LlewellynConsulting
Independent Economic Advisers

PUMA ENERGY

THE CHANGING FACE OF THE OIL INDUSTRY

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Authors' note:
The market is complex and multifaceted. A range of diverse companies operate at all levels of the value-chain. And this is an industry that has always undergone powerful structural change.

To see the main issues clearly, it is necessary to "fly over the subject at the right height." This we hope we have done even if, in so doing, we have had to truncate the paper in various areas, each of which could have been a subject of study on its own.

FOREWORD

Introduction for independent commissioned research
We are pleased to have commissioned this independent report into *The Changing Face of the Oil Industry*. This concise report looks at the oil industry over the past century; current developments; and the period ahead, with a particular focus on the price of oil, and other influences that stand to impact equity valuations.

The industry is, once again, undergoing much change, and this report's analysis of the historical development of the industry helps not only to explain how the industry came to be what it is today, but also how businesses such as Puma Energy are well positioned to thrive in the years ahead.

The global energy market is deconsolidating – National oil companies are progressively building up their reserves, and developing their productive up-stream capabilities. International oil companies are also becoming increasingly up-stream focussed, and selling down-stream assets, particularly in saturated Western markets. Trading houses are growing in size and scope, diversifying along the value chain, integrating vertically, and looking increasingly like a new form of oil 'major'. Many companies, such as Puma Energy, meanwhile are specialising in lower-risk – yet highly valuable – down-stream opportunities.

Puma Energy has global momentum and a unique business model – We have a special relationship with our parent Trafigura and key shareholders. This gives us an expanding global reach, significant pricing power, and security of supply. Yet while we enjoy many of the benefits of being close to a larger enterprise, we are able to operate with the nimbleness and flexibility for which independents are prized: this enables us to act quickly to take advantage of new opportunities; and we are more capable of adapting to changing market conditions than are larger conglomerates.

Puma Energy is well positioned in the global market – We have invested heavily, ahead of the competition, in mid- and down-stream assets in a number of fast-growing frontier markets. Our investment in these areas is critical, because we believe that there are not enough of the right storage assets in key locations where oil demand is growing.

We have worked hard to ensure access to an expansive global supply network, and we have built up a well-positioned and efficient distribution network: both elements enable us to deliver high-quality fuel safely, quickly, reliably, and at a fair price.

We are executing a well thought out strategy. We are gaining a growing share of the mid- and down-stream market in our target regions, and now employ over 5,000 people, with a strong commitment to employing local people and local resources. We enjoy solving complex problems for our customers in a variety of regulated and unregulated market conditions.

We hope that you will find this report instructive, and that you will also come to appreciate the significant opportunity that lies ahead for a unique independent firm such as Puma Energy.

CHAPTER ONE
THE EVOLUTION OF THE GLOBAL OIL INDUSTRY

The oil industry has changed markedly over the past century. Fundamental shifts in the economy, including rising globalisation, transformed the industry, enabling new players with unique competitive advantages to participate.

— Vertical integration and consolidation gave Rockefeller's Standard Oil control, insulated his operations, and brought stability to a disorderly and wasteful market. By 1879 Standard Oil controlled 90% of US refining

— Global competitors then rose to challenge Standard Oil

— A few international oil companies came to dominate the industry. By WWII, a dominant group, the so-called 'Seven Sisters', controlled nearly 90% of the global oil trade

— By the 1960s, globalisation had taken off. Producing nations reclaimed control of their resources, and the independent oil trade emerged following the 1970s oil shocks

With more participants involved than ever before, the industry has grown more competitive, with each player seeking to maintain a dominant position.

THE LATE 1800s: ORIGINS OF A LARGE-SCALE OIL INDUSTRY

The industry began as a cottage industry

The oil trade developed in the early 1800s

Prior to the development of a large-scale oil industry, crude oil was processed and sold by small-scale traders. Oil was recovered by various means as early as the first century A.D. in the Middle East; in China around 347 A.D; in Baku in the Middle Ages; in Poland in the 1500s; and in Canada, France and the United States in the early 1800s.[1]

Oil products were used for a variety of purposes: protecting wounds; waterproofing; and most importantly, as a light source. By the early 1800s, global demand for a high quality luminate was enormous as growing economic development and rising populations fuelled the need for an affordable light source.[2]

Demand for kerosene spurred growth

In the early half of the nineteenth century, a small but thriving oil industry developed in Eastern Europe, fuelled by technological advances in extraction techniques and distillation methods. New drilling methods[3] greatly increased the potential supplies of crude that could be retrieved, bringing down the price of crude and crude by-products significantly. Innovations in crude distillation produced kerosene,[4] a clean-burning oil luminate which came to replace whale oil as the primary light source in the pre-electric era because of its abundant supply and ease of use. Rapid growth in demand for kerosene spurred growth of the oil industry around the world.

New technology and mass production techniques cut costs

By the late 1800s, the oil trade was a large-scale industry

Mass production techniques and technological developments in machinery, transportation and communications revolutionised manufacturing. This enabled businesses to operate more efficiently, and on a larger scale, bringing down costs and prices significantly for a variety of products.

As the advantages of economies of scale became ever more clear, small-scale cottage industries evolved into larger operations. A number of US companies were the first-movers, applying new large-scale operational methods in a variety of capital-intensive industries, including oil.

The US oil industry grew out of the Pennsylvanian oil fields

In 1859, Colonel Drake successfully drilled for oil in Western Pennsylvania, demonstrating that abundant supplies of rock oil could be retrieved using a process similar to that which had been developed by salt drillers. As word spread, people rushed to buy land in the area, secure leases, and drill in search of flowing wells. Once extracted, the crude was sent to refineries for processing into kerosene and lubricants.

Storing and transporting the product was difficult, and a variety of support businesses rose with the fledgling industry, notably barrel and tanker makers, pipeline builders, and carriage and rail transport operations.

FIGURE 1:
'COLONEL' EDWIN DRAKE'S OIL WELL, TITUSVILLE, PENNSYLVANIA

Source: Drake Well Museum Collection, Pennsylvania Historical & Museum Commission

FIGURE 2:
STREET OF AN OIL BOOM TOWN

Source: Drake Well Museum Collection, Pennsylvania Historical & Museum Commission

By 1871 a formal oil trading exchange had been established

Trading – the matching of buyers and sellers – was another issue. Originally trades were negotiated ad hoc but, by 1871, a formal oil trading exchange had been established in Titusville, Pennsylvania. Soon more exchanges were established throughout the region and in New York, to formally arrange 'spot', 'regular', and 'future' sales of oil.[5]

The infant industry was wasteful and disorganised

The young oil industry was populated by a chaotic mix of players

Similar to gold rushes of the era, the scramble for oil quickly drew swarms of people into production and refining. The oil rushes often brought much new production to market in a relatively short period, causing prices to be notoriously volatile. Production was often rushed and wasteful, with producers laying claim to whatever resources could be found. When the oil ran out, previously booming oil towns collapsed just as rapidly as they had risen.

Rockefeller's oil operation grew rapidly

Rockefeller entered the oil market while it was in its infancy

In the same year that Colonel Drake first struck oil (1859), John D. Rockefeller started a produce trading company in Cleveland, Ohio. Rockefeller originally traded wheat, salt and pork. Then, as the Pennsylvania oil fields took off, he began trading oil. His oil operations grew rapidly and, by 1865, his firm was the largest oil refinery in Cleveland.

A key advantage for Standard Oil was low-cost transportation

In 1867 Rockefeller was joined by Henry Flagler, who played a crucial role in the firm's success by negotiating favourable deals with railroad companies for product transport – giving them a significant advantage over competitors. By January 1870 Rockefeller, his partners, and a few regional competitors established Standard Oil, a joint stock company.

Vertical integration along the value chain was also crucial to Standard's success...

Rockefeller aimed to make the industry more stable through integration and consolidation

Vertical integration of Rockefeller's refining operations drew in activities along the value chain from refining, storage and transport. He thereby had full control over the movement of goods from the well to the final consumer. Integration was so expansive that it even involved purchasing land to grow the lumber for barrels, as well as buying tank cars, boats and warehouses to store and transport the refined product. He consolidated the industry by buying out, or driving out, competitors – part of a deliberate strategy to prevent a large number of competitors from driving the price of oil down to what he considered to be unsustainable levels.

...as was consolidation

Integration and consolidation thus insulated his operations from volatility in the oil market. For example, storage capacity made it possible to absorb temporary periods of excess supply or demand. Integration and consolidation also improved the firm's control over transportation. Working at a large scale with high traded volume significantly increased Standard Oil's bargaining power with railroads, contributing to a reduction in marginal costs per barrel. Reliable, low-cost transport was crucial to Standard Oil's success as it ensured consistent product delivery, a near monopoly in certain markets, and considerable pricing power.

By 1879, Standard Oil controlled 90% of US refining capacity, with significant control over pipelines, transport and storage in the oil regions.[6] The name Standard Oil was chosen specifically to emphasise the company's commitment to producing a consistently high quality product. This was a critical concern for the consumer as poorly refined kerosene caused explosions.

Rockefeller entered production to secure supply

Standard Oil became 100% integrated when it entered production

Standard Oil had stayed out of the production business because, compared with down-stream operations, it looked unduly risky and speculative. By the 1880s, however, geologists were predicting that oil was at risk of running out. Indeed in 1885, State Geologist Pennsylvania's warned that oil was a "temporary and vanishing phenomenon – one which young men will see come to its natural end."[7]

By the late 1800s Standard Oil produced 25% of US crude

Growing fears of declining supply convinced Rockefeller to enter the business of production to guarantee stable supply for his down-stream operations. He proceeded to buy as many producing properties as he could, and by the late 19th century Standard Oil was producing 25% of total US crude output,[8] and 90% of global kerosene exports passed through it.

Price stability was further enhanced when, in 1895, Standard Oil began buying oil directly from producers instead of on the exchanges. Until international competitors emerged with their own fully-integrated oil operations, made in Standard Oil's image, the domestic price of crude in the US was effectively set by the purchasing arm of Standard Oil, rather than by traders on exchanges.

THE TURN OF THE CENTURY: RISE OF GLOBAL COMPETITION

By the turn of the century Standard's dominance was challenged...

By the late nineteenth century, international competitors had grown both in size and in market power. Operations arose on the back of oil discoveries in other parts of the world, e.g. those run by the Nobel Brothers, the Rothschilds and other Russian producers out of the Baku region (Azerbaijan), and later by Royal Dutch from discoveries in Sumatra (Indonesia) in 1885.

...by the rise of international rivals

With the supply in these oil-rich regions seemingly limitless, securing markets in which to sell necessitated the building of their own distribution and marketing operations. The competing firms also had to find a way to compete with Standard Oil, which already had a toehold in foreign markets.

Each firm sought to grow and maintain international market share by whatever means available – technological, strategic or political. Standard Oil's dominance was successfully challenged by competitors such as Shell Oil, who acted on key competitive advantages such as more transport-efficient tanker ships, and access to previously inaccessible trade routes, i.e. the Suez Canal.

An international oligopoly soon emerged

By the turn of the century, a few dominant international oil companies (IOCs) controlled sizeable markets of their own. The global oil industry had evolved into a relatively stable oligopoly.

Competition also increased in the United States

New discoveries throughout the US, including in California and Texas, enabled a number of independent competitors (independents is a term used to describe smaller competitors who generally specialise in one activity, and/or have smaller-scale integrated operations) such as Union Oil of California,[9] and Texaco, Gulf and Sun from Texas, to compete. By 1911 Standard Oil's control of refining capacity in the US had declined from its peak of over 90% in 1880, to around 60%.[10]

US competition further reduced Standard's grip on the market

Domestic competition between Standard Oil and its rivals remained fierce, particularly after the break-up of the Standard Oil Trust in 1911, following an order by the Supreme Court for its dissolution because of its nearly-complete domination of the industry. Offshoots of the formerly integrated giant sought to grow their own fully-integrated companies, and competed intensely to gain up-stream and down-stream assets, and their own shares of the market.

Major technological advances reshaped the market

Meanwhile, major technological advances reshaped the oil market

In the first two decades of the twentieth century, three key inventions transformed the oil industry: electric lighting, automobiles and planes. The advent of the electric light bulb reduced the demand for kerosene. The falling demand for kerosene, however, was offset by a rapid rise in demand for gasoline (a formerly useless by-product of the oil refining process) propelled by the growing use of automobiles and planes. From 1900 to 1911 Standard Oil's gasoline sales tripled, to exceed those of kerosene.[11]

IOCs grew by virtue of large foreign oil discoveries

In the first few decades of the twentieth century, the IOCs sought out new sources of supply

Economically powerful from successful domestic operations, they had the capabilities necessary for expansion into new foreign regions. This included: the financial resources to build international operations and fund large-scale exploration and development projects, the technological and managerial skills necessary for further expansion and experience with running large-scale operations. The IOCs' ability to operate in foreign regions was further assisted by their being the primary suppliers of oil products to foreign markets, with access to world markets through their existing down-stream distribution networks.

