Oil Market Outlook

April 2013

Editorial

The price of commodities affects a wide variety of industries, from manufacturers to retailers, and can have a huge impact on company earnings, margin and thus profit. It is with this in mind that late last year Atradius Economic Research began a project designed to explain to those many businesses for which this is a critical issue how commodity prices are established and what factors affect them. Our first focus, and the subject of this report, is on oil.

Atradius' knowledge of the oil industry is extensive: our analysis and risk assessment of countries of oil producing countries and of the oil market in general is crucial to our broader task of risk management and supporting our customers in their credit management. We aim, through our series on commodities, beginning with oil, to share our knowledge and thus provide the reader with a guide to that market and the direction in which it is heading.

As well as drawing on our own resources, we have been assisted in our venture to capture the essentials of the oil market from an almost insurmountable quantity of research. In particular, we have been helped by preliminary discussions with colleagues from ABN AMRO, ING, Jan Hein Jesse and the International Energy agency (IEA), to whom we are most grateful. Coby van der Linden, director of the Clingendael International Energy Program and Professor of Geopolitics and Energy at the University of Groningen, helped us to better understand the market and provided invaluable comments on the draft report. Henk Jager, emeritus Professor of International Economics of the University of Amsterdam, gave us useful advice and patiently reviewed and improved the draft report. However, the views presented in this report are our own.

I would like to thank my colleagues Marijn Kastelein and Afke Zeilstra who carried the burden of the backbone of the report: the supply and demand analysis. Daan Willebrands carried out the indispensable task of pre-reading manuscript and providing help to upgrade the text, especially the pricing part, and was also instrumental in the final layout of the report.

John Lorié, Chief Economist Atradius

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Executive summary

In this Atradius Oil Outlook we have broadly set ourselves two tasks. Firstly, we attempt to provide the reader with an analysis of the economic, technical and political factors that dominate the development of the oil market. Secondly, we describe the development of the oil market and provide an outlook, for the period up to 2015 and, further ahead, to 2035. We have done this with the ultimate objective of equipping the reader with the essentials to understand and perhaps interpret developments in the oil market.

We would like our readers to take away from this report a number of salient points - five in particular:

1: The main development - if not revolution - in the oil market has been on the supply side. The historically high oil price over the past decade has allowed investments in production outlays that were previously not economical. Helped by technological developments, North American oil production in particular has expanded from tar sands and light tight oil. This has pushed up marginal costs of production in the industry but also helped boost oil production in the OECD countries and across the world. We are seeing that development continue, albeit gradually, and it is difficult to predict whether oil production has peaked or will peak anytime soon.

2: The rise of the emerging economies has spurred demand for oil. Whereas in the OECD countries energy efficiency is the buzzword and consumption is sliding, the reverse holds true for the emerging markets. Heavy investments in industrial outlays and infrastructure have pushed up demand, driven by what is now the second largets economy in the world: China. That trend is likely to continue, although the growth in oil consumption will switch source as passenger transport starts to play a prominent role in that economy. Moreover, as Chinese demand moderates over time as its population ages, India, with its vast population and potential for economic growth, is likely to increase its demand. Growth in demand is therefore set to continue in the coming decades.

3: Confronting long term supply and demand developments leads to a structural supply deficit. To make up for this, the oil price will have to rise to a level of around $130, in today's money, by 2035. That gradual rise is subject to significant fluctuations along the way, which are hard - if not impossible - to predict. They will be prey predominantly to swings in the global business cycle and political events such as wars and sanctions triggering supply disruptions. The role of Saudi Arabia in containing these swings may perhaps erode somewhat but will remain critical.

4: As the $130 oil price is an estimate for the longer term, tentative boundaries need to be set as to where the longer term oil price may end up. We consider that, given the growth prospects in the emerging markets and the increasing costs of additional production, oil prices are unlikely in the long term to end up below $80, again in today's money. At the same time, energy savings and a threatened production boost at a high oil price level will probably keep long-term prices below $150.

5: We have considered whether financial factors - speculation, the exchange rate and monetary policy - play a role in oil price determination. We find that they do, but not in the manner commonly assumed. Indeed, there is scant empirical evidence of these factors having significant *direct* impact on the oil price. However, exchange rate and monetary policy do have an impact on the economy as a whole and therefore ultimately affect the oil price.

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Part 1 - Introduction

Few markets attract more attention, are more important for the world economy and are less understood than the oil market. While armies of analysts and journalists (and economists, for that matter) try to get to grips with, and report on, the market on a daily basis, the fundamentals that underlie the movement in prices are sometimes difficult to grasp. In a period of a few months during the Lehman crisis year of 2008, how could the oil price move from $92 per barrel in February to $133 in July – and then end up at $40 in December? Currently the oil price hovers around $110: historically quite high. Underlying these movements, an array of financial, economic, technical and political forces is at work. Understanding them is important if we are to develop a view on where the oil market, and ultimately the oil price, is heading.

1.1 Motivation and research questions

In this report we make our bid to identify these forces and describe their development and impact on the oil market so that we can arrive at an outlook. This differs from reports provided on a regular basis by, for example, the International Energy Agency (IEA), the Organisation of the Petroleum Exporting Countries (OPEC) and the International Monetary fund (IMF), in the sense that we attempt to capture, in a relatively brief report, the major issues in the oil market and to peer into its future: for the short term up to 2015 and further, to 2035. Our perspective is broad in the sense that we indeed describe and analyse financial, economic, technical and political issues. In this way we hope to provide the reader with a broad view on the market and thus be better able to understand and perhaps interpret the regular news bulletins on the market.

1.2 Approach

Our approach is simple. We describe supply, demand and the result thereof - the price - in the following three sections, each of which focuses on one of these subjects: detailing the forces, development and outlook, in turn, of supply, demand and price. As mentioned, our approach remains holistic throughout the report, although the reader will undoubtedly recognise 'the economist' when reading between the lines.

1.3 Reading guide

We start, in Part 2, with Supply. That is perhaps unusual, but we think it is justified by the fact that the major developments over the past couple of years have taken place on the supply side, spurred by the high oil price. In particular, the production of oil from North American fields, where new technologies are used to produce shale and light tight oil and oil from tar sand, is no less than a revolutionary development - with a huge impact on the market, as we will see later in this report. We discuss three views on how production will develop and highlight the importance of political factors, especially for the shorter term.

In Part 3, on Demand, the role of the emerging markets, and more specifically China, is highlighted, in terms of both the past growth in demand and future developments. Underlying forces described in more detail are economic growth and geographical developments, as well as the level of the oil price. The latter triggers oil efficiency measures that play a role in the outlook for the longer term.

Part 4 in essence confronts supply and demand by considering the major metric in the oil market: Price. Longer term factors as described in the previous parts determine the (gradually upward sloping) longer-term price, which is now also arguably influenced by the relatively high production costs in the new North American oil fields. For the shorter term, financial factors such as speculation, exchange rate movements and monetary policy are candidate drivers, and we will investigate these in more detail. These are often perceived as having limited direct importance but that does not hold for political events, particularly in the Middle East, and the swings in the global business cycle. Volatility in the oil price is therefore a major characteristic and that has arguably hardly changed over time.

Given the size of the report - and perhaps the limited time some readers may have - we consider it our task to provide some reading guidelines. As the report is in essence an outlook, you should at least turn to those sections that focus on outlook, both short and longer term: sections 2.4, 3.4, 4.2 and 4.3. For a deeper understanding of the underlying factors, read section 2.2 on the future production and section 3.1 on the emerging markets. Having said that, we clearly hope this encourages you to read the rest of the report as well.

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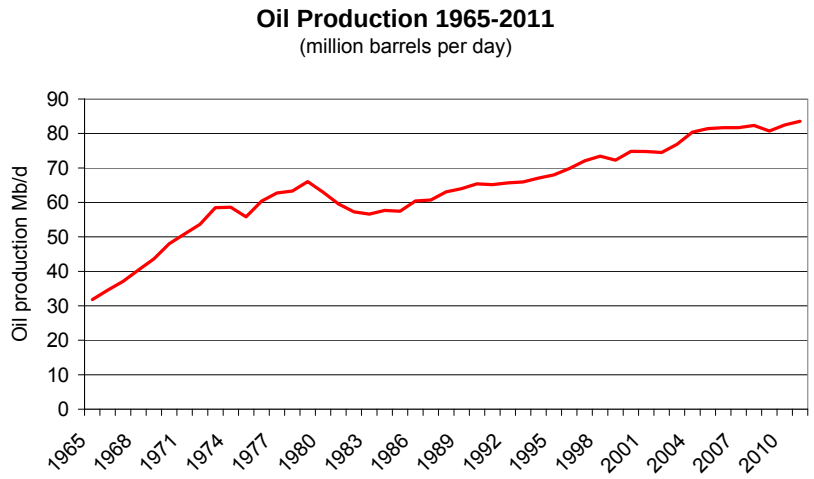
Part 2 - Supply

2.1 Background

In theory, oil is a widely available resource that could fulfil global energy needs for many decades to come. Before commercial exploitation began, total global conventional oil reserves were about eight to ten trillion barrels, according to the US Geological Survey. Of this 'original oil in place' only one trillion has so far been produced since oil production started in the second half of the 19th century. Approximately six trillion barrels of the remaining oil in place are classified as ultimately technically recoverable. The rest is simply too difficult to extract, given the current state of technology.

Figure 2.1



Source: BP Statistics (2011)

Figure 2.1 shows the annual average of global daily oil production over the past decades. Global oil production has steadily increased since 1965. Except for the 1980s, there has been no period of multi-year decline in production. This seemingly smooth growth of output hides the fact that production is highly uncertain, because of technological, economic and geopolitical constraints that may prevent the oil from being explored. Technical costs of oil exploration in newly discovered fields may also be high. Future oil supply is therefore subject to a significant degree of uncertainty.

The total oil production (which includes natural gas liquids like ethane, propane, butane and pentane) is currently about 87 million barrels per day (Mb/d). The most important oil producing region is the Middle East: with almost 33% of global production. Saudi Arabia (13.2%), Iran (5.2%), Kuwait and Iraq (3.5% and 3.4% respectively) are the most important producers. Eastern Europe is the second most important region (approximately 16% of global production) with Russia by far the most important producer. The third region is North America, with the US, Canada and Mexico respectively producing 8.8%, 4.3% and 3.6% of global supply. North America produces mainly for its home market, while the Middle East and Russia are also large exporters to European and Asian consumer countries. West Africa (Nigeria, Angola) is a relatively small oil producer but, since it exports the bulk of its crude, it is still a significant player in the international oil market.

This chapter attempts to explain the factors that drive the oil supply and provides projections of future oil production under various scenarios. We can distinguish between two types of factors that influence oil production: those that lie beneath the surface (the presence of oil and the technical possibilities to exploit them) and those that lie above the surface (mainly the political decisions regarding oil exploration and geopolitical risks to production).

In the case of the presence and ability to extract oil, three different 'schools of thought' are presented and discussed. These are;

- The 'main stream': the International Energy Agency (IEA) which, according to its base scenario, assumes that global oil supply will keep up with oil demand. The IEA projections do not deviate much from those made by OPEC.
- The 'peak oil advocates', who presume that global oil supply has peaked and that we will see a structural supply shortage in the near future.
- The 'oil glut advocates', of whom Harvard fellow Leonardo Maugeri is the main adherent, and who believe that we may see an excess supply of oil in the near future.

Other issues discussed in this chapter are the role of OPEC and the impact of geopolitical events, the latter of which does indeed play a role in short-term supply.

2.2 Beneath the surface: Technical factors

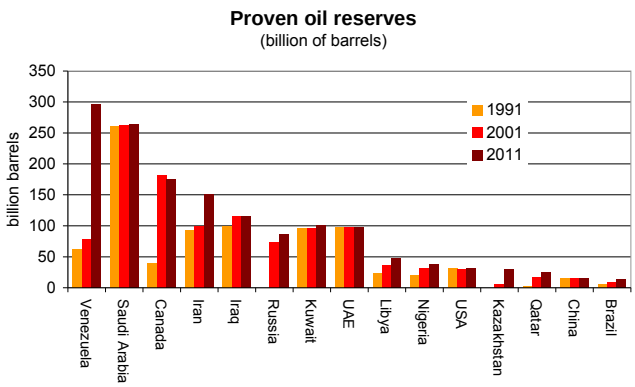
2.2.1 Supply increase

Developments that increase the (potential) oil supply are reserve growth, the discovery of new oil fields and the exploration of unconventional oil reserves. On the other hand, the decline rate reduces the (potential) oil supply.

