

Section A

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Fundamentals of Commodities

INTRODUCTION

This guide sets out to present a thumbnail portrait of commodities trading. The aim is to inform readers about the specialist nature of the business and the services it provides, as well as to dispel some of the myths that have grown up around trading over the years.

It makes clear that this is at its core, a physical and logistical business, and not the dematerialised, speculative activity that is sometimes suggested.

The 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 is designed to provide concrete case studies and illustrations. We do not claim that this is a definitive guide to all facets of the industry. Other firms than Trafigura 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.

This section establishes some basic definitions and parameters of commodities, the recent history of energy and metals markets, and the firms that trade them.

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.

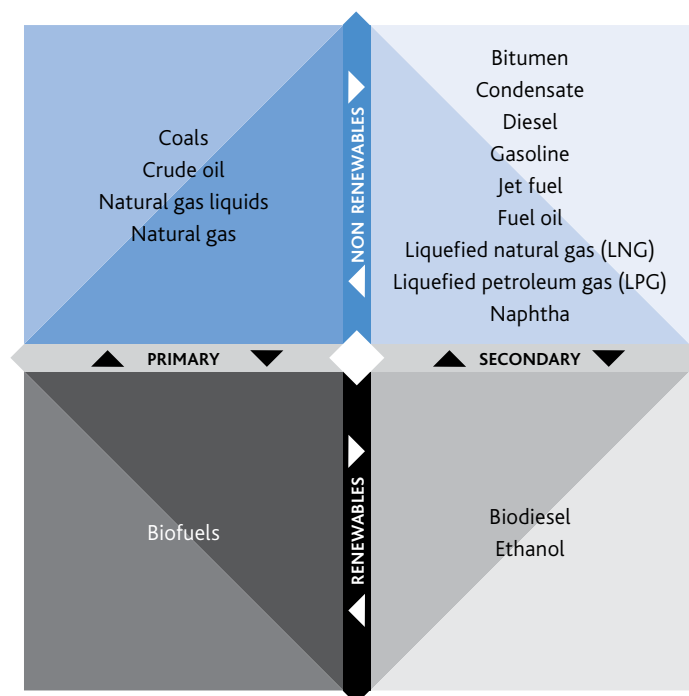
Commodities are basic products, but not every basic product is a commodity.

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. This relationship – between space, time and form – is a key driver for this business, which will be discussed at a later point.

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.

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.

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. Farmers traded commodity futures with speculators on the CBOT to lock in harvest prices in advance.

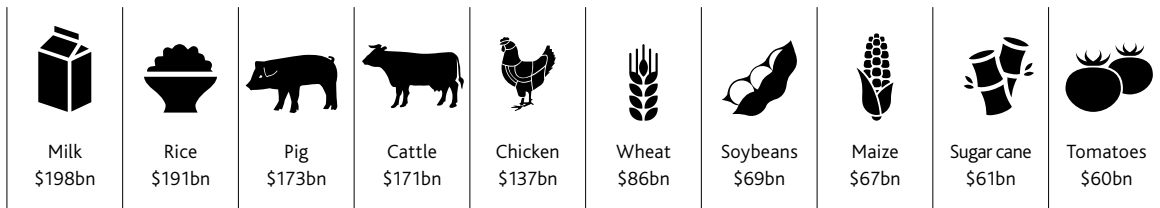
It continued to expand over the following century, and then took a leap forward in the early 1970s when the Soviet Union started to buy massive amounts of foreign grain to compensate for its failing harvests. At one stage, Moscow was buying a quarter of US grain crops, a level of demand almost comparable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

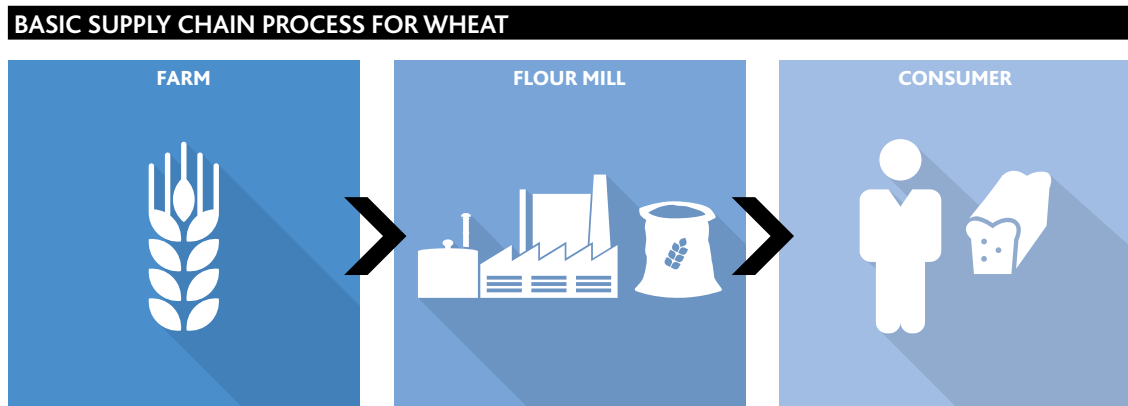
It is significant, in terms of the way the world economy is moving, that most of the traditional agricultural commodity trading houses such as Cargill or Louis Dreyfus have over the years added energy, metals and minerals to their portfolios.

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).

Top ten agricultural commodities (\$ per year)



Source: FAO United Nations, 2013



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.

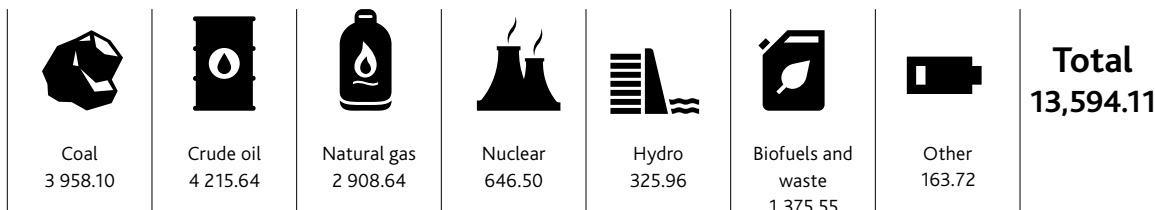
Energy commodities have been pivotal in the development of globalised markets

