

Brand New Model, Same Old Price

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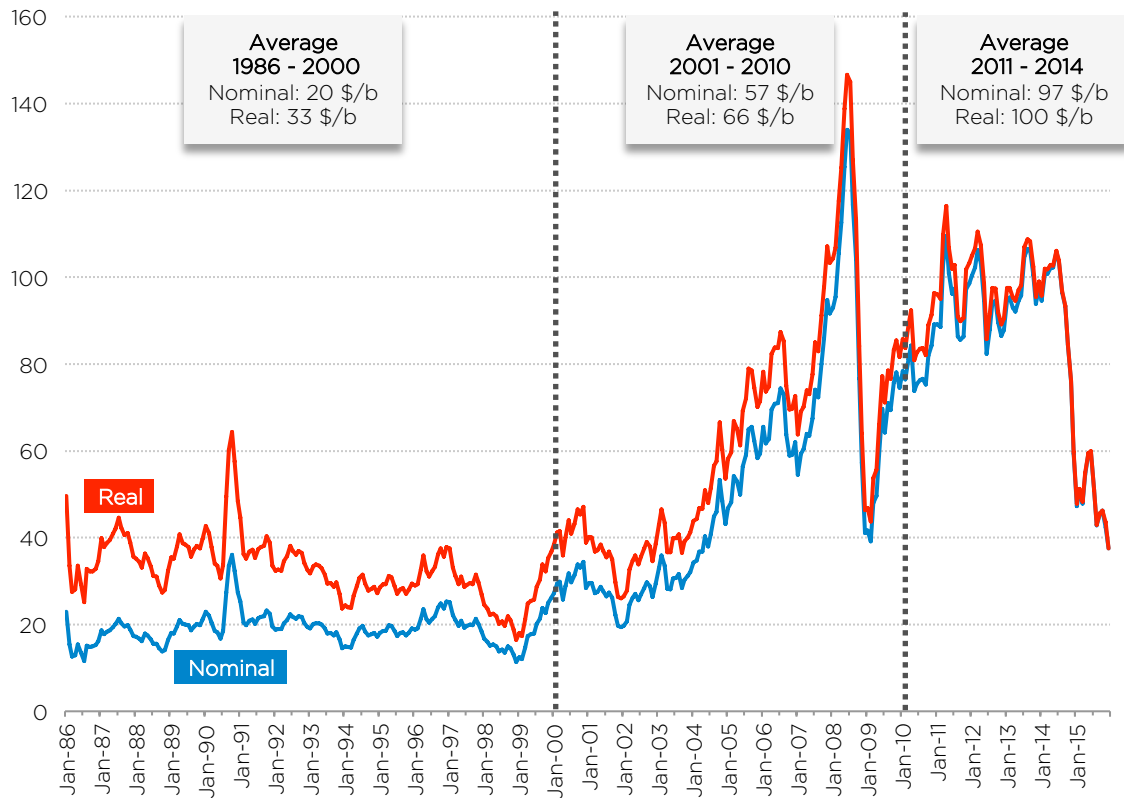
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The fall in oil prices during the last quarter of 2014 and throughout 2015, which reached an average of US\$37 per barrel in December 2015,¹ reflects a structural shift in the way the international oil market works. The price of oil in December of 2015 was a little less than 40 percent of the average price of the period between the first quarter of 2011 and the third quarter of 2014, which was US\$97 per barrel (Figure 1).

Figure 1 | West Texas Intermediate (WTI), monthly price, nominal and real \$/b



The primary cause of plunging oil prices is the increase in production in the United States. The 85 percent increase in national output during the past seven years is primarily due to the development of unconventional oil reserves. The United States has become, once again, the world's largest oil producer.

The second reason behind the collapse of oil prices during the last five quarters is the staunch position by Saudi Arabia and the rest of the Organization of Petroleum Exporting Countries (OPEC), in November 2014, against curbing production to make room in the global market for incremental output from the United States, which is leading to reduced imports of crude and forcing producers that sold crude in the US to market their product elsewhere at reduced prices.

The competition for market space among private producers of the United States and OPEC member countries has been based on a sustained price reduction. Moreover, countries outside of the Organization for Economic Co-operation and Development (OECD) and OPEC have not lowered their production in light of plummeting prices.

¹ Based on data from the U.S. Energy Information Administration (EIA).

² Based on annual data up to 2014: BP Statistical Review of World Industry.

The factors above have led to an increase supply, while global demand for crude has been decelerating for more than three years, particularly in developing countries in Asia where oil consumption growth has slowed. Historic growth in demand in these countries spurred the demand boom that gave rise to the so-called super cycle, with high prices that began in 2000. Now, competition for space in a declining market has exacerbated the price plunge.

New production in the United States, due to a significant increase in unconventional oil reserves that were not exploited until recently, is changing the outlook for the international oil market. The size of these reserves and the speed of response in their development by numerous competing private producers have brought about a new operational model for the global market, in which the price of crude is determined by the marginal cost of production from these unconventional reserves in the United States.

The new model replaces its predecessor, in effect since the mid-1970s, in which the oligopoly consisting of OPEC countries adjusted their output against the level of demand to secure monopoly gains. In the new model, U.S. oil output will increase until it fills the demand gap that OPEC production has been unable to meet, creating an unprecedented level of competition in the global oil market. The lifting of restrictions on its oil export further bolts the U.S. presence. In the new model, the profits of OPEC countries will be reduced to the difference between their cost of production and the marginal cost of U.S. production.

This paper illustrates the new outlook and operational model of the global oil market. The first three sections analyze market evolution over the past 30 years from a supply perspective of the United States, OPEC member countries, and the rest of the world, respectively.

The fourth section reexamines market evolution from a demand perspective of two groups of countries—OPEC members and the rest of the world. The fifth section describes the evolution of the price of oil based on the evolution of supply and demand, and builds a scenario to illustrate its mid-term prospects. The sixth section outlines the new operational model of the international oil market.

The United States

The United States has boosted its oil production by 85 percent since 2008. This increase is primarily due to the drilling of unconventional oil reserves through a groundbreaking combination of existing technologies. Oil production in the United States jumped from 6.78 million barrels per day (Mbd) in 2008 to 11.64 Mbd in 2014²³ (Figure 2), making the country, once again, the world's largest oil producer and recovering the ranking it had held until 1975. Most of the additional production comes from exploiting hydrocarbon deposits contained in shale.

The increase in U.S. output primarily comes from Texas, which contributes one-half of all new production, and North Dakota, which contributes one-fourth of new production (Figure 3). The amount of technically recoverable shale oil reserves in the United States is calculated to be more than 900 billion barrels

² Based on annual data up to 2014: BP Statistical Review of World Industry.

³ Based on monthly data 2015: IEA.

according to recent estimates⁴, which is equivalent to the combined reserves of all OPEC countries (Figure 4).

Figure 2 | USA annual production, 1985-2014, million barrels per day

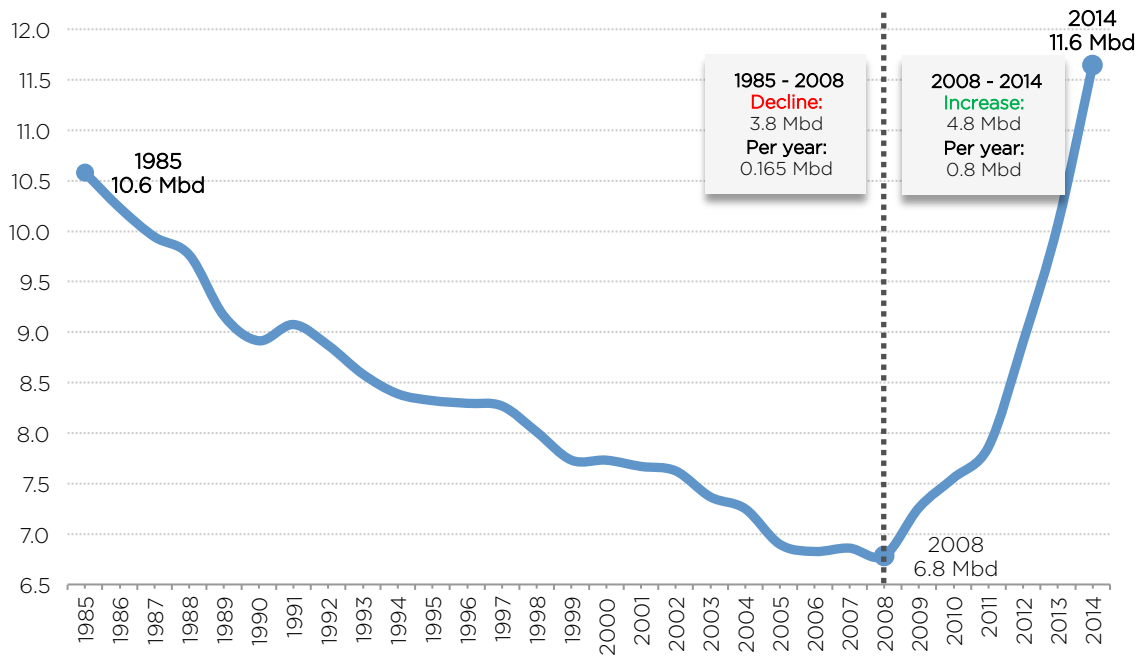
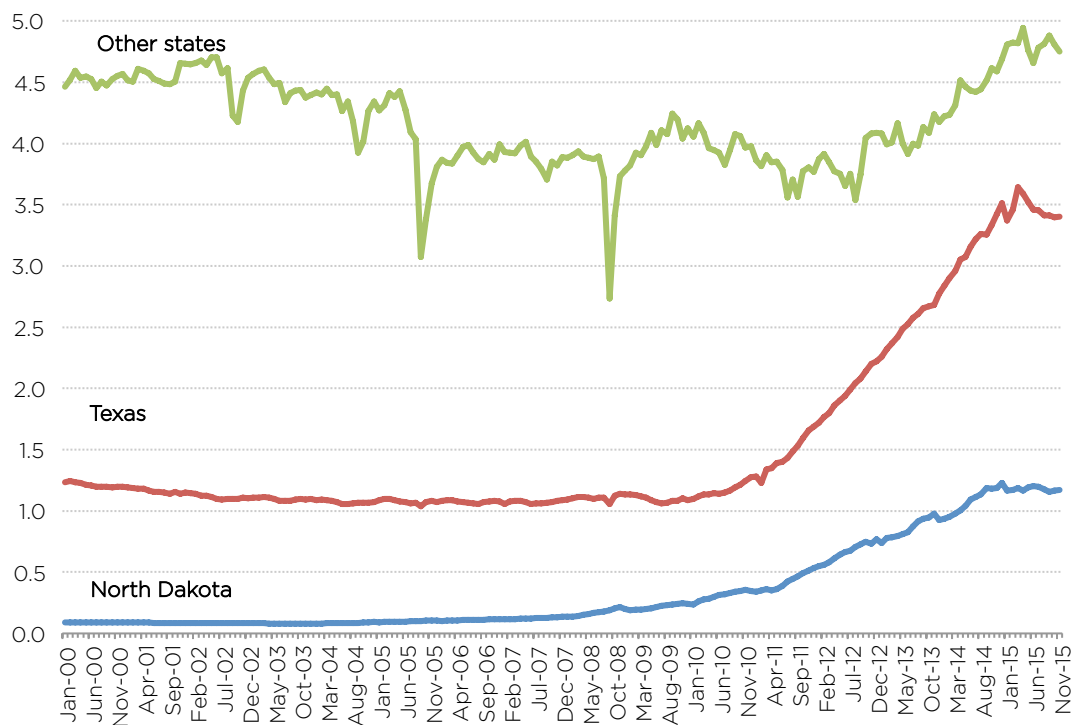
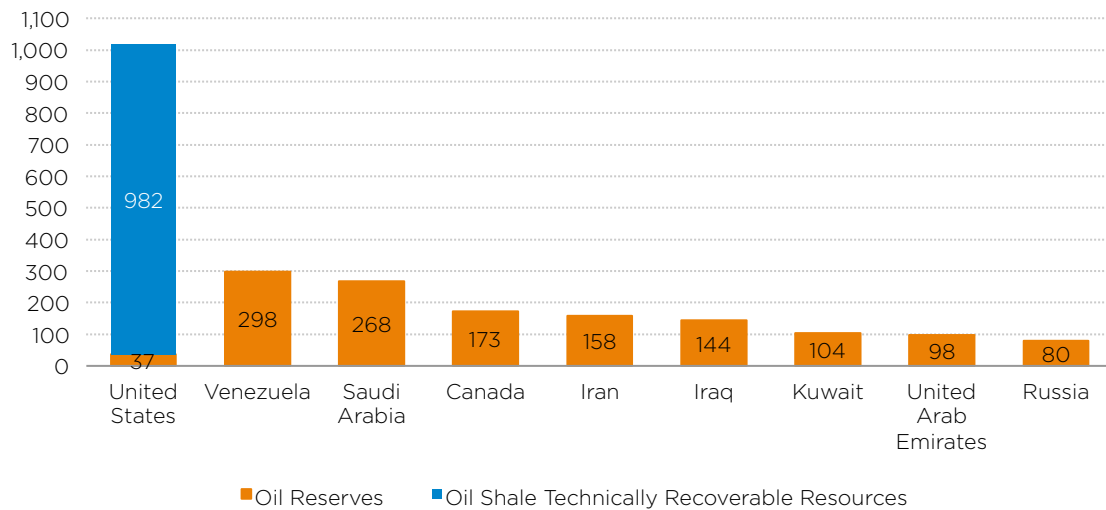