To understand how these factors change over time we need to see how they are constructed. There is a distinction between the amount of oil in the ground and what can actually be extracted using today's technology. The oil that can be extracted is called *proven reserve* and is generally seen as the most important figure in estimating potential supply.

An important phenomenon in the oil industry is *reserve growth*. Reserve growth is the upward adjustment of existing oil fields due to extension, revision, improved recovery rates (see below) and the addition of new reservoirs to existing wells. Figure 2.2 shows the evolution of proven oil reserves in a number of countries. Reserve growth is an important contributor to the observed increases.

Figure 2.2



Source: BP Statistics (2011)

The ratio of extractable versus total oil in a specific oil field is the *recovery rate*. The current worldwide average recovery rate is only 35% and differs significantly by country and by oil well. Recovery rates are high (approximately 45%) in Western countries (USA, Canada, Norway, UK) and low (around 20%) in less developed countries (Russia, Iran, Venezuela, Kuwait). The reasons for these large disparities are the presence of international oil companies versus the monopoly of national oil companies (and thus the degree of competition and the efficiency of the operations), the state of technology and reservoir management.

The future production of a particular oil field is thus a function of the depletion, on the one hand, and reserve growth on the other. On balance, the reserve growth has historically been the stronger of the two. Because of reserve growth, global proven reserves have been growing steadily, even without any new oil discoveries. However, there are exceptions: Norway, the UK, Mexico and Iran all experience net loss of production. Global proven oil reserves have increased by approximately 30% since 2000. More than 70% of this increase has come from improving recovery rates and the remainder from new discoveries. The discovery of new conventional oil wells, the second important driver of production growth, will be concentrated in Iraq and, in the long term, possibly in the Arctic.

The last source of supply increase is the so-called *non-conventional oil*. Conventional oil is defined as 'produced by a well drilled into geological formation in which the reservoir and fluid characteristics permit the oil and natural gas to readily flow to the wellbore'. Unconventional oil, by contrast, is oil captured by geological formations with very low porosity and permeability or oil of very high density that prevents conventional production, transportation and refining methods.

Fundamental oil supply increase (except for reserve growth) often implies massive new investment and is therefore almost by definition a medium to long-term affair.

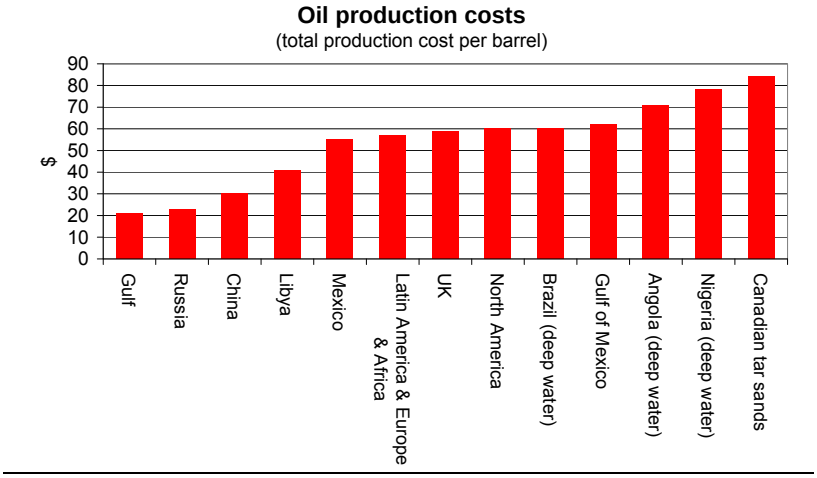
2.2.2 Production cost

Production costs have shown a steadily increasing trend over past decades. Since oil producers have tended to exploit the most convenient oil sources, the first - the so called 'cheap oil' - has become increasingly rare. However we have to stress that other considerations have also played an important role in investment decisions: accessibility, the security situation, and the investment climate. Therefore, in practice, we have seen many examples of 'expensive oil' being explored earlier than 'cheap oil'.

The old gigantic fields that were discovered in the 1930s, 1940 and 1950s (Persian Gulf, Mexico, Venezuela and Russia) have on average very low production costs. A barrel of the cheapest Saudi crude oil is produced at a marginal cost of only $1-$2 and a total cost of $4-$6 per barrel when investment cost is included. Production costs in the Gulf are nevertheless rising, resulting in an average price of $20 for the Gulf producers. Currently marginal production cost per barrel varies between $6 (Central & South America) and $13 (USA & Canada).

Obviously, the price of oil will never fall below the marginal cost of production plus the transport costs in the short term. In the long term, the average cost per barrel is the relevant benchmark. This cost varies between $26 (Central & South America) and $52 (US offshore) per barrel. The production cost of unconventional oil is even higher: oil from deep water fields costs between $60 and $80 per barrel while oil from Canadian tar sands is only economically feasible with an oil price of $70 to $90 per barrel.

Figure 2.3



Source: Atradius Economic Research

The investment in new oil exploration and new technology correlates with the oil price. Investment in the oil industry tends to be a long-term affair (8-12 years), which means that supply tends to be unsynchronized with demand. In addition, investments in the industry are very difficult to stop. A particular additional problem for the international oil companies is that they have commitments to make pre-specified investments with the owner countries of the reserves. Failure to comply can result in heavy fines or even revocation of the granted concessions. Finally, there is continuous pressure on international oil companies (amongst others, from their shareholders) to keep their oil reserves at the same or even higher level, forcing them to invest in reserve growth or the discovery of new fields, even when demand for oil is falling.

The importance of national oil companies (NOCs) (like Saudi Aramaco, Petrobras, Gazprom) should not be underestimated. Nowadays, NOCs control around 75% of global oil reserves. Since these NOCs are state controlled, their investment decisions may be driven by political argument rather than business logic. This may further contribute to unsynchronized oil supply.

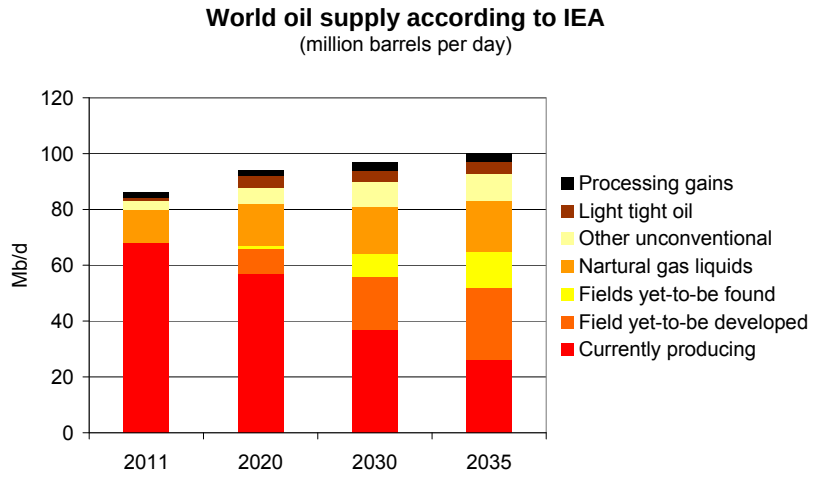
The IEA has listed the investment projects up to 2035. The total amount expected to be invested in upstream oil exploitation is $8.9 trillion. About $3 trillion will take place in the OECD: mainly in North America. The rest is projected to be invested in the developing world, of which Latin America ($1.6 trillion), Africa ($1.6 trillion) and Eastern Europe/Central Asia ($1.1 trillion) are the most important regions.

2.2.3 Three views on future production

IEA New Policies Scenario

The projection for future oil production depends on a number of assumptions and is therefore subject to a degree of uncertainty. We take the IEA New Policies scenario as our base scenario. The New Policies scenario assumes that broad policy commitments about energy-related challenges that have been announced will be implemented. This concerns energy consumption policies, not policies about the upstream petroleum industry. The IEA assumes that global oil production will be able to keep up with demand. Figure 2.4 shows the sources from which future oil supply is expected to come. In the long term, the fields yet to be developed or found play an important role. Not surprisingly, the amount of oil from these categories is subject to a significant degree of uncertainty.

Figure 2.4



Source: IEA (2012)

The IEA states that the net increase in oil production will rise from 87 Mb/d currently to 97 Mb/d in 2035. The net growth comes entirely from natural gas liquids and unconventional sources. The IEA and most other analysts agree on the most promising countries for future production growth: Iraq, US, Canada and Brazil.

In summary, this is the main development in these four markets:

Firstly, Iraq is considered the major source of additional oil during the coming two decades. Iraq is currently producing 2.5 Mb/d and intends to increase production to 10.4 Mb/d in 2020. Due to the Gulf wars, the international isolation of Saddam Hussein's regime and the subsequent political instability, the oil sector has long been neglected. Oil exploration in Iraq is supposed to be dominated by the international oil companies. However, progress has been slow due to sluggish government bureaucracy, government reluctance in the promised reimbursement of costs and the features of the contracts between the Iraqi government and the oil companies which pay financial fees rather than a share of the physical oil production. Moreover, the transport infrastructure remains poor and the security situation unpredictable.

NOCs are also significantly involved in Iraqi oil exploration. Although they may be less sensitive to security and governance obstacles, they may also lack the technology for efficient exploration.

All this means that additional oil may be significantly lower than envisaged by the Iraqi authorities. Maugeri (2012) estimates that additional production will be only half the potential amount, i.e. 5.1 Mb/d, bringing total production to 7.6 Mb/d in 2020. The IEA regards this as still optimistic: forecasting only 6.1 Mb/d.

Secondly, the US is expected to become the world's largest producer of shale and light tight oil. Total American oil supply is expected to increase by 2 Mb/d to total production of 11.1 Mb/d in 2020. Thereafter oil production will level off. The presence of oil shales in sparsely populated areas is one of the reasons that the shale oil revolution took place in the US. There are other reasons too. In the US, the landowner is also entitled to exploit the possible natural resources beneath the surface, whereas in

most countries everything beneath the surface belongs to the state. Moreover, the US has thousands of small independent oil companies, which act as pioneers, investing in high risk, high reward projects like shale and tight oil. Finally, the US has sufficient drilling rigs and well trained labour at its disposal. Except for Canada, many of these conditions are absent in other oil producing countries.

Thirdly, Canada is likely to increase its production due to the exploration of tar sands, with the additional oil likely to be exported to the US. However, it may encounter environmental concerns. The construction of pipelines has met with strong opposition from environmental organisations. Another concern is that extraction of tar sand oil is more carbon-intensive than that of light oil. Although the developments of unconventional oil will greatly improve the energy situation for North America, it is uncertain whether North America will become completely self sufficient in oil. Current oil consumption is 21 Mb/d and the US and Canadian oil production combined is not estimated to exceed 18 Mb/d. In any case, geopolitical relations may shift quite dramatically.

Finally, Brazil is the fourth most promising country with regard to future oil production growth. Brazil's future oil production will come largely from deep water fields. The Lula oil field, offshore from Rio de Janeiro State, is one of the largest oil discoveries of recent decades. The field is located at a so-called pre-salt reservoir, below 2 km of water and 5 km of salt, sand and rocks. Because of its difficult location, production costs are expected to be high and uncertain.

According to the IEA, the output of natural gas liquids is expected to grow markedly due to increased production of natural gas in the Middle East and North America and the reduction of flaring in Russia (Russia currently flares around one third of the gas extracted from its oilfields). A last significant source of growth is the extra heavy oil from Venezuela.

What follows are two differing scenarios for the evolution of future oil production: the peak oil theory and the oil glut prediction.

Peak oil

The peak oil hypothesis is based on the observation that annual oil production in any oil field first increases, then peaks at a certain moment and then gradually decreases. The American geologist Marion King Hubbert developed his peak oil theory in the 1950s. According to his theory, oil production follows a symmetric logistic distribution function. Hubbert's theory predicted the peak in American oil production quite precisely (around 1970) but failed to predict future annual production accurately. Peak oil adherents extended Hubbert's hypothesis from a particular oil well to total global oil production.