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

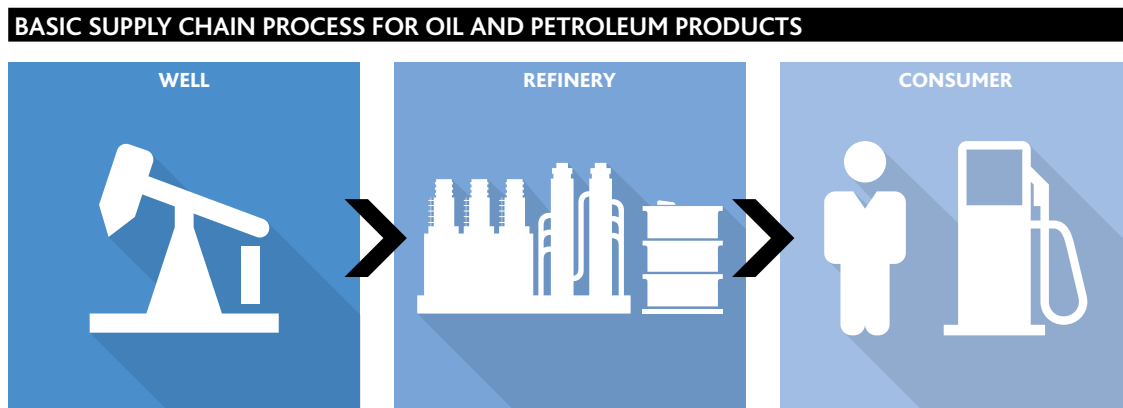
nationalism to help producing countries' national oil companies sell their output, and they have used capital markets to finance trade and futures markets to offset risk. They are helping to export the US shale revolution by bringing its oil, gas and petrochemical feedstock to world markets and are engaged 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 2013 (Million metric tonnes - mmt)



Source: © OECD/IEA, 2015



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 has 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.

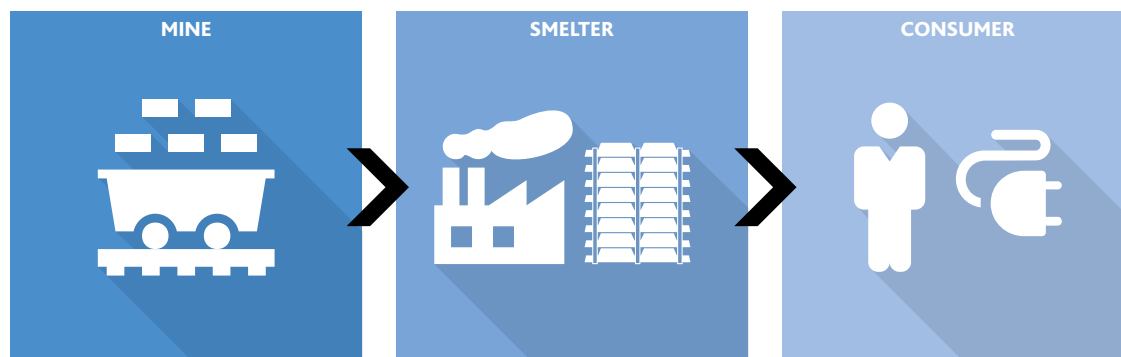
The major metals

Value of world output (est.) 2014 and uses

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<p>Iron ore \$225bn</p>	<p>Copper \$130bn</p>	<p>Aluminium \$90bn</p>	<p>Nickel \$40bn</p>	<p>Zinc \$31bn</p>	<p>Lead \$15bn</p>
<p>Steel making</p>	<p>Electronics, plumbing</p>	<p>Transport, automotive, construction, packaging</p>	<p>Used to make stainless and specialty steels</p>	<p>Used for galvanising iron and steel and making brass</p>	<p>Batteries, alloys, radiation shielding</p>

Source: IMF World Economic Outlook, October 2015

BASIC SUPPLY CHAIN PROCESS FOR COPPER



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.

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 on 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.

Commoditisation

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

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.

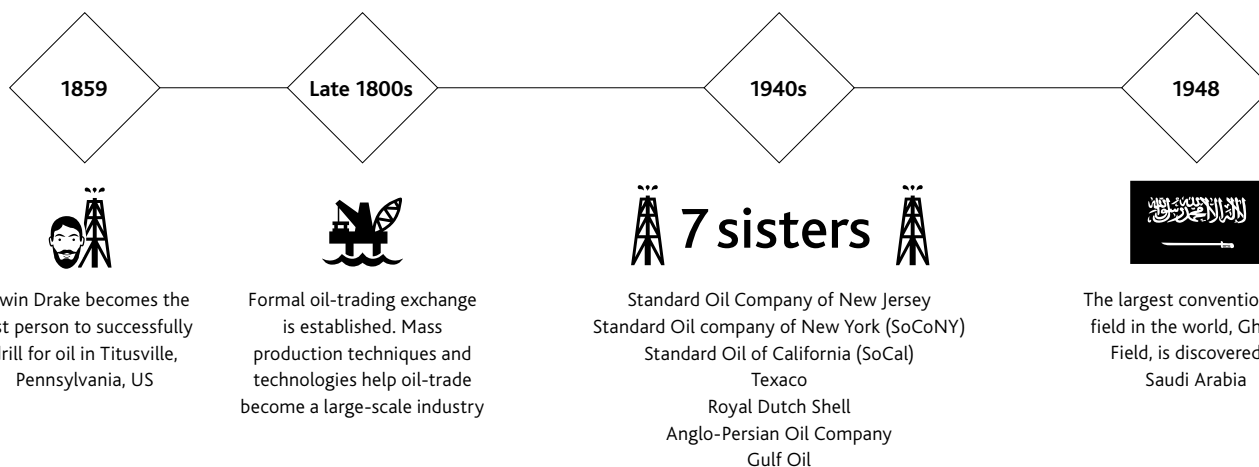
Oil and petroleum products

OPEC's (The Organisation of the Petroleum Exporting Countries) decision to flex the collective muscles of its member nations was the catalyst that 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 was being eroded as oil-producing nations, especially in the Middle East, asserted 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.

Producing nations took back control of their oil assets

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 they were able to exert a high degree of control.

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.