IOCs obtained control of a large share of global reserves

Moreover, the IOCs' relative political strength enabled them to gain access to, and later produce in, oil-rich countries. Enormous reserves were discovered in the Middle East, North Africa, South East Asia, and South America. At the time, these countries were relatively undeveloped, under colonial or dictatorial rule, and unable to exploit their own oil resources. The IOCs thereby obtained control of a large proportion of global reserves and production as a result of their ability to operate in these regions.

THE TWENTIETH CENTURY: RISE OF THE 'SEVEN SISTERS'

WWI and WWII demonstrated the importance of oil as a strategic asset

The established global players grew in size and influence

The early part of the 20th century, with its two World Wars, demonstrated the growing importance of oil as a strategic asset. By the end of WWII, seven Anglo-American major international oil companies ('the majors'), or so-called 'Seven Sisters', dominated world oil production:

— Standard Oil of New York (Mobil)
— Anglo Persian Oil Company (BP)
— Royal Dutch Shell
— Standard Oil of California (Chevron)
— Gulf Oil
— Texaco
— Standard Oil of New Jersey (Esso).

The Seven Sisters dominated the oil industry for decades

Throughout the first half of the twentieth century, the major international oil companies grew to dominate the industry, fuelled both by rising demand for oil, and new foreign discoveries. The two World Wars entrenched their market power as governments became increasingly interested in securing a sufficient supply of oil for the war effort, and provided support in the form of large supply contracts. In the UK in 1917, for instance, Winston Churchill pushed for the government to invest in the Anglo-Persian (eventually called BP) to "*protect British interests*". That year the government played a pivotal role in the firm's expansion by seizing a German firm with down-stream assets in the UK, and giving it to Anglo-Persian.

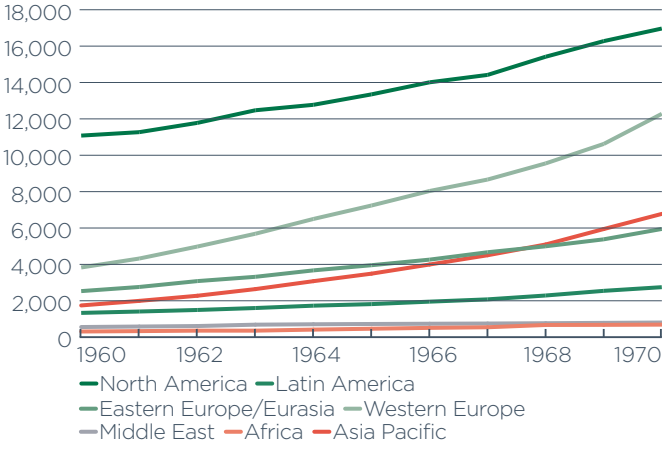
By 1949, the Seven Sisters controlled the majority of the industry

By the end of World War II, the Seven Sisters were in control of a majority of the industry. According to a US Federal Trade Commission study,[12] by 1949 the Seven Sisters owned and operated oil wells that accounted for 88% of oil traded globally. Furthermore, nearly all of the oil was sent to refineries that were also owned by the Seven Sisters.

Barriers to entry maintained the Seven Sister's control

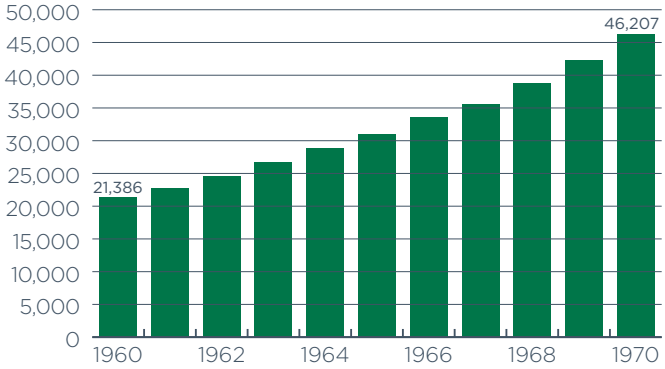
Market dominance was maintained, in large part, by their ability to maintain high barriers to entry for would-be competitors. This was achieved through vertical integration, the control of new and essential technology, and relationships with governments. Vertical integration enabled setting of the internal transfer price of oil, and the price at which they sold to third parties, leaving only limited profit margins for potential competitors in down-stream activities. With such low margins down-stream, profits lay further up-stream in exploration and production. New entrants wishing to compete with the majors had to meet the huge fixed costs of setting up a fully integrated operation. Barriers to entry were further enforced by the pioneering developments in, and tight control of, key essential technologies by the Seven Sisters, in drilling, production, and refining techniques. Relationships with governments also played a key role, and Western governments worked hard on behalf of these oil companies to build strong relationships with oil-rich countries. The US relationship with Saudi Arabia is a prime example.

FIGURE 3:
OIL CONSUMPTION BY REGION (THOUSAND BARRELS/DAY)



Source: OPEC Annual Statistical Bulletin, 2012

FIGURE 4:
TOTAL WORLD OIL CONSUMPTION (THOUSAND BARRELS/DAY)



Source: OPEC Annual Statistical Bulletin, 2012

FROM THE 1960s: GLOBALISATION INTENSIFIED COMPETITION

The 1960s marked the beginning of a new wave of globalisation. Global trade and economic integration took off in a way that had not been seen since the pre WWI era, transforming the oil industry once again.

With globalisation new powerful players emerged

Economies were booming in Europe, the US, and Asia; former European colonies gained independence; and competition amongst multinational corporations increased. Against this backdrop, new players exerted greater power in the global market and succeeded in challenging the Seven Sisters' oligopoly. According to Wharton's Stephen Kobrin:

> *"During the interwar period and through the 1950s, international petroleum was a very tight oligopoly dominated by seven major international oil companies... However, between 1953 and 1972 more than three hundred private firms and fifty state-owned firms entered the industry, drawn by the explosion in oil consumption and substantially diminished barriers to entry."*[13]

In the increasingly globalised international market – producing nations reclaimed control of their oil resources; independents expanded abroad; and commodity traders created an independent oil trade, outside the control of the 'Seven Sisters'.

From 1960-1970 world consumption more than doubled

Rapid global growth increased the demand for oil
Total world oil consumption more than doubled in volume from 1960 to 1970, from around 21.4 million barrels per day to over 46 million – an increase of 115%. (See figures 3 and 4.) The rise in demand exerted much pressure on existing supply structures.

By the 1970s, following post-war economic and political strengthening, and rising nationalistic sentiment in a number of Third World countries, perceptions and tolerances of IOCs had changed fundamentally. In a wave of nationalisations, IOCs were either pushed out, or forced to renegotiate the terms of their production agreements, threatening IOC dominance.

Rising nationalism forced IOCs out of oil-rich regions

Nationalisations had occurred intermittently throughout the first half of the twentieth century, including in Russia (1918), Bolivia (1937), Mexico (1938), Argentina (1958), and Indonesia (1963). By the early 1970s, however, the number increased markedly, including: Algeria (1971), Libya (1971), Iraq (1972), Saudi Arabia (1972), Kuwait (1972), Abu Dhabi (1972), Iran (1973), and Venezuela (1976).

THE ESTABLISHMENT OF OPEC

The Organisation of Petroleum Exporting Countries (OPEC) was founded in 1960 by Iran, Iraq, Venezuela, Kuwait and Saudi Arabia. OPEC's goal was to control production and increase its bargaining power with the IOCs.

Producing nations were motivated to take collective action because they were dissatisfied with their existing arrangements with the Seven Sisters.

The Seven Sisters effectively set the price of oil. From 1948 to 1970 the price had been kept relatively stable, at between $2.5 and $3 per barrel. During the same period, prices for other industrial commodities had risen significantly. Thus producing nations' oil earnings were not keeping up with their rising costs of imports.

This development proceeded further when, in August 1971, President Nixon closed the gold window, and the dollar proceeded to lose 20-40 percent of its value relative to other currencies. The impact on producing nations was profound because oil was, at the time, priced in US dollars. Consequently their earning power from oil sales declined dramatically.

Though OPEC appeared to have little influence in its first decade, by the early 1970s the situation had changed. OPEC pushed for more nationalisations in the early 1970s. It successfully coordinated production cuts and price increases following the Yom Kippur War (the Arab Oil embargo) in 1973.

Producing nations proceeded to use their oil profits to serve/fund domestic interests.

Market pressures reached a tipping point with the two oil price shocks

The new-found power of the national producers became apparent when a series of crises played out in the Middle East. As Middle East product was withheld, including importantly by the Arab oil embargo, or failed to come to market, IOCs were unable to increase production sufficiently to compensate for the loss of supply. Western nations experienced dramatic oil shortages and price increases. In 1973, the oil price quadrupled from under $3 per barrel in September to over $11 in December. From 1979 to 1981, oil prices more than doubled, from $13 to $34 a barrel. (See figure 5.)

The IOCs also faced a growing threat from independents

The IOCs also faced a persistent threat from independents. Out of a concern for their own dwindling domestic oil resources, and in an effort to compete with the Seven Sisters, who for decades had benefited from privileged access to abundant oil supplies, independents had, from the 1960s, been searching for their own low-cost reserves. They were now in a position to compete in foreign markets by offering better terms to local governments, i.e. agreeing to share a greater portion of oil profits.

As competition between the major IOCs and independents grew, producing nations could demand more for their natural resources than ever before, so that existing agreements between the Seven Sisters and oil rich nations became even less favourable than before.

Independents also challenged previously-dominant players by being more aggressive in exploration efforts, and, in some instances, threatening hostile takeovers. One example involved oil tycoon T. Boone Pickens, owner of the independent oil company Mesa. An outspoken advocate of a shake-up of the majors, he argued that shareholders deserved better management of oil company resources. His firm pushed for takeovers of weak oil majors that (according to Pickens) were neglecting to make efficient use of their resources, and spending insufficiently on exploration. The purchase of Gulf Oil by Chevron, in 1983, was instigated by a takeover bid made by Pickens.

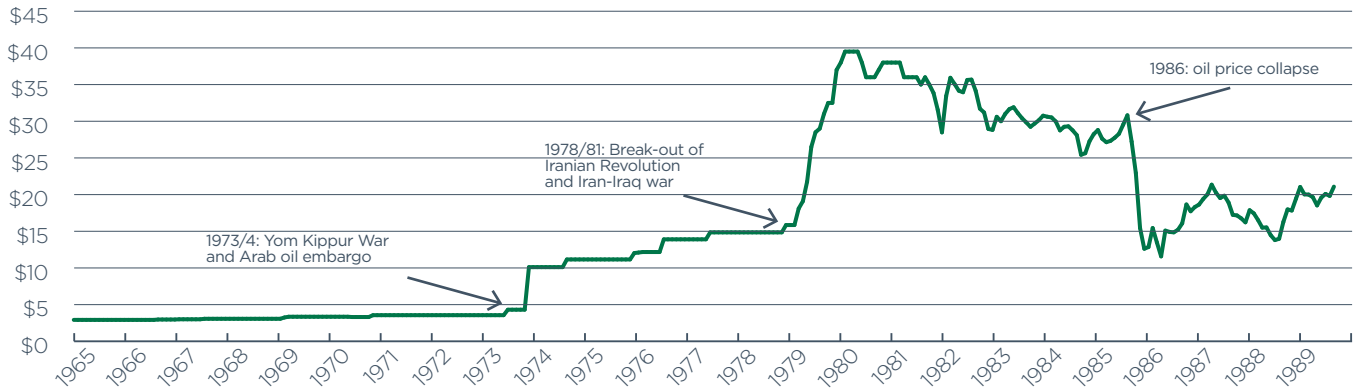
Driven by reduced access to supplies, and rising prices...

With significantly less control of global oil reserves, in a weakened position, but with demand for oil still growing, the Seven Sisters reinvigorated efforts into finding their own reserves, and competing with up-and-coming independents and producing nation rivals. They invested heavily in exploration and production to build up their own non-OPEC resources.

...IOCs invested heavily in exploration and production

Their exploration led to discoveries in the North Sea, Alaska, Latin America and Canada. Large discoveries were made in the North Sea in 1968 and Alaska in 1969. Developing such wells, and bringing them into production, took time however: North Sea oil did not begin adding to world supply until 1975; North Slope Alaskan oil did not come to market until 1977.

FIGURE 5: WTI CRUDE PRICE (US$ PER BARREL, NOMINAL, MONTHLY AVERAGE)



Source: The Federal Reserve Bank of St. Louis, FRED

POST 1970s OIL SHOCKS: INDEPENDENT OIL TRADING TAKES OFF

Oil markets changed fundamentally following the 1970s shocks with the rise of the independent oil trade and the resurgence of oil contract trading on public exchanges.

In the early days of the industry, the oil price was set through open trading on exchanges. This type of trading ended with the advent of the fully integrated oil company. Vertically integrated oil companies set the prices of oil through purchasing agreements with producers. Agreements were long term, often lasting up to two years. Fully integrated operations rarely sold on the open market. When they did, it was to sell a temporary surplus or to provide supply during times of temporary shortage. Overall, it was a buyers' market where the IOCs, as the primary buyers of crude, had the power to set prices they were willing to offer sellers (oil producing nations).

More firms were purchasing oil in the world market

By the second half of the twentieth century, the growing number of players, up-stream and down-stream, reduced the top-to-bottom control previously maintained by the IOCs. The up-stream market grew more complex as a result of nationalisations in producing nations, and growing competition from independents.