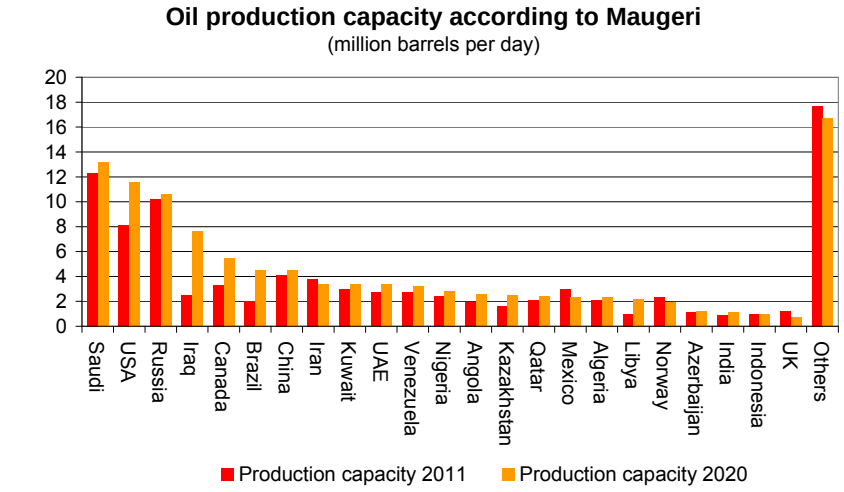
Global oil production per capita already peaked in 1979, since the growth rate of oil production is slower than the population growth rate. According to peak oil adherents, global oil production peaked in 2009 and global oil production could fall to approximately 67 Mb/d in 2020.

Although the peak oil hypothesis is undeniably true in the very long term, the statement that world oil production has peaked or is on the verge of peaking is unlikely to hold true. The main weakness of the peak oil theory is its inability to account for the dynamics in the petroleum industry. As stated earlier, the amount of oil in place is still enormous and, thanks to technological innovation, the recoverable amount is increasing, albeit not always at a regular and predictable pace.

A new oil glut

The Harvard fellow and former top manager at leading energy company ENI, Leonardo Maugeri published a much discussed paper about future oil supply in 2012. He predicts an abundance of oil supply in the period up to 2020. Like most analysts, Maugeri stresses the importance of unconventional oil and reserve growth. He assumes a decline rate of existing oil sources of only 1.5% per annum. He has been widely criticised for this optimistic assumption, since empirically a decline rate of about 4.5% per annum has been observed. Maugeri's calculation result in a possible oversupply of oil (110.6 Mb/d) in 2020. Figure 2.5 shows the production capacity increases by country. Also controversially, Maugeri assumes that production capacity will be fully used and is therefore equal to oil supply.

Figure 2.5



Source: Maugeri (2012)

According to Maugeri, 2015 will be a decisive year for investment in new oil production. If a drop in the oil price were to occur before 2015, the duration of the oil price collapse would probably be short, since investment projects could still be stopped. However, if a correction were to take place after 2015, many of the projects would be 'running trains' and a prolonged period of overproduction could be the result.

Box 1 OPEC

OPEC is the Organisation of Petroleum Exporting Countries, founded in 1960. The current member states are Algeria, Angola, Ecuador, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, UAE and Venezuela. OPEC defends its interests and that of its member states by maximising long-term revenues, preventing the oil price from unnecessary volatility, ensuring an efficient and regular supply to oil consuming countries and ensuring a fair return to investors in the oil industry. OPEC intends to maximise revenues by setting the quantity of supply. A complicating factor is that, in the medium-term, the oil price itself is a factor in global economic growth and therefore global oil demand.

By setting production quotas for all its members, OPEC is to some extent able to control the oil supply. However, it seems that not all members always comply with their quota. Moreover there are differing views on OPEC's strategy, with some member states preferring a reduction in production to push up the price, while others (mainly Saudi Arabia) have a more long-term view, fearing that oil substitution may increase when OPEC is not able or willing to supply sufficient oil.

Saudi Arabia unilaterally decided in 2008 to increase supply. Currently Iraq is not bound to its OPEC quota and can therefore autonomously decide its production volumes.

OPEC can anticipate short-term demand volatility by increasing or decreasing production. Saudi Arabia is particularly important in this respect since it acts as 'swing' producer and is therefore highly influential. The Kingdom's spare capacity is officially 2.5 Mb/d. However, in practice this varies by production level. There are signs that since 2005 Saudi Arabia's excess capacity has been eroded. Although denied by the Saudi authorities, this may be to blame for declining production at the great Ghawar oil field. If this is true, the power of OPEC to manipulate the oil price may be significantly reduced. Iraq is regarded as a possible new swing producer, but the development of its new oil fields is behind schedule. The IEA expects OPEC's total spare capacity to rise to 5.9 Mb/d in 2017.

Currently OPEC possesses almost 72% of proven oil reserves and controls 42% of global production, compared to 47% of production in 1970. Its importance for global oil production has thus decreased only marginally since then. OAPEC, a subset of OPEC which encompasses the Arab member states of OPEC, played the leading role in the first oil crisis (1973).

2.3 Above the surface: Political factors

2.3.1 Geopolitical events

Supply disruptions can be caused by policy decisions and geopolitical events. The most striking example of a geopolitical event influencing the global oil supply was the 1973 decision by OAPEC (see Box 1) to declare a total embargo on oil supplies to the US and a limited boycott to a number of other Western countries as retaliation for their help to Israel. The boycott resulted in a reduction in oil production of 5%. The impact on the oil price was tremendous: it rose from $3 per barrel to $12 per barrel almost immediately. Although the embargo lasted only six months it had a sustained impact on the oil price. In spite of the oil crisis, global oil production increased over the whole year: from 53 Mb/d to 58 Mb/d.

Another profound shock took place in 1979, with the second oil crisis. Again, political developments were the source of a sustained price hike. During 1977 and 1978, there was increasing civil unrest in Iran (at the time, the world's largest oil producer), directed at the chief of state, the Shah of Persia. In November 1978, mass strikes at Iranian oil refineries significantly reduced Iran's petroleum production and a couple of months later the Shah and his family were forced to flee the country. Iranian oil production and exports stalled, resulting in a sharp increase of the oil price: from $14 to $39 per barrel. As in the first oil crisis, annual oil production did not shrink, but increased from 63Mb/d to 66 Mb/d.

In 1980 the infamous Iran-Iraq war broke out: one of the most prolonged military conflicts of the 20th century. Oil production in both Iran and Iraq was severely disrupted and production took a clearly downward trend. Strikingly, the effect on the oil price was not upwards. Instead, the oil price began a six year decline that bottomed at a price of $10 per barrel in 1986. The reason for this lies in the fall in demand as, mindful of the experience of the first oil crisis, energy substitutes were sought, coupled with stagnating Western economies. The subsequent fall in demand led to an oversupply of oil: the so-called oil glut.

More recent, but also much smaller, shocks took place during the First and Second Gulf Wars, when oil supply from Iraq (First and Second) and Kuwait was severely disrupted. However, these shocks were brief as the loss of production could be offset by increased production in Saudi Arabia and by the release of strategic petroleum reserves. Strategic petroleum reserves are held by the US, the EU and other Western countries. They can usually cover one to three months of consumption and can be released in times of oil supply disruption.

2.3.2 Current geopolitical developments

There is still a significant degree of political uncertainty in the most important oil producing regions.

Middle East
Since the Gulf remains one of the largest oil producing regions, the tensions in the Middle East are decisive for the world oil supply. Two conflicts are of particular importance: the tensions between Iran and Israel and those between Sunni and Shia factions of Islam. In this latter conflict, again Iran plays an important role since it is the only state, apart from small Bahrain, with a Shia majority. Saudi Arabia, the leading Sunni majority country, is regarded as its main opponent. In the event of an escalation of either conflict, the possibility of Iran closing off the Persian Gulf would cause serious disruption to exports from the Gulf countries. Saudi Arabia and the UAE have, however, anticipated this risk by investing in logistical infrastructure to allow the transport of oil to the Red Sea.

A major change in global oil flows has taken place since the First Gulf War. Until the 1990s, the US was very dependent on oil imports from the Middle East but, with its increased domestic production and a shift towards Latin-American and African oil, this dependency on oil from the Gulf has diminished markedly: to around 10% of US demand. In turn, the Middle East has become much more reliant on exports to South and East Asia. Europe has also reduced its dependence on the Middle East by shifting towards Russian oil. This indicates a shift in geopolitical relations. The interests of the US in the Gulf have decreased, while at the same time the interests of Asia in the region have increased.

Russia
Russia is currently the world's second largest oil exporter and traditionally sees itself as a great power actively involved in geopolitics. In recent international political issues (e.g. in Libya and Syria) we have noted that Russia can have a different political agenda than the West: with oil deployed as a political instrument, since for many European countries Russia has become the main energy supplier. Neverthess, Russia is also bound to Europe: by far its most important buyer of Russian oil. Since

Russia's economy and government budget have become strongly dependent on oil revenues, the country will be careful not to cut oil supplies as this would damage its reputation as a reliable supplier. What is more, Russia's oil industry is not monopolistic. Several national oil companies are active, and have an interest in maintaining supplies.

West Africa
As mentioned earlier, the West African region is a relatively important oil exporter. However, Nigeria in particular is somewhat unstable. Rebels in the Niger Delta (one of Nigeria's most important oil producing regions) and severe tensions between Moslems and Christians pose a continuous threat to political stability, while disruptions to oil flows are a frequent occurrence.

2.3.3 Energy related policies

Most energy policies in Western countries deal with the trade-off between energy security on one hand and environmental concerns on the other. In oil producing countries, oil policies have to deal with corruption, administrative capacity problems and vested interests. The energy policies that most significantly influence future oil supply concern opposition to hydraulic fracturing, the development of new oil wells and pipelines, especially in environmentally vulnerable areas and the willingness of governments of developing oil producing countries to let international oil companies operate there and to grant them profitable concessions and conditions.

The exploitation of light tight oil demands alternative technologies: horizontal drilling and hydraulic fracturing. The latter technique in particular is controversial since it requires considerable volumes of water and chemicals to be injected into the soil by a large number of heavy and noisy pumping trucks. Oil transport from Canadian tar sands is impeded by environmental concerns. The Obama administration has, for example, postponed the construction of the Keystone XL pipeline to the Texas Gulf Coast. Moreover, the carbon footprint of tar sands is significantly higher than that of light oil, which further hampers its future. The EU's clean fuel directive prevents Canadian tar sands oil from being exported to Europe.

Policy making in the developing oil producing countries is also an issue. In particular, the case of Iraq is important since this is regarded as the most promising source of production increase in the medium term. As hinted at earlier, the reliability and competence of the authorities in oil related issues is often disappointing. This may result in substantial downward risk to future oil production.

2.4 Supply outlook

Long term outlook 2035

The outlook for future oil supply depends on the horizon and on a number of assumptions about reserve growth, production decline rate, new recoveries and political opposition to unconventional oil exploration in the US, Canada and Brazil, and new conventional oil exploration in Iraq.

A relatively accommodating environmental policy will permit unconventional oil to add significantly to future supply. Iraq is likely to remain an uncertain contributor of oil supply growth.
The following table shows the IEA projections according to their New Policies scenario.

Table 2.1 Supply projections (Mb/d)

	2011	2020	2035
Crude oil	68.5	66.9	65.4
Natural gas liquids	12.0	15.2	18.2
Unconventional oil	3.9	9.7	13.2
Total	84.5	91.8	96.8

Source: IEA (2012)

IEA and OPEC make oil supply projections that are quite similar and show a moderate increase, due mainly to increased production of unconventional oil and increased conventional oil in Iraq. Their base assumption is that oil supply will be able to hold up with demand. Alternative scenarios come mainly from less conventional organisations or analysts and depend on questionable assumptions.

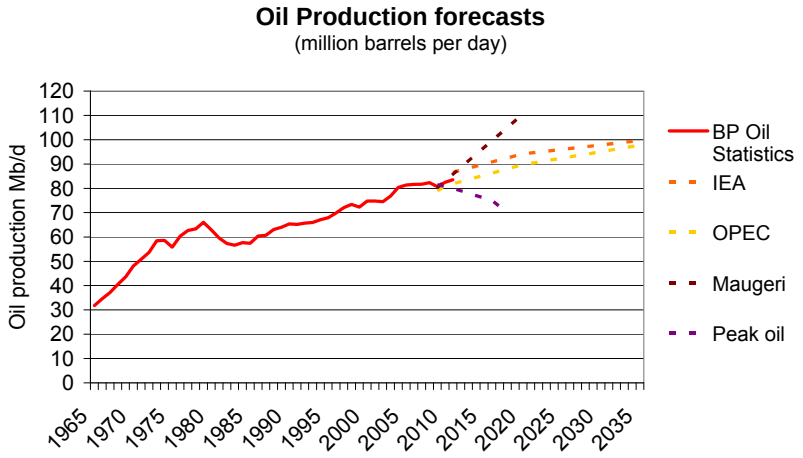
Two contradictory scenarios come from the peak oil analysts on the one hand and oil glut advocates on the other.