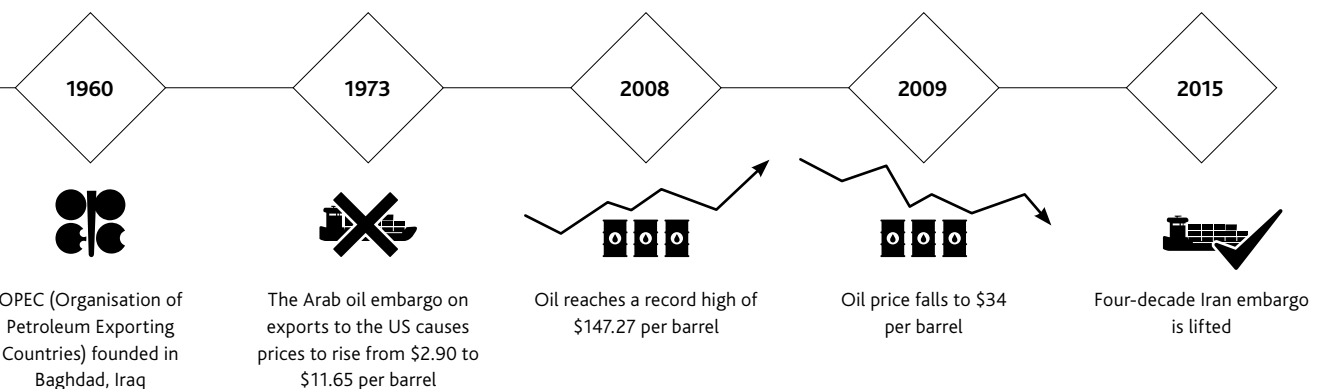
Vertical disintegration has continued. Higher oil prices encouraged the majors to sell off refineries and non-core downstream distribution to focus more on highly capital-intensive and specialised upstream exploration and production. Some commodity trading houses seized the opportunity to buy refineries, around which to build their trading business. Others, like Trafigura, are less interested in outright ownership of refining. They see 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, majors owned just 9.4 percent of all tanker tonnage. BP, Kuwait Oil Tanker Company, Chevron, Sonangol, Petrobras, Pertamina and PDVSA still have small market shares, but most of the oil industry relies on chartering other people's tankers. Ironically, the National Iranian Tanker Company is the world's biggest tanker owner. Sanctions in recent years have made it very hard for it to put its 2.8 percent of world tanker tonnage to use.

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 2014 (thousand barrels / day)

Producers

United States: 11,810
Saudi Arabia: 11,630
Russia: 10,947
Canada: 4,202
China: 4,190
UAE: 3,578
Iran: 3,442
Iraq: 3,419
Kuwait: 3,100
Mexico: 2,797



Consumers

United States: 19,343
China: 10,421
Japan: 4,297
India: 3,860
Russia: 3,637
Brazil: 3,218
Saudi Arabia: 3,216
Canada: 2,413
Germany: 2,399
South Korea: 2,350



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 the pricing model. 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.

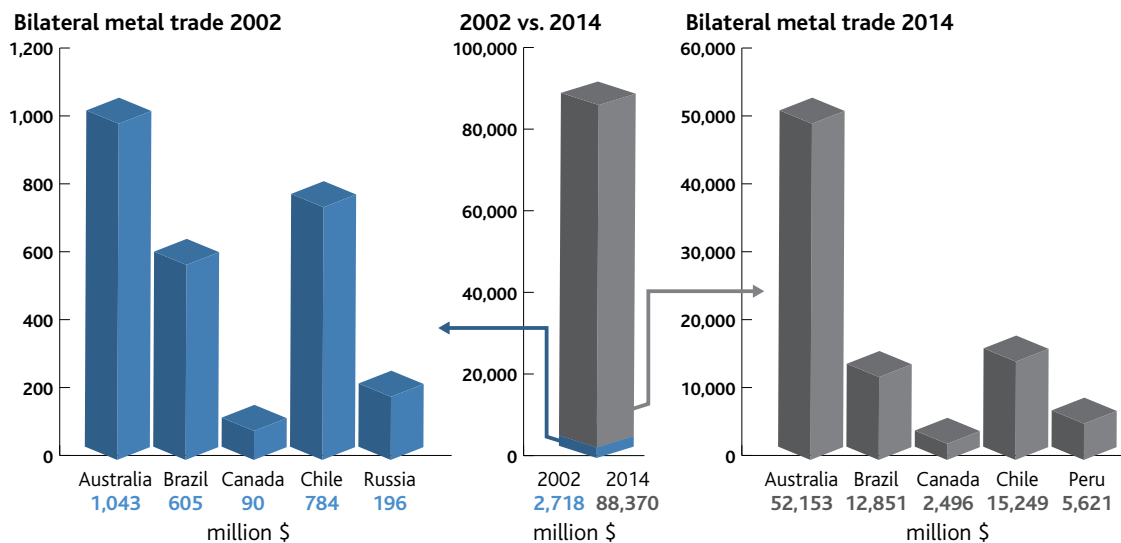
Fast growth in Chinese demand encouraged new producers and short-term pricing

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 Chinese firms started renouncing 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 continues 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 steel has 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.

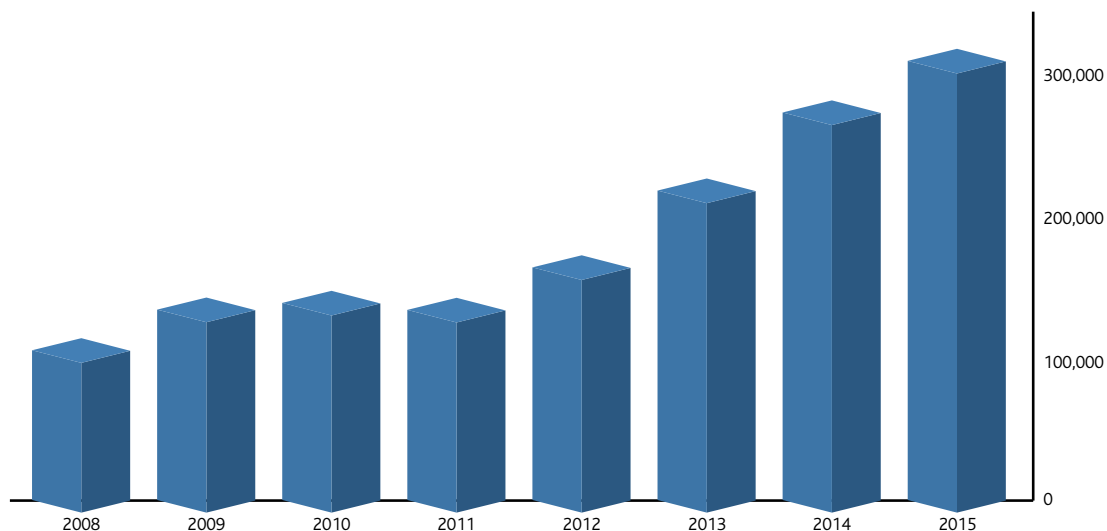
Traders can assist smaller mines by providing marketing know-how and working capital. They often combine concentrate from different sources. From the smelter's perspective, trading firms play a number of useful roles. They aggregate smaller mines' output into larger, more cost-effective shipments. Traders 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 (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 turned 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).