These developments also impacted the down-stream side of the market, which grew increasingly complex and multi-faceted, as reduced barriers to entry enabled new entrants to claim IOC down-stream market share. New entrants included: new fully integrated operations (independents and producing nations); and firms with no supplies of their own, primarily independent refiners.

The number of independent refiners rose, in large part because IOCs began selling refineries, in preparation for a time when they no longer had abundant crude oil supplies upstream:

> *"...by 1978 the refinery capacity of five of the seven majors was 13 million barrels per day, 2.4 million barrels fewer than in 1973; this decline took place at a time when global refining capacity outside the communist world rose by almost 20 percent, reaching 64.7 million barrels per day in 1978."*[14]

Demand for an independent oil trade was growing

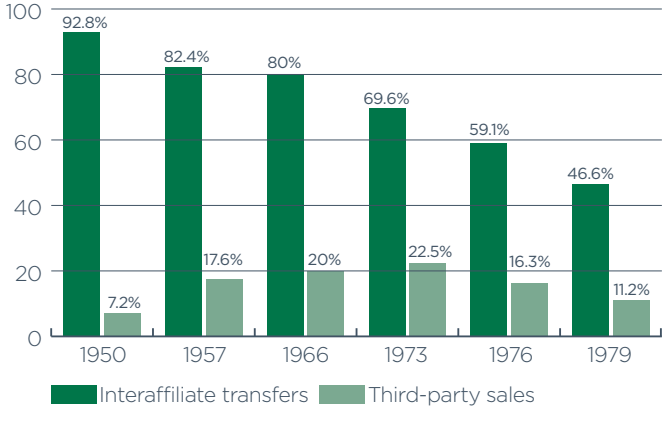
The rise in US crude imports – from 1.3 million barrels per day in 1970 to 6.6 in 1977 – contributed to the rise in independent refiners purchasing oil in the world market.

From the 1950s to 1973, IOC third-party sales rose from 7.2 to 22.5 percent, whereas IOC inter-affiliate transfers declined from just under 93 percent to just under 70 percent. Producing nations increasingly sold directly to independent refiners because, as the world oil market tightened in the 1970s, third-party sales of crude by IOCs to independent refiners fell. (See figures 6 and 7.)

Independent oil trading took off...

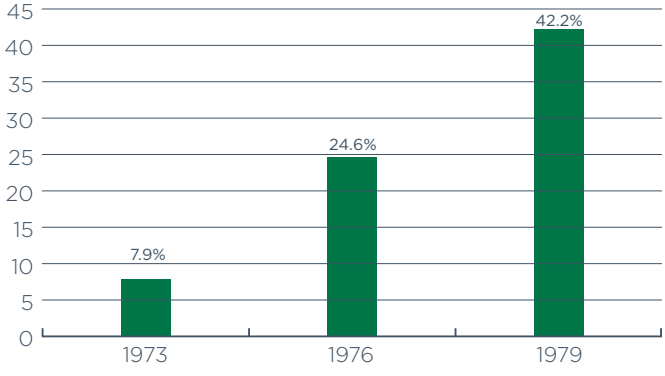
Open market trading of oil was further spurred by the emergence of independent oil trading operations, a development often attributed to Phillips Brothers commodity trader Marc Rich in the years following the 1973 oil price shock.

FIGURE 6:
INTER-AFFILIATE TRANSFERS AND THIRD-PARTY SALES BY IOCs



Source: Levy (1982) 'World oil marketing in transition'
Note: % of internationally traded oil

FIGURE 7:
DIRECT SALES BY PRODUCER COUNTRIES



Source: Levy (1982) 'World oil marketing in transition'
Note: % of internationally traded oil

...as a new generation of traders bypassed the Seven Sisters' network

Rich arranged long-term contracts with producing countries, and paid relatively higher prices for the oil than the Seven Sisters were willing to pay, on the judgement that, over the long run, the price of oil was destined to rise significantly. His bet paid off. In less than 10 years after founding his own trading firm, Marc Rich & Co. in 1974, the company became the largest and most profitable independent oil-trading company in the world.[15]

According to *Swiss Style* journalist Dominique de la Barre, the rise of independent trading was a sea-change for the industry:

> *"The real turning point... came with the Yom Kippur war in 1973, triggering the first oil shock. The price of a gallon of crude oil rose fourfold..., and caused a revolution in the way oil was sold throughout the world. Before the war, oil-producing countries would sell exclusively to the Seven Sisters, as the major oil companies were then called, within the framework of a very rigid and inefficient system.*
>
> *With oil now a scarce commodity worth USD 12 a barrel, transportation of oil was set to become a lucrative business for intermediaries. A new generation of traders emerged, whose business it was to find the best buyer for a cargo at the best price, in the process creating a market which the majors, accustomed only to dealing exclusively among themselves or with sovereign states, were ill-equipped to serve."*[16]

The industry thereafter was far more competitive...

As intermediaries, independent trading houses thus grew to meet the growing demand for oil from an increasingly fragmented network of buyers and sellers. With producing-nation market power on the rise, and IOC control over the production and sale of oil on the decline, independent trading houses were well placed to buy and distribute supply globally in the newly-fragmented market environment. Trading houses were not always focused solely on crude. Many, such as Vitol (founded in 1966), started off trading a variety of petroleum products, but later expanded to crude thereafter.

Greater use and demand for independent oil trading contributed to the eventual return of a formal spot market for oil, which balanced global supply and demand. It provided much-needed supply for IOCs: having been forced out of many oil rich regions, the IOCs had to become buyers and traders of oil on the open market to supply their down-stream operations. BP, for example, had to purchase oil in the open market after it lost more than 40 percent of its supply through conflicts in Iran, and nationalisations in Nigeria, Kuwait, Iraq and Libya.[17] The spot market also found buyers for excess supply: following the oil price shocks of the 1970s, producing nations had surplus supplies to sell because domestic spending in producing countries had adapted to higher oil earnings, and more oil was produced to maintain income levels amidst drops in the price.

By the early 1980s, oil contracts traded on futures exchanges

In the 1970s, regulations were relaxed, enabling the trading of commodities such as gold, interest rates, currencies, and eventually oil, on established futures exchanges. The New York Mercantile Exchange (NYMEX) began trading oil futures in 1983, and soon oil companies and financial houses were trading oil as a regular part of their operations.

Majors began trading oil to manage price risk, and trade for profit

The return of open market trading enabled big buyers, like the majors, to search for the cheapest oil available anywhere in the world, which could be used to supply their down-stream operations, or traded again for profit. Majors established trading offices as separate profit centres, and as a means of reducing price risk: "*Price risk being what it was, none of them could afford to stay out.*"[18] The rise in trading by the majors also coincided with a widespread effort to decentralise the international oil companies to make them more efficient. According to Daniel Yergin, BP used trading as a key means of becoming more competitive:

> *"With the emergence of the short-term spot markets the virtues of 'old-style' integration were no longer so evident. The new BP could shop around for the cheapest crude; it could push efficiency throughout its operating units; it could beat the competition; it could be more entrepreneurial."*[19]

By the end of the 1980s...

By the end of the 1980s, tight supply and falling barriers to entry radically changed the structure of the world oil market. NOCs and IOCs retained up-stream dominance while new players entered mid- and down-stream, leading to a reduction in the share of oil traded down-stream through IOCs from 90 percent in 1973, to around 50 percent by the early 1980s.

...NOCs, IOCs, independents and traders emerged as the key players

New players that entered the international oil market included: state-owned marketing operations of oil-producing countries and a mix of buyers, such as consuming country governments throughout the developed and developing world, independent oil refiners, oil traders and independent distributors of oil products.[20]

THE 1990s TO THE PRESENT: COMPETITION BECOMES EVER MORE FIERCE

In the 1990s competition intensified again

In the mid-1990s another wave of globalisation hit the oil market, bringing considerable change. Three changes were key:

1. The collapse of the Soviet Union;
2. The end of the Gulf War; and
3. Growth in the developing world.

Previously-controlled economies liberalised; nationally-operated oil companies privatised; and barriers to entry into new oil rich markets fell. The IOCs and independents benefited considerably because they could explore and produce in markets which had vast oil reserves, helping them build their resource base and replace legacy assets.

Asian Pacific oil consumption doubled from 1990 to 2011

Rising global growth, especially in developing Asia, increased the demand for oil resources. Asia-Pacific consumption doubled, from just under 14 million barrels per day in 1990 to over 28 million in 2011 (see figure 8).

The Middle East provided most of the incremental production

Middle East production rose over 40% from 1990 to 2011 to meet growing demand. (See figure 9.) The drop in production from the Middle East in the mid-1980s was largely a result of production cuts by Saudi Arabia. Eastern European and Eurasian production fell in the early 1990s, and subsequently recovered strongly, approaching the previous peak. Western European production meanwhile declined significantly.

Meanwhile, Western production fell

Rising globalisation, and the consequent flow of goods, people and capital, enabled producing nations to operate independently, and compete with the IOCs as never before. Equipment and technology could be exchanged in the open market, allowing NOCs to develop their oil resources on their own, rather than rely on IOC assets. As a result, producing nations gained more economic and political power.

IOCs consolidated to become the 'Super Majors'

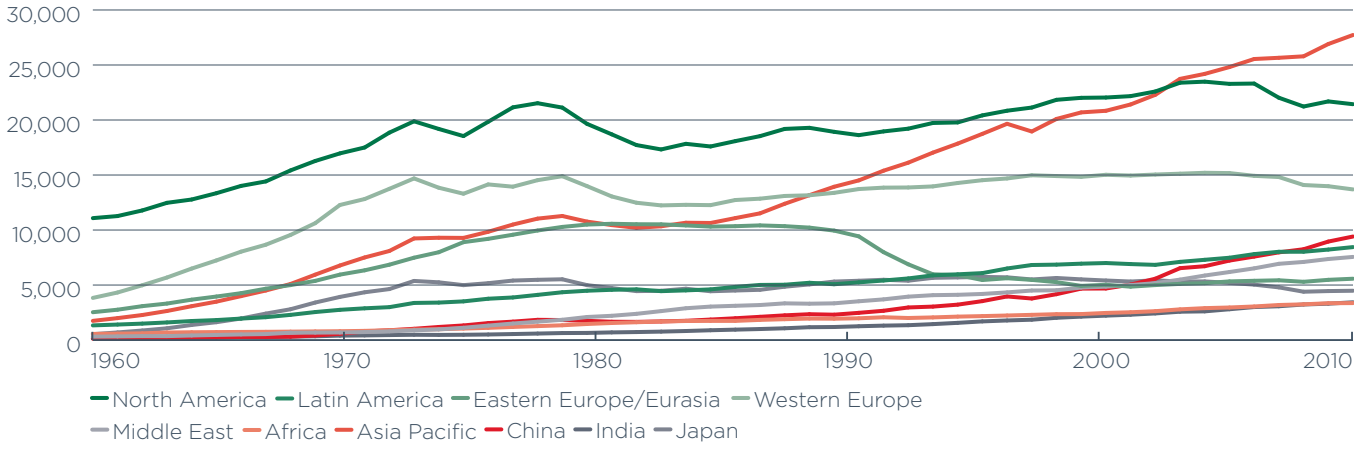
In need of new reserves, the IOCs consolidated to build resources to fund complex exploration projects. This gave rise to a new industry structure, the 'Super Majors' – Chevron, British Petroleum, ConocoPhillips, Royal Dutch Shell, Total and ExxonMobil. According to Yergin, the consolidations of the majors marked a significant reshaping of the structure of the oil industry:

> *"What had unfolded between 1998 and 2002 was the largest and most significant remaking of the structure of the international oil industry since 1911. All the merged companies still had to go through the tumult and stress of integration, which could take years. They all came out not only bigger but also with greater efficiencies, more thoroughly globalised, and with the capacity to take on more projects – projects that were larger and more complex."*[21]

Today, NOCs dominate global oil and gas reserves

Today, NOCs dominate global oil and gas reserves
In 2005, it was estimated that NOCs controlled around 77% of the global oil and gas reserves. Independents controlled an additional 8% of global oil and gas reserves.[22] (See figure 12.) Four of the original Seven Sisters (ExxonMobil, Chevron, BP and Royal Dutch Shell) produce less than 10%-odd of the world's oil and gas, and hold just 3% of reserves.[23]

FIGURE 8: WORLD OIL CONSUMPTION (THOUSAND BARRELS/DAY)



Source: OPEC Annual Statistical Bulletin, 2012

Control has shifted away from the majors

The world's largest NOCs, the so-called 'New Seven Sisters'[24] include:

— **Petrobras** (Brazil);
— **Petronas** (Malaysia);
— **Saudi Aramco** (Saudi Arabia, largest oil company in the world);
— **NIOC** (Iran);
— **Gazprom** (Russia);
— **CNPC** (China); and
— **PDVSA** (Venezuela).

This new landscape contrasts starkly with the market in 1949, when the Seven Sisters controlled 88% of the entire global oil trade. (See figure 11.)