The peak oil analysts predicted a continuously falling production volume beginning around 2010. This has turned out to be incorrect and, while peak oil theory may be right on field level, it is not on global oil production.

At the other end of the spectrum, Maugeri has predicted a moderate oil glut starting after 2015. However, his assumptions were widely criticised, with those criticisms focused mainly on his very optimistic assumptions about reserve growth and thus about the decline rate of oil fields.

The moderate outlook of the IEA's New Policies scenario seems the most plausible and therefore forms the basis for the rest of this report. It should nevertheless be realised that deviations from the projections are highly possible because of the uncertainties surrounding the set of assumptions on which these projections are made.

Figure 2.6



Source: IEA (2012), BP (2011), OPEC, Maugeri (2012)

Short term outlook 2015

The risks to the short-term outlook lie largely in causes ‘above the surface’. In particular, geopolitical events pose a risk to oil supply, which are likely to have a downward effect on production volumes. Oil supply disruption may to certain extent (say, 2.5 Mb/d) be offset by increased production from swing producer Saudi Arabia. However, when the cause of the disruption is located in the Gulf, this offers little comfort. A severe conflict in the Middle East is therefore certain to cause a dramatic fall in the global oil supply. Nevertheless, the effect of a possible closure of the Persian Gulf is mitigated by infrastructural investment by the Gulf states. Political developments in other oil producing regions (e.g. West Africa) may also affect the oil supply, albeit to a lesser extent, since their contribution to global oil supply is much smaller.

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Part 3 - Demand

3.1 Background

In the past, the price of oil has risen sharply, with increasing oil demand one of the two contributors. In this chapter we will show that emerging markets were mainly responsible for this rising demand. Furthermore, we will highlight the major developments in oil consumption: asking what these developments are, who the major consumers are and what determines demand for oil. And, despite increases in renewable energy, gas production, etc., oil is still the largest energy source, accounting for around 33% of total energy demand, followed by coal (28%) and natural gas (23%).

Several factors influence the demand for oil, but for this research we will focus on the main determinants that have an impact on future demand. The most important factors are economic growth, population growth and the price of oil. We can distinguish between factors which have an immediate impact on oil consumption and factors that take some time to have an impact. For instance, in the short term, the business cycle has the most effect on oil demand but, in the longer term, it is population growth and the income trend that will determine consumption. Other, mainly long-term, influential factors are consumer behaviour, market saturation (especially in vehicles), technology and government regulation, the consequences of which are already visible in OECD markets. As each of these merits its own research paper, we will not go into detail here. Nevertheless, they constitute an important factor for the longer term. The outlook for demand is based on the projections of the IEA following its New Policies scenario[1] in which government measures, either taken or announced, are included.

Oil is used throughout the economy. We will have a close look on a sector level to see what oil is used for. In the section about demand on a sector level we will see that transport is the most oil-intensive user and that it is quite difficult to change this, not just in the short term but also in the longer term: this sector is a major determinant of longer-term demand. We will end this chapter with our longer-term demand projections.

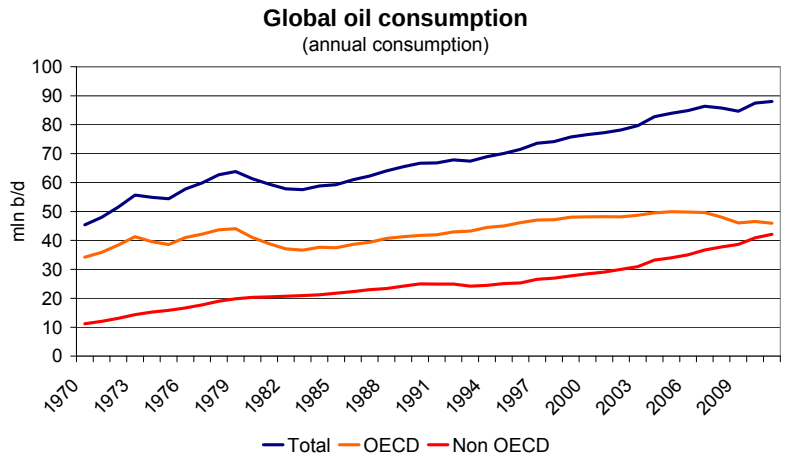
3.2 The rise of emerging markets

In 2011, world oil demand was 88 million barrels per day (Mb/d). Demand from the OECD markets was 45.9 Mb/d and from non-OECD markets 42.1 Mb/d. The regional distribution of demand has changed dramatically over the years and, while the OECD countries dominated total demand in 1970 - with a 75% share - by 2011 this had declined to 52.2%.

It can be seen from Figure 3.1 that consumption in OECD markets in particular was hit during and after both the first and second oil crises of 1973 and 1979. Not until 1994 did the level of OECD consumption regain its high 1979 level. The first oil crisis was actually the first step in,switching to oil-saving techniques. It was the beginning of looking for renewable energy. This was done especially for oil used for residual buildings and power generating.

[1] This scenario includes renewable energy and energy efficiency targets, nuclear phase-out programmes, national targets to reduce greenhouse-gas emissions under the 2010 Cancun Agreements, initiatives taken by G20 and Asia-Pacific Economic Cooperation economies to phase out inefficient fossil-fuel subsidies. This scenario assumes a cautious implementation of current targets and commitments.

Figure 3.1

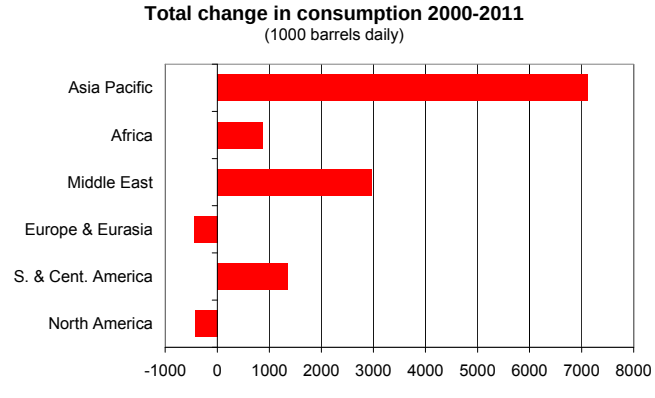


Source: BP Statistics (2011)

Overall, growth in the OECD markets was subdued in past decades and actually declined in the last six years. Hence, growth in total oil consumption comes from strong demand in non-OECD markets. The most notable influence of the past decade has been the rise of the emerging economies and their growing importance in the world economy. In line with an acceleration of economic growth in these markets, especially in China, increasing demand from these markets has dominated the increase in total oil consumption.

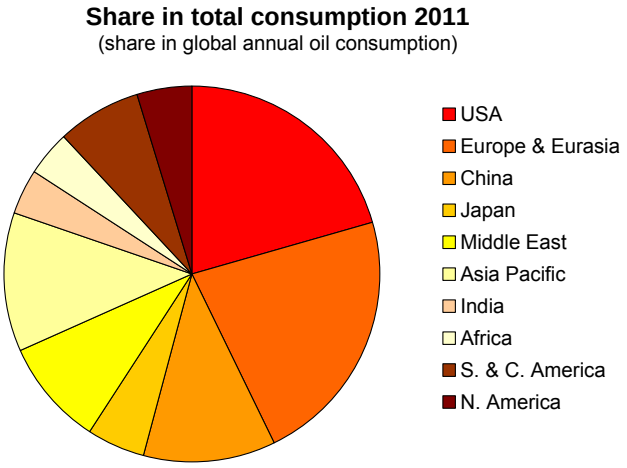
If we look in more detail at the period from 2000 to 2011, growth in demand came mainly from Asia Pacific (see Figure 3.2). Its share of the total increase in consumption during this period was 62.2%, followed by countries in the Middle East, with a share of 25.9%. Declines were recorded by North America, Europe and Eurasia. With a share of 43.6% in the total increase in consumption, China has by far the strongest growth in demand, followed by Saudi Arabia (11.2%), slightly higher then India (10.6%). From 2000 to 2011 sizeable declines were seen in the US (especially in 2008 and 2009) and Japan. Despite these changes in the past decade, the main consumer country of oil is still the US with a share of 21.4%, followed by China with 11.1% (see Figure 3.3).

Figure 3.2



Source: BP Statistics (2011)

Figure 3.3



Source: BP Statistics (2011)

3.2.1 Economic growth

Economic growth is one of the most important factors influencing oil demand in both the short and longer terms. Short-term economic growth can be described as the business cycle, fluctuating because of external and internal changes that impact on a country's total production. In the long run, economic growth is determined by new technology, capital and labour. Hence, population growth influences the demand for oil through its impact on the labour force and consequently on economic growth.

Continuing demand from the non-OECD markets is underscored by economic growth in those regions. Table 3.1 shows the average economic growth figures for the major world regions and countries. In the past two decades high economic growth was seen in Asia and, for the projected period, Asia will again show the highest growth figures. Growth in China will decelerate as it becomes a more developed country and its working-age population shrinks. In the long term, India will probably see the highest economic growth, especially after 2020.

Table 3.1 Real GDP growth (compound average annual growth rate)

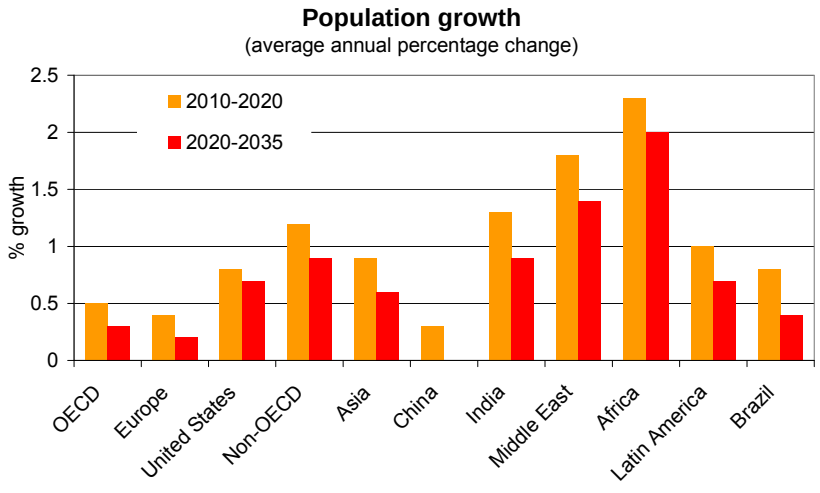
	1990-2010	2010-15	2010-20	2010-35
OECD	2.2	2.1	2.2	2.1
United States	2.5	2.5	2.6	2.4
Europe	2.0	1.5	1.8	1.8
Non-OECD	4.9	6.1	5.9	4.8
Asia	7.5	7.5	7.0	5.5
China	10.1	8.6	7.9	5.7
India	6.5	7.3	7.1	6.3
Middle East	4.3	3.7	3.9	3.8
Africa	3.8	4.4	4.6	3.8
Latin America	3.4	4.2	4.1	3.4
Brazil	3.1	3.6	3.8	3.6

Source: IEA (2012)

3.2.2 Demographics

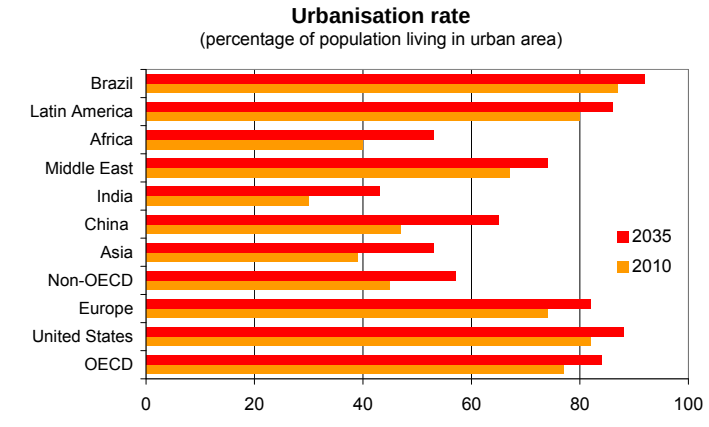
As mentioned above, population growth is a driver of economic growth, but it also has a direct impact on oil demand: 'more people' means 'more demand' for energy products, affecting demand for oil in the longer term. In the coming decades, the rise in the world's population will take place mainly in the Middle East and Africa (see Figure 3.4). In absolute terms, India will show the largest increase in the period to 2035 - by more then 350 million people – compared to an increase of some 40 million in China. India will overtake China as most populous country in 2021. Figure 3.5 shows that, up to 2035, urbanisation will continue to rise, particularly in China, India and Africa, but also in OECD countries. This will result in increased energy usage, as city dwellers have better access to energy services, outweighing the efficiency gains of higher density.