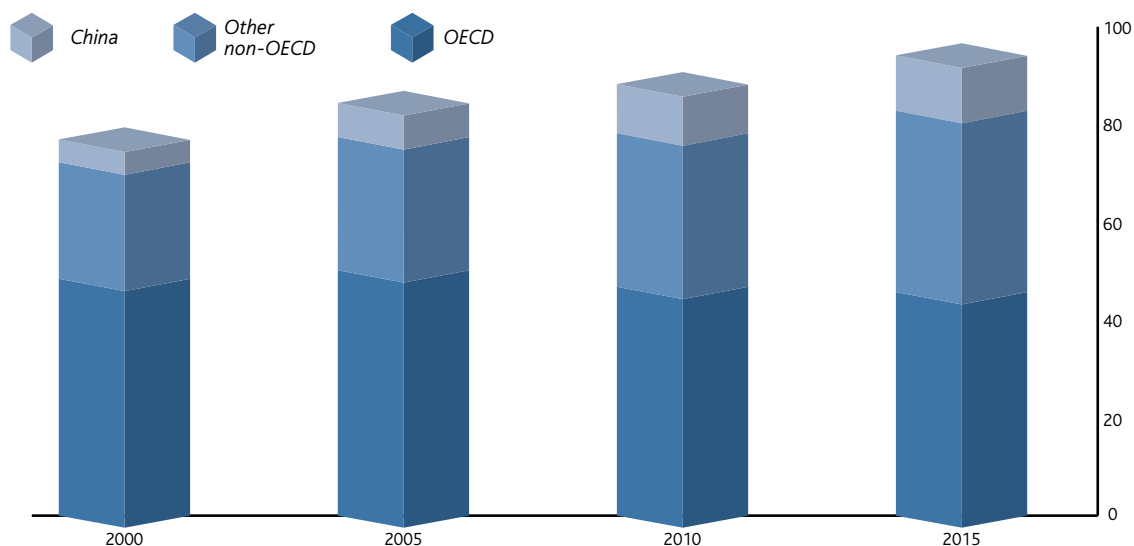
International Energy Agency

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

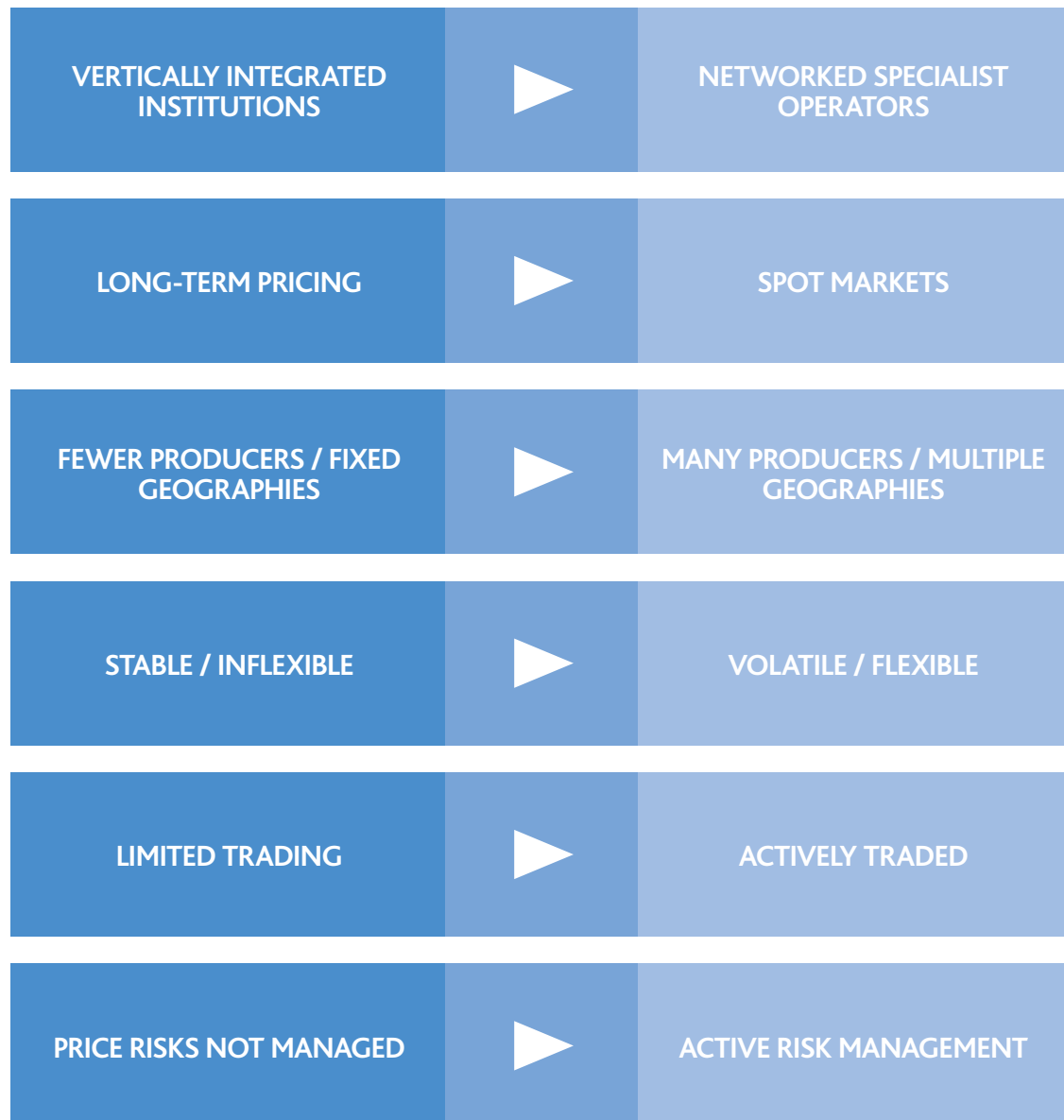
The same regional pattern exists for gas, where consumption in non-OECD countries now exceeds that in OECD countries. Again, Asia is exerting its magnetic pull on the market. China is now the third largest gas consumer behind the US and Russia.