Figure 3 | USA monthly production by state, million barrels per day



⁴ Data according to the Institute for Energy Research. Available at: <http://instituteforenergyresearch.org/topics/encyclopedia/oil-shale/>

Figure 4 | Proven oil reserves and technically recoverable oil shale resources



Source: Institute for Energy Research

Technology

Shale formations contain hydrocarbons, but its porosity does not allow for oil and gas to be extracted with conventional wells. However, the combination of two decade-old technologies has made it possible to drill oil from these deposits. Horizontal drilling along rather thin layers of shale containing these hydrocarbons, combined with hydraulic fracturing and sand pumping, create the artificial porosity that allows for the outflow of the oil and gas content. This process is known as fracking. The combined use of these technologies by small producers determined to extract oil from these rocks has led to a true revolution in the U.S. and global oil markets.

Shale Oil Production: Engineering and Economics

The unique nature of shale oil production means that its economics is different than that of oil extraction from conventional fields. Investing in oil wells on shale deposits is relatively cheap and rather “stand-alone.” It takes less than a month to build a typical well in Texas, and to start drilling and fracking. The process costs about US\$7 million and produces 300,000 barrels in 18 months, after which output sharply diminishes (Gafney and Cline, 2014).

On the contrary, optimal operation of a conventional oil reserve calls for a development strategy involving simultaneous drilling of different wells with significant upfront investment, which is paid back over time. Compared with conventional reserves, extraction from shale reserves is much more flexible, and allows for a significantly more agile response to price signals. It is important, nevertheless, to consider the competitive advantage of oil projects in the United States, which enjoys easy access to production infrastructure, transportation, and surface infrastructure in general, translating into significant cost savings when compared to projects in other countries.

Ownership of Hydrocarbon-rich Lands

In the United States, unlike in the rest of the world, most land (including the ground that may contain hydrocarbons), except for territories belonging to the federal or state government, is privately owned. The landowner can also sell mineral rights over underground resources to third parties. In the case of hydrocarbons, the owner of the reserves has the right to drill and develop them.

Industrial Organization

The nature of hydrocarbon ownership lends itself perfectly to individual well technology for shale oil extraction, leading to an industrial organization with multiple owners of reserves and different companies hired to exploit them. The process begins with the investors, who acquire the rights to drill and plan the exploitation of their reserves by contracting companies to perform the drilling and the fracking, as well as to build surface infrastructure. This means that hundreds of investors and service companies would be competing to improve technologies and reduce costs to maximize profits.⁵

The Political Economy of Oil Production in the United States

To develop shale oil reserves, numerous investors and service companies come together in an ad hoc manner for specific projects, as it is impossible to coordinate among so many different producers all acting of their own accord. Coordination is done through the market. Each investor and each service company responds separately to price signals that ensure minimum profits.

Competition acts as the ubiquitous incentive for each player to increase its productivity. Through the competitive process, individual actions lead to a collective outcome that reflects sustained growth in productivity and reduction in production costs. Given the number and diversity of market players, participants swiftly adapt to changing situations whenever a business opportunity arises.

Oil Production in the United States

The evolution of oil production in the United States over the past 30 years illustrates that, after reaching a historic peak of 10.58 Mbd in 1985, output declined by more than one-third to 6.78 Mbd in 2008 (Figure 2). There are two reasons behind the decline. First, oil prices collapsed in 1986, and then remained at dismal levels for over 15 years, into the beginning of this century. Second, there was a depletion of conventional oil reserves. The widespread perception was that the downturn in production was irreversible.

Defying all expectations, oil production in the United States began to grow in 2008, hitting a record high of 11.6 Mbd in 2014, an increase of 75 percent in six years. The proportion of U.S. oil production over world output decreased by more than half between 1985 and 2008, from 18 to 8 percent. From 2008 onward, U.S. oil production grew by more than 50 percent, reaching 13 percent of world output by 2014.

There are three primary reasons behind the unexpected and large-scale recovery of oil production since 2008: (i) the soaring oil prices up until 2014, (ii) the exploitation of abundant deep water oil reserves in the Gulf of Mexico, and (iii) the development of extensive unconventional oil reserves. Unthinkable a few decades ago, the development of deepwater oil reserves and unconventional deposits is the result of extraordinary technological progress in various fields of oil production spurred by high prices. Global developments, along with advances in technology, have been crucial for preventing the depletion of hydrocarbon reserves in the United States and worldwide.

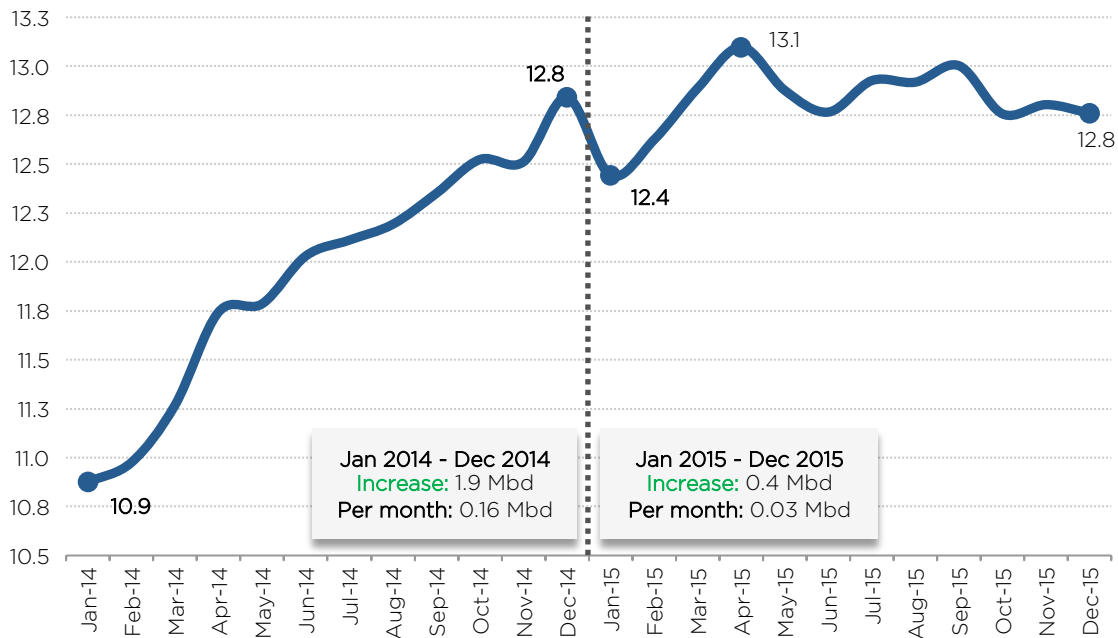
As previously mentioned, recent shifts are changing the face of the international oil market. The United States is once again the leader in global oil production and home to the largest technically recoverable reserves.

⁵ To understand how shale oil development works, refer to Zuckerman (2013) and Gold (2014).

Despite the steep decline in prices, oil production in the United States is far from falling. Production increased until the second quarter of 2015, and December output was 400,000 b/d more than that of January (Figure 5). In November 2014, Saudi Arabia and other OPEC countries announced their strategy of not yielding market space to make room for increased output in the United States, which has been partially successful as the latter stopped increasing production beyond April 2015.

However, contrary to numerous analyst projections, average annual oil production in the United States grew **between** 2014 and 2015, in spite of prices falling to US\$40 per barrel toward year-end. Oil production in the United States grew in the first four months of the year to 13.1 Mbd, decreasing slightly to 12.76 Mbd by December. Production averaged 12.8 Mbd in 2015, compared with 11.6 Mbd in 2014 and 6.78 Mbd in 2008, showing increases of 8 and 85 percent, respectively.

Figure 5 | USA monthly production, 2014-2015, million barrels per day



Why has oil production in the United States been more resilient than what analysts forecasted in a low-price scenario? One explanation is that there was more room for productivity growth than what was thought possible early on. Horizontal drilling techniques have improved significantly in terms of distances reached, while methods in fracking have also advanced, leading to an increase in the amount of hydrocarbons that can be drilled from wells (Braziel, 2015).