Figure 3.4



Source: IEA

Figure 3.5



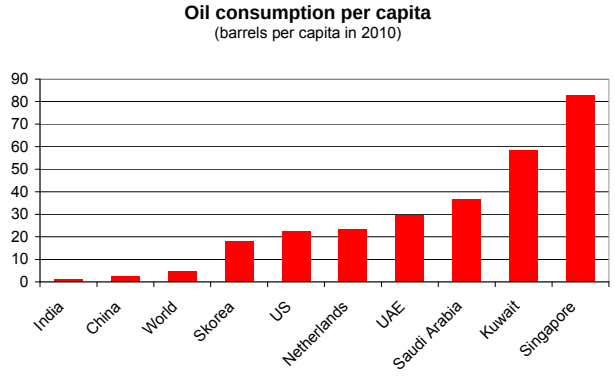
Source: IEA

Figure 3.6 shows that some oil producing countries and small highly developed economies are using the most oil per capita, whereas China and India have scores far below the world average. Even more remarkable is that some oil producing countries use more oil per capita than the United States. One of

the main reasons for this is the inefficiency of the domestic energy markets in oil producing countries. The main source of energy is oil as it is cheap and readily available. Moreover, oil consumption is heavily subsidised. According to the IEA, global oil subsidies were around $192 billion in 2010, with OPEC countries accounting for $121 billion of this.

OPEC's economic structure also entails high consumption; it takes energy to make energy. Much of the increase in oil demand comes from the power generators. For instance, in Saudi Arabia oil is used for generating power and the hot summers put great demands on domestic air conditioning. In the past decade, oil consumed for power generation has more than doubled: and according to several analysts most of this is due to consumer peaks in summertime. As Saudi Arabia increasingly uses oil for domestic consumption, its role as a swing producer erodes. To curb the demand for oil, Saudi Arabia is trying to diversify its energy sources into gas, solar and nuclear energy.

Figure 3.6



Source: IEA

3.2.3 Oil prices and its impact on demand

As we have seen during the first and second oil crises, high oil prices can accelerate the move to other energy sources. Although the 'easy substitution' has already occurred, this process is ongoing and, with higher oil prices, further acceleration could take place. In both the short and longer terms, oil consumption hardly changes when there is a change in price (see Table 3.1). According to IMF research, short-term elasticity is -0.02%, so that a 10% increase in the oil price would result in a reduction in demand of just 0.2%. In the longer term, the impact of high oil prices on demand is limited in many emerging markets because of oil subsidies and, in some developed countries, due to taxation. In some countries attempts are made to abandon subsidies, but progress is slow and politically sensitive. For example, in the Middle East and Northern Africa it will be particularly difficult to reduce oil subsidies because of the political and social unrest seen in the past. In this region high oil prices will hardly affect consumption behaviour or the switching to other sources.

Table 3.2 Demand elasticity

	Short term elasticity		Long term elasticity	
	Price	Income	Price	Income
Combined	-0.02	0.7	-0.07	0.3
OECD	-0.03	0.7	-0.09	0.2
Non-OECD	-0.01	0.7	-0.04	0.4

Source: IMF (2011)

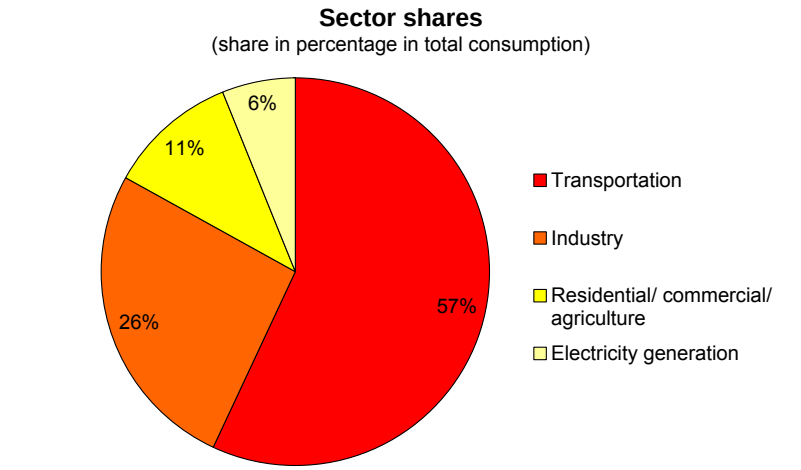
Oil demand increases with income but, at a certain energy level, higher prices will limit the increase in demand. It appears from OECD experience that oil demand increases exponentially when real per capita income reaches $3000 (at year 2000 value) and begins to decelerate after passing $20,000 (in 2000 dollars). This underlines IMF research showing high income elasticity in OECD countries, but declining demand as GDP per person increases. The short-term income elasticity in ~Table 3.2 indicates that a 1% increase in income will result in an increase of 0.7% in oil demand. The poorer the country, the faster its growth in oil demand will be. The longer-term income elasticity for non-OECD countries is higher but, in line with economic progress, this will eventually lessen.

3.3 Distribution of sector demand

Everyone uses oil. To what extent depends on whether you drive a car, what products you buy, your consumption of electronics and the country in which you live. Exactly what kinds of business or who consumes the most oil is described in this section.

Transport is one of the most energy-intensive sectors, followed by industry, and residential/commercial/agriculture and heating/power generation. These sectors can use a mix of energy sources, depending on the availability of other energy sources, the level of economic development and other social, demographic and political factors. Therefore, the energy source per sector, and with that the share of oil, varies by region.

Figure 3.7



Source: OPEC

Transport

Use of energy in the transport sector is related to moving people (or freight) by road, air and water. The key factors determining energy consumption in this sector are economic activity and population growth. Therefore, living standards are a key determinant of the potential for the growth in oil consumption. For instance, in developing countries economic growth results in a higher income per capita, leading to increasing demand for personal transportation. In non-OECD markets the ownership of vehicles is projected to grow rapidly, but in the more mature markets the saturation level is already assumed to have been reached.

However, it is important to make a distinction between passenger and commercial vehicles. While for passenger vehicles the saturation level is important, especially at higher income levels, it is the nature and pace of economic growth and trade that determines the stock of commercial vehicles. In 2009 there were 868.9 million cars in the world, of which around 68% were in OECD countries. That OECD share has decreased markedly since 1970, when it was around 90%. Although car ownership has increased sharply in the developing world, especially in China, car ownership per capita is still significantly lower than in more mature markets: by 2009 478 of every 1,000 people owned cars in OECD countries compared to just 40 per 1,000 people in developing countries. Saturation of car ownership is most visible in the US, where 713 out of 1,000 people own a car: the same as in 2002. We should however keep in mind that saturation levels differ between countries due to demographic structure, cultural and geographical differences.

On this evidence it seems clear that saturation levels have not yet been reached in developing countries. Projections of the expansion of car ownership in these markets are uncertain, for instance because of infrastructure constraints and congestion. The number of commercial vehicles is also expected to increase sharply in the medium term, with the largest increases projected in developing Asia, especially India. Moreover, strong growth in international trade results in increasing fuel consumption for freight transportation by air.

So, in the medium term, it will be the transport sector that is important for future oil demand growth, in view of the limited possibility of switching to another form of fuel. It is expected that in 2035 the total number of cars will have doubled from its 2009 level, with the largest increase in developing countries.

Not only has the number of cars affected demand for fuel, but also the amount of oil used per car. The fuel efficiency of cars has improved in recent years as new technologies have developed. But at present the alternatives to traditional petrol driven vehicles are hindered, mostly by high costs, and are therefore not immediately feasible. Of those alternatives, most is expected of the hybrids. While there is some progress with electric cars, this progress is constrained by high costs, low driving range, long charging time and a sparsity of charging stations. The use of natural gas has drawn attention, especially in the US, where the shale gas revolution has had an impact on the price of gas. Natural gas is already used in road transportation, but only marginally because, due to the low energy density of retail natural gas, a tank has to be five times larger than in a vehicle using traditional fuel. Therefore, natural gas in the transport sector is more likely to be used for freight and in large urban transport.

Industry

The next largest user is industry, which we will categorise as petrochemicals and other industries. Petrochemicals account for approximately 11% of total oil use, with oil processed into chemical products like ethylene and propylene. It is also used as base material and as energy to transform this material into end-products. Almost 60% of petrochemical use is in the OECD.

The category 'other industries' includes iron and steel, glass and cement production, construction and mining, where oil is one of the main products used. Developing countries use more oil than OECD countries in this category because these industries in OECD countries tend to be more energy efficient than the developing world.

And there is of course another reason. Demand in the industry sector is influenced by economic growth, the share of this sector in the economy and oil prices compared to other fuels. The highest growth figures in this sector were in the burgeoning economies of India and China and for the medium term these two countries will continue to show the largest increases in oil demand for industry, although not as high as in the recent past.

Residential/commercial/ agriculture

The OECD treats these sectors as one for the sake of accuracy and, of these sectors, with the residential element accounting for half of oil consumption. Although oil use in this sector has risen sharply in developing countries, oil use per capita is still much lower than in OECD countries. Demand in the residential sector depends on income, climate, available energy infrastructure and domestic resources. The more income, the bigger the houses and the more energy-intensive products that the householder uses. The Commercial element includes offices, stores, schools, and hotels where demand for energy is determined by economic activity and income levels.

Electric power sector

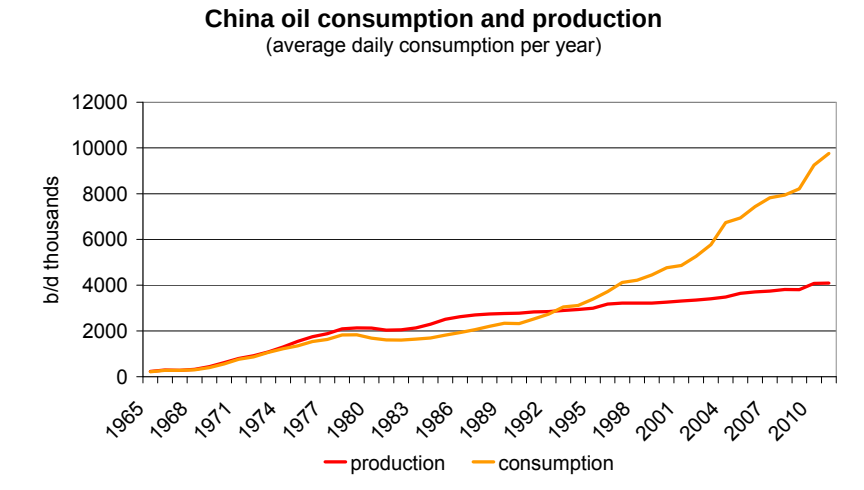
In contrast to the sectors mentioned earlier, this is the only one where total use of oil is in decline. Coal is the most important fuel in this sector except in the OPEC countries, where oil is by far the most important product used to generate electricity. Indeed, OPEC is the largest user of oil in this sector. In the short term, some rise in oil demand is expected because of the shutdown of Japan's nuclear power plants following the catastrophe at Fukushima which, in 2011, led to a small increase in oil demand. However, liquified natural gas (LNG) is the most important substitute for nuclear energy: so for some countries natural gas, and for others nuclear power, will be an alternative to the use of oil in this sector.

3.4 China

China is the largest energy consumer in the world and, as one of the most populous countries with a rapidly growing economy, its impact on the energy market is considerable. But oil is by no means the main source of its energy consumption: coal is by far China's most important energy source, with a share of 70% of its total energy consumption compared to 19% for oil.

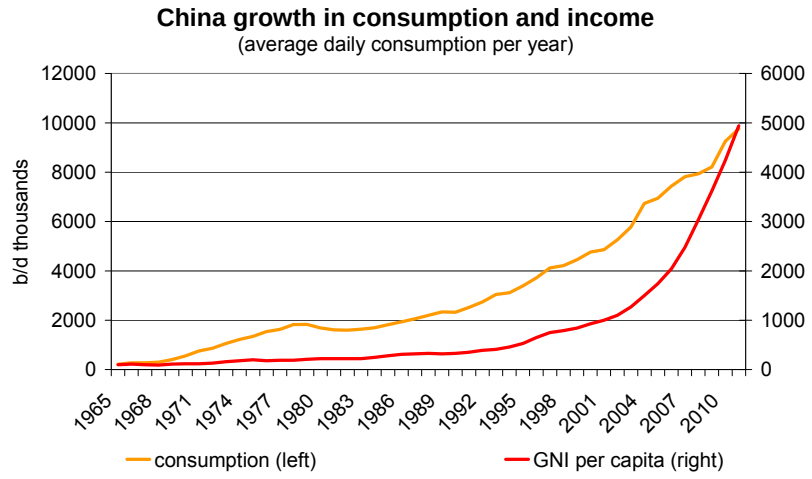
Even so, China is still one of the world's largest consumers of oil. Moreover, while until 1993 it was a net exporter of oil, by 2009 it had become the second largest net oil importer. In 2011 it imported around 5.5 Mb/d: almost half of its consumption.