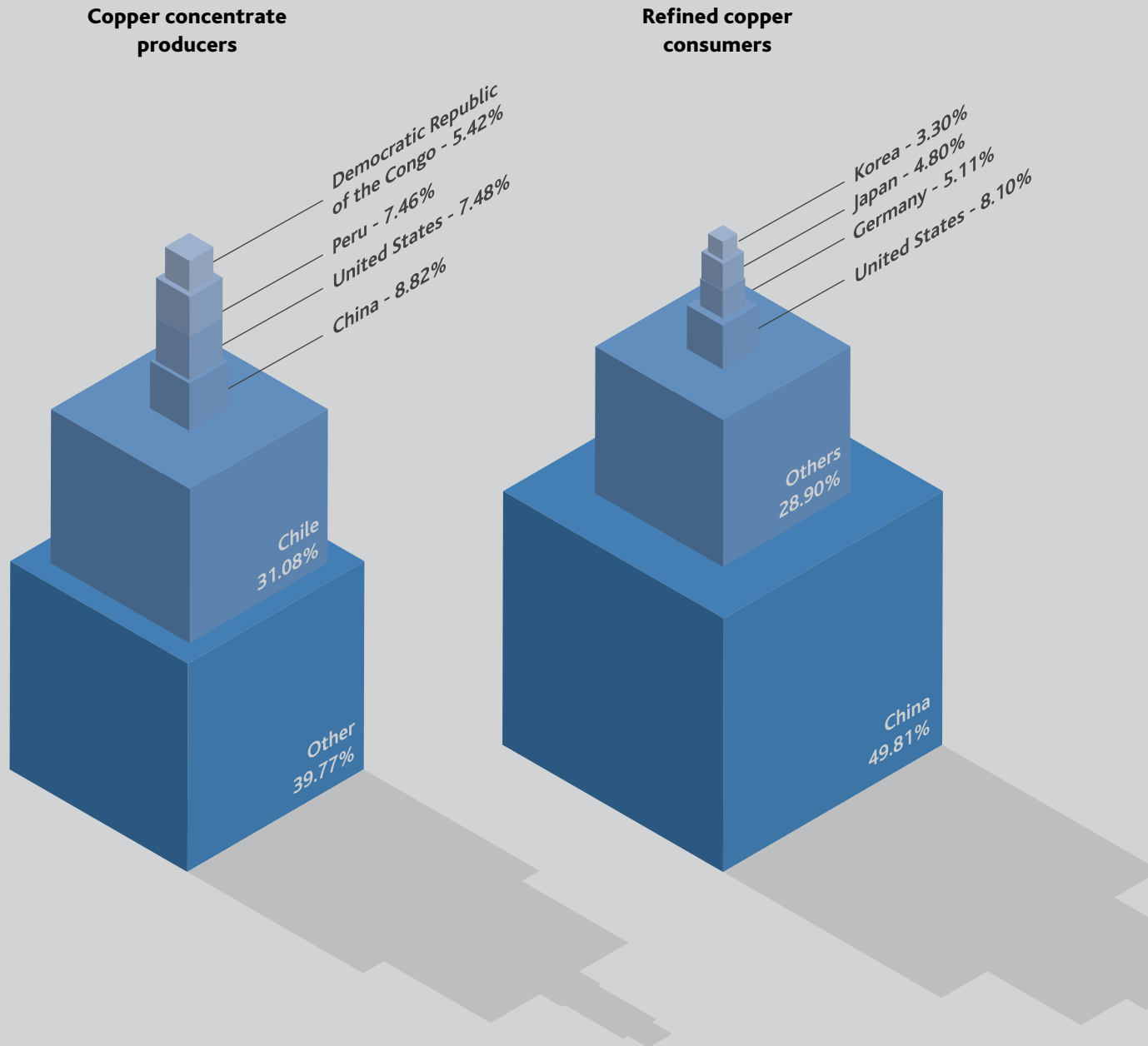
Because of its low density compared to other fossil fuels, gas is expensive and difficult to transport. Only around 30 percent of global gas is traded between major regions of the world, and this is unlikely to alter. But what is changing, and in a manner very relevant to commodity traders, is the

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

Of the two biggest gas import markets in the world today, 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



Top copper producers and consumers in 2014

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.

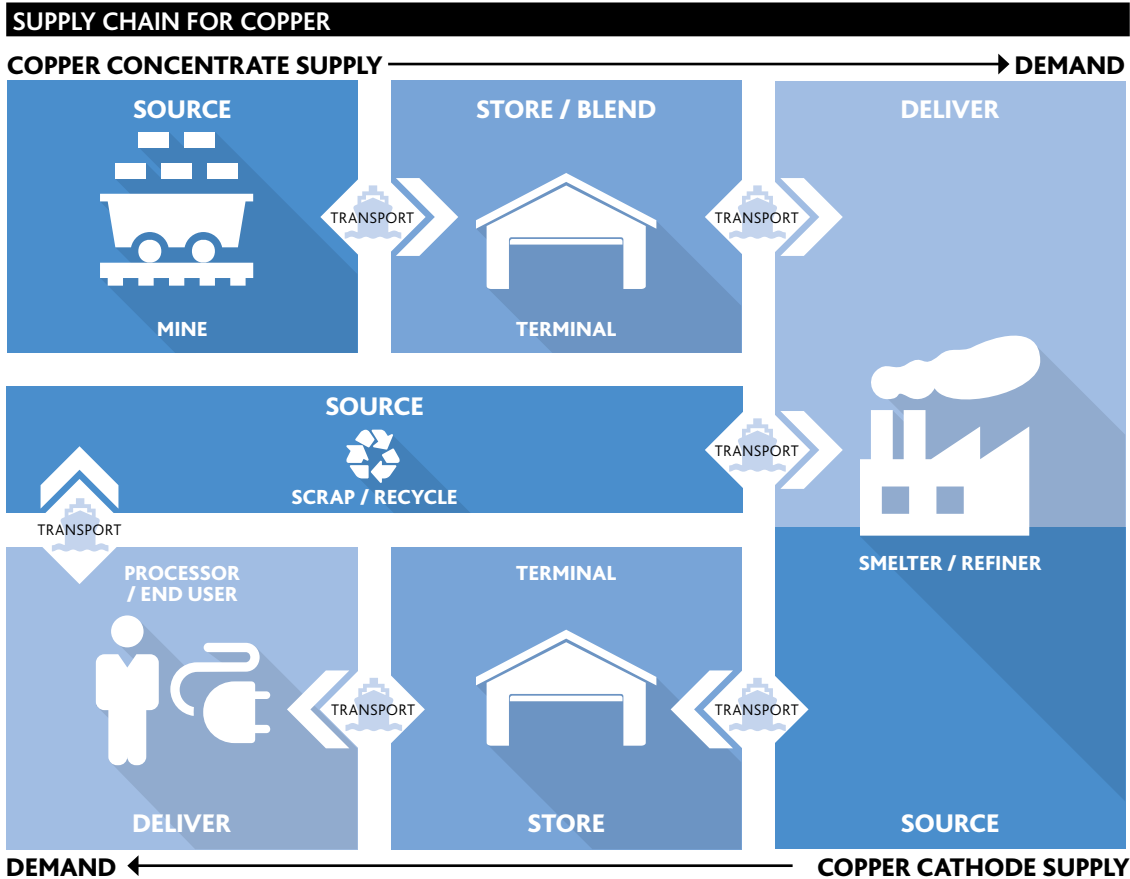
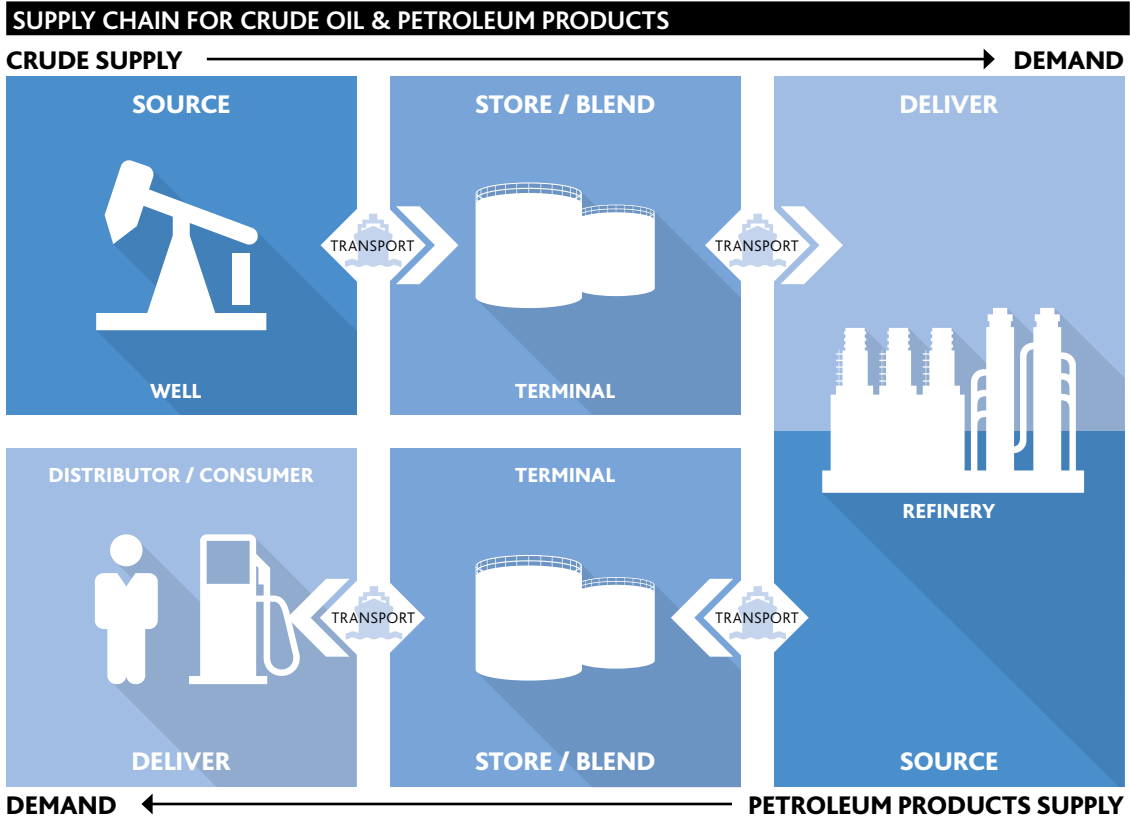
Connected markets