The size and influence of the NOCs continues to grow

The size and influence of the NOCs continues to grow through renationalisation, and aggressive exploration and acquisition efforts. In recent years, for example, oil assets have been renationalised in Russia (nationalisation of Yukos in 2003); Venezuela (ExxonMobil and ConocoPhillips were forced to leave Venezuela in June 2007, leaving billions of dollars worth of investments behind); and Argentina (Argentina nationalised 51% of YPF (an oil and gas group) in April 2012).

According to Petroleum Intelligence Weekly (PIW), 14 of the top 20 oil producers are now NOCs or newly privatised NOCs.[25] PIW rankings in 2010 identified Asian-based NOCs among the fastest-rising companies in the industry.[26] Growing Asian-based firms include: India's Reliance Industries; Malaysia's Petronas; China's CNOOC; and Thailand's PTT.[27]

Joint ventures with private firms however are becoming more common

NOCs are increasingly competing with IOCs in exploration for new reserves; and collaborating with other nationals to gain a competitive edge over the IOCs. Producing nations have, however, also asked IOCs and independents to enter into joint ventures to help them develop their reserves. Although preferring to operate independently, many NOCs realise that in order to grow and become more efficient, they need help from IOCs and Independents because these private sector firms have the requisite technologies and skills that NOCs often lack, or cannot fund.

Requests for private sector assistance can be found in Latin America. In Brazil, for example, state-owned Petrobras took steps toward privatisation when it sold part of the company in a public share offering in 2010, raising $70 billion. Newly-elected president of Mexico Enrique Peña Nieto has made strong statements indicating his intention to improve Mexico's NOC Pemex by engaging in joint ventures with private companies.[28]

NOCs often lack the skills, technologies, and distribution networks needed

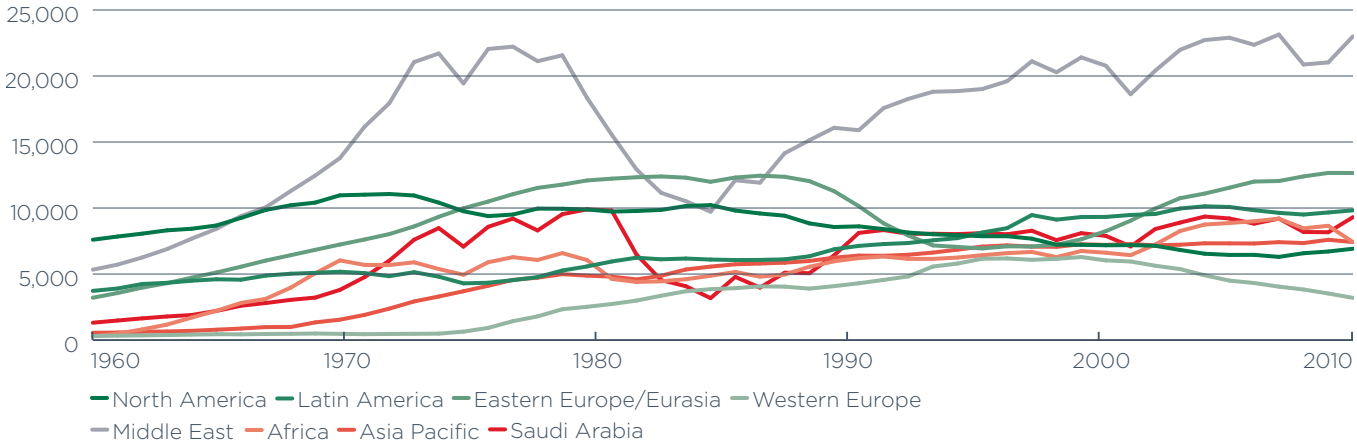
NOCs also often lack down-stream distribution networks. This makes it advantageous for them to work with the IOCs, independents and independent trading companies which possess down-stream assets and distribution networks. In Africa, for example, Angola's national oil company Sonangol has partnered with mid- and down-stream independent Puma Energy to assist it with the refining, and distribution of Angola's vast oil resources.

Exploration for new reserves has been a high priority for all players in the industry, and high prices have encouraged this.

Rising non-OECD demand has sustained an upward trend in prices...

Fluctuations aside, the price of WTI crude has continued its upward trend over the past decade. The WTI crude oil price peaked at nearly $140 per barrel in 2008. As a result of the 2008 financial crisis, the price fell to around $40 per barrel near the start of 2009, but has since settled between $80 and $110.

FIGURE 9: WORLD CRUDE PRODUCTION (THOUSAND BARRELS/DAY)



Source: OPEC Annual Statistical Bulletin, 2012

...spurring further exploration by all players

This high average price range has had a major impact on the key players in the industry as expensive and complex projects that would not have been attempted in a lower price environment have become economic.

IOCs have been ill-equipped to compete with nimble competitors

The IOCs, or 'Super Majors' remain highly relevant, and rank among the top 10 global oil companies according to Petroleum Intelligence Weekly (PIW).[29] The Super Majors, however, have been less successful than the NOCs and independents in growing their reserves.

Independents have proved better at finding and exploiting new reserves

Many recent discoveries have come from independents and mid-sized competitors who have a solid track record of finding projects and getting them into production relatively quickly. According to energy consultancy Wood Mackenzie, between 2001 and 2010 the eight IOCs' reserve replacement ratio was much lower than that of their independent and mid-sized competitors.[30]

IOCs have been looking for creative ways to compete

This reserve replacement performance is most often attributed to the majors being too big and bureaucratic. IOCs have been slower to start new projects than their smaller independent competitors, and are often also less flexible and less willing to take on risk. With new reserves becoming ever more difficult to find and extract, and with rising competitive pressure from independents and traders, IOCs have been looking for creative ways to compete.

Meanwhile, independent global trading firms have grown

Meanwhile, the number of large, independent trading houses has been growing for decades

Prominent examples include:

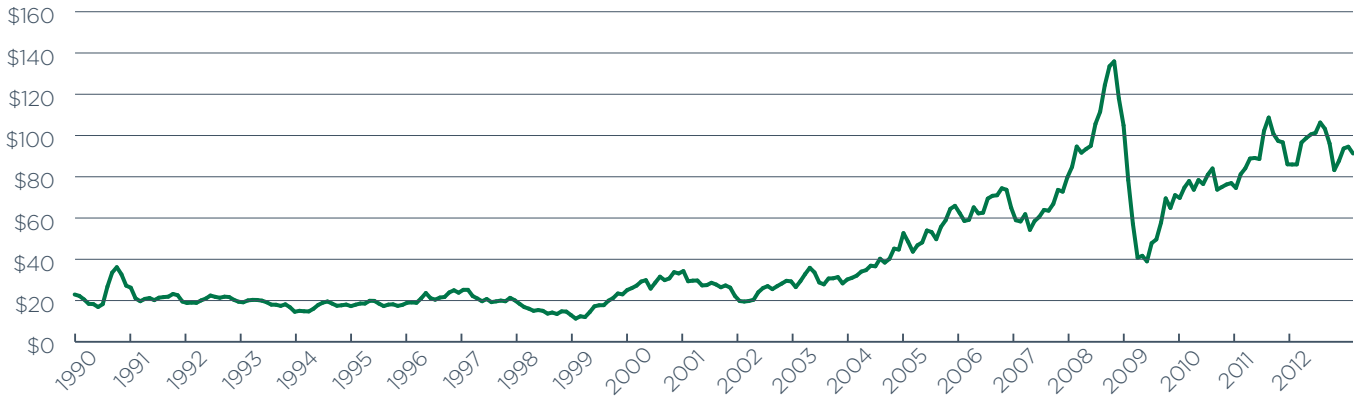
— Vitol (established in 1966)
— Glencore (originally, Marc Rich & Co., established in 1974)
— Noble Group (1986)
— Arcadia Petroleum Limited (1988)
— Trafigura (1993)
— Gunvor (1999)
— Mercuria (2004).

Traders are competing with IOCs and NOCs as never before

In the past decade, in particular, oil trading houses' operations have grown enormously in size and scope. Mercuria, for example, started only in 2004, but has quickly become one of the top five global oil trading firms. In 2004, Mercuria's physical volumes sold (all commodities) was 30 million metric tons. By 2011, it had grown to 127 million metric tons. Together, Vitol and Trafigura sold around 1.1 million metric tons of oil per day in 2010, an amount equal to the combined oil exports of Saudi Arabia and Venezuela.[31]

In addition to growing their trading volume, trading houses have continued to buy mid- and down-stream assets globally. Trafigura and Glencore have offices in more than 50 countries; and Vitol, Trafigura and Mercuria have expanded rapidly throughout Africa, South-East Asia and South America to gain exposure to rapidly growing markets. Many have also become more vertically integrated. Glencore began buying industrial assets in the 1980s. Mercuria, Vitol, Trafigura, Noble Group, and Gunvor have followed. Noble's capital spending and investment has risen from $161 million in 2006 to $1,485 million in 2011.[32]

FIGURE 10: WTI CRUDE OIL PRICE (US$ PER BARREL, MONTHLY AVERAGE)



Source: Federal Reserve Bank of St. Louis, FRED

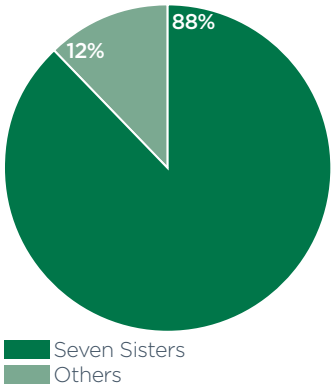
Four key groups continue to dominate the industry

Thus while, from the 1990s to the present, NOCs and IOCs have retained their places as market leaders, traders and independents have increasingly competed, and intensely, all along the value chain.

NOCs remain powerful because of their large resource base, and enhanced efforts to boost production. Many of the historically-dominant IOCs still rank among the top ten oil companies, even if they are feeling the ever-increasing pressure from NOCs and independents, especially in the search for new reserves. Meanwhile, a diverse group of independents remain highly competitive with all players in the industry (exploiting their own individual competitive advantages); and independent trading houses are growing significantly in size and scope.

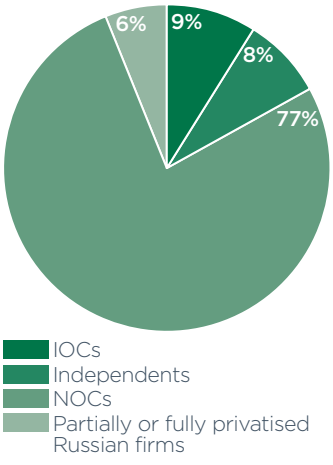
Collectively, firms within the industry produce, process, store and distribute a complex range of products, ranging from gasoline to diesel oil; jet fuel to bunker fuel; heating oil to bitumen. These enter the production process at all stages, from the earliest right through to final consumption, and are used for a variety of essential functions vital to industrial activity, development and economic growth.

FIGURE 11:
SHARE OF CONTROL OVER GLOBAL OIL TRADE, 1949



Source: US Federal Trade Commission, 1952

FIGURE 12:
SHARE OF GLOBAL OIL AND GAS RESERVES, 2005



Source: The Baker Institute, 2007

CHAPTER TWO
CURRENT DEVELOPMENTS AND STRATEGIES

Competition in the oil industry today is as intense as ever. In response, the key players are operating quite distinct strategies. IOCs are decentralising, and trading houses are looking increasingly like a new form of oil 'major'.

— The dominant national oil companies (NOCs) are progressively building up their reserves, and developing their up-stream capabilities

— Many independents operate all along the value chain and remain competitive by specialising, and by being more nimble and flexible than the big multinationals

— The IOCs are decentralising, and focussing on 'core up-stream activities'. Down-stream assets in saturated Western markets are being sold, and exploration and production activity funding is being increased

— Trading houses are growing in size and scope, building their asset base globally, and becoming more vertically integrated by investing in up-stream assets. To fund acquisitions, ownership structures are being transformed

Determinants of success for both IOCs and trading houses will depend, in particular, on access to finance, their ability to remain flexible, and their readiness to continue adapting to the changing market conditions.

TODAY'S ENVIRONMENT: COMPETITION AS INTENSE AS EVER

Market pressures have obliged creative means of competing

As competitive pressures on all four key players continue to mount, each has worked hard to maintain its competitive edge. NOCs and independents are continuing their prevailing strategies for growth. IOCs and independent trading houses, on the other hand, are distinguishing themselves by implementing new, and very different, strategies:

— IOCs are decentralising operations, and concentrating on up-stream activities
— Traders are growing in size, and integrating operations all along the value chain

NOCs continue to strengthen

National oil companies continue to build their reserves, and productive up-stream capabilities. NOCs of developing countries, notably China, are growing operations by making billions of dollars of strategic acquisitions, and investments in production technology.

Acquisition and investment plans are aggressive

Their growth strategies appear to be bearing fruit. Two nationally-owned companies, PetroChina (China) and Petrobras (Brazil), recently demonstrated their intent and ability to compete with the Super Majors. In early 2012, PetroChina's daily oil production overtook that of Exxon (the largest publicly-traded US producer of oil and gas).[33] Petrobras is carrying out a multi-billion dollar investment plan that aims to boost production to four million barrels per day (near Exxon's current production).[34]

Independents compete by specialising

Independents continue to compete by specialising in particular activities down-stream, mid-stream and up-stream; and by being more flexible and quick to exploit profit opportunities. A great number of independents sell and distribute an array of oil products, and many large independent refiners are doing particularly well. Valero, the world's largest independent refiner, is a prime example: it has grown steadily through strategic acquisitions in the US, Canada, the UK, Ireland, and the Caribbean, and is currently ranked 12th in the Fortune 500 list.