Figure 3.8



Source: BP Statistics (2011)

Figure 3.9



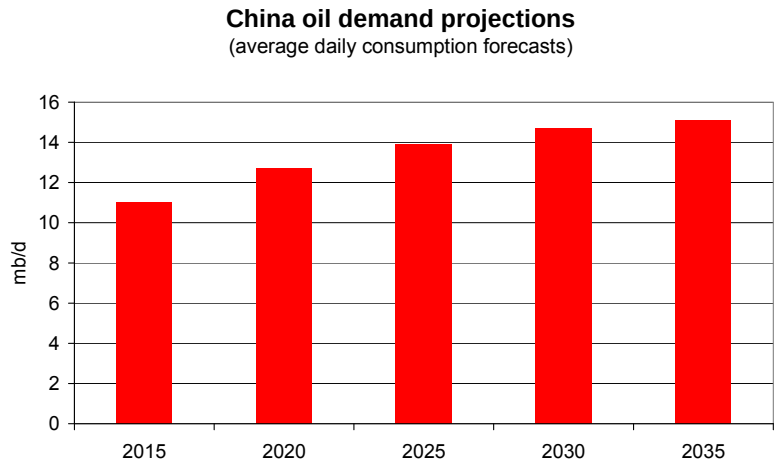
Source: BP Statistics (2011), World Bank

As mentioned above, China has led the growth in global oil demand. In the past ten years its average oil demand has grown by 7% a year. But according to IEA, in 2012 economic growth in China decelerated sharply, resulting in a decrease in the growth of oil demand of 2.6. Although its economic growth will be higher in 2013, it will not regain the growth figures of recent years for some time yet. What's more, China will introduce several policy measures to curb oil demand: in its new 12th Five Year Plan the government announced reductions of its carbon intensity (carbon emissions per unit of GDP) and also that it would be scrapping its subsidies for oil products before 2020. Back in 2009, China had already begun to change its pricing mechanism to link retail oil products to international oil prices. It is expected that growth in China's oil demand will now moderate.

A more fundamental issue for China is of a demographic nature. Its one-child policy will create problems for the medium term as it causes population constraints. As a consequence, the growth in the working-age group will slow considerably in comparison to the past decade.

Another factor in China's moderate demand growth outlook is its already sharply elevated income levels. An inevitable rebalancing of the economy should have an impact on oil demand. In the past decade the focus of economic growth was investments, with high spending on infrastructure and property supporting growth for steel and cement. Currently, investments account for around 50% of GDP, which is high and unsustainable. The rebalancing of the economy to meet consumption and increasing incomes will however support demand for transport.

Figure 3.10



Source: IEA (2012)

China's growing demand for oil is also changing the geo-political field. To meet its thirst for oil, China is already diversifying its import sources: already signing long term contracts and making overseas investments. In 2011 more then half of its imports came from the Middle East and around a quarter from African countries, with Saudi Arabia and Angola its largest oil providers (around a third).

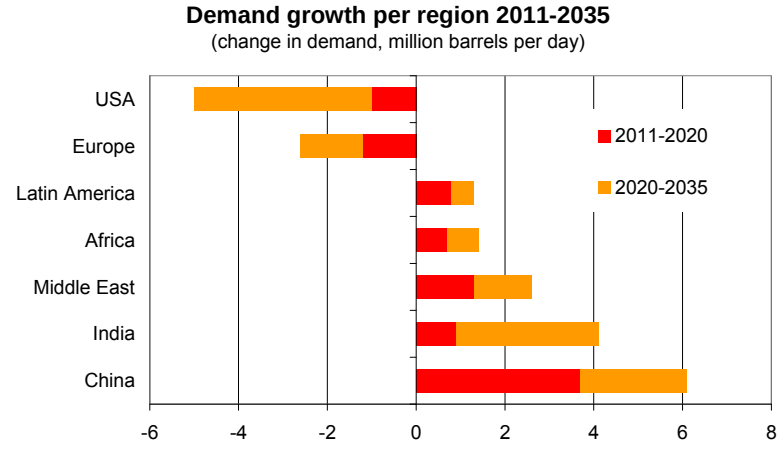
3.5 Demand outlook

Long term outlook 2035

The fundamentals determining long-term oil consumption are economic growth, population growth and oil prices and these have been discussed in the previous sections. Taking into account projections for population growth and economic growth for the longer term, we can see that the expected major oil demand growth regions are China, India and the Middle East (see Figure 3.11). Although growth in oil consumption in China will slow down, it will still have a considerable impact on the market due to its growing economy. In relative terms, while China's oil demand will slow, demand will grow even faster than in earlier years in other non-OECD markets. For instance, in India demographic and economic growth and an increasing industrial base will boost demand. Growth in demand for oil is also expected in the Middle East, especially in Saudi Arabia and Iraq, not just because of the growing population but also because of the inexpensive availability of ample sources of oil in the region. Oil subsidies will only gradually be reduced and a switch to other sources of power generation are not expected in the near term.

One major projected change for the longer term is oil demand from the US. The increase in non-conventional production in Canada and the US will change the demand pattern dramatically; as can be seen from table 3.3, demand from the US is expected to decline.

Figure 3.11



Source: IEA (2012)

The outlook for oil demand will be distinctly different before 2020 and after that date. Most of the announced policy measures will not have an impact on oil demand before then. Therefore growth in oil demand, especially in non-OECD markets, will slow in the period up to 2020, because it takes time to introduce new technologies and make them commercially viable. For example. the average life of a car is at least fifteen years.

Efficiency gains will continue, but the scope for improvement is limited in OECD markets. However, the IEA is expecting substantial gains in the transport sector, where switching to other energy sources is expected. These gains will in the main be achieved after 2020. Although efficiency is expected to improve in non-OECD markets, the growth in demand will more than offset these efficiency gains. One of the main reasons is that increasing incomes in non-OECD markets creates an enormous potential for demand in personal mobility.

Table 3.3 Oil demand projections by region (b/d)

	2011	2015	2020	2025	2030	2035
OECD	**42,1**	**41,2**	**39,4**	**37,4**	**35,2**	**33,3**
USA	17,6	17,5	16,6	15,4	13,9	12,6
Europe	12,6	12	11,4	10,9	10,4	10
Japan	4,3	4,1	3,7	3,5	3,2	3,1
Non-OECD	**38,4**	**43,2**	**47,1**	**50,5**	**53,9**	**57,1**
Russia	3,1	3,2	3,2	3,3	3,4	3,5
Asia	18,3	21,3	23,8	26,2	28,6	30,9
China	9	11	12,7	13,9	14,7	15,1
India	3,4	3,8	4,3	5	6,2	7,5
Middle East	6,8	7,5	8,1	8,6	8,9	9,4
Africa	3,1	3,4	3,8	4	4,2	4,5
Latin America	5,5	6	6,3	6,5	6,6	6,8
Brazil	2,4	2,6	2,7	2,8	2,9	3,1
World	**87,4**	**91,6**	**94,2**	**96,1**	**97,7**	**99,7**

Source: IEA (2012)

Short term outlook 2015

In the short term, it is expected that economic growth will be moderate for OECD countries, with a further decline in oil consumption expected in these markets.

Therefore, in the short term, growth in total oil demand will come wholly from non-OECD markets and it is expected that these markets will overtake OECD economies, in terms of oil demand, in 2014. In general, emerging economies are more energy-intensive than the mature markets of the OECD, while in OECD countries there is also more environmental regulation. The IEA projects an increase of 0.9% in total oil demand in 2013. In line with an expected acceleration of worldwide economic growth in 2014, world oil consumption is expected to increase by 1.3%. One of the risks for the short-term outlook is a major economic slowdown in China.

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Part 4 - Pricing

In this section, we combine the information from the previous sections on the fundamental supply and demand factors and discuss their impact on pricing. Around the long-term price trend we see room for substantial price fluctuations due to the slow adjustment process of supply, sudden shocks to demand and supply, and other non-fundamental factors.

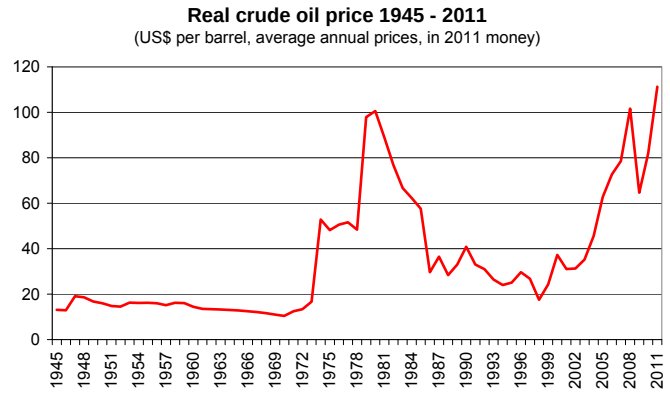
Firstly, we will discuss long-term pricing developments, and discuss the impact of supply and demand. The outlook for price development up to 2035 is analysed and suggestions made of a lower and upper boundary. Then we will discuss the short-term developments, following a similar structure to the first part. In addition to the supply and demand factors, the impact of speculation, exchange rates and monetary policy is considered. The chapter concludes with the short-term outlook - up to 2015 - and again provides an estimate of the lower and upper short term boundary for the oil price presented.

4.1 Determinants of the long term oil price

In the long run, the price of oil is largely determined by supply and demand, as in other markets. A decrease in the production of oil or an increase in demand would lead to upward pressure on price, other things being constant. In turn, an increase in production or drop in demand lowers the oil price. A structural change leads to a shift in the supply curve (e.g. increasing reserves) or demand curve (e.g. increasing wealth), thereby permanently changing the equilibrium price. Given that investment in new capacity to boost supply can take more than a decade, there may be a substantial lag in the adjustment of supply to a sudden boost of demand. Prices, therefore, can deviate from their long-term equilibrium value during such a period of adjustment. Both supply and demand have increased substantially over the past century, leading to mixed pressure on the price.

Historically, the real price of oil has shown no clear trend (IMF, 2011). Figure 4.1 shows that real oil prices (in 2011 money) were relatively stable between 1945 and the early seventies, fluctuating around $15 per barrel until two supply-side shocks disrupted the market in 1973 and 1979. The oil price quickly rose to more than $50 and later to $100. As the supply of oil was brought back in line with demand, the price slowly came down and stabilised between $40 and $20 from 1986 to 2002. Over the past decade the oil price has again increased substantially, due to booming demand from emerging markets, and is currently at an historically high level.

Figure 4.1



Source: BP Statistics (2011)

4.1.1 Fundamental factors in long-term pricing

There may be three factors explaining long-term pricing of oil; supply, demand and, possibly, a resource rent or Hotelling rent. Each factor impacts the oil price differently, pushing the price up or down.

The importance of supply in pricing was clearly visible during the first and second oil shock. As supply dropped shortages emerged and prices soared. A longer term reduction in supply would have a less severe longer-term price impact as demand would adjust, but prices would inevitably rise. The future of oil production is currently very uncertain but as discussed in Part 2 of this report, we do not expect production to be lowered any time soon. In fact we expect production to keep on growing rapidly over the coming years as technological developments are introduced to keep up with the depletion of fields. Proven global oil reserves have increased by approximately 30% since 2000 of which a large part, more than 70%, comes from reserve growth, viz. the ability to get oil out of a seemingly depleted source. As a result, oil supply is expected to grow, from 84 Mb/d in 2011 to 96,9 Mb/d in 2035. This expected increase in supply will put downward pressure on the future oil price.

Another aspect of the ongoing technological development however is its growing complexity and cost. The cost of extraction has increased over the past decades as the easy accessible fields are all in production or depleted. The rise in cost implies an increase in the cost of production. It is difficult to predict the future development of extraction costs as technology not only gets more complex, but in general also gets cheaper to produce. Overall, the recent experience does point to a structural increase in cost that puts upward pressure on the long term oil price.