Outlook

To build a scenario of oil price evolution in the next five years, it is essential to evaluate the prospect of oil production, and particularly the outlook of unconventional oil production. The basic component that differentiates the new operating model of the international oil market from the current one has three pillars: (i) the size of unconventional oil reserves, (ii) the constant reduction in production costs, and (iii) the oil market's industrial organization with hundreds of players competing against each other. Under the new structure, production costs of unconventional oil in the United States will determine the price ceiling for the evolution of oil prices around the world.

That price level is being defined by the market dynamics of these months. Although oil production in the United States is stagnant, it has hardly fallen either. To forecast the future trajectory of oil prices, it is important to consider not only the evolution of production technologies but also the different levels of natural productivity of various unconventional oil reserves in the United States, as well as varying density levels of surface infrastructure available to oil-producing states, which affect production costs. For example, oil production in North Dakota is more vulnerable to price downturns due to higher sunken costs as a result of less surface infrastructure, while oil production in Texas is much more resilient to current price levels.

Going forward, everything seems to indicate that prices above US\$50 per barrel will allow for the United States to extract significant amounts of unconventional and deep water oil, and that international mid-term prices (in the next five years) would fall below this level, provided that there are no geopolitical disruptions. Production costs in the United States will set the limit for international oil prices.

OPEC

As in some other countries outside of the United States, the State owns OPEC's hydrocarbon reserves. Governments around the world control oil production in two ways: (i) directly through state-owned enterprises that keep production under a monopoly control or (ii) indirectly through regulatory agencies or other institutions to manage the exploitation of natural resources.

Regulatory agencies open up oil-rich lands to competing investments from private or public companies. In all of OPEC's 13 member countries, the governments maintain direct control over oil production. The United States has a different situation, in which oil production is in the hands of hundreds of private companies acting independently, instead of being controlled by the government.

OPEC Political Economy

To understand oil policy dynamics in OPEC countries, it is helpful to start by dividing these countries into two groups, each with common features and similar oil policy direction among themselves. On one hand, there are countries with relatively small populations and economies, very large oil reserves, and high production capacity. This group consists of Kuwait, Qatar, Saudi Arabia, and United Arab Emirates, which, aside from having similar characteristics, are politically connected as members of the Gulf Cooperation Council (GCC), which also includes non-OPEC countries Bahrain and Oman.

Due to their smaller sizes and higher oil production than other OPEC countries, members of the GCC are better at weathering lower prices. Additionally, by having vast reserves, GCC countries have remarkably long-term perspectives when it comes to oil policy design; they are willing to sacrifice high prices in the short term to keep their production competitive, thus maintaining or increasing market share to develop its abundant hydrocarbon reserves in the long run.

The rest of the countries—especially Iran, Nigeria, and Venezuela—have relatively large populations and economies, as well as greater capital absorption capacity that, due to political reasons, prefer high prices in the short term even at the expense of sacrificing competitiveness of their reserves in the long run. This leads to loss of market share. These countries also have lower oil production and thus less capacity to influence the market.

Currently, OPEC member countries produce more than 38 Mbd, of which almost one-third comes from Saudi Arabia and more than one-half from Kuwait, Qatar, and United Arab Emirates. These countries, and Saudi Arabia in particular, have the necessary weight to assert leadership over the rest of the OPEC members.

Oil Policy of OPEC Countries

We will divide the analysis of the evolution of OPEC's oil policy in the last 35 years in periods defined around milestones that have marked the progression of prices over the timespan. The same periods are used in the later sections of the essay.

1980 to 1985: Price defense

After a number of politically driven supply disruptions through the 1970s, oil prices went from US\$1.8/b in 1970 to US\$ 36.8/b in 1980 (when adjusted for inflation and in 2015 U.S. dollars, the price went from US\$11/b in 1970 to US\$106/b in 1980). Similar to how they reacted to the quantum leap in prices, OPEC countries dealt with shrinking demand by cutting production to defend high prices throughout the first half of 1980s.

At first, production was reduced voluntarily and individually, while from 1980 forward, governments collectively enforced the cuts. Analysts at the time regarded the contraction in demand to be temporary, while industrialized countries recovered historical growth rates. Convinced by their assessment that demand would pick up without affecting prices when the world economy recovered, OPEC countries agreed to these cuts to maintain the high prices.

By 1985, OPEC countries had reduced their oil production by almost 50 percent, from 30 Mbd to slightly over 15 Mbd. Saudi Arabia carried out the bulk of production cuts in absolute and relative terms, which reduced its output by almost two-thirds, from about 10 Mbd to barely 3 Mbd. Prices further decreased, as energy consumption became more efficient and energy supply more diversified in non-OPEC countries.

Not only did prices keep falling, but these historically high prices rendered proved undeveloped reserves profitable in various OECD countries such as Norway, the UK, and the United States, and stimulated production in a large number of countries outside of OPEC and OECD, including Mexico, which later became a member of the latter.

1985 to 2000: Reclaiming Markets

In August 1985, before the perceived failure of the output reduction policy, Saudi Arabia distanced itself from the rest of OPEC. After cutting its output by nearly 70 percent in a futile attempt to cling onto exceptionally high prices recorded in the 1970s, the Saudi Arabian government unilaterally announced that it would set the price of its oil export according to demand in principal markets (known as "netback pricing policy"). As such, they could recover market share lost in the process of price defense and steadily increase production. Other OPEC members had no choice but to follow Saudi Arabia's lead, as well as that of fellow GCC members. The announcement of the policy change triggered a price crash in 1986 to one-third of the level in 1980. The policy of adjusting prices down to competitive levels yielded results, allowing OPEC member countries—in particular Saudi Arabia—to regain a hegemonic role in the market at the turn of the century.

By 2000, OPEC had more than doubled output compared with 1985, adding 15.2 Mbd and returning to pre-cut levels of 1979. Saudi Arabia nearly tripled its output and reclaimed the lead in oil production, far exceeding Russia and the

United States, reaching 9.5 Mbd. Throughout this period, OPEC added 1 Mbd per year on average, of which 40 percent, or 0.4 Mbd, came from Saudi Arabia (Figures 6 and 7).

Figure 6 | OPEC annual production, 1985-2014, million barrels per day

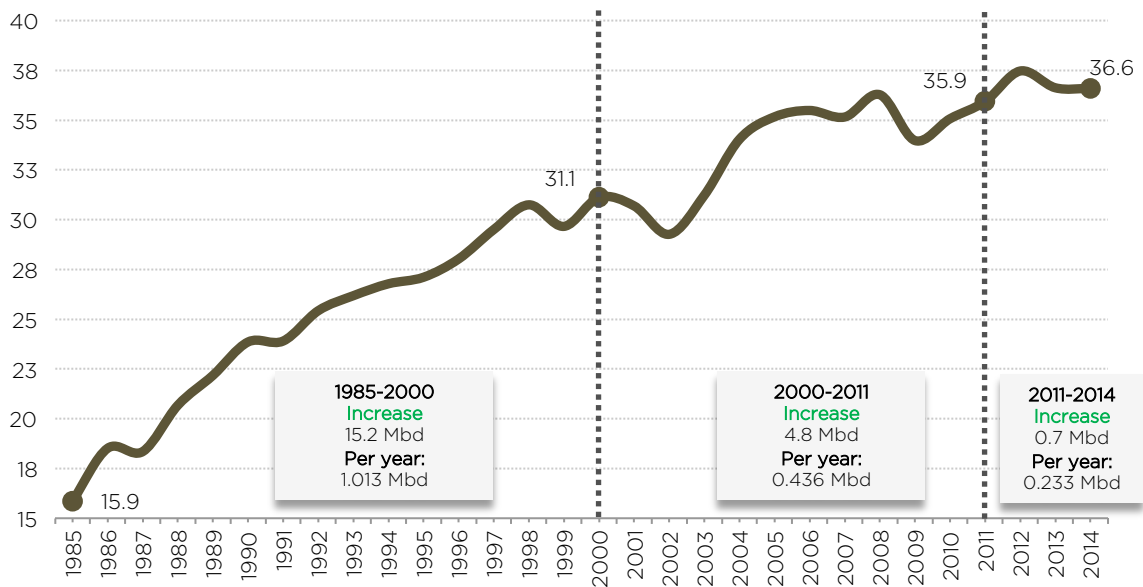
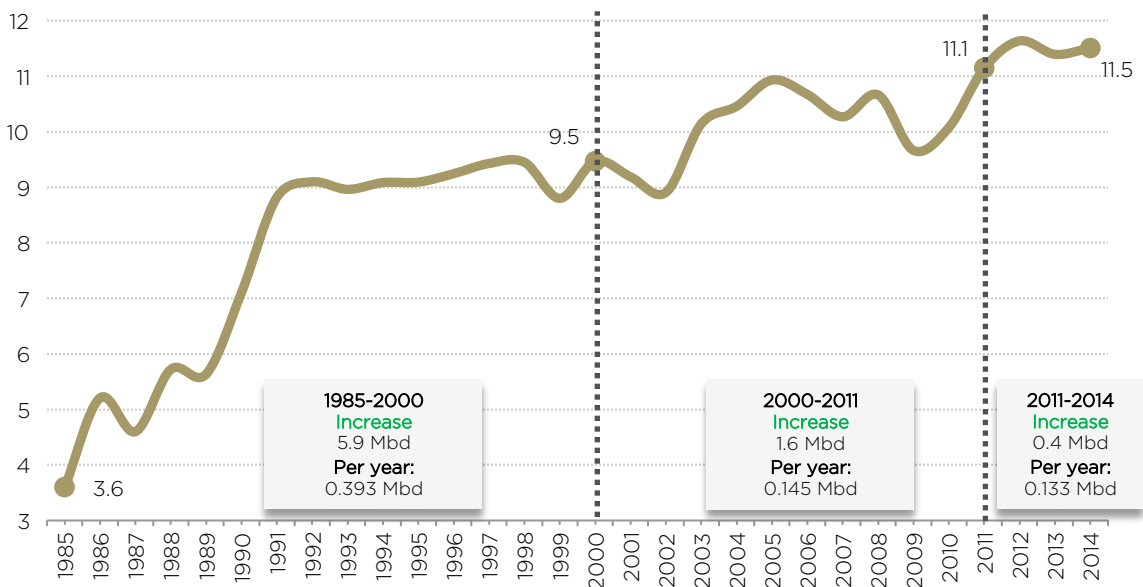


Figure 7 | Saudi Arabia annual production, 1985-2014, million barrels per day



2000 to 2011: Oil Price Super Cycle

The policy aimed at regaining market share was successful in its own right. In the early 2000s, OPEC members had exhausted idle capacity freed up by output reduction in the first half of 1980s. This led to slower and more costly growth in OPEC output compared to 15 years prior. Expanding production now meant building additional capacity, which slowed down growth and raised production costs.