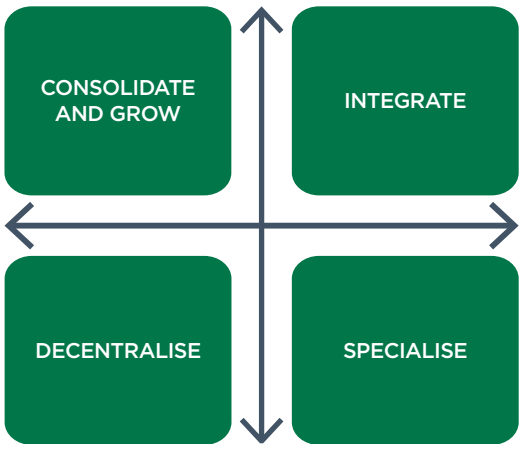
IOC global oil and gas reserves have fallen to below 10%

IOCs respond through a change in strategy

Meanwhile, IOCs are playing catch-up with the NOCs and independents as consolidation in the last decade failed to boost reserves. During and after their consolidations in the 1990s and 2000s, the IOCs focused less on exploration for new oil reserves, and more on producing from legacy assets. The IOCs now control less than 10% of the world's known oil and gas resource base.[35]

IOCs spend billions on exploration every year, yet compared with smaller competitors they have had little success in replacing depleting oil and gas reserves. Their crude oil and NGL reserves have grown little, if at all. (See figures 14 and 15.)

FIGURE 13: DIVERGENT STRATEGIES FOR IOCs AND INDEPENDENT TRADING HOUSES



Source: Llewellyn Consulting

Many IOCs believe they have to become less unwieldy

As a result, IOCs are reconsidering their optimal structure. Many have concluded that, in order to grow, they have to improve efficiency through divestitures and acquisitions, both in up-stream and down-stream divisions, by decentralising and focusing on what they have defined as their 'core activities'. According to a recent Petroleum Intelligence Weekly, the current phase of restructuring is likely to have lasting consequences for the future landscape of the industry:

> *"Divestitures and acquisitions were more significant in altering the "Big Oil" leadership landscape than either organic growth or the megamergers of yesteryear... Companies are increasingly rising or falling based on their ability to look beyond the integrated model to grow their operations... With new reserves becoming ever scarcer, companies that come up with innovative ways to create value will reap ever bigger rewards."*[36]

Many IOCs are edging away from the integrated model

Many are edging away from the integrated model, driven by the increasingly-common view that "the strategic logic for integration has worn thin".[37] Conoco's CEO Ryan Lance, a proponent of this view, argues that many IOCs already operate like contractors, assisting NOCs with activities that they do best, rather than offering their services as a fully integrated operation:

> *"In the last decade, integration was important. Resource-rich countries, and their national oil companies, wanted partnerships to secure their access to refineries and customers in the US and Europe, and western companies had to offer a package including both experience and technology for oil production, and a secure route to market.*
>
> *But as the NOCs have increased their capabilities, now they're really coming to companies and saying who's got the best upstream technology, who's got the best downstream capabilities, and it's not necessarily [about] looking for an integrated package.*
>
> *The physical integration of Conoco's operations had become minimal. Only about 10 percent of the crude it produced was fed into its own refineries."*[38]

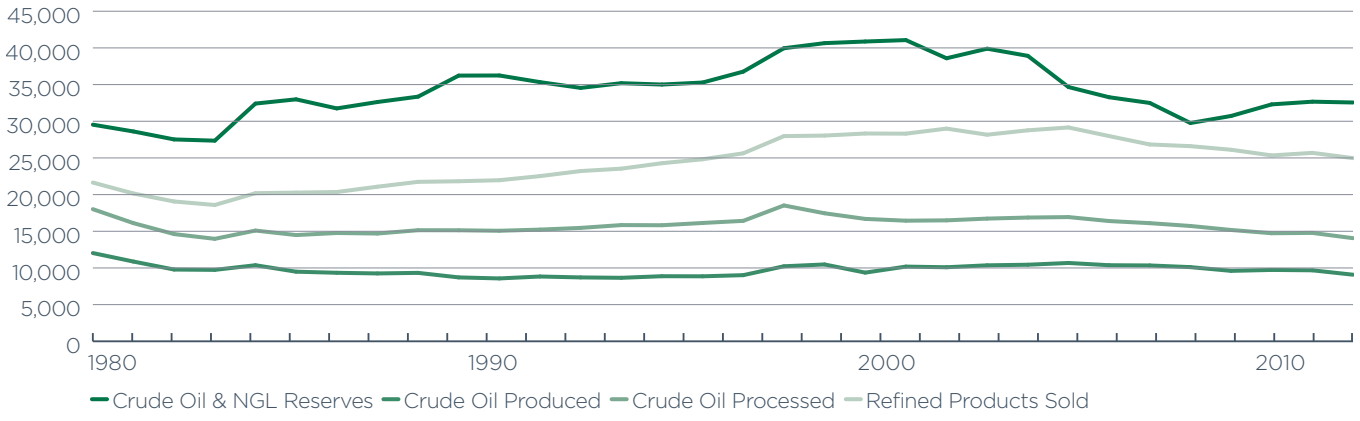
ConocoPhillips decentralised

In 2012 ConocoPhillips became part of a wider trend of decentralisations amongst the larger companies and, following a public offering for its down-stream asset base, was split in half, as part of a 'shrink to grow' strategy. According to Daniel Kerstein, head of the strategic finance group at Barclays:

> *"A key driver [of the current wave of restructuring] is the major companies moving their way back to basics,"..."We've seen this across industries. Companies have highlighted the fact they're going to shrink to grow."*[39]

The decision to decentralise ConnocoPhillips, and create two specialised firms under the broader corporate umbrella – ConocoPhillips entirely up-stream focused, and Phillips 66 down-stream – was viewed as a sound move by some analysts. The up-stream-focused branch could carry out an exploration centred strategy, and offer investors leverage to the oil price; and Phillips 66 could carry out a down-stream-focused specialist strategy of its own.

FIGURE 14: PRINCIPAL OPERATIONS OF THE MAJORS, 1980-2011 (THOUSAND BARRELS/DAY)



Source: OPEC Annual Statistical Bulletin, 2012

Others, however, expressed concerns about whether the separately-focused firms could meet investor expectations. The argument being that it could prove difficult for each to provide both the growth of a successful independent, and the reliability of an integrated company.

Many IOCs see production and exploration as providing growth...

From 2000 to the present, production and exploration spending by the majors rose comparatively more than down-stream and other spending, and this is likely to continue. (See figure 15.) According to the IEA, global up-stream oil and gas investment is likely to reach a new record in 2012 of $618 billion, about 20 percent higher than in 2008, and five times that in 2000.[40] Although rising costs have contributed to this, rising 12 percent since 2009, and more than doubling since 2000, the focus of IOC strategic spending for the years ahead seems clear.

...and are selling down-stream assets

To fund more exploration IOCs are selling off 'non-core' assets. Recent further examples include:

- Chesapeake Energy: in September 2012 announced their intention to sell $6.9 billion in assets to raise cash, fund capital expenditures, and pay off debt
- Chevron: throughout 2011 sold their UK and Ireland marketing operations; their Pembroke refinery in the UK; and 13 terminals worldwide. In total they left 27 countries
- Royal Dutch Shell: from 2009-2011 completed $17billion of asset sales. $2-3 billion worth of divestitures were expected to have been completed in 2012
- BP: by the end of 2013 aims to have sold $38 billion of assets. $32 billion has already been raised from asset sales since the Deepwater Horizon oil spill in 2010
- Marathon Oil: in 2011 also split its up-stream and down-stream assets into two. Down-stream operations became Marathon Petroleum Corp., while up-stream operations kept the name Marathon Oil

Trading houses are transforming themselves

Trading houses adapt their strategy to boost 'optionality'

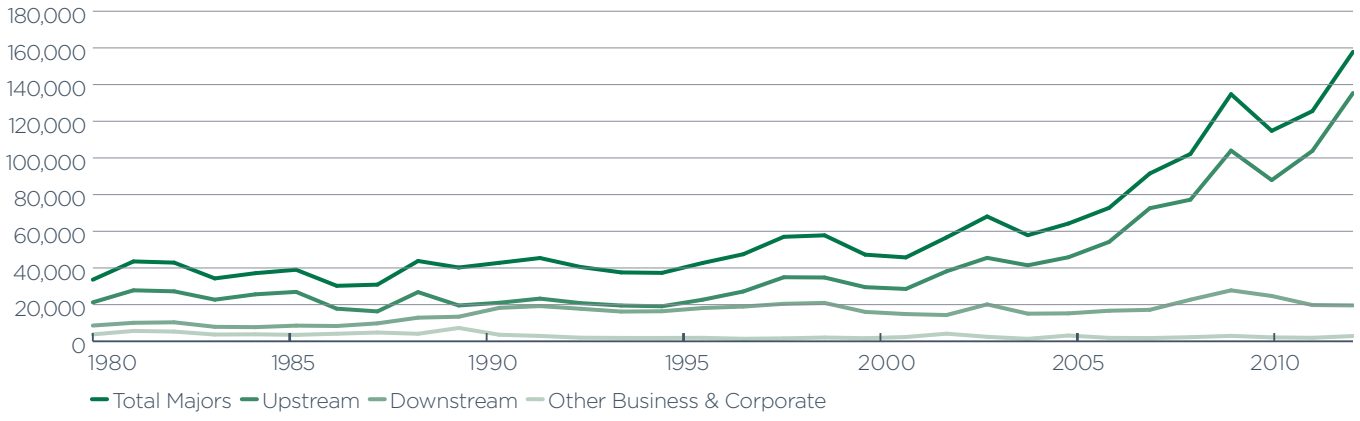
The independent trading houses have also responded to the growing competition, and are transforming themselves from 'middle-men' to fully integrated oil companies, in effect becoming large integrated oil companies.

Traditionally, traders held a portfolio of supply and purchase contracts, and made money by exploiting price differences relating to lot size, quality, location, time and transport. Increasingly, however, they have been rapidly expanding their global footprint, and entering up-stream activities through capital-heavy acquisitions.

Today, the world's largest independent oil traders include: Glencore; Vitol; Trafigura; Gunvor; Mercuria; and Noble Group. Some growth statistics:

- Vitol: in 2011 traded $105 billion of crude oil, and had an energy volume in of 457 million metric tonnes, up from 200 million in 2004
- Trafigura: its mid- and down-stream oil subsidiary, Puma Energy, started in 1997 in Central America. By 2012 its operations had expanded into 32 countries
- Glencore: throughout 2012 handled (i.e. processed, traded, stored and/or transported) 3 percent of the world's daily oil consumption[41]

FIGURE 15: CAPITAL AND EXPLORATION SPENDING BY THE MAJORS (MILLIONS OF US$)



Source: OPEC Annual Statistical Bulletin, 2012

Amid competitive pressures...

Amidst this remarkable growth, however, the market has become more difficult for the trading houses. According to Oliver Wyman, some commodity traders' revenues were 35 percent less in 2010 than 2009, notwithstanding higher commodity prices.[42] Reasons include:

— Information technology advances making it easier for market participants to obtain accurate, timely information
— More competitors in the trading, production, and end consumer level

End consumers such as airlines, for example, have invested in oil assets to ensure their own supply, enabling them to operate independently. Furthermore, with more independent trading houses and trading operations of oil majors competing with one another, it is harder for each to find and exploit large profitable trades.

...they are expanding their global reach and diversifying their revenue streams

The expansion strategy of the trading houses, in addition to expanding their global footprint, aims to improve relative competitive strength through increased diversification along the value chain, including importantly into the more capital-intensive up-stream activities. The strategy also aims at greater diversity of revenues, and 'optionality' i.e. a greater ability to exploit imbalances in supply and demand that may arise in different regions.

For trading houses, size of the distribution network is paramount to the ability to exploit trading opportunities. Global reach is being expanded by moving into new fast-growing developing markets. A significant presence has been built in Latin America, Africa, and Asia.

Glencore, Vitol, Trafigura, Nobel Group, et al. have bought exploration and production assets, giving them exposure to higher return activities along the production-chain, and also helping to guarantee a consistent, low-cost supply for their down-stream activities.

A key determinant of success for the trading house's strategy is likely to be access to finance. Trading houses generally require vast amounts of capital to purchase large volumes of product for everyday trading operations, and as they continue to carry out their current strategy, access to capital will be ever more crucial for funding on-going purchases of down-stream and up-stream assets.