Growing demand also has an impact on the oil price, possibly most clearly illustrated during the first decade of the 21st century. Prices more than quadrupled in years of strong global economic growth and steeply increasing demand for oil from emerging markets. Despite the small correction in oil demand during the recent financial crisis, the long term outlook is still expected to see continued strong growth in demand. Demand growth from 87.4 Mb/d in 2011 to 99.7 Mb/d in 2035[2] takes place in the emerging markets, where China accounts for 50% of the increase in demand until 2035, whilst OECD countries witness a steady decline due to efficiency gains, substitution to other fuels and market saturation. From a sector point of view, it is transport that drives the demand growth, in

[2] This implies a supply deficit of 2.7 Mb/d, an issue we will revert to below.

particular, the demand coming from passenger car sales, although air freight as a source of demand will increase as well. This structural development puts upward pressure on the oil price.

Other factors not discussed so far may influence pricing, most notably the existence of a resource rent. This rent is a compensation for the foregone profit of future production, as the oil can only be sold and used once. Box 2 on page 39 gives a detailed account of the resource-rent theory, postulated by Hotelling. As long as technological advances are able to keep up with production, on average the depletion rate of oil resources worldwide does not change substantially. Therefore, it seems unlikely that such resource rents would play a significant role in the oil price and on pricing up to the year 2035.

4.2 Price outlook for 2035

The oil price is expected to face upward pressure over the next decades due to changes in the fundamental forces. The main question seems to be whether supply will be able to keep up with booming demand. The larger the gap between demand and production, the higher will be the oil price. According to the IEA (2012) latent demand indeed surpasses supply in both of its scenarios.

The IEA (2012) distinguishes two outlook scenarios, building on the extent that policy measures related to energy are being implemented.[3] The first, base case, scenario is where policy measures already implemented and announced are supposed to impact demand. In the second - and perhaps more conservative - scenario, demand is impacted only by policy measures already taken and implemented, and is therefore less constrained.[4]

Let us first consider the IEA's base case, or new policies, scenario. Under this scenario demand will, driven by the factors discussed above, gradually increase from 87.4 Mb/d in 2011 to 99.7 Mb/d in 2035. Given the supply developments (taking into account no price change), this creates an annual shortage of around 2.8 Mb/d which has to be cleared by a movement in the oil price (in real terms). Therefore, under this scenario we see the oil price leap up from $111 per barrel in 2011 to $124 in 2015 and then more gradually to $130 in 2035.

Table 4.1: Outlook oil prices (Brent) 2015-2035

	2015	2020	2025	2030	2035
Demand (Mb/d)	91.6	94.2	96.1	97.7	99.7
Supply (Mb/d)	89.3	91.7	93.4	94.9	96.9
Difference (Mb/d)	2.3	2.5	2.7	2.8	2.8
Price Brent	120	124	126	128	130

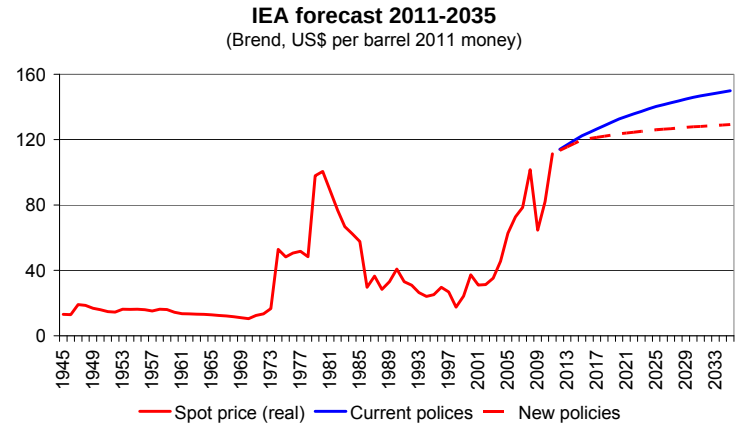
Source: IEA (2012)

Alternatively, in the so-called current polices scenario (the blue line in Figure 4.2), if it is assumed that only the actual policies will be implemented, demand will grow faster with the obvious consequence that the shortage will be higher and that the price adjustment required to bring supply in line with demand will be larger. More particularly, under such a scenario the price would rise in a more or less linear fashion to $150 per barrel in 2035.

[3] These policies relate to renewable energy targets and energy efficiency targets, nuclear phase out or additions, greenhouse-gas emissions (communicated under the 2010 Cancun Agreement) as well as the initiatives taken by the G20 to phase out inefficient fossil fuel subsidies.

[4] The third scenario in the IEA report is not discussed here as it is based on the premise that the concentration of greenhouse gases in the atmosphere is to be reduced in order to limit the average temperature increase to 2 degrees Celsius. In the report it is called a 'plausible pathway' rather than a projection and for that reason is omitted here.

Figure 4.2



Source: IEA (2012,B), Atradius Economic Research

A note of caution is warranted as the forecasts for the price of oil are highly uncertain. The IMF (2011) concluded that, for the period since 1875, no persistent trend in real prices is perceivable. A long lasting change in prices is eventually responded to by market participants. Also, statistical predictability is hard, a point made by Hamilton (2008). He cites the lack of statistical significance of GDP, lagged oil prices and US nominal interest rates to the explanation of the oil price level, as well as to lagged changes of the oil price for (future) oil price *change*. These results are consistent with real oil prices that follow a 'random walk'. More specifically, given the lack of a trend, they follow 'a random walk without a drift'. A naïve oil price change prediction of 'no change' would therefore be best. Nonetheless, at the same time such a prediction could still be very wrong. The reason is that, as Hamilton (2008) points out, the prediction interval for a price forecast explodes if we peer no further than the very near-term future: e.g. the 95% confidence forecast interval for a price of $115 for the next (second) quarter is between $85 and $156, whereas that interval has widened to $34 and $391 in the fourth quarter – indeed, intervals too broad to be meaningful.

4.2.1 Upper and lower boundary pricing for 2035

Given the fact that the oil price has proved hard to predict and shows large swings, the price of oil may end up anywhere between two extremes in 2035. These upper and lower boundaries are defined by the structure of the oil market. The prices discussed here are equilibrium prices in which the market is stable. On the adjustment path towards that equilibrium, prices can be substantially higher or lower, as we will discuss in the next section.

The upper boundary is formed by substitution on the demand side and increased capacity. A structurally high oil price makes substitutes for oil products, such as gas, coal or wind, economically more attractive as energy sources. As transport is the largest user of oil, cars and trucks could be remodelled to use other types of fuel. At the current low price elasticities of demand these developments are bound to exert a slow but continuous impact on prices. But, at certain higher levels, such as the $150 mentioned by IMF (2011), that may change markedly, and indeed provide the backstop that is needed.

The second, and perhaps more powerful, force mitigating a high oil price is the expansion of supply, as more difficult to reach fields become economically viable and new technology profitable to apply. The relatively high oil price over the past decade has given momentum to the revolution in non-conventional oil production. As supplies in these harder to reach sources are plentiful, a structurally

high oil price would potentially unleash a large supply. The current oil price of about $110 has allowed the extraction of unconventional reserves (light tight oil and oil sands in North America). One can then imagine that a considerably higher oil price, such as the $150 mentioned, would make large scale investment to extract oil from currently expensive sources beneficial.

At the lower end, prices are unlikely to fall to the levels seen in the decades up to 1970.The long-term lower boundary has to do with the marginal cost of production. This in turn depends on the size of production, i.e. a large reduction in the production of oil could reduce the use of only the cheapest oil producing fields. This would put us back in the situation that existed before the 1970s. However, under current supply and marginal cost of production, the long term lower boundary is much higher. The latest project developments in Canada and the United States are said to have a cost of around $80 per barrel. This would put a floor in the market around that price, in the sense that prices below that level are (much) less likely.

Box 2 Hotelling principle

The oil price level should, at least in theory, be impacted by what is called the Hotelling principle (Hotelling, 1931). To explain this principle, assume a competitive market. Remember that under such conditions it holds that the price for which a normal, non-exhaustible product is sold equals its marginal costs. Now consider a product that is exhaustible, oil: oil producers face the geological truth that future production will inevitably be lower than current production: say 90% of that current production. If one then assumes that demand elasticity is low, e.g. -0.1, the 10% decline in future production will force the future price to double, otherwise the market will not clear as supply and demand would not match. That clearly provides an incentive for the producer to postpone production and is obviously not in the interest of the consumer, who will pay a premium over the marginal costs to entice the producer to get the oil out of the ground. That is the scarcity rent of oil.

We come to the next step, involving the time value of money. The scarcity rent will be available at any moment in time and therefore future rents will have to reflect the interest rate. This can be understood by considering that, if the future rent is higher than the current plus interest, there will be an incentive to postpone production. But that pushes up current prices and depresses future prices, restoring the equilibrium. Along similar lines, equilibrium is restored if the future rent is lower. The implication for the oil price is then that it is impacted by 1) the scarcity rent, which is assumed to be constant over time and 2) the interest rate. The latter is compounded every period and thus pushes up the rent every period. Consequently, we would see an ever-increasing oil price in real terms.

The empirical evidence does not show price development as predicted by the Hotelling principle. The real oil price has been historically stable and shows no trend. The failure of the Hotelling principle may be due to the constant discovery of new oil sources, the improvement of technology or the fact that the market is heavily impacted by regulation and monopolistic behaviour (Sumlich and Wilson, 2009). In addition, there may be constraints for producers to turn the tap off due to revenue constraints. As a result, scarcity may not be reflected in the price.

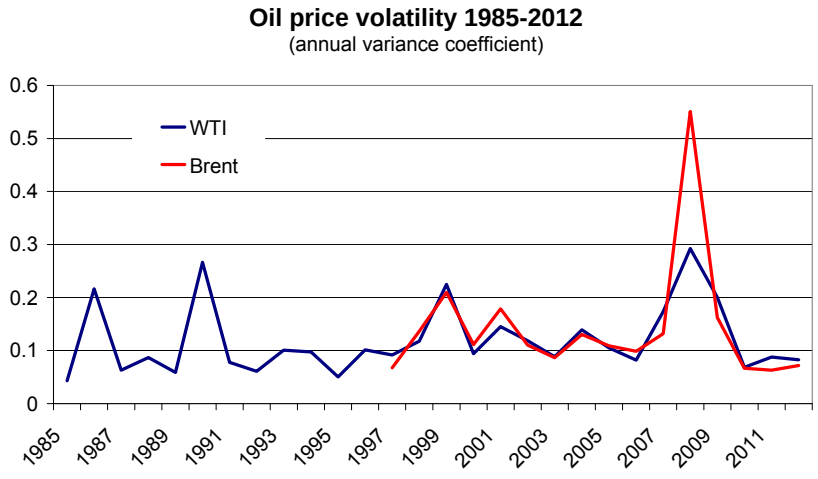
In the future, that may change as at some point production will inevitably fall. Already at the national level this may take place. Kuwait has faced political pressure to preserve oil for future generations since the middle of the last decade, whereas Reuters reported in 2008 that the Saudi King had ordered some new oil discoveries to be left untapped for similar reasons. (Hamilton, 2008, p. 12)

4.3 Determinants of the short-term oil price

In the short run, both supply and demand are inelastic, leading to possible large price fluctuations. The production capacity can fluctuate somewhat, depending on the available spare capacity of large producers such as Saudi Arabia. However, as a percentage of total production, this supply flexibility is limited. The strategic reserves also count as a supply buffer that can be used to boost supply in the short run, but is limited to a few months of consumption. Structural change in the supply has to come from large scale investments that take around a decade before the first oil is produced. In turn, demand is equally inflexible in the short term, as we show in Table 3.2. This means that a 10% increase in the price reduces demand by only 0.2%. A strong increase in demand or a drop in supply would therefore lead to a large short-term increase in the short term price, and vice versa.

The short-term inflexibility translates into a highly volatile oil price. For example, the price dropped by almost 80% over a period of just six months as a result of the lower demand in 2008. We define volatility as fluctuations around a mean, for which we can best use the coefficient of variation.[5] What we see in Figure 4.3, for the period 1985-2012, is that volatility increased in the later parts of the nineties and stayed more or less at that level during the first decade of this century. It exploded during the crisis of 2008 and, after that, fell to pre-1997 levels.[6]

Figure 4.3



Source: BP Statistics (2011), Atradius Economic Research

4.3.1 Fundamental factors in short-term pricing

A number of factors may explain the short-term oil price: supply, demand, speculation, exchange rates and monetary policy. Each factor impacts the oil price differently, pushing the price up or down.