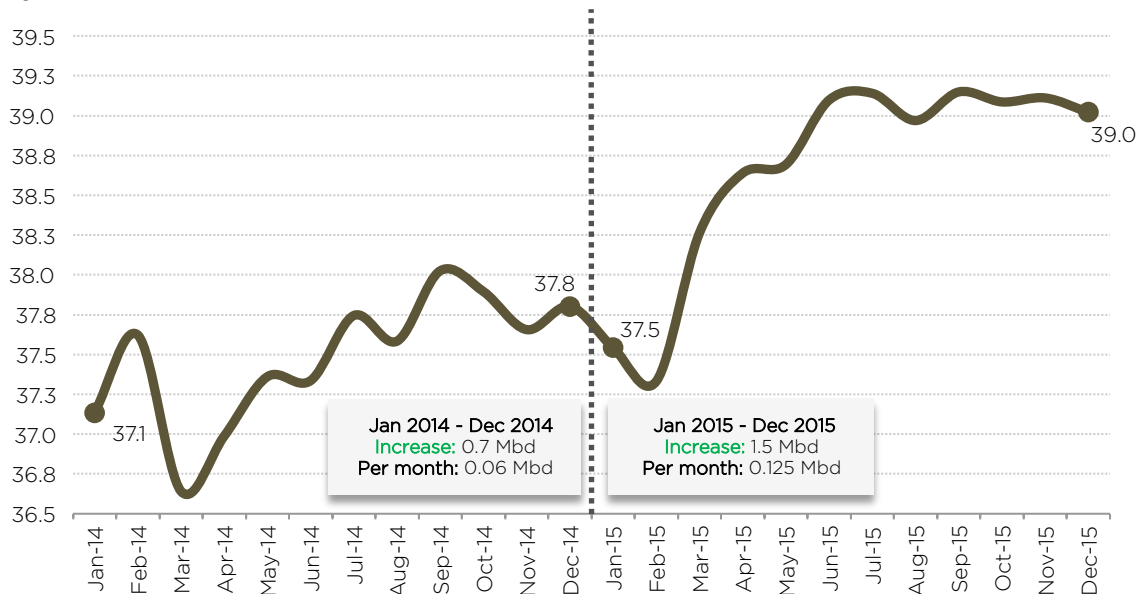
The decline in the growth of OPEC supply, combined with an unprecedented acceleration in demand by developing countries, triggered steady price hikes from 2000 onward. Oil prices quintupled from 2000 to 2008; then experienced a temporary drop associated with the financial crisis in 2009; and maintained the new level until mid-2014 (Figure 1). The increase in price not only involved oil, but also all commodities, and was fueled by a shift in world demand from industrialized countries grouped into OECD to developing countries, particularly Asian countries, as will be discussed later herein. Commodity prices became stagnant in 2011, with the exception of oil prices, analyzed below.

Despite a sustained increase in prices, OPEC countries expanded output by less than one-sixth between 2000 and 2014, which in turn contributed to high prices. OPEC output rose from 31.1 Mbd in 2000 to 35.9 Mbd in 2011, a 40 percent average growth over the past 15 years (Figure 6).

2011 to 2014: Recent Policy

The historical context sheds light on why Saudi Arabia, along with fellow GCC members, decided against reducing output to free up market space for growing production from the United States. This decision took place in an Ordinary Meeting of OPEC on November 27, 2014, while earlier, Saudi Arabia had hinted that it would ramp up production to force the United States to cut its output (Ali Naimi, 2014). The announcement of the OPEC declaration, following the leadership of GCC, triggered a price crash in the international oil market. In the months following the meeting, OPEC member countries scaled up output by approximately 2 Mbd (Figure 8).

Figure 8 | OPEC monthly production, 2014-2015, million barrels per day



This position was nothing new given what happened in 1985 and what had been demonstrated over the previous five years. In the recent past, Saudi Arabia had shown evidence of their declared policy of avoiding unexpected and uncontrollable spikes to maintain competitiveness vis-à-vis alternative energy sources without affecting global economic growth (Ali Naimi, 2014). The first evidence became clear in 2011, when oil production in Libya collapsed as a result of the insurrection that toppled the Regime of Colonel Gadhafi. Saudi Arabia swiftly reacted by raising its output by more than 1 Mbd to compensate for Libya's exit from the market and prevent a price hike to well above US\$100 per barrel (Figure 7).

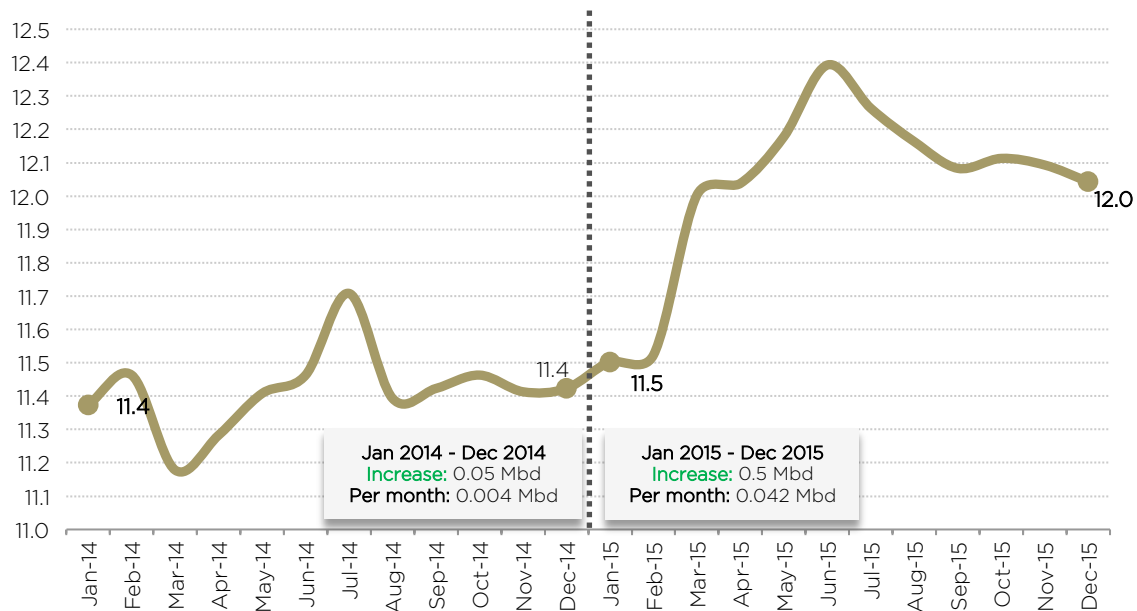
Saudi's oil minister, Ali Naimi, stated that the increase in output was aimed at keeping prices at around US\$100 per barrel, a price at which world economy and demand for oil were still growing, and at which it was considered an equilibrium price. Saudi Arabia ramped up production again throughout 2012 when OECD countries imposed economic sanctions on Iran. Finally in 2013, Saudi Arabia increased output to maintain prices at around US\$100 per barrel, while domestic conflict in Libya led to yet another collapse in its oil production.

These supply disruptions kept oil prices at levels reached between 2011 and 2014, while other commodities saw falling prices as demand declined (Espinasa and Sucre, 2015). In quantitative terms, although Iran and Libya withdrew from the market, OPEC output rose by one-half Mbd, reaching 36.6 Mbd in 2014, as Saudi Arabia more than compensated for decreased supply in these countries (Figure 6). While events in North Africa and the Middle East kept the market on edge and prices at historical levels, the United States took a quantum leap in oil production. When world oil demand took a downturn in 2014 in the absence of further political disruptions, prices collapsed and revealed the market situation, which is discussed later herein.

2015

In accordance with their policy declaration in November 2014, OPEC ramped up oil production by 1.5 Mbd throughout 2015 (Figure 8) in an open battle for market space against American producers. The bulk of the increase came from Iraq, with a rise of 0.9 Mbd, followed by Saudi Arabia, with positive 0.5 Mbd (Figure 9).

Figure 9 | Saudi Arabia monthly production, 2014-2015, million barrels per day



The rest of OPEC countries increased the output by 0.3 Mbd. Far from cutting production in times of oversupply, OPEC boosted output to 37.2 Mbd by the end of 2015 (Figure 8). Output increase of OPEC member countries, along with the reluctance of the United States and the rest of the world to lower production, led to year-end prices being the lowest of 2015 (Figure 1).

Outlook

Global oil production has grown to an annual average of 1 Mbd during the past 30 years, to meet demand, which grew to an average of 1.1 Mbd by 2014. For the main scenario, average growth in the next five years is assumed to be the same as it was during the last 30 years (1 Mbd).

Currently, OPEC output represents 42 percent of global oil supply. Supposing that for the main scenario OPEC will maintain its market share, it will have to increase output by approximately 400,000 barrels per day in the next five years, equivalent to a 1 percent increase per year, which seems realistic. Saudi Arabia could easily produce half of this increase.

In addition, based on mid-term market prospects, Iran, Iraq, and Libya should be examined more closely than other OPEC countries. In Libya, more than 1 Mbd of production capacity is shut down due to domestic conflict, while in Iran, more than one-half Mbd of capacity sits idle due to sanctions (Espinasa and Sucre, 2015).

These two countries will likely increase production at current price levels as soon as political conditions allow, weakening the market even further. Iraq, the second largest producer of OPEC, is continuing to ramp up production both to pay for postwar reconstruction and to recover the level of production compatible with the magnitude of its vast reserves.

Rest of the World

We will divide the rest of the world outside of OPEC in two blocs: industrialized OECD countries (Figure 10) and non-OECD developing countries (Figure 11). There is no connection of any type that binds these countries to act jointly in terms of oil policy; oil companies in these countries—national or foreign, private or public—respond primarily to market signals. Companies make investment and production decisions based on price signals and business opportunities, given the operational and tax framework of these countries.

As of 1990, with the dissolution of Soviet Union, former USSR member countries opened up their strategic sectors—in particular the oil sector—to private investment and began to function as market economies. Likewise, China was incorporated into world trade at the beginning of this century, and its economy now follows market-based rules. To analyze the evolution of oil production in these two blocs, the same periods will be used that were defined for describing oil policy of OPEC member countries.