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

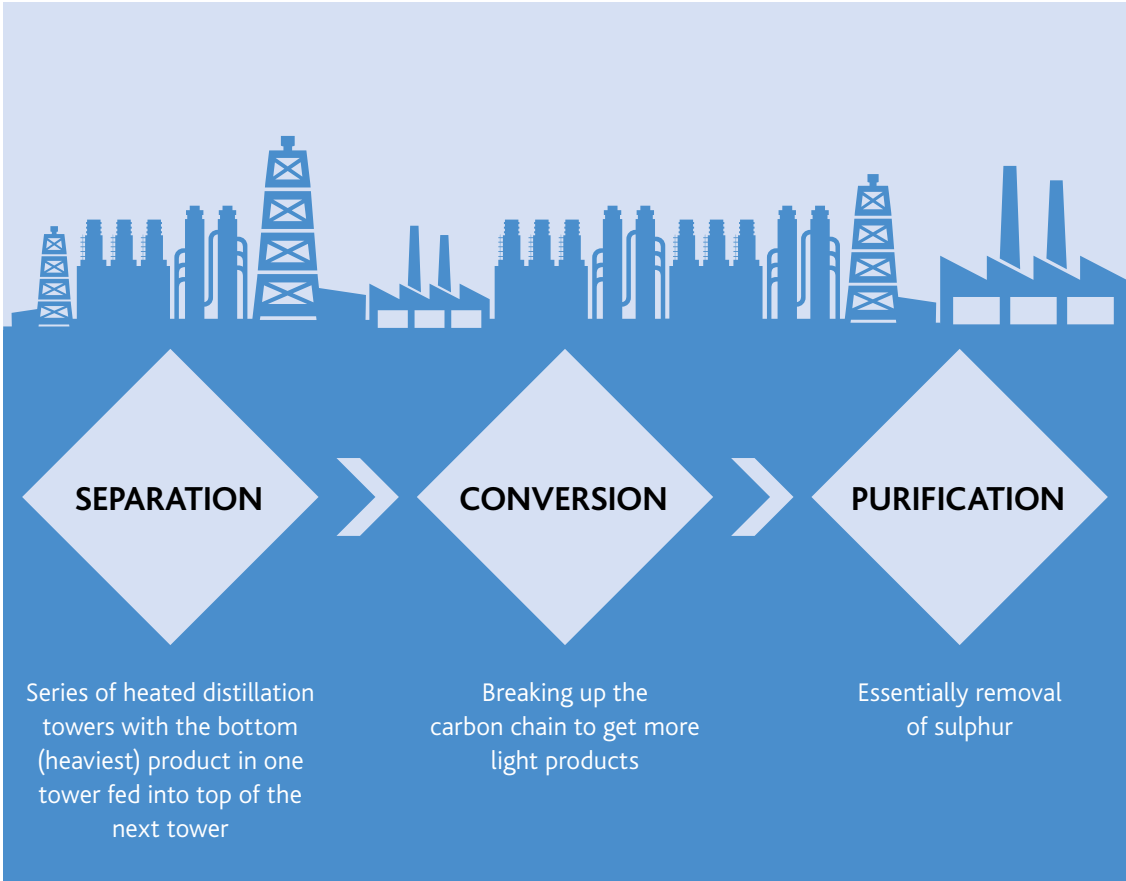
There is no homogeneous, global market for crude. Instead, linked regional markets co-exist for its many different varieties and grades priced off regionally based benchmarks.

Over 150 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.

