costs, enhance channels of distribution or provide preferential access to sources of production.

Control of such assets confers long-term competitive advantage, which can be extremely valuable for a trading firm. Trafigura, for example, has invested over a billion dollars to improve Colombia's transportation infrastructure. It has built a new terminal by the country's main river and developed a fluvial transportation system. With improved logistics it will be able to transport goods far more cost-effectively than its competitors. The expected larger share of the country's international trade coming from this competitively advantageous position will more than outweigh this substantial initial investment.

Trading firms don't have to own assets to benefit from controlling logistics

Control does not necessarily imply ownership. Trafigura has a track record of buying underperforming assets, developing them and then divesting without relinquishing control. For instance, it acquired an oil terminal complex in Corpus Christi, Texas in 2011 just as shale production was gathering momentum. Three years later, with Trafigura having developed the complex, Corpus Christi had become a major hub for oil products. It sold a majority interest to a professional terminal operator. Critically, it retained a minority stake and exclusive commercial rights to use of the terminal. The sale released over \$800 million for reinvestment.

Another popular mechanism for trading firms wanting to extend control over strategic assets is through participation in joint ventures. Many firms have strategic partnerships with asset-rich institutions, such as sovereign wealth organisations. Typically, trading firms contribute a share of the financial resources and manage operational issues in return for shared ownership.

Balance sheet management

Ultimately, the quality of the trading firm's balance sheet will dictate its ability to compete effectively. Concerns about leverage increase yields on its bond debt, impacting its ability to borrow in capital markets. The cost of insuring its debt is also likely to rise.

More immediately, maintaining its debt within investment grade parameters determines whether it is able to continue to trade competitively. Trading firms depend on a strong credit profile to access the funding essential for the shipment of millions of tonnes of oil and metal. ■

They need to maintain a strong credit rating to trade effectively

POSTSCRIPT

The story presented in these pages has two main strands.

First, it documents the role played by massive flows of raw materials in enabling the global economic integration of recent decades. The scale of commodities on the move across the world since the turn of millennium has been without precedent in human history. Achieving that required a new type of organisation able to deploy a combination of logistical, financial and risk management skills to connect centres of production, processing and consumption. Without these organisations or something like them, the modern industrial revolution and emergence of China and other Asian countries as centres of manufacturing and consumption would simply not have been possible.

Second, it illustrates the utter supremacy of market forces in today's global economy. The history of modern commodities trading shows sectors that had previously been dominated by vertically-integrated oligopolies opening up to competition and disintermediated trading based on various forms of market pricing. Whether in oil as a result of resource nationalism and the rise of OPEC, or in metals and mining under the impact of Chinese demand, or more recently in LNG in the face of a surge of tradeable product, supply chains that had once been tightly-knit have fractured, creating space into which independent commodity traders could move.

In fact, the trading firms have been both beneficiaries and catalysts of this trend. As markets

become cheaper to use, transactions that used to take place within vertically integrated firms can be undertaken in markets instead, and the upstream and downstream parts of the firm can be separated. By facilitating liquid, competitive markets – for example in crude oil and refined products – commodity trading firms have made it more economical and efficient to use them.

Similar logic applies in newer traded markets, including iron ore and LNG, where traded supplies are seen as an attractive alternative to pipeline gas from such sources as Russia. In effect, the vertical structures that used to be seen as essential to secure reliable flows of commodities from producers to consumers are being found wanting. In their place, free-market trading has become the guarantor of security of supply.

These are reasons to suppose that the commodities trading growth of recent decades is not a transient phenomenon, but that the extension of trading from the 'soft' commodities of agriculture to the 'hard' commodities of energy, minerals and metals is here to stay.

What issues are the leading commodities trading firms going to have to confront in order to ensure this is so?

Recent history suggests three principal challenges. The first relates to finance and financial markets. The success of commodities trading firms is inextricably entwined with the existence of a banking sector with

an appetite to finance trade and of deep and liquid derivatives markets in which they can lay off their price risks. Without both of these elements and the financial confidence underpinning them, the trading business would dry up.

Sustaining that access requires commodities trading firms to continue to manage their financial risks carefully on the one hand, and governments around the world to maintain a conducive regulatory system on the other. The latter cannot be taken for granted. There is a constant risk that regulators, in their understandable concern to limit systemic financial risk of the kind that nearly brought the global banking industry down in the financial crisis of 2008, will adopt measures that create unintended negative consequences for trading. It is not hard to imagine circumstances in which regulation could diminish banks' appetite to provide trade finance or impose capital or hedging constraints on the trading business itself. It is in the interest of the global economy that such unintended consequences be avoided.