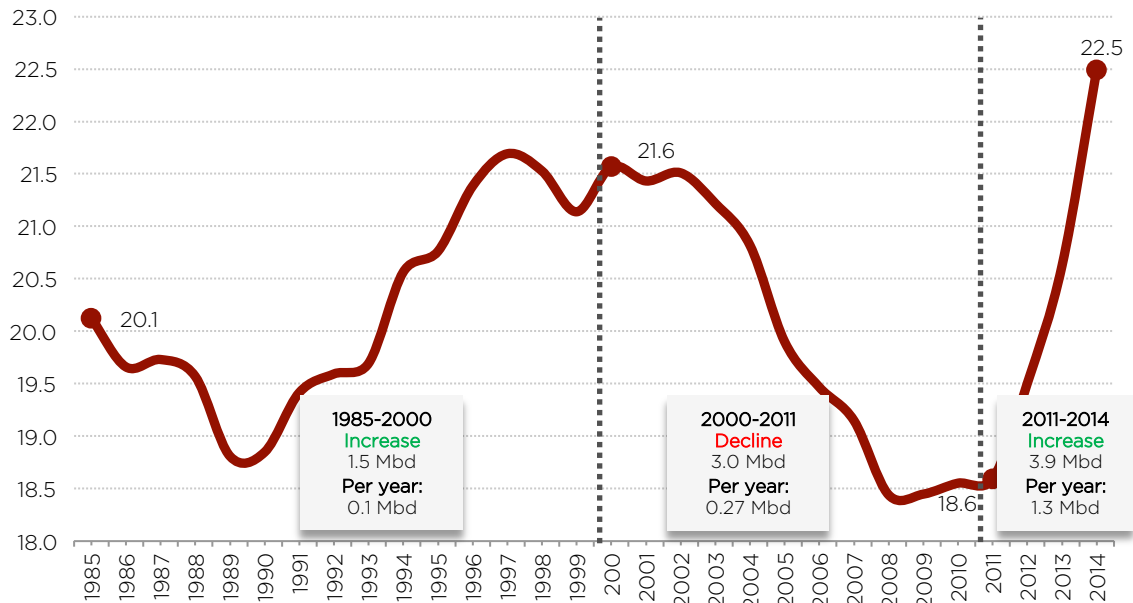
1985 to 2000

OPEC's strategy of relying on competitive pricing to gain market share meant that the rest of the world as a whole did not increase their production in absolute terms, and that OPEC production grew along with world demand for oil during these 15 years. As previously mentioned, OPEC output grew by 15.2 Mbd, while output from the rest of the world rose by 2.6 Mbd. The following describes what happened in the rest of the countries during this period.

OECD

OECD countries as a whole increased their production by 1.9 Mbd throughout the 15-year period (Figure 10). As mentioned above, U.S. production fell by 2.8 Mbd, more than one-third of its production level for 1985, to 7.7 Mbd in 2000. This drop was partially offset in North America by a combined production increase of 1.4 Mbd in Canada and Mexico. Nevertheless, the production expansion of Norway in the North Sea compensated for the bulk of the decline in output in North America. Norway's oil production rose by 2.5 Mbd between 1985 and 2000.

Figure 10 OECD annual production, 1985-2014, million barrels per day

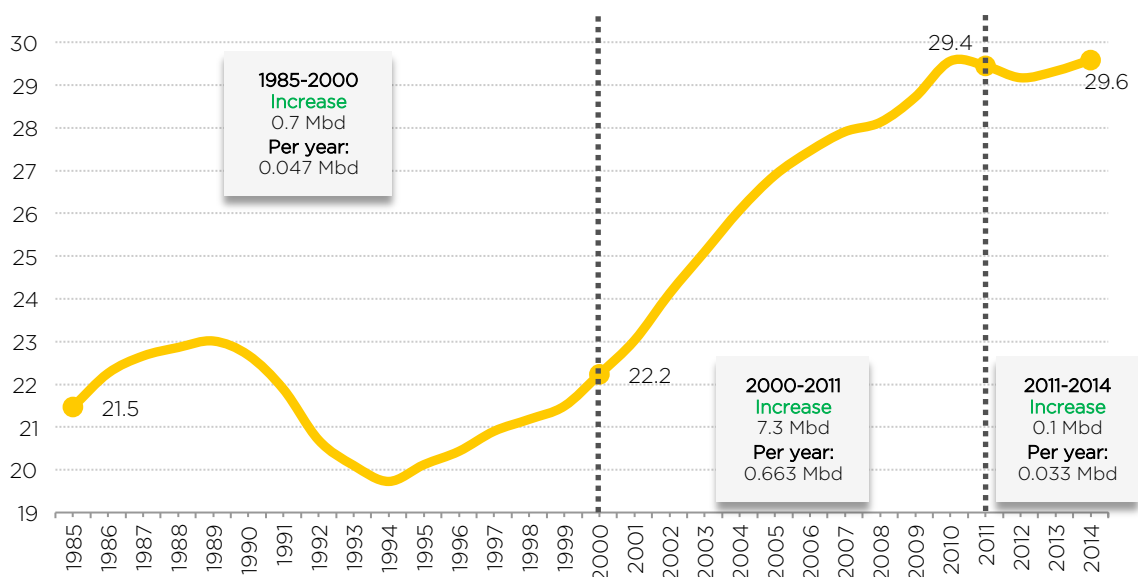


Non-OECD

The oil production crash in the Soviet Bloc is the most important incident to highlight between 1985 and 2000. Soviet Bloc production fell by 4.0 Mbd, from 12.0 Mbd to 8.0 Mbd between 1986 and 2000. The decline in production of the former Soviet Union was more than compensated by the increase in production in the rest of the world outside of OPEC.

Countries in the rest of the world increased output by 4.7 Mbd, with equal parts coming from Africa, Asia, and South America. With this, non-OPEC, non-OECD countries increased production by 0.7 Mbd during the same period (Figure 11). Despite low prices throughout this time, however, countries outside of the Soviet Bloc, OPEC, and the OECD raised their output by more than 50 percent from 9 Mbd to 14 Mbd.

Figure 11 | Non OECD / Non OPEC annual production, 1985-2014, million barrels per day



2000 to 2011

Output increase in OPEC countries slowed down as they used up idle capacity resulting from production cuts in the first half of 1980s. In addition, oil production of OECD countries as a whole continued to decrease throughout this period. Given sustained growth in demand, now buoyed by non-OECD countries, as analyzed further below, countries outside of OPEC and OECD steadily increased their output in light of declining supply from conventional producers. The dynamics of this period is discussed next.

OECD

The production slump in the United States that began in 1985 continued, bottoming out at 6.7 Mbd in 2008, at which point oil drilling from deep waters and unconventional reserves helped to reverse the trend. By 2011, output in the US was at a similar level to the year 2000 of 7.9 Mbd.

Declining output in the US was met with similar declines in the North Sea. Between 2000 and 2011, the combined output of Norway and the UK declined by 3.3 Mbd. Oil production also began to decrease in Mexico in 2005 and by 2011 had fallen by 3.0 mbd relative to the level reached during the year 2000. Despite the steady increase in production in Canada and the United States between 2000 and 2008, overall OECD production fell by 3.0 Mbd between 2000 and 2011 (Figure 10).

Non-OECD

Global oil supply grew by 9 Mbd between 2000 and 2011. During this time, supply from OECD countries fell by 3 Mbd, while output from OPEC countries rose by 5 Mbd. Non-OECD, non-OPEC countries filled the gap of 7.3 Mbd (Figure 11), the bulk of which came from former Soviet Union countries. These countries had increased their production by 5.5 Mbd, mostly by exploiting temporarily idle capacity that resulted from the collapse of the Soviet Bloc and the change in the economic system. The remaining 1.8 Mbd in output came in equal parts from Africa, Asia, and South America.

2011 to 2014

As was the case for other commodities, demand for oil slowed down as developing economies in Asia lost steam from 2011 onward. Output increased as demand declined, leading to oversupply. On one hand, due to a rise in production in Saudi Arabia, OPEC output increased as a whole during this period, despite a decrease in supply in Iran and Libya. Nevertheless, the main supply-side factor that led to oversupply was undeniably the large-scale development of unconventional oil in the United States. The next subsection analyzes the evolution of non-OPEC output during this period.

OECD

Between 2011 and 2014, output in the North Sea and Mexico continued to fall, albeit at a decreased level. The reduction in output in Mexico, Norway, and the UK was more than compensated by the increase in Canada. Thus, incremental output in the United States led to a net increase in OECD production. Oil production in the United States grew by nearly 4 Mbd, from 7.9 Mbd in 2011 to over 11.6 Mbd in 2014 (Figure 10).

Non-OECD

Oil production outside of the OECD and OPEC remained largely unchanged between 2011 and 2014 (Figure 11), during which time global oil output grew by 4.6 Mbd and demand only grew by 3.1 Mbd, leading to oversupply and low prices in the international oil market.

2015

Oil production outside of OPEC member countries increased slightly throughout 2015. Output grew by 0.6 Mbd, or about 1 percent, between January and December (IEA, 2016). Contrary to expectations and despite the sustained drop in oil prices, output increased. Both OECD and non-OECD countries increased in equal parts (0.3 Mbd per group) (Figures 12 and 13). The increase in OECD countries was concentrated in the United States, while in non-OECD countries it was spread among various producers.

Figure 12 | OECD monthly production, 2014-2015, million barrels per day

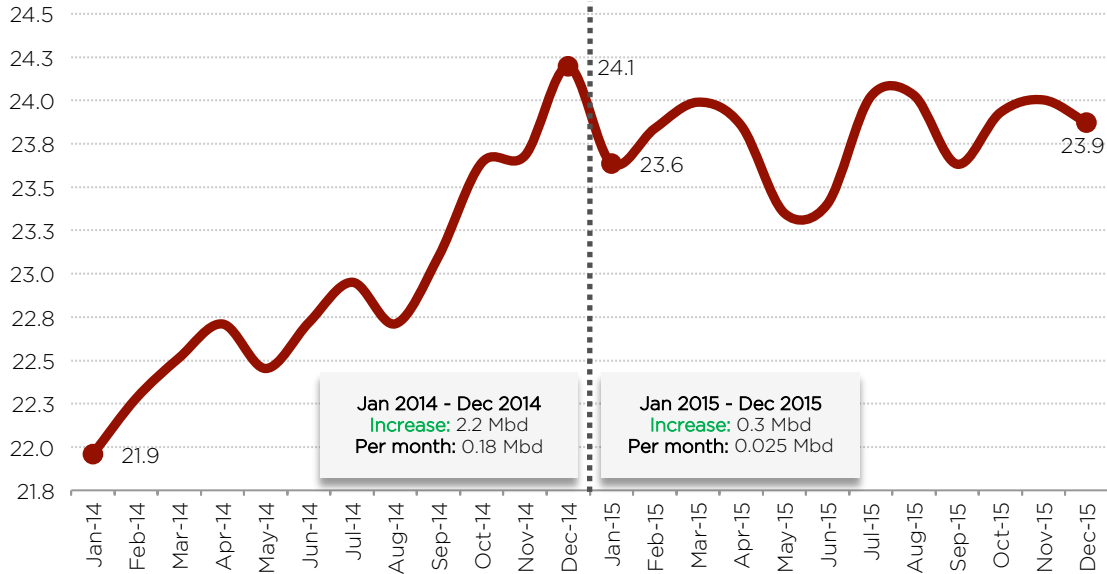
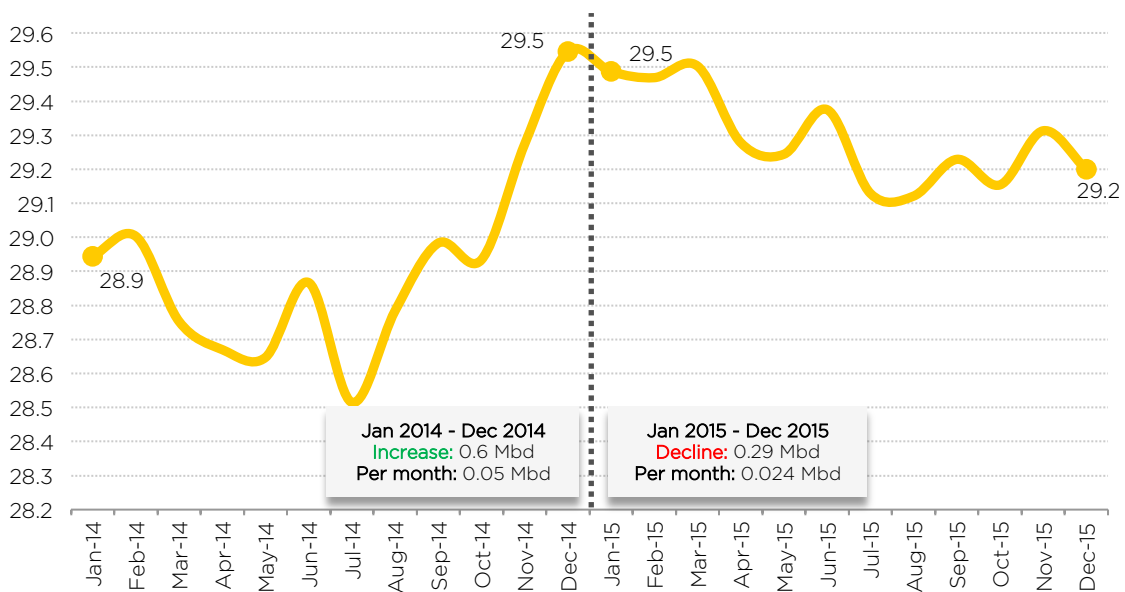