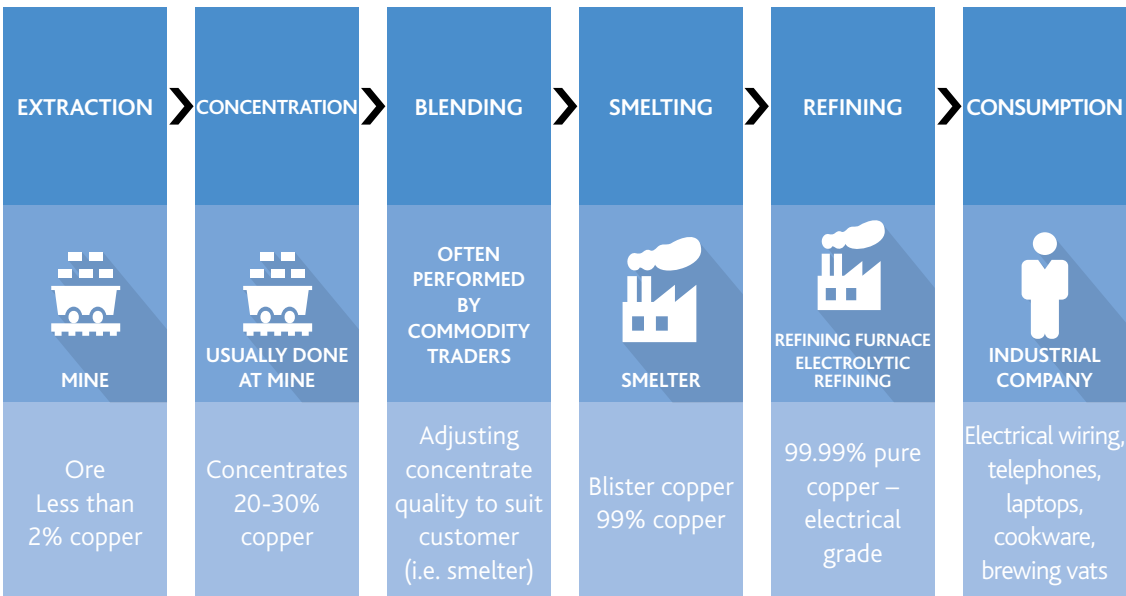
The global supply chain comprises numerous interconnected supply chains.



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 suppliers of the US, 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 volatility in the markets. Shutting down a mine is very expensive. Once a mine has closed down 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".

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 arbitrage. Far from making markets more volatile, arbitrage actually helps to re-establish balance and improve efficiency and transparency in physical markets. ■

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".













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 are very diverse 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. But 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. The great utility of futures trading is, firstly, the benchmarks it produces – such as Brent, WTI and Dubai – around which actual physical oil can be priced, at a premium or discount, according to quality, transport and destination – and secondly, the facility they offer buyers, sellers and traders of physical oil shipments to hedge the risks and exposures on OTC contracts.

Top commodity trading houses by revenue in 2015

Company	Founding date	Revenues 2015 (\$)	Commodities traded	Corporate status
ENERGY, METALS AND MINERALS				
 Glencore <i>Founded as Marc Rich and Co AG</i>	1974	170.5 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	168 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	97.2 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
 Noble Group	1986	66.7 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
 Gunvor	2000	64 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
 Mercuria	2004	56 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
AGRICULTURAL PRODUCTS (MAINLY OR WHOLLY)				
 Cargill	1865	120.4 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	67.7 billion	Food (acidulantes, 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	55.6 billion	Oilseeds, grains, rice, freight, coffee, cotton, sugar, juice, dairy, fertiliser, metals.	Private
 Bunge	1818	43.5 billion	Oilseeds, sugar, bioenergy, edible oils, wheat, corn, rice, fertiliser.	Public
 Wilmar International	1991	38.8 billion	Palm oil, oilseed, edible oils, sugar, specialty fats, oleo chemicals, biodiesel, fertiliser, flour, rice.	Public
 Olam International	1989	19.1 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

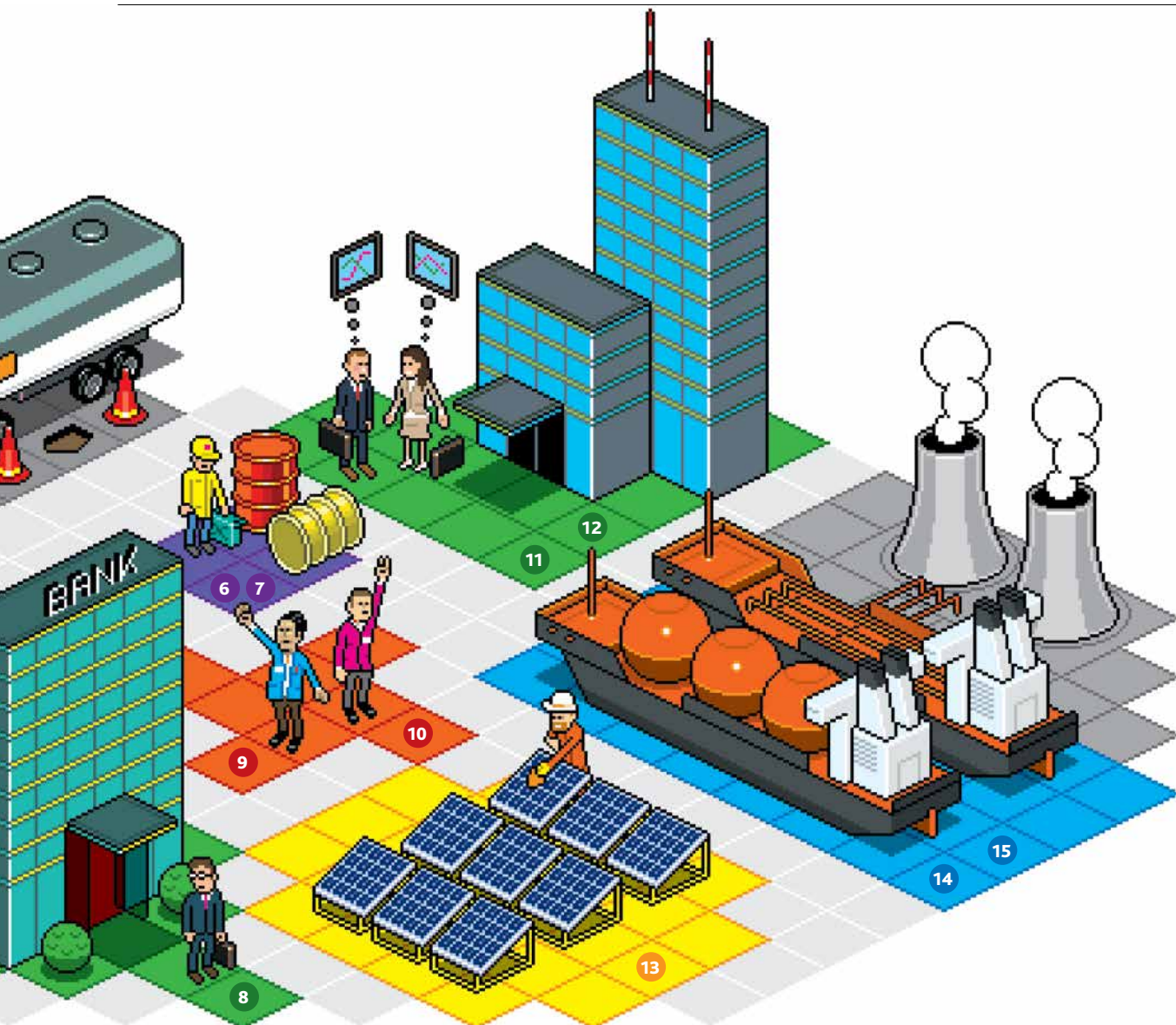
transporting it by barge may be more cost-effective than bringing the same shipment to port using the road network.