The oil price can react strongly to changes in supply. The probability of a large reduction in production is much more likely than a sudden supply glut. Causes can include armed conflict in important oil producing countries (e.g. Iran or Iraq), terrorist attacks on vital links in the supply chain or political action by oil producing countries. The larger the disruption to supply and the longer it lasts,

[5] What we show here are standard deviations from an annual mean using monthly nominal data. We divide by the (annual) mean to normalise and obtain the coefficient of variation.
[6] We expand on the difference between Brent and WTI in Box 2 below.

the higher will be the oil price. We see such severe supply disruption as a possibility, but of low likelihood up to 2015.

In contrast to supply, demand can in the short term both grow and decrease, with mixed impact on prices. Strong economic growth can boost demand, especially in emerging markets. Over the past decade this may have been the reason for the relatively high oil price. On the other hand, the financial crisis in 2008 swiftly reduced demand, sending prices downward. Based on our expectation for a global recovery of economic growth and the return to the path of high growth by emerging countries, we expect demand to continue to increase rapidly over the coming years. This is likely to put upward pressure on the oil price in the short term.

There are a few issues that, in addition to supply and demand, arguably play a role in the determination of that outlook: speculation (regarding supply and demand), the role of the exchange rate and monetary policy.

The role of speculation

First consider the role of speculation in the oil markets. There is some evidence, at least anecdotal, that oil index trading has exploded since the early years of the millennium. Hamilton (2008) mentions an increased flow of assets into the commodity index (of which oil is a significant part) from $13 billion to $260 billion over the 2003-2008 period; IEA (2012) points at an amount of $6.48 trillion outstanding in the unregulated (OTC) oil derivatives market, where oil futures are traded. It seems inconceivable that this had no impact: inconceivable because the assumptions required to come to this conclusion seem very strong - risk-neutral investors and symmetric information. To see the latter we imagine a flow of money being poured into the oil derivatives market. If there are sufficient risk-neutral investors and information is shared between participants, the market will be able to absorb such a flow without a price change. But risk-averse investors or asymmetric information (as opposed to risk-neutral investors and symmetric information) may lead prices to go up as markets suspect that other participants know more (e.g. about oil reserves)., on the basis of the large inflow. Time is then required to find out about this and arbitrage away an unjustified price increase, if any. That time could be considerable and in the meantime the underlying drift from fundamental factors could feed a speculative bubble. Such a bubble will however be checked by at least two factors. The first is that higher future prices will provide an incentive to store oil, raising storage costs as storage capacity becomes depleted. That in turn checks the current oil price rise. The second is that, if oil prices go up, consumers are expected to react by cutting consumption, at least over time. As a consequence, the future price comes under pressure with large amounts flowing away to other assets. That impacts the current price as well. Therefore, while it is inconceivable that speculative flows have no impact on the oil price in a world of uncertainty and asymmetric information, its impact, and certainly its long-term impact, should not be overstated.

Such a conclusion should at least hold for the oil price level.[7] For the volatility of the oil price, matters could perhaps be different: increased speculative flows are expected to make oil prices more volatile. The reason is that macroeconomic facts and geopolitical developments, or even rumours about them, more easily set financial flows in motion if cash is at hand - and indeed move prices. Such movements could be compounded by specific characteristics of the oil markets, the lack of clear data (on e.g. current production, reserves, inventories and transport) and supply inflexibilities. However, the explosion of speculative flows seems not to be reflected in the volatility of the oil price.[8] Again, it

[7] On the basis of a review of the existing literature, Kilian, Fattouh and Madaheva (2012) find no support of an important role of speculation in driving the value of oil. See also Lombardi and Van Robays (2011).
[8] We note that the important increase of the mean after 1997 in combination with the relative stable variation coefficient (barring 2008) suggests that the standard deviation has increased.

supports the statement that the impact of speculative flows should perhaps not be overstated. Oil prices, in short, have gone up, but fluctuations around the trend have not.[9]

The role of the dollar value

The other potential determinant is the US$ exchange rate. The argument goes as follows. Oil prices are denominated in US$ and therefore one would expect to see a lower price in, for instance, Euros, when the US$ depreciates, providing a spur to demand in the Eurozone and pushing up oil prices in US$. Indeed, looking at the past decade, this relationship seems to hold. The graph of the real effective exchange rate and the oil price is quite convincing for the period 2000-2012. The measured correlation between the real effective exchange rate and the oil price for the period 2000-2012 is very high: at a correlation coefficient of -0.9. [10]

But we should be careful not to jump to conclusions, as correlation tells us little about causation (IEA, 2012). That might indeed run from the oil price to the US$ exchange rate as traditional balance of payments theory suggests. A higher oil price causes (at least for net oil importers such as the USA) a balance of payment deterioration, as price elasticity of demand is low. That would trigger depreciation of the US dollar. This is more plausible than the reverse causation, which rests on the following arguments, which are arguably weak. Firstly, a lower US$ should lead to an increase in the oil demand in the non US$ economies. But that is not very likely given the high demand inelasticities shown in Table 3.2. Secondly, investors are supposed to step into the oil market as it is seen as a hedge against inflation when the US$ falls. However, until now, limited - if any - empirical evidence backs up this argument. In short, the reverse causation arguments are thin and the correlation between the US$ and the oil price may be more likely to run from the oil price to the US$ exchange rate rather than the other way around.

The role of monetary policy

Given the unprecedented state of the monetary easing that the Fed and (to a lesser extent) ECB have created since the start of the crisis in 2008, it has been suggested that oil prices are driven up by monetary easing, via the so-called portfolio effects. The idea is that oil reserves are kept as part of a portfolio of assets. If liquidity is pushed up, the portfolio of investors will be subject to reallocation, pushing up the prices of other assets, including bond prices. This argument seems plausible but awaits empirical testing.

Meanwhile, we have to rely on indirect effects of monetary policy, meaning the effects that run via the fundamental factors of the supply and demand of oil. In this context we can think of the following (IEA, 2012). Firstly, monetary easing pushes up inflation and/or growth expectations, which will affect the oil price positively. Secondly, the lower interest rate that usually comes with the monetary easing will lower the cost of holding inventories and therefore push up demand for oil. Thirdly, under the (admittedly unlikely) assumption that the Hotelling principal holds, the scarcity rent is lower and therefore the inclination to reduce supply by keeping the oil in the ground is higher. Fourthly, the US$ is likely to weaken, with the impact discussed above. Indeed, the latter two arguments are rather weak in the light of our discussion above. Empirical evidence, moreover, is mixed (IEA, 2012).

[9] Our findings are corroborated by IEA (2012, p. 20), which uses daily volatility data.

[10] We have used Data Insight figures. Calculations are available on request.

Box 2 Brent and WTI

The Brent and WTI (West Taxes Intermediate) oil price benchmarks started to diverge in the middle of the past decade. The price difference of around US$20 has been seen since 2009, with a lower WTI price. This price difference is attributed to supply increases, sluggish demand due to the muted US recovery and bottlenecks in the shipment to refineries on the Mexican Gulf Coast. Let us see how this price difference can be broken down. The Mexican Gulf bottleneck indeed implies that arbitrage between markets does not properly function, allowing a US$10 per barrel price difference to persist. With another US$3-4 per barrel for transport to Europe, an estimated US$15 per barrel price difference is currently envisaged as sustainable, and futures markets indicate that this will persist at least until 2015 (IMF, 2012). Any additional difference may be attributed to the fact that Brent and WTI are not perfect substitutes (IEA, 2012).

4.4 Price outlook for 2015

The short- term price reflects the long-run equilibrium price, and deviations from the path as a result of short-term inflexibilities and temporary supply and demand shocks. Volatily is determined by 'black swans', or unknown unknowns: unpredictable events with a large impact.

IEA (2012)'s demand outlook to 2015 is based on an expansion of the world economy of 3.9% over the outlook period and an improvement in energy efficiency of 2.5%. On the supply side, the growth of 1.9 Mb/d in 2014 is largely due to OPEC expansion (in particular Iraq), in 2015. However, the growth comes largely from non-OPEC sources (North American sand and light oil). As appears from the outlook, the difference between supply and demand is smaller than 1% of demand for the forthcoming period, which is negligible. That broadly supports the industry views of an unchanged oil price which is shown in the forecast mean line of Figure 4.4.

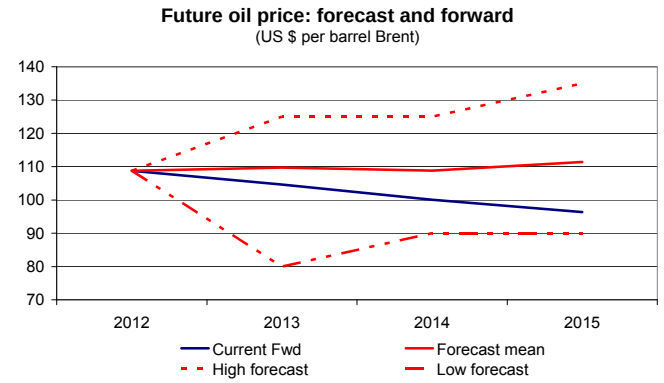
Table 4.2 Outlook oil prices (Brent) 2013-2015

	2013	2014	2015
Demand (Mb/d)	90.60	91.82	93.42
Supply (Mb/d)	89.78	91.70	93.40
-of which OPEC	35.78	36.9	37.42
Difference (Mb/d)	0.82	0.12	-0.26

Note: The demand and supply forecast in this table deviates somewhat from the longer-term forecasts, and more particularly for 2015. This reflects the difference between long-term trends in supply and demand and an outlook as close as possible for the forthcoming two years by the IEA.
Source: IEA (2012)

As to the boundaries of the forecast, the figures indicate that the risk is tilted slightly upward (as shown by the rising upward boundary). To underpin such upward bias one would normally expect to see increasing global economic growth. But that is precisely what is not happening. The latest (January 2013) IMF forecasts of world economic expansion stand at 3.5% and 4.1% for 2013 and 2014, and are slightly below the one used in the current IEA forecast. Moreover, the growth figures are still subject to downside risk as the policy measures taken in the Eurozone are still subject to large implementation risks. Alternatively, we could look at the supply side. The OPEC supply mentioned above contains around 5.5 Mb/d spare capacity in 2013, running up to 6.5 Mb/d and 7 Mb/d in 2014 and 2015. Yet again, this does not support the upward bias. However, those latter IEA figures are subject to large uncertainties. If these uncertainties are high, the supply side might contain an upward determinant strong enough to outweigh the demand downside. This indeed may explain the industry panel's point of view.

Figure 4.4



Source: Bloomberg

However, these statements on the future oil price seem to be at odds with what we see in the futures market. It can be shown[11] that future and current oil prices should be equal (excluding costs). But what we see in Figure 4.4 is indeed a lower oil future price if the period included is longer: a phenomenon known in the market as 'backwardation'. But it reflects a specific characteristic of the oil market. Futures markets are dominated by oil producers seeking a hedge against a price decline that would push them out of business. These producers are willing to pay what is essentially a premium above the current price to be hedged against this risk.[12] Barring this, the said equality is supposed to hold[13]. Then we can maintain that the future price does not add information relative to the current oil price as a predictor of future oil prices. This position is corroborated by the fact that forecasts of the oil price, as derived from a Bloomberg panel of industry watchers, is flat for the forthcoming period, until 2015.

4.4.1 Upper and lower boundary pricing for 2015

The range of possible prices in the short term is extremely wide as a result of the supply and demand rigidities. Prices could drop to 'dump' level in the event that demand disappears or reaches $200 or even $300 when supply stalls. But such a large price swing would require a substantial shock, which is possible but rather unlikely over the next two years. More realistically, forces will keep the price within a narrower band.

The lower boundary of the oil price is defended by oil producers. They have a clear incentive to keep the oil price from falling too far. This does however require a reduction of production: something only Saudi Arabia seems willing and able to do. Given the fact that the budget break-even price for Saudi Arabia, and many other Middle East oil producers, has increased over the past year to about $83, they are likely to push for a price above that level. The short-term upper boundary of the oil price comes from the reaction of demand to higher oil prices and the attractiveness of subsitutes. A high oil price would, for example, damage economic growth across emerging markets, automatically lowering demand and thereby easing pressure on the price. This is a 'sliding scale' so no clear ceiling can be placed on the oil price for this period.[14]

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[11] See Hamilton (2008), p.7-9
[12] See Alternative Asset Valuation and Fixed Income, Pearson (2010), p. 117.
[13]. To give a rough idea of this premium: given the difference between the current and future price (109-93 = 16) we can calculate a 'back-of-the-envelope' premium which is at 4% interest and 4 years approximately 2.5% per annum.
[14] IMF (2011, p.96) mentions a so-called backstop price - $155 at current prices - at which demand will start to react strongly.

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