Figure 13 | Non OECD / Non OPEC monthly production, 2014-2015, million barrels per day



Outlook

The outlook for production is built on the following premises: (i) that oil production increases by 1 Mbd each year in the next five years, and (ii) that OPEC maintains its market share, wherewith its output increases by 0.4 Mbd

per year. As such, output in the rest of the world would grow by 0.6 Mbd per year over the next five years.

Pricing will determine whether or not non-OPEC countries can reach this goal, and unconventional oil in the United States could be a sufficient source to fuel this incremental production. Given the magnitude of the reserves and the speed of response to market signals, unconventional oil in the United States will set a global price ceiling for oil based on its production cost.

Additionally, the pressure of falling prices in the recent past will boost productivity in the rest of the world. Competition will reduce production costs and make additional output profitable at much lower price levels than US\$100 per barrel, the average market price for oil between 2011 and 2014. Ultimately, unconventional oil production in the United States will set the global price for oil based on the marginal volume it generates. As previously argued, this price is unlikely to exceed US\$50 dollars per barrel.

Demand

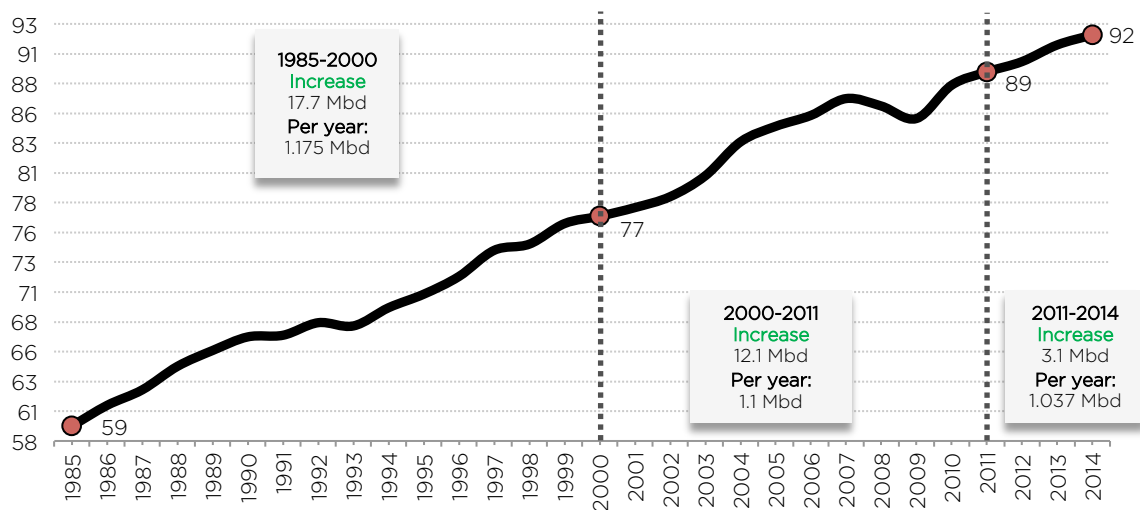
Perhaps the main argument used to justify the super cycle of oil prices between 2000 and 2011 has been a quantic leap in global oil demand throughout this period. This is not the case. In fact, the opposite was true, as average annual demand between 2000 and 2011 was lower than that of the previous 15 years. Demand for oil between 1985 and 2000 grew at an annual average rate of nearly 1.2 Mbd, while it increased by nearly 1.1 Mbd between 2000 and 2011.

What, then, explains the fourfold price increase? An important part of the answer is that, although the annual growth rates of the two periods were similar, there was a drastic change in the composition of global oil consumption growth, which shifted from industrialized countries (OECD) to developing countries (non-OECD). This section examines both of these periods

1985 to 2000

During this period, global oil consumption grew from 59.2 Mbd to 76.9 Mbd, an increase of 17.7 Mbd in 15 years, equivalent to a 26 percent increase or 1.175 Mbd in average annual increase (Figure 14). Consumption by OECD countries was one of the key drivers of this increase.

Figure 14 | World annual consumption, 1985-2014, million barrels per day



OECD

Consumption in OECD countries grew from 37.5 Mbd to 48.3 Mbd (Figure 15), an increase of 10.8 Mbd in 15 years, equivalent to a 25 percent growth or 1.175 Mbd in average annual terms.

Non-OECD

Consumption in developing countries grew from 21.8 Mbd to 28.6 Mbd (Figure 16), an increase of 6.8 Mbd in 15 years, equivalent to 28 percent growth or 0.453 Mbd in average annual growth. In absolute terms, industrialized countries—whose consumption grew by 50 percent more than that of developing countries—boosted global consumption during this period. In relative terms, however, consumption in developing countries had slightly higher growth than in industrialized countries, at 28 and 25 percent, respectively.

Figure 15 | OECD Annual consumption, 1985-2014, million barrels per day

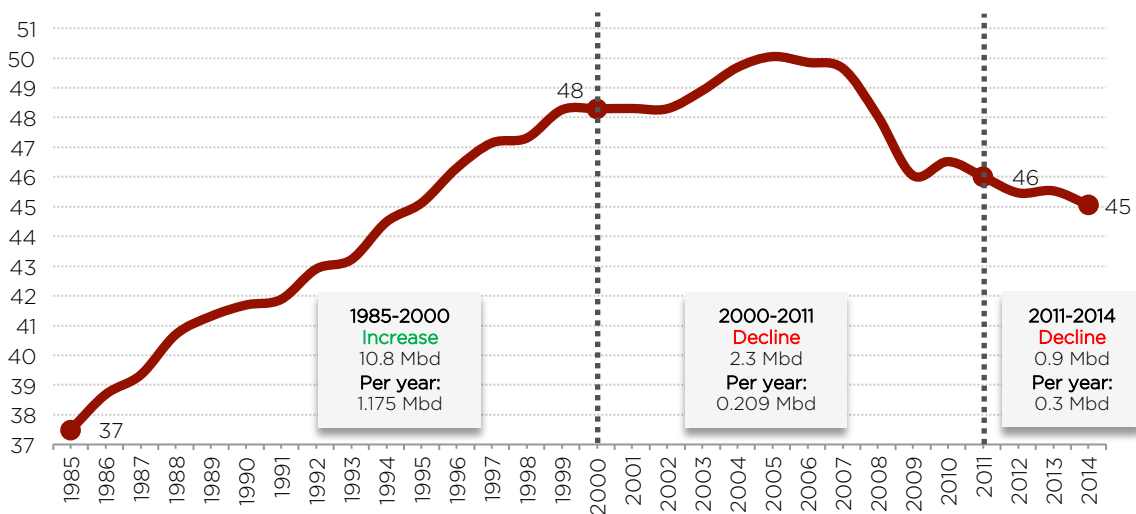
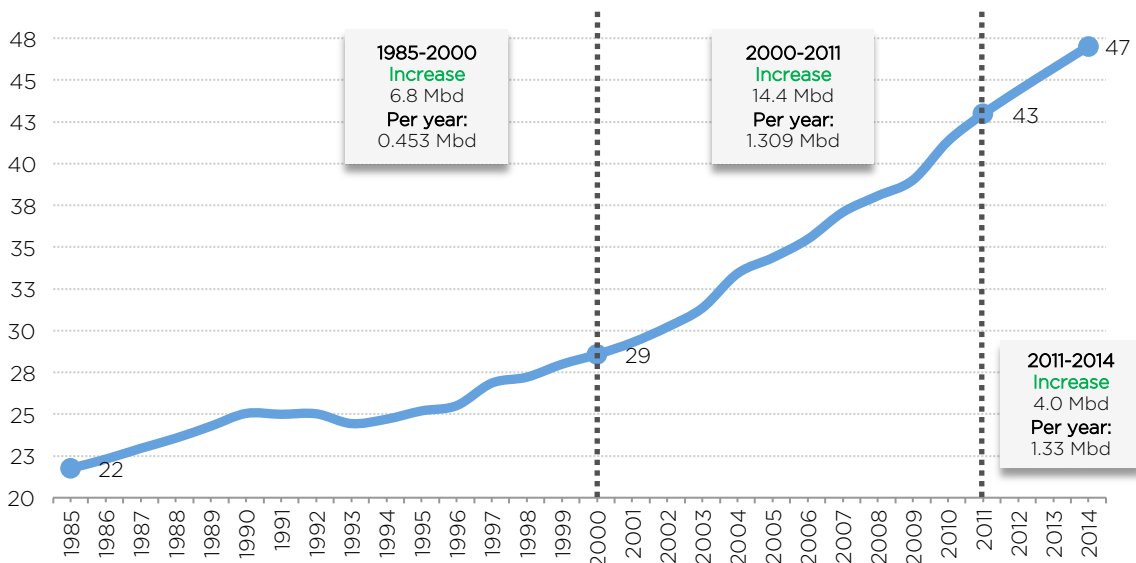


Figure 16 | Non-OECD Annual consumption, 1985-2014, million barrels per day



2000 to 2011

Global oil consumption during this period grew from 76.8 Mbd to 89.0 Mbd, an increase of 12.2 Mbd in 11 years, equivalent to a 20 percent growth in total or 1.109 Mbd on average per year (Figure 14), which is slightly lower than growth between 1986 and 2000. However, unlike during the previous period, between 2000 and 2011 non-OECD countries drove consumption growth.