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.

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.

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

They transport, and in several ways, transform, commodities across the world. This notion of transformation is key. It can involve:

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.

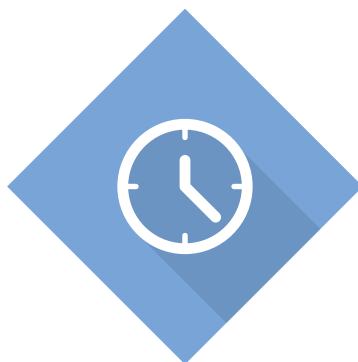
Firms deal with mismatches in supply and demand through temporal transformation. They store commodities while supply is unusually high and draw down inventories when demand is unusually high. Storage reduces volatility by smoothing fluctuations in the prices and availability of commodities. To do this 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

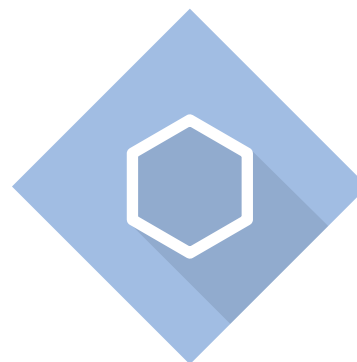
Unlike financial markets, where pricing relationships are relatively stable because products are basically interchangeable, in the physical trading world there is a lot more disjunction in prices. If there is a refinery accident or bad weather and there is a sudden need for a product, there might be 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 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. In doing this they make markets more competitive and in exchange earn profit.

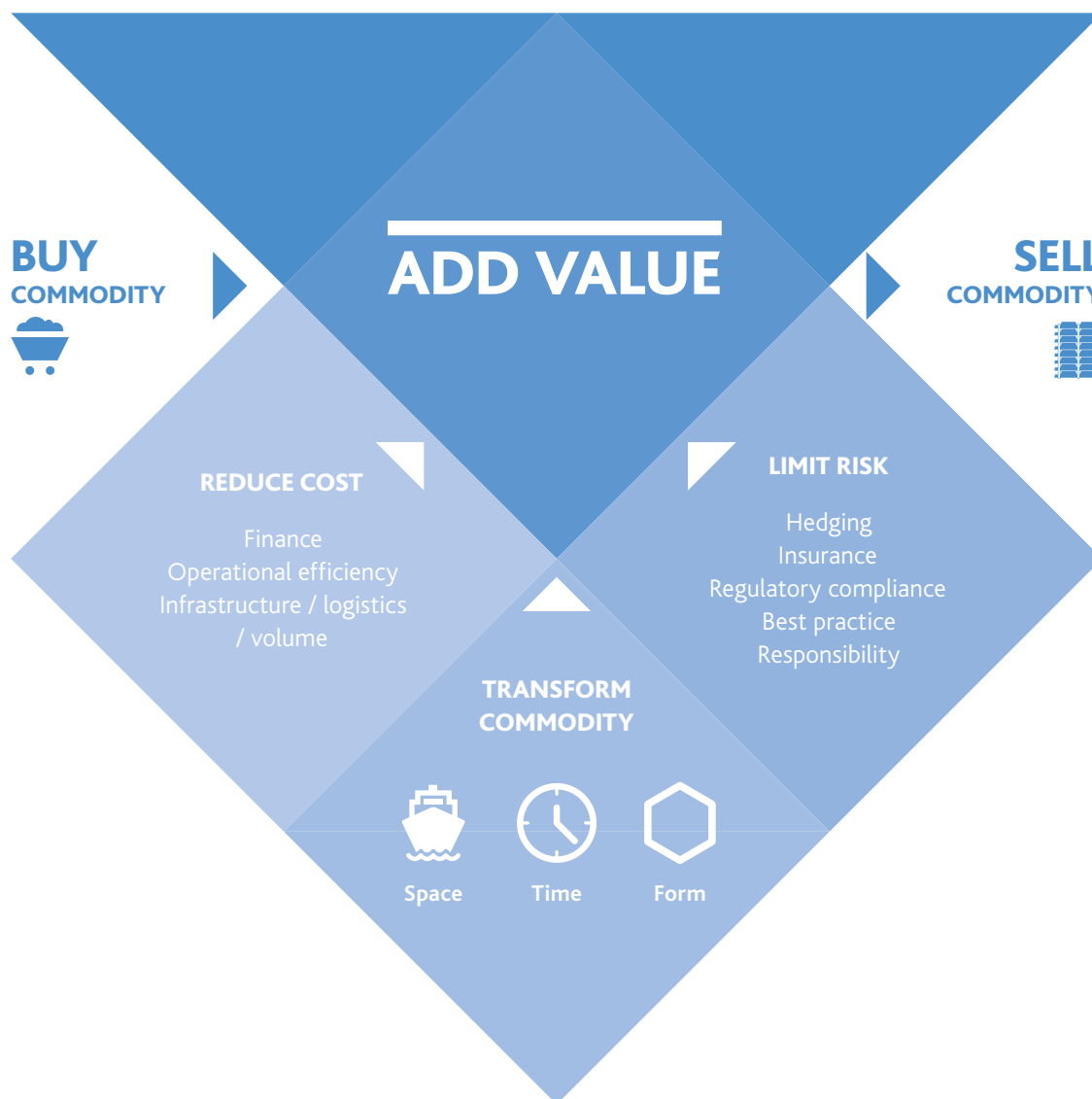
Traders focus on spotting any gaps in the market, mispricing or dislocation in distribution. They monitor relative prices for different grades of a commodity (the quality spread), for the same commodity with different delivery locations (the geographic spread) and for different delivery dates (the forward 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 a higher price on the future date (see page 47).

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 TRANSFORM 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.

Next, 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.

Finally, 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

Price anomalies occur where there has been poor information or limited competition. 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