Many trading houses are altering their ownership structures to attract capital

Trading houses have generally been privately owned, limiting their ability to finance new growth, and many are now altering their ownership structures to attract capital. Some are turning to debt and equity markets for financing; others are taking investment capital from sovereign wealth funds and private equity firms. Recent examples include:

— Vitol, which sold 50% of its stake in its tanking and terminal business (Vitol Tank Terminals International, VTTI) to a subsidiary of Malaysia's national oil company, Petronas, for $735 million in cash in 2010[43]
— Trafigura, which sold 20% of its down-stream-focused subsidiary, Puma Energy, in 2011 to Sonangol Holdings, a subsidiary of Angola's state-owned oil firm
— Glencore, which raised $10 billion in an initial public offering in May 2011
— Mercuria, which sold 50% of its terminals business to Sinopec Kantons, a subsidiary of China's state-owned oil company, in October 2012[44]

There is cognisance of the need to balance size and flexibility

While trading houses are acquiring new assets and diversifying their revenue streams, they remain cognisant (like the IOCs) of the need to strike a balance between integrating and getting bigger, and maintaining a quick-acting and adaptable structure. According to Richard Elman, the Chairman of Noble Group:

> *"We have ... tried to be big enough to remain well-capitalised to survive the capital drought, yet not too big that we can't change, adapt and be managed"*[45]

While IOCs and trading houses seek their ideal balance – between integrating yet retaining a flexible and decentralised structure – mergers, acquisitions, restructuring, and divestitures are likely to persist throughout the industry.

Conclusion

As current strategies play out, there will likely be a relatively stable set of NOCs, IOCs, independents and independent trading houses. Competition seems likely to continue to intensify, although, given that the barriers to entry are high, the possibility for new entrants is limited. Producing nations and the NOCs are likely to retain their market power. Independents and smaller integrated competitors will likely maintain their share by being more nimble than the majors in a range of activities along the value chain.

IOCs stand to remain influential, given their existing strong position in the industry, both up-stream and down-stream. Oil trading houses will likely continue investing in up-stream and down-stream assets, and those with access to capital will be in a position to continue to invest more heavily.

CHAPTER THREE
LOOKING AHEAD – IMPLICATIONS FOR EQUITY VALUATIONS

Many factors will shape the oil industry. Most important may be the price of oil. The consensus is that oil prices will continue rising. Our view is that this will likely prove wrong: this would be significant for some equity valuations.

— While the long-term drivers for the demand and supply of oil are generally understood, the timing and extent of the changes are less well understood, and there is much price uncertainty

— There are two schools of thought that prevail: the first sees oil prices rising dramatically, the result of long-run supply constraints. The second sees the oil price falling continually, due to price-induced-technological progress. Neither proponent takes the other's key propositions properly into account

— Myriad factors influence equity values. For oil companies operational, political, and financial factors are particularly important sources of risk, and these differ inherently by activity

— Risk expectations, and importantly changes in these expectations, impact company equity values differently, depending on their up-stream or down-stream focus

Investors will need, as a part of their top-down and bottom-up analysis, to take full account of such activity-specific factors, and the unique risk profiles of each oil company.

FACTORS INFLUENCING EQUITY VALUATIONS

Myriad factors influence equity values

Valuing equities is one of the more difficult, and obscure, of the financial arts. It has been said that the valuing of equities, like the making of economic forecasts, is like the making of sausages – the less the consumer sees of it, the better.

Nevertheless equities have to be valued – and investors have to understand how those valuations arise. Many company, industry, and market-based factors are typically at work. To take these into account, equity analysts employ both top-down and bottom-up analysis.

To account for these, investors employ top-down and bottom-up analysis

Top-down analysis covers broad macroeconomic factors that stand to impact the market as a whole, or a specific industry. Analysts typically consider the likely evolution of at least the following:

- Inflation rates
- Fiscal and monetary policy
- Tax policy
- Employment
- Liquidity flows
- Investor sentiment
- Demographics
- Technological change.

Earnings history, projected costs, and investment plans weigh heavily

Bottom-up analysis focuses on company-specific factors, and requires a thorough examination of the many internal factors that stand to impact future share performance.

A firm's financial condition and its growth prospects are typically taken into consideration by reviewing annual and quarterly financial statements, together with company-specific analyst research. Because the value of a firm is highly dependent on the market's expectations of future earnings potential – earnings history, costs, and investment plans generally weigh heavily on earnings forecasts and valuations.

Determining the quality of management is also essential. Management responsibility is broad: from making strategic investment decisions through to determining whom to employ, their decisions, and style, impact significantly on company prospects.

For oil companies three factors are particularly important sources of risk

For the analysis of oil companies, three factors in particular can be substantial sources of risk, have a significant influence on valuations, and are relevant for investors using both top-down and bottom-up analysis:

- Operational
- Political
- Financial, including:
  - Earnings volatility/uncertainty
  - Leverage
  - Interest rates; and perhaps most importantly
  - The oil price.

Risks differ inherently by activity

In considering the potential impact of these risks, investors need to account for the fact that both the level and weight of these operational, political, and financial risks differ inherently by activity. Generally speaking, a firm's exposure to these risks differs to the extent to which it is engaged in up-stream or down-stream activities.

Operational and political risks are generally lower down-stream...

Operational risk is generally higher in more up-stream activities. Capital-intensive up-stream processes are particularly susceptible to accidents with serious consequences. For example, in 2010, an explosion at BP's Deepwater Horizon oil well killed 11 people, and oil flowed into the Gulf of Mexico for three months until it was capped. BP paid $4.5 billion (US) in fines and payments to environmental groups.

...and the consequences less severe

Operational errors can occur in mid- and down-stream activities as well, however the consequences tend to be less severe. The key point is that, regardless of where a firm operates along the value chain, operational risk can differ significantly by company, and the quality of management.

Political risk is generally higher for up-stream firms as exploration and production require much cooperation from governments, such as gaining permission to develop land. Permits are important in down-stream activities too, albeit to a lesser extent.

Financial risk is typically more inherent up-stream...

Financial risk is significant along the value chain. Elements of financial risk that are particularly important for oil companies include: earnings volatility; leverage; interest rates; and the oil price.

— Earnings volatility: this is inherently higher in up-stream activities. High earnings potential often coincides with longer investment timescales, and uncertain pay-offs. In down-stream activities, by contrast, earnings tend to be more stable. Disruption in expected earnings, however, tends to have serious consequences.

...more discretionary down-stream

— Leverage: although degrees of leverage are at the discretion of management, capital-intensive operations often require heavy borrowing, for example to fund acquisitions of land and equipment. As a result, they typically use more leverage.

— Interest rates: both capital-intensive up- and down-stream activities are highly sensitive to changes in borrowing costs. Arguably, down-stream firms are more susceptible because they generally employ debt finance, whereas up-stream explorers, for example, tend to obtain finance by issuing equity.

— Oil price: up-streams are far more sensitive to oil price changes. They are 'leveraged to the oil price' i.e. profitability rises and falls with the price of oil.

Changes in expectations affect valuations

Markets price in expected risks and their consequences: When expectations change, a given company's valuation may be affected differentially, based in significant part on the extent to which the company is more up-stream or down-stream focused:

A rise in operational risk

— With a rise in operational risk, up-stream valuations would fall relative to down-stream valuations. Down-streams would be less affected because the likelihood of major operational failures is less, and the consequences of such failures tend to be less severe.

A rise in political risk

— By the same token, a rise in political risk would reduce up-stream valuations more relative to down-stream. Since down-stream firms are, in many cases, less reliant on political cooperation, mid- and down-stream firm valuations stand to be less affected by political upset, changes in regulations, or threats of nationalisation.

A rise in financial risks

— An increase in earnings uncertainty would affect both up-stream and down-stream focused companies fairly similarly, and hence probably not affect relative valuations significantly.

— An increase in interest rates would raise borrowing costs, impacting all leveraged operations, irrespective of activity focus.

— Similarly, greater leverage would increase the negative impact of an interest rate rise. The relative valuations of down-stream debt-financed operations would be impacted comparatively more by the higher borrowing costs than would up-stream equity financed operations.

— Finally, an increase in the oil price would increase the valuation of up-stream relative to down-stream focused companies by increasing the 'discovery premium' granted to explorers.

FIGURE 16:
OPERATIONAL AND POLITICAL RISK BY POSITION IN THE VALUE-CHAIN

Risks	Up-stream	Mid-stream	Down-stream
Operational	>	(-)	<
Politics	>	(-)	<

Source: Llewellyn Consulting
Notes: The table lays out the point that each activity, by its nature, possesses a relatively greater (>) , lesser (<), or similar (-) degree of risk.

FIGURE 17:
FINANCIAL RISK BY POSITION IN THE VALUE-CHAIN

Financial Risks	Up-stream	Mid-stream	Down-stream
Earnings volatility	>	(-)	<
Leverage	(-)	(-)	(-)
Interest rates	(-)	(-)	(-)
Oil price	>	(-)	<

Source: Llewellyn Consulting
Key: The table lays out the point that each activity, by its nature, possesses a relatively greater (>) , lesser (<), or similar (-) degree of risk.

Price performance of key players has varied

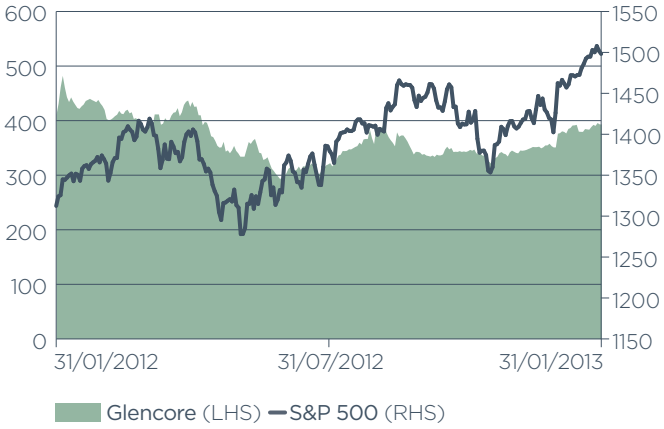
Differences in price performance can be due to a variety of factors, including company-specific, as well as industry-wide, news/issues, and the general market trend. One way to assess – up to a point at least – the extent to which a given company's share price has moved as a result of company-specific information, is to compare the movement of its share price relative to that of an appropriate benchmark e.g. the S&P 500.

As the Picture Book shows, the performance of a sample of independents, IOCs, and independent trading houses has been quite different from the S&P 500 over the past year. For example, the share price of Glencore, an independent trading house, has fallen markedly relative to the S&P 500, while Marathon Petroleum, a down-stream-focused independent, has risen significantly.

Other valuation metrics, such as return on capital employed (ROCE), return on equity (ROE), return on assets (ROA), debt to equity ratios (D/E), and price to earnings ratios (P/E) can each be instructive, and different analysts tend to have individual preferences. P/E ratios are particularly commonly cited.

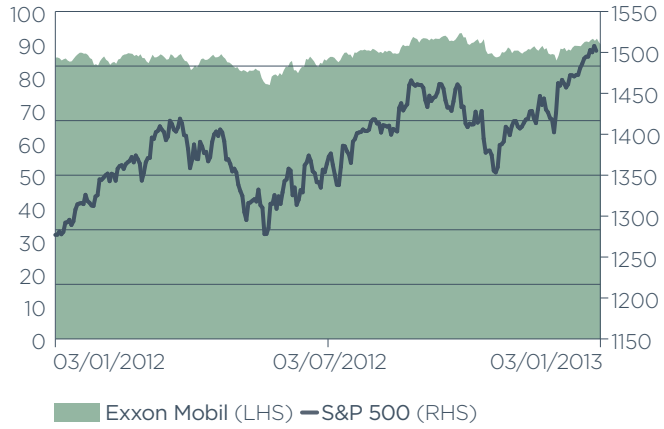
PICTURE BOOK: OIL STOCKS VERSUS THE S&P 500
GLENCORE, EXXON MOBIL, MARATHON PETROLEUM, AND WHITING PETROLEUM

GLENCORE vs. THE S&P 500
LONDON STOCK EXCHANGE (GBP)



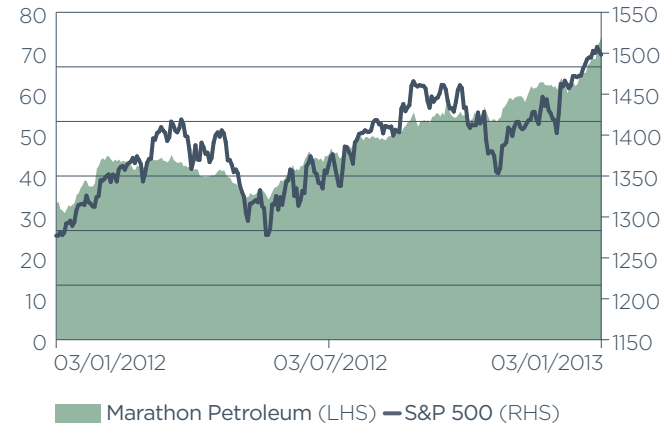
Source: Yahoo Finance
Note: Glencore (GLEN.L)

EXXON MOBIL vs. THE S&P 500
NEW YORK STOCK EXCHANGE (US DOLLAR)



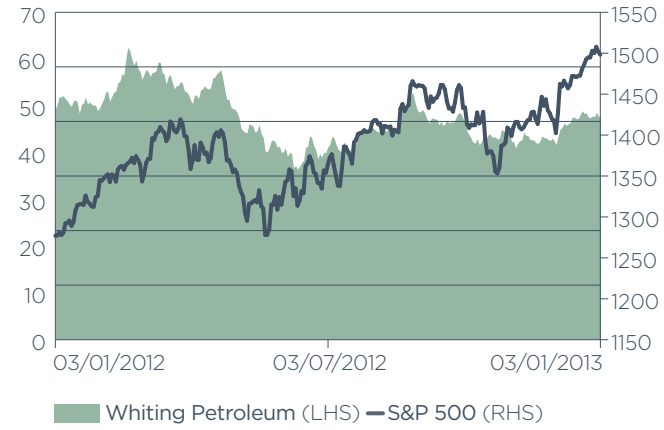
Source: Yahoo Finance
Note: Exxon Mobil (XOM)

MARATHON PETROLEUM vs. THE S&P 500
NEW YORK STOCK EXCHANGE (US DOLLAR)



Source: Yahoo Finance
Note: Marathon Petroleum (MPC)

WHITING PETROLEUM vs. THE S&P 500
NEW YORK STOCK EXCHANGE (US DOLLAR)



Source: Yahoo Finance
Note: Whiting Petroleum (WLL)

Price to earnings ratios differ widely across companies...