OECD

Consumption by industrialized countries fell during this period, from 48.3 Mbd to 46.0 Mbd, a drop of 2.3 Mbd in 11 years, with a decrease of 0.209 Mbd per year on average (Figure 15).

Non-OECD

Decreasing consumption in OECD countries was more than compensated for by growth in non-OECD countries between 2000 and 2011, which went from 28.6 Mbd to 43.0 Mbd, an increase of 14.4 Mbd in 11 years, equivalent to a consumption growth of 60 percent and an average annual increase of 1.309 Mbd (Figure 16).

Although average annual consumption during this period was lower than that of the previous 15-year period, there was a substantial shift in the composition of global demand from industrialized countries to developing countries, which helps explain the quantic leap in prices from a demand perspective.

Why has the shift in demand contributed to the quantic leap in oil prices? Accommodating consumption growth of such magnitude in developing countries has entailed building new transportation infrastructure and managing volumes of crude never seen before in an extraordinarily short period of time.

Bottlenecks associated with building new infrastructure at a time of rising demand forced developing countries, especially in Asia, to pay higher prices to secure the oil needed to fuel their growth. In addition to changes in demand and costs associated with supply bottlenecks, these countries also faced rising production costs as OPEC used up the idle capacity that allowed for sustained supply growth at low prices between 1985 and 2000.

2011 to 2014

As was the case for other commodities, global demand growth for oil slowed down between 2011 and 2014, with an increase of 3.1 Mbd (from 89.0 Mbd to 92.1 Mbd), equivalent to a 3.5 percent growth and an average annual increase of 1.037 Mbd (Figure 14), compared to 1.175 Mbd and 1.109 Mbd in previous periods (1986–2000 and 2000–2011, respectively). Global demand growth further decelerated in 2014, dropping to 0.8 Mbd. OECD countries played a larger role than non-OECD countries in the slowdown of global demand during this period.

OECD

The downturn in consumption by OECD countries accelerated compared to the period between 2000 and 2011. Consumption in 2014 was 45.1 Mbd, compared to 46.0 in 2011 (Figure 15)—a contraction of 0.9 Mbd, equivalent to reduction by two-thirds and an average annual decrease by 0.3 Mbd, while consumption decreased by 0.209 per year on average during this period.

Non-OECD

Consumption in developing countries grew from 43.0 Mbd to 47.0 Mbd between 2011 and 2014, a 4.0 Mbd increase equivalent to a 9 percent growth and an average annual increase of 1.33 Mbd (Figure 16), which was

almost the same as the previous period. Average yearly growth showed no signs of deceleration. Each year, however, consumption was less than the previous one during the four-year period, even though the annual average remained the same. As discussed above, decreasing demand in light of growing supply paved the way for the oil price crash that began in the third quarter of 2014.

2015

The drop in oil prices throughout 2015 translated into a significant increase in consumption over the average amount during the last 30 years. Preliminary results show an average annual increase of 1.7 Mbd in 2015, compared to 1.1 Mbd in nearly three decades beginning in 1986. Global consumption grew by about 2 percent in 2015.

It is worth noting that the largest relative increase in consumption came from OECD countries, which went from a contraction of 0.33 Mbd in 2014 to an expansion of 0.48 in 2015, nearly 1.50 Mbd more than that of 2013. Consumption in OECD countries increased by barely over 1 percent in 2015. In absolute terms, in non-OECD countries consumption growth was 1.2 Mbd in 2015, which is almost the same as that of 2014.

It is difficult to estimate how much of the increase in final demand in 2015 was strictly associated with economic growth, and how much was due to greater elasticity at lower prices. To calculate, it would be necessary to differentiate the accumulation of stock not classified as business inventory by companies.

As expected, business inventories took a great leap forward in 2015, growing in OECD countries by 140 Mbd between October 2014 and October 2015, and hitting a historic record of 2.460 million barrels, equivalent to 54 days of consumption needs by these countries. This historic level of inventories is another factor laid against price recovery in the short term. Global data show sustained accumulation of inventories throughout 2014 and the first three quarters of 2015 (IEA, 2016). Average daily oversupply during these seven quarters was 1.2 Mbd.

Outlook

Global oil consumption has shown highly stable average growth throughout the three periods discussed herein. Average consumption growth was 1.175 Mbd between 1986 and 2000, 1.11 Mbd between 2000 and 2011, and 1.037 between 2011 and 2014. The overall average consumption growth for the entire period was 1.111 Mbd.

On the other hand, consumption growth varied from year to year. There were two years in which growth hit a record of 2.8 Mbd (2010 and 2004), and seven years (including these two) during which growth was more than 1.7 Mbd. In other words, consumption growth for 2015 was high, but not exceptional given the historical context.

Going forward, there are two sets of opposing forces that will affect demand growth. On the one hand there are two main forces, among others, that push up demand: (i) global economic growth and (ii) greater elasticity of oil demand to economic growth at lower oil prices.

On the other, there are two main forces, among others, that kept demand down: (i) greater energy efficiency and diversification, which arose out of the need for alternative energy sources designed in response to the historic increase in prices, and (ii) additional restrictions on hydrocarbon consumption that may stem from new agreements to cap the pace of global warming. In the

absence of a thorough analysis that goes beyond the scope of this paper, the average demand growth in the last three decades is set at 1.1 Mbd as a proxy for average growth in the next five years.

Oil Prices

To follow on to the discussion of the evolution of global oil supply and demand, this section examines the evolution of oil prices, first putting the current situation in the context of the past 30 years, and from there, building a scenario to simulate mid-term price evolution in the next five years. This section examines the same periods previously discussed, which are mainly influenced by two supply-side actors: OPEC members (Saudi Arabia in particular) and the United States.

1986 to 2000

As previously summarized, the increase in oil supply between 1986 and 2000 was propelled by production growth in OPEC countries with relatively little effort, as they steadily scaled up production by making use of idle capacity from the first half of the 1980s. OPEC increased output by 15.2 Mbd—to which Saudi Arabia alone contributed 5.8Mbd—while global supply grew by 15.4 Mbd.

It is worth recalling, however, that during this period the collapse of the Soviet Union in 1990 led to a decrease in 4.0 Mbd. OECD countries raised production by 1.4 Mbd, while non-OPEC and non-Soviet countries raised production by 4.8 Mbd. This is an important point, since these countries, which had heretofore played a minor role, compensated for the Soviet Union's exit from the global oil market.

Average WTI price for this period was US\$20 per barrel, which, when adjusted for inflation would be equivalent to a price of US\$33 per barrel today, or one-fifth and one-third, respectively, of the exorbitantly high prices that prevailed between 2011 and mid-2014. It is important to emphasize that the prevailing prices between 1986 and 2000 were attractive enough to boost supply from developing countries outside of OPEC and the former Soviet Union by 50 percent or 5 Mbd.

2000 to 2011

During this period, known as the super cycle of commodities in general and of oil in particular, prices tripled from US\$30 per barrel in early 2000 to US\$90 per barrel in the beginning of 2011. Based on a comparison of average prices of this period with average prices of the previous one, the nominal price nearly tripled, increasing from US\$20 per barrel to US\$56 per barrel. In real terms, between the two periods oil prices doubled from US\$33 per barrel to US\$66 per barrel in real terms.

As argued above, there are three reasons behind the price increase: (i) the massive shift in demand composition from industrialized countries to developing countries, in general, and to Asian countries, in particular; (ii) the exhaustion of idle capacity that once allowed OPEC countries to increase output with minimal effort during the past 15 years, which led to high development costs; (iii) the substantial decline in oil production in OECD countries. Due to the last two factors, oil supply in the rest of the world rose by 7 Mbd or one-third during this period.

Output increases in both OPEC countries and the rest of the world called for building additional infrastructure, constantly increasing marginal cost of production, which, along with large-scale infrastructure development to meet new consumption demands in developing countries contributed to the rise in observed prices. It is difficult to distinguish which component of the rising

prices was due to higher production costs and which was influenced by costs associated with new infrastructure for transportation and distribution. In fact, marginal price reached US\$100 per barrel, while average price over this period was US\$56 per barrel.

2011 to 2014

Oil prices hovered around US\$97 per barrel in 2011, equivalent to US\$100 per barrel in real terms, while demand began to slow down. According to the detailed analysis above, average annual demand fell during the following three years (2012–2014), in particular due to the economic slowdown in developing countries, while developed economies further contracted. On the contrary, global supply grew during this period, largely driven by accelerated output growth in the United States.

Why, then, did prices remain at historically high levels during these three years? The reasons have been previously stated and analyzed in detail: the high prices had to do with the impact of the sudden exit of Iran and Libya from the supply chain, the shift of the Syrian war to Iraq, and, on a more general level, perceived instability throughout the Muslim world.

Although output increase in Saudi Arabia more than offset the effect of the exit of Iran and Libya, market uncertainty regarding the course of events in North Africa and the Middle East translated into high price premiums. Additionally, the market counted on a swift recovery of demand in developing countries of Asia. As this was not the case, the physical imbalance in the market resulted in historic hikes in business inventories across the world, and especially in OECD countries.

There were two major turning points in the price slump. The first took place in early September, when the World Bank and the International Monetary Fund (IMF), during a joint meeting, corrected the expected global economic growth rate for 2015 by revising it downward and thus changing the expectations of those who anticipated high prices driven by demand despite supply growth.

The second and more important turning point came on November 27, when Saudi Arabia announced that it would not reduce its output to free up market space for incremental production in the United States during the Ordinary OPEC Meeting in Vienna. Instead, Saudi Arabia declared that it planned to ramp up production in an open battle for market space.

As a result of these two announcements, the market had no choice but to accept that the situation of oversupply was structural and could not be fixed in the short term. The benchmark price for WTI fell to US\$60 per barrel in December 2014, a drop of more than 40 percent compared with prices in July of the same year.

2015

The average price for WTI was US\$49 per barrel in 2015, compared to US\$94 per barrel the previous year and US\$ 96 per barrel between 2011 and 2014. The prices showed a downward trend throughout the year. The first semester average was US\$53 per barrel, compared with US\$43 per barrel in the second half the year. The price slump worsened in December, with monthly average price falling to US\$38 per barrel. The reason behind falling prices was sustained oversupply, which is reflected in the steady accumulation of inventories.

As argued throughout this paper, this situation was caused by supply side factors. On one hand, OPEC member countries, particularly Saudi Arabia, increased production up to historic high levels beginning in February and

maintained production at full capacity from June onward. On the other, despite a drop of 200,000 barrels per day during the year, output of OECD countries remained at historic highs. Additionally, the rest of the world ramped up their output during 2015 to historic levels.

Outlook

To see the evolution of oil prices in the next five years, it is important to establish two timeframes: a short-term timeframe ending in 2016 and a longer one that includes the four years that follow. This analysis will also focus on the supply side in principle. Assuming that the current situation of oversupply is around the magnitude of 1.2 Mbd, the correction would have to mainly come from the supply side. Demand moves much more slowly and the global economy as a whole is growing at a slower pace.