The second challenge concerns sustainable business models. Today's global commodities markets are more competitive and transparent than ever, and profit margins for the firms that operate in them are wafer-thin. That makes trading a scale business, demanding that firms invest heavily in state-of-the-art systems, processes and technology. Sustainable success also requires firms to protect their licence

to operate by becoming more transparent about their activities and demonstrating a commitment to acting responsibly.

Third is the need for firms to stay nimble and fleet-of-foot as the trading industry consolidates and matures. Trading firms have thrived and prospered through the years by surfing the waves of economic change and market volatility. They will fail if they become complacent or miss the waves of change to come – whether in the form of new competitors, opportunities for partnership, political upheavals or shifts in global trade flows. If change created the modern trading industry, being alive to continuing change will ensure its survival.

GLOSSARY

A

Alumina Aluminium oxide, also called alumina, is the raw material required to produce primary aluminium. It is a white powder produced by the refining of bauxite.

Arbitrage The simultaneous purchase and sale of an asset to profit from a difference in the price. It is a trade that profits by exploiting the price differences of identical or similar financial instruments on different markets or in different forms.

B

Backwardation Situation where early periods in a price curve are valued at a premium to later periods. This can be a result of short supply or a peak in demand in the short term.

Basis risk The risk that the value of a derivatives-based hedge will not move in line with its underlying exposure.

Bauxite The main raw material for aluminium metal production. Bauxite deposits are mainly found in a wide belt around the equator.

Benchmark (crude) A crude oil specification that serves as a reference price for buyers and sellers. There are three primary benchmarks, West Texas Intermediate (WTI), Brent Blend, and Dubai Crude.

Benchmark (metals) A benchmark is a measurement of the price per unit of quantity of the underlying commodity traded in the international marketplace. It is set periodically by the country or through negotiation between the major producer and consumer organisations that consistently sell or buy large quantities of the commodity in a marketplace, and is used to serve as a point of reference against which sectors can be evaluated.

Bid / offer A market maker quotes a two-way price for a commodity with the bid price lower than the offer price. Customers can sell to the market maker at his bid price and buy from him at his offer price.

Bill of lading (BL) A document issued by the master of a ship when loading is completed. This acts as receipt for the goods, document of title to the goods and evidence of the contract of carriage. The rightful receiver of the cargo presents the BL to claim it at the discharge port.

Blister copper An impure form of copper produced in a furnace.

Bunkers The fuel used by ships. The term for fuelling a ship is bunkering.

C

Call option A call option gives its owner the right but not the obligation to buy a specific quantity of a given commodity at a defined price up until a certain point in time, in return for a premium.

Charter party (CP) A contract to charter a vessel.

Charterer A company in the charter party that hires a ship and its crew for a single voyage or for a fixed period.

Collateral Security pledged in exchange for a loan.

Concentrate The tradable commodity created by initial processing of lead, zinc or copper ore. Concentrates are used as raw materials by smelters to produce refined metals.

Condensate An ultralight oil found in huge quantities in shale deposits. When underground it is mostly in gaseous form. It condenses into a liquid when pumped to the surface.

Contango A market environment where early periods in a price curve are valued at a discount to later periods. It can be the result of over-supply or lack of demand in the present. This is normally a temporary phenomenon.

Copper cathode A 99 percent pure form of copper – the primary raw material for copper wire and cable.

Counterparty The opposite party in a contract or financial transaction.

D

Deadweight tonnage (DWT) The cargo-carrying capacity of a vessel, in metric tonnes, plus the weight of bunkers, stores, lubes, fresh water, etc. It does not include the weight of the ship.

Demurrage The compensation paid by charterers to the owners of a vessel for extra time used at the port, beyond what has been granted under the charter.

E

Exposure The portion of a trader's position that is subject to the risk of price movement.

F

Flat position Having no outright position – either because nothing is held or because long and short positions net off.

Flat price risk Exposure to a change in absolute prices in a particular market.

Futures Contracts for commodities to be delivered in the future. The product, quality, delivery and quantity is specified. These are traded on exchanges and there is no counterparty-based credit risk. The only variable is price. Contracts are marked to market daily.

G

Geographic spread The price differential between commodities with the same quality and grade characteristics deliverable on the same date but at different locations.

Giveaways Refined petroleum products, especially gasoline, that exceed a required specification.

H

Hedge A position taken to counteract an exposed position intended to minimise or remove price risk. This is usually achieved using futures contracts and other derivatives.

I

Incoterms International commercial terms are trade terms published by the International Chamber of Commerce (ICC). They are commonly used to ease domestic and international trade by helping traders to understand one another.

Initial margin The per contract financial guarantee required by a clearing house to be able to trade on its exchange.