P/E ratios differ widely among oil companies, regardless of their activity focus. As figure 18 illustrates, there is great deal of variation in P/E ratios for independent companies focused up-stream and down-stream, as well as for majors with fully integrated operations. Sunoco, for example, an independent mid-and down-stream company, has a P/E ratio of around 17, double that of Marathon Petroleum, a close competitor. Meanwhile, Noble Energy, an independent exploration and production firm, has a P/E ratio over 18. Up-stream rivals such as ConocoPhillips and Whiting Petroleum, however, have much lower P/E's.

...along all levels of the value chain

Divergent views on the 'correct value' of a share arise often

Valuations are subjective and varied

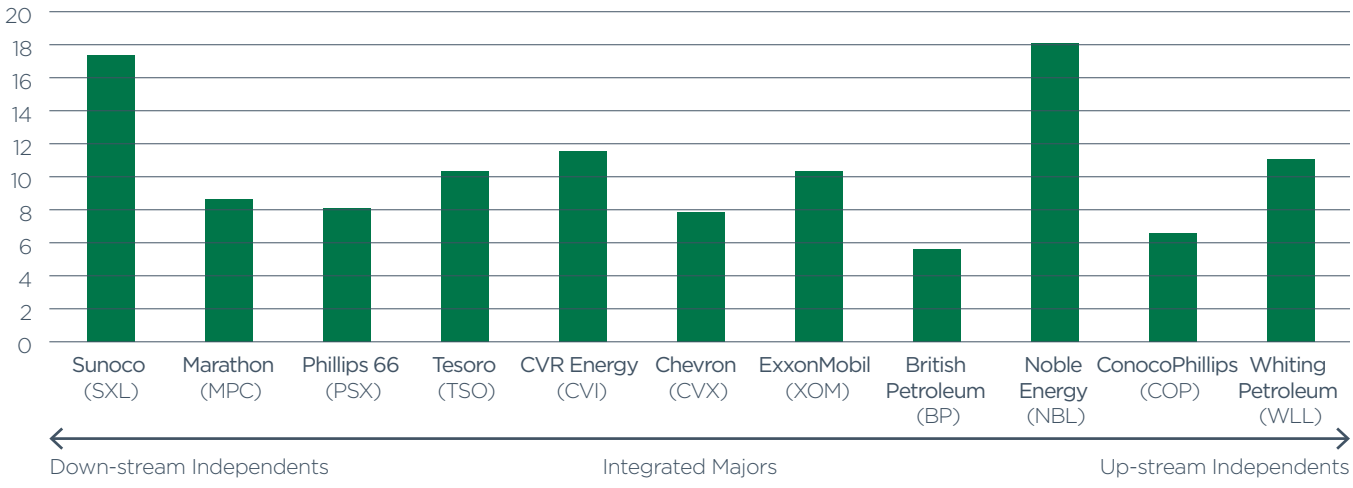
The consensus view on a share's value is the current market price: however, to each investor, the current market price could be higher or lower than it otherwise should be. To an investor who has a view on what the 'correct value' should be, the current price could have two distinct messages:

- A high price could mean:
  - that the share is a good investment, whose price is likely to continue to rise
  - that it is possibly overvalued, or priced higher than its future earnings may support
- A low price could mean:
  - that the company is undervalued, and would make a good investment because, in the future, the market could recognise that it has failed to realise the true value of its operations, and the price would rise accordingly
  - or, that the firm could have serious problems, and a low valuation could be well justified

It is crucial to engage in both top-down and bottom-up analysis

Views on the 'correct valuation' of a share are often contested, and a subject of continuous debate among analysts and investors. The key point for all investors is that it is crucial to engage in both top-down and bottom-up analysis of any given set of stocks, as macro and company-specific factors play a very important role in shaping future market prices.

FIGURE 18: TRAILING P/E RATIOS BASED ON ACTUAL 2011 EARNINGS



Source: Nasdaq.com
Notes: Trailing P/E arrived at by dividing the last sale price by the average EPS estimate of the specified time period. Latest update: 6 Dec. 2012

EXPECTATIONS FOR THE PRICE OF OIL

Over the next decade, many factors will play a key role in shaping the oil industry, and hence the valuations of oil companies. Particularly important will be the price of oil, as determined by the global balance of demand and supply of oil, as well as hydrocarbons more generally.

The long-term drivers are generally understood...

There is a range of expectations for the demand and supply of oil, and the influences are many and complex. The long-term fundamental drivers, however, are generally understood.

Demand: according to the IEA,[46] demand will rise steadily, from 87 mill barrels/day in 2011 to nearly 100 mill barrels/day in 2035. This demand will be driven, in large part, by the transport sector in developing countries – China alone is expected to generate half of the net increase in global consumption. In OECD countries, by contrast, demand in already-well-saturated markets is expected to fall, due to increased energy efficiency, and substitution.

Supply: this is expected to rise, as a result of exploration and production from more unconventional/cost-intensive sources. Production from OPEC and non-OPEC regions is expected to rise from 84 mill barrels/day in 2011 to 97 mill barrels/day in 2035. The increase will come largely from natural gas liquids, and unconventional oil resources.[47]

...but uncertainty leads to a range of price expectations

While the general direction of change in demand and supply is understood, the timing and extent of the changes are less well understood. Such uncertainty leads to a range of expectations for the price of oil, as figures 19 and 20 illustrate.

There are two main schools of thought on the energy market, and price projections: the Geological, 'peak-oil' school; and the Economic, 'technology-driven' school. They are conceptually quite distinct, and have divergent views on supply, demand, and the consequential price implications.

The Geological school sees ever rising prices

The Geological, 'peak-oil' school argues that supply is heavily constrained, and that rising demand will lead to higher prices, and the eventual depletion of oil resources. The essence of the argument, at least in its extreme form, runs as follows:

- Supply: oil field locations and reserve quantities are known, and are taken essentially as an engineering given i.e. supply will not rise significantly, even if prices rise
- Demand: energy demand increases more or less in proportion to economic growth
- Price implications: the price of oil in real terms will rise over time, perhaps to $200 per barrel
- Proponents: the view was strongly in evidence as far back as 1885, and resurged in the 1970s. Echoes remain to this day, particularly with engineers and geologists

FIGURE 19:
SHORT-TERM OIL-PRICE FORECAST, 2015

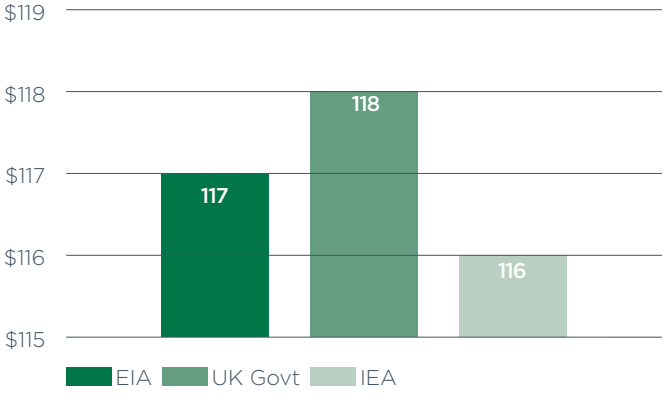
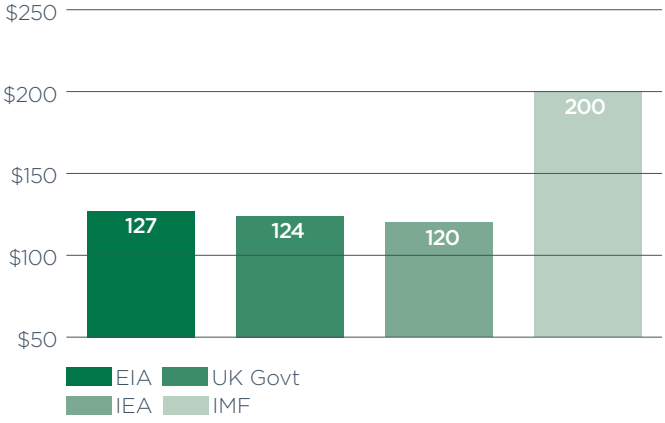


FIGURE 20:
MEDIUM-TERM OIL-PRICE FORECAST, 2020



Sources: EIA, UK Government, IEA, IMF
Notes: Oil price quoted in US$/barrel (real terms)

The Economic school tends towards a (relatively) lower price

The Economic, 'technology-driven', school is more optimistic, particularly about supply potential. High prices are viewed as motivating significant advances in technology:

- Supply: economic signals generate responses – supply tends to rise, albeit with a considerable lag, when prices rise. Furthermore, the rising prices induce substitutes. Both responses raise total supply potential
- Demand: energy demand reduces when prices rise substantially i.e. energy efficiency/ conservation increases materially
- Price implications: the price of oil in real terms will fall over time, perhaps to significantly below $100 per barrel
- Proponents: this view is held by many, including the IEA and the EIA

Neither takes the other's key proposition properly into account

There are weaknesses to both schools, to the extent that neither takes the other's key propositions sufficiently into account. The Geological school, at least in its extreme form, does not appreciate the powerful impact that high prices have on supply and demand, i.e. it assumes that supply is given, rather than given at the prevailing market price. The Economic school, in its extreme form, perhaps pays less attention than it should both to specific information about oil, and general market mechanisms of the industry.

In practice, the outcome is likely to contain elements of both schools – in the limit, supplies are finite; but price does exert an effect on both demand and supply, driving the development of new technologies and substitutes. For example, it could scarcely have been envisaged ten years ago that a close substitute, shale oil and gas, would transform the US energy scene.

A reconciliation of the Geological and Economic schools

At any given moment, the reserves of each oil type can be taken essentially as given. To meet higher levels of demand, new supply must come from increasingly expensive sources, with incremental oil production effectively moving up the cost curve. (See figure 21.)

This is the phenomenon that supports the general expectation that rising aggregate demand over time will, in and of itself, lead to progressively higher prices. Longer term, however, high prices can be expected to affect supply by driving advances in technology and the use of substitutes – it in effect moves the supply curve outwards. (See figure 23.)

Price forecasts reflect judgements on future supply and demand. Analysts take expectations of market fundamentals, notably world supply and demand, form their views, and generate their price projections. Some oil-price projections extend 20 years or more ahead.

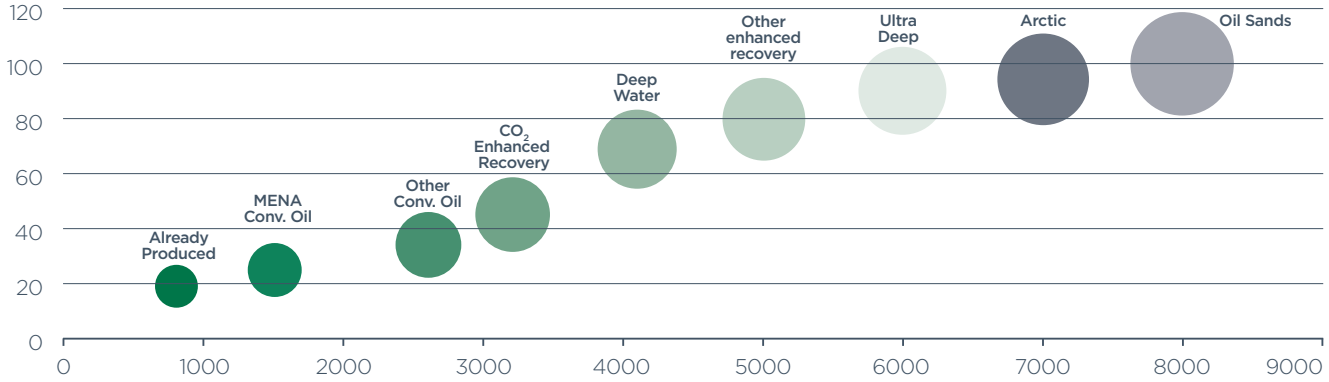
Consensus currently believes prices will continue rising

The market as a whole in turn expresses a 'consensus view' (the aggregation of individual views), through oil price futures; but typically these run only 3 – 5 years ahead. The current consensus for the years ahead is that oil prices will continue to increase. This is based on the twin expectations that:

- Demand will continue to grow strongly, driven by developing economies; and
- Supply will continue to increase, but from progressively more expensive resources

A number of less fundamental influences too may put upward pressure on prices, at least from time to time: including rising investment demand from commodities becoming an

FIGURE 21:
PRODUCTION COST CURVE (US$ PER BARREL vs. BILLIONS OF BARRELS)



Source: BP Statistical Report, IEA, Carnegie Foundation, BAML Global Commodities Research estimates
Notes: This is a stylised graph based on figures from multiple reports

asset class. Such demand has risen over the past decade as commodity investing has become an increasingly popular method for institutional and retail investors to obtain inflation protection and portfolio diversification.