Saudi Arabia seemed firm in its oil policy position of not yielding market space to accommodate for additional output of the United States. If Saudi Arabia and OPEC as a whole do not budge, prices will creep up very slowly and may experience a drastic drop in the short term, especially considering the production recovery in Iran and Libya and the need-driven output increase in Iraq.

As elaborated earlier, oil production in the United States is showing more resilience to low prices than what most analysts have anticipated. Unconventional oil production at prices below US\$40 per barrel will fall gradually, not only because of development costs but also due to financing costs that small producers have to incur. Additionally, plans to scale up deep water extraction in the Gulf of Mexico remain unaffected by low prices.

For global oil production in countries outside of OPEC and the United States, low prices are driving considerable productivity growth. After almost a decade with prices hovering at over US\$60 per barrel, and the five-year period until the end of 2014 with prices above US\$100 per barrel, the global oil industry had become complacent with its cost structure and investment plans. The current price plunge is driving down costs and discouraging low-impact production investments. The industry is finding plenty of room for cost reduction and productivity growth, which is why production has shown more resilience than what most analysts have expected.

It is important to keep in mind, however, that when prices were below current levels, the rest of the world increased their production by more than 5 Mbd between 1986 and 2000, at an average annual rate of more than 300,000 barrels per day. Although one can argue that less costly reserves were developed first, and that given the same technology, costs go up with time, one can also argue that constant technological progress and accumulation of know-how drive down production costs.

In conclusion, price recovery will be sluggish, as global production growth decelerates and demand slowly recovers. In any case, the responsiveness of production in the United States will set a price ceiling in the next five years, which may be at US\$50 per barrel. Acting of their own accord, the hundreds of players in the United States oil market will ramp up production if they see a possibility of making a profit. These unconventional producers will set the global price for oil, at least over the next five years.

A New Model of the Global Oil Market

The eruption of new production from nonconventional oil reserves in the United States is changing the landscape of the global oil market. Since the

creation of Standard Oil conglomerate in 1880, the oil market has been dominated by—or in other words, its functioning has been heavily influenced by—the actions of oligopolies of large producers that control the bulk of global supply.

After the reign of Standard Oil, which controlled production in the United States until its dissolution in 1911, the oligopoly of the International Petroleum Cartel (the Seven Sisters) was established, and controlled production in major oil exporting countries from early 1930s until the mid-1970s, during which said countries that were members of OPEC took control of oil production within their territories and have continued to act as an oligopoly until the present day. This succession of oligopolies has influenced price setting, regulated production, and generated monopoly earnings over the past century and a half.

One thing these oligopolies had in common was that output for the most efficient producer was regulated to determine market entry of increasingly less efficient competitors with higher production costs and lower volumes. Less efficient, lower-volume producers would set the price on the margin. This kept prices far above costs faced by the most efficient producers who had higher capacity to build up volume, which resulted in monopoly profits.

The shift currently under way is that new marginal producers, developing unconventional oil reserves in the United States, are doing so in a context of full competition and cost reduction. Additionally, given the magnitude of unconventional oil reserves in its territories, the United States can increase output considerably at competitive prices. Thus, any reduction in production by OPEC countries, especially Saudi Arabia, to defend prices can be offset by incremental production in the United States, which is why OPEC and Saudi Arabia in particular are not willing to reduce output.

Similarly, in the first half of the 1980s, OPEC, and Saudi Arabia in particular, scaled back production in a futile attempt to defend high prices, only to have the freed up market space taken up by new production in Mexico and the North Sea as prices continued on the downward spiral. Saudi Arabia learned its lesson and did not want to repeat this mistake.

The current situation is even worse for Saudi Arabia and the rest of OPEC due to the size of recoverable reserves in the United States and its capacity to scale up and maintain production. In fact, the increase in production in the United States from 2011 onward has already surpassed the combined output increase of Mexico and the North Sea back then, and this increase can be more permanent due to the vastness of unconventional oil reserves in the country.

Bolstered by the action of individual companies coming together to produce huge volumes, the United States has established itself as the world's largest oil producer and is changing the face of the international oil market. Competition between producers, like never before in the existence of the global oil market, will determine prices in the future.

Undeniably, with the same technology, productivity of the different unconventional oil fields in the United States will be different due to geological and geographical reasons. As one would expect, oil fields that cost less to develop with the current technology have been going into production first. Keeping technology constant, production costs tend to rise over time as production moves into less productive areas.

Nevertheless, just as other technologies have evolved over the past four years, drilling and fracking technologies will continue to advance, and are expected to

enhance productivity and compensate, in varying degrees, for lower natural productivity levels of new oil fields.

In conclusion, in the new oil market, the international price will be determined by the marginal cost of production of unconventional oil fields in the United States. This cost will, in turn, depend on the natural productivity of crude reserves and on technologies used for oil extraction. The resilience displayed by unconventional oil production in the United States shows that the price floor is much lower than what most analysts expected in the beginning of 2015.

Conclusions

- The decline in oil prices that began toward the end of the third quarter of 2014 and deteriorated throughout 2015 is due to a permanent supply shock.
- The supply shock is caused by a steady increase in production in the United States from 2008 onward. Production in this country has grown by more than 85 percent over the last seven years, making it once again the largest oil producer in the world.
- The size of unconventional oil reserves in the United States, the industrial organization of its oil sector, and the constant technological progress suggest that current production levels can be maintained and scaled up in response to market conditions.
- The supply shock that originated in the United States has been exacerbated, as OPEC has refused to cut back its output to make room for U.S. incremental production, triggering a price war to fight for market space since the fourth quarter of 2014.
- Inasmuch as the current price can cover operational costs, oil production in the rest of the world has not diminished, which further compounds the problem of oversupply.
- In summary, far from reducing production in light of the price crash caused by a situation of oversupply, global output has increased, particularly in the United States and OPEC member countries.
- Deceleration of world economy and the subsequent slowdown in oil demand have worsened the price plunge.
- Oil prices will remain sluggish at least in 2016 due to oversupply in some OPEC member countries and the extraordinarily high levels of business inventories.
- If prices persist at current levels, oil production in the United States will gradually fall throughout 2016. Nonetheless, given the current engineering and industrial organization of unconventional oil production in the country, output can swiftly respond to positive price signals and ramp up volume in just a few months.
- Due to the magnitude of reserves and the speed of response, production costs of unconventional oil in the United States will determine the upper limit for the global oil price. In the next five years, this price ceiling may be around US\$50 per barrel.
- Given price dynamics in January 2016, it seems that there is a psychological price floor for investors at around US\$30 per barrel.
- Finally, we propose a working scenario for oil prices over the next five years, with a floor of US\$30 per barrel and a ceiling of US\$50 per barrel.

Epilogue

This paper was written in January of 2016, which is why it includes all the data on monthly production during 2015 and some preliminary consumption estimates made by the International Energy Agency (IEA). Without a doubt, the most important thing that happened this January and the reason for this

epilogue is the steady decline of oil prices that averaged US\$31.5 per barrel by month-end for the U.S. benchmark price, WTI.

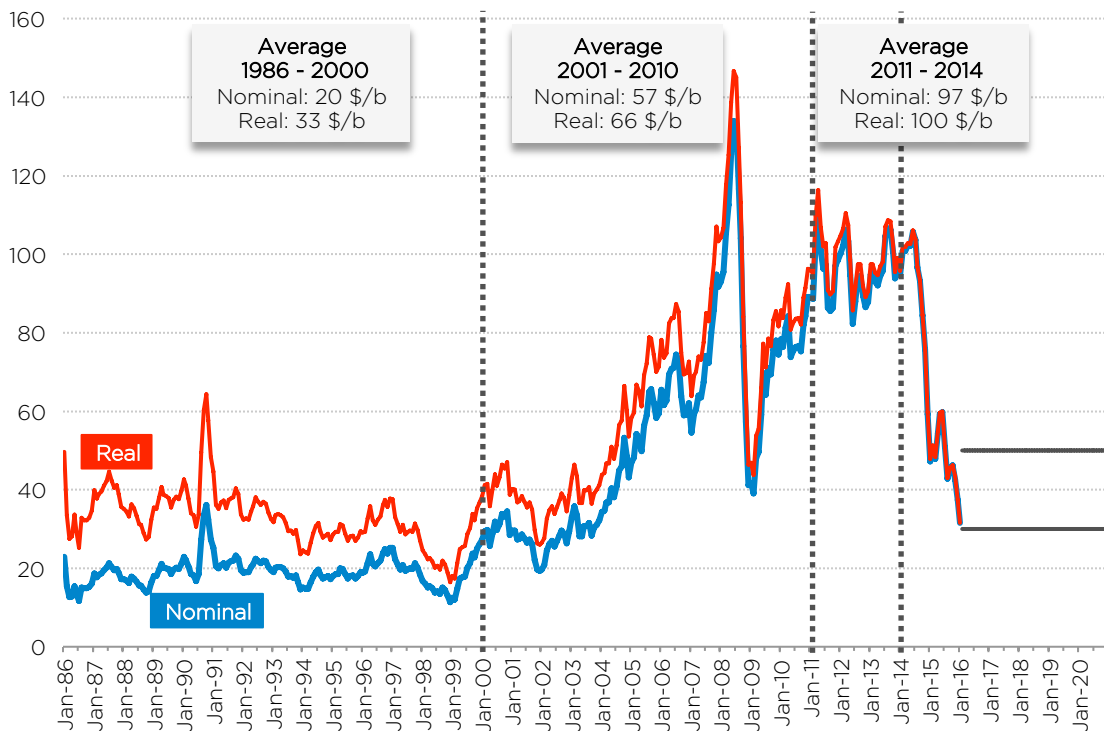
This represents a fall of 16 percent compared to the average price in December 2015, which was US\$37.2 per barrel. The average for WTI in January 2016 was the lowest monthly average in the past 12 years, since November 2003, when it was US\$ 31.1 per barrel.

However, if we adjust for inflation and compare the price per barrel by purchasing power, we have to go back February 2002 to find a price lower than that for January 2016. However, the price in January 2016 is barely 6 percent lower than the prevailing price between 1985 and 2000, averaging US\$ 33.4 per barrel in 2015 U.S. dollars.

Between January 15 and 21, oil prices fell below US\$30 per barrel to a rock bottom of US\$26.7 per barrel, and then bounced back to US\$32 per barrel in the last week of the month. Although speculative, this seems to indicate that there is a psychological threshold in the market for oil prices around US\$30 per barrel, although this does not mean that prices may fall through the “floor” again in the future.

The present study assumes a price floor of US\$30 per barrel for WTI in the mid-term scenario. For reasons explained above, which are related to the increasingly competitive global oil market and the flexibility and responsiveness of the market in the United States, the biggest and most competitive of oil producing country, the price ceiling will be set at US\$50 per barrel for the next five years. This scenario, placed within the context of prices in the last 30 years is illustrated in Figure 17.

Figure 17 | WTI, monthly nominal and real price US\$/b, projection 2016-2020



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