L

Laytime The amount of time in port granted by the owners of the vessel, as stated in the charter party, for the loading and discharging of cargo.

Letter of credit (LC) A document from a bank guaranteeing that the seller will receive payment in full, as long as certain delivery conditions have been met.

Letter of indemnity (LOI)

A guarantee that losses will not be suffered should certain provisions of a contract not be met. If a BL is not available, then a letter of indemnity is submitted to the owners for the delivery of the goods instead.

London Metals Exchange (LME)

A commodities exchange in London, England, that deals in metal futures. Contracts on the exchange include aluminium, copper and zinc. The LME is a non-ferrous exchange, which means that iron and steel are not traded on the exchange.

Long position The net position of a trader holding / owning a commodity in the market.

M

Mark-to-market An accounting mechanism that revalues trading positions against current market prices. Profits and losses are realised at each revaluation.

Middle distillates The range of refined products situated between lighter fractions, such as gasoline, and heavier products, such as fuel oil. They include jet fuel, kerosene and diesel.

Multimodal Infrastructure that provides alternative transportation modalities for commodities, e.g. road, rail and river.

N

Naphtha A flammable liquid made from distilling petroleum. It is used as a diluent to help move heavy oil through pipelines and as a solvent.

National oil company (NOC) An oil company fully or in the majority owned by a national government.

O

Offtake agreement A long-term supply agreement where a trader agrees to buy a fixed quantity or proportion of a resource producer's future output at a specified price.

Optionality A strategy that may have limited short-term benefits, but confers considerable longer-term value by extending choice and improving contingent outcomes.

Over-the-counter (OTC) A security or financial transaction conducted away from a formal, centralised exchange.

P

Posted pricing A posted price is set by a government or national company where the price is set for a fixed period of time and only reviewed by that price-setting body.

Premium / discount Applied to benchmarks, being the addition or subtraction in price over or under a reference price negotiated between physical trading partners for a specific product, delivery location and date.

Put option A contract providing the owner with the right but not the obligation to sell a volume of a given commodity at a certain price up until a certain point in time, in return for a premium.

Q

Quality spread The difference in price between different grades of a commodity deliverable on the same date at the same location. The higher grade commodity will normally trade at a premium.

R

Reid vapour pressure (RVP) is a common measure of the volatility of gasoline. It is defined as the absolute vapour pressure exerted by a liquid at 37.8 °C (100 °F) as determined by the test method ASTM-D-323.

Repurchase agreement (REPO)

A contract that operates like a secured loan. The seller of a security simultaneously agrees to repurchase it from the buyer on a specified future date at an agreed price.

S

Short position The net position of a trader owing a commodity in the market, often associated with futures markets. They have undertaken to sell a commodity and will need to buy back or cover that position by the delivery date.

Splitter A restricted refining process that splits condensate into various products, including naphtha and distillates.

Spot price The current market price at which a commodity is bought or sold for immediate payment and delivery.

T

Time charter Hiring a vessel for a fixed period. The owner manages the vessel but the charterer specifies journeys, fuel, port charges, etc.

Time spread The difference in price between a commodity delivered on a particular date and the identical commodity deliverable on a different date. Also known as calendar spread.

Treatment charge (TC) and Refining charge (RC) TC / RC are amounts designed to cover the cost incurred by the smelter during the smelting and refining process, whereby the treatment costs occur during the smelting process to extract metal from the ore and the refining costs occur during further purification to pure metal where all undesirable by products are removed. They are negotiated fees that may be linked to metal prices as well as market supply and demand, and in the concentrates business are usually paid by the seller to the buyer.

The Steel Index (TSI) The steel index is a specialist provider of price information for key steel, iron ore, ferrous scrap and coking coal products around the world, based on spot market transaction data.

V

Variation margin Futures contracts are marked to market at the end of each trading session. Variation margin refers to the top-up payment required of those holding loss-making positions before the start of each trading session.

Vertical integration The combination in one company of two or more stages of the supply chain that would normally be operated by separate, specialist firms.

Viscosity Oil's resistance to flow. Higher viscosity crude oil is much more difficult to pump from the ground, transport and refine.

Volatility (oil) The speed at which evaporation occurs. More volatile oils have better burning properties, particularly in cold climates, but they also require more active temperature regulation and sealing procedures to protect the environment and minimise oil losses.

Volatility (price) The degree of variation in a trading price series over time as measured by standard deviation.

Voyage charter Hiring a vessel for a specific voyage between a load port and a discharge port. The charterer pays the vessel owner on a per-tonne or lump-sum basis. The owner pays port costs, excluding loading and unloading, as well as fuel and crew costs.

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