The extent to which the consensus forecast for a higher price turns out to be right will depend on whether both the projections, and judgements made on world demand, supply and the other factors, are correct.

Startling things have been happening to supply, particularly in the US

Historically high prices have driven much innovation

Consistently-high oil prices have had, and continue to have, a profound impact on supply, by increasing the incentive for new technological development. Game-changing advances in technology include enhanced recovery techniques, hydraulic fracturing, and horizontal drilling.

Enhanced recovery techniques have significantly increased the industry's estimates of technically recoverable oil reserves. (As of 2011, proven oil reserve estimates were 1.35 trillion barrels. These estimates represent a rise of one-third since 2000, and are more than double estimates of 1980.)[48]

Hydraulic fracturing and horizontal drilling techniques are now having a profound impact on supply, particularly in the US. Unconventional production by means of hydraulic fracturing and horizontal drilling has grown remarkably over the past decade in the US, particularly in shale gas. US shale gas production has grown from almost nothing in 2000 to more than 10 billion cubic feet per day in 2010 (~1.9 million barrels oil equivalent). Over the next 20 years, shale production may more than quadruple.[49]

Shale oil and gas is transforming the US, and is a potential game-changer

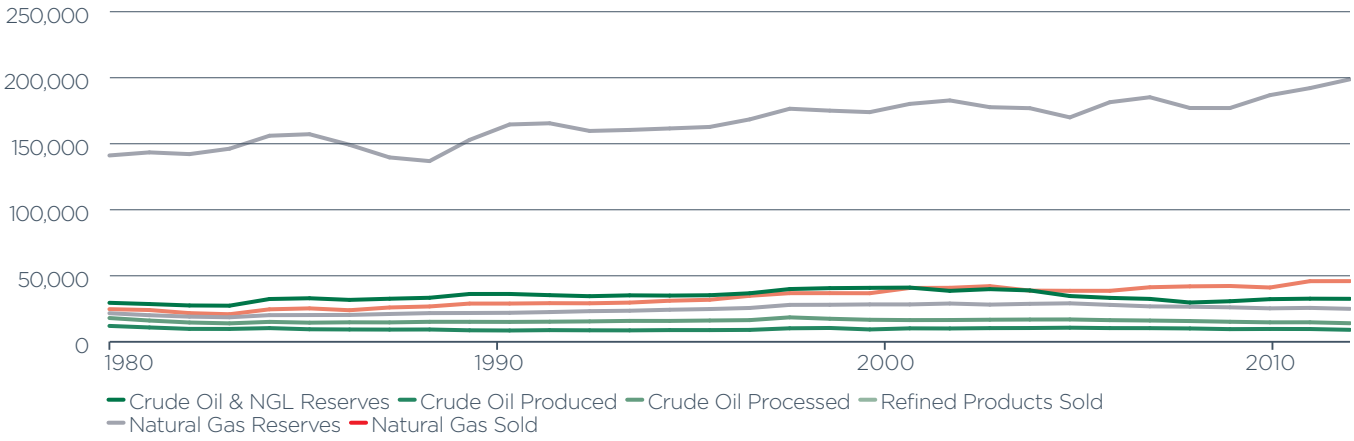
As a leader in the use of newly developed unconventional recovery methods, the US is now the fastest-growing oil producer in the world. In 2011, oil production grew by 285,000 barrels per day, (the third year of increase in a row), and reached its highest level since 1998; US net imports were 29% below their 2005 peak; and the US became, for the first time, a net exporter of refined products.[50]

In the early 1970s, when the US became a much larger net importer of oil, the balance of the world oil market changed dramatically, and the shift of oil flow towards the US put significant strain on global supply. This contributed importantly to the quadrupling of the world price of energy in 1973/74, and the further doubling in 1978/79. If, as expected, the US becomes energy self-sufficient over the coming 20 years, the shift could be equally profound.

Opportunities for unconventional production beyond the US are also considerable. Shale gas deposits around the world are substantial, notably in Russia.[51] Mexico, Argentina, and Colombia too are possible sources of substantial shale deposits.

As new extraction techniques come into use around the world, the geographic diversity of new supply sources is likely to have a large impact on prices in different regions, putting further downward pressure on prices world-wide.

FIGURE 22: PRINCIPAL OPERATIONS OF THE MAJORS (THOUSAND BARRELS/DAY)



Source: OPEC Annual Statistical Bulletin, 2012
Notes: Natural gas reserves are measured in billions of cubic feet at year end

Our considered view is for a below-consensus price ...

Our considered view is for a below-consensus price for oil

We judge that a sub-$100 per barrel price (Brent, in real terms) will eventuate by 2020 as a result of a number of economic and policy-driven factors.

Economic factors: A high oil price of around $100-120/barrel has driven, and will continue to drive, technological innovation, both in finding new reserves, and more efficient extraction. This contrasts sharply with the 1990s, where a price between $20-30/barrel effectively destroyed the incentive for development of new technologies.

There is also much potential to switch to abundant low-cost substitutes, such as natural gas: global reserves held by the majors have risen by more than a third since the early 1990s. (See figure 22.)

Policy measures: To the extent that a carbon price is introduced more widely, this will raise the oil price in the short-term, reducing elastic demand. But in the medium-term it will also induce substitutes i.e. low-carbon alternatives, further lowering the demand for oil. To the extent that subsidies for fossil-fuels – which are important in a number of developing countries, including India – are removed or reduced, this will tend to reduce demand, and lower the oil price.

THE POTENTIAL IMPACT ON VALUATIONS

...this will impact equity valuations of the key players...

What a below-consensus price of oil would mean for the key players

The four key players in the oil industry: NOCs, IOCs, independents, and independent trading houses engage in up-stream and down-stream activities to varying degrees and, as a result, have different risk profiles.

...depending on their risk profiles

Although each company is different, in general:

— NOCs and IOCs are mixed, but are frequently up-stream heavy
— Trading houses are mixed
— Independents operate all along the value chain, some specialising up-stream, some mid-stream, and some down-stream.

With a lower than consensus oil price, up-stream valuations stand to fall relative to down-stream

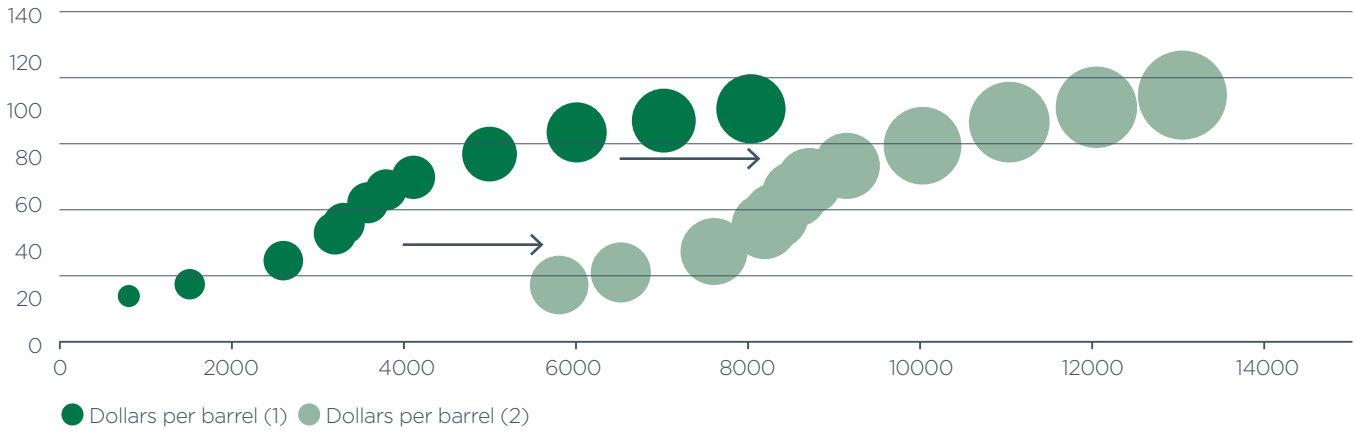
To the extent that, as we judge likely, the world price of oil turns out lower than currently expected (principally because of a shift in the supply curve as a result of technology), valuations of up-stream-oriented companies stand to fall relative to down-stream-oriented companies, for two principal reasons: the price effect, and the income effect.

1. The price effect – a fall in the oil price increases the aggregate (world) demand for oil, and thereby increases traded volume, boosting earnings. It would also reduce the viability of exploration activity that is profitable only when oil prices are high.

   The price effect is likely to be reinforced by the growing geographic diversity of supply. As countries outside of the US adopt new extraction methods, supplies will likely increase in various regions around the world. This will reduce transport costs for mid- and down-stream distributors, and potentially increase margins.

2. The income effect – the world economy picks up from a drop in the oil price, and growing economic activity increases traded volume.

FIGURE 23: SHIFT IN THE PRODUCTION COST CURVE



Source: BP Statistical Report, IEA, Carnegie Foundation, BAML Global Commodities Research estimates
Notes: This is a stylised graph based on figures from multiple reports

SUMMARY

The dominant force of change in the oil industry has been the growing intensity of competition between a greater pool of players.

Following the industry's development in the mid-1800s, it came to be dominated by an international oligopoly. But by the 1960s, fundamental factors, including rising globalisation, transformed the industry by enabling new players with unique competitive advantages to participate.

Today, four key groups dominate the industry: National Oil Companies (NOCs), International Oil Companies (IOCs), independents, and independent oil trading houses.

NOCs and IOCs have retained their places as market leaders, while traders and independents compete intensely all along the value chain. NOCs remain powerful because of their large resource base, and enhanced efforts to boost production. Many of the historically-dominant IOCs still rank among the top ten oil companies, but they are feeling ever-increasing pressure from NOCs and independents, especially in the search for new reserves. Meanwhile, a diverse group of independents remain highly competitive with all players in the industry (exploiting their own individual competitive advantages); and independent trading houses are growing significantly in size and scope.

Competition in the oil industry today is particularly intense. In response, the key players are operating quite distinct strategies.

The dominant NOCs are progressively building up their reserves, and developing their up-stream capabilities. The IOCs are decentralising in an effort to become less unwieldy. They are edging away from the integrated model – many focussing more on what they have defined as their 'core up-stream activities', selling down-stream assets in saturated Western markets, and increasing funding of exploration and production activity. Independents continue to compete by specialising, and by being nimble and flexible. The trading houses are growing in size and scope, building their asset base in under-served, fast-growing markets, and becoming more vertically integrated by investing in up-stream assets. To fund up-stream and down-stream acquisitions, ownership structures are being transformed, with some opening themselves to outside investors from debt and equity markets, sovereign wealth funds, and national oil companies.

There will likely remain a relatively stable set of NOCs, IOCs, independents and independent trading houses. Competition may intensify further, but perhaps not significantly: the barriers to entry are high, and the possibility for new entrants is limited.

Producing nations and the NOCs are likely to retain their market power. IOCs stand to remain influential, given their existing strong position in the industry, both up-stream and down-stream. Independents and smaller integrated competitors will likely maintain their share by being more nimble than the majors in a range of activities along the value chain. Oil trading houses will likely continue investing in up-stream and down-stream assets; and those with access to capital will be in a position to continue to invest more heavily.

Determinants of success in the coming years for both IOCs and trading houses (the market players which are making the most notable shifts in strategy) will depend on their access to finance, their ability to remain flexible, and their readiness to continue adapting to changing market conditions.

One key influence on how all market players fare in the years ahead will be the price of oil. The consensus view is that oil prices will continue rising, however, our judgement is that this will likely prove wrong; and this could be significant for oil companies and their equity valuations. An unexpectedly low oil price could have significant and distinct consequences for up-stream and down-stream focused oil companies.

END NOTES

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3 The first modern oil well was drilled in Asia, north-east of Baku, by Russian engineer F.N. Semyenov in 1848.
4 Attributed to Canadian geologist Dr. Abraham Gesner in 1849.
5 Note: 'Spot': the contract had to be settled immediately. 'Regular': the contract needed to be settled within ten days. 'Futures': established the quantity and price of a future sale that would need to be executed by a set date in the future.
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8 In 1891. Source: Yergin. (1991) p.79.
9 Note: Union Oil was the only major American Corporation outside of Standard Oil to have maintained a continuous independent existence since 1890 as a major integrated oil company.
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50 BP Statistical Review. (2012). p.3.
51 Shale resources are believed to be particularly large in Western Siberia. See: IEA, WEO. (2012).

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