

DEVELOPMENT OF OIL AND GAZ INDUSTRY IN THE WORLD

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*Oil has been and in the future will remain the leading resource of the world economy, the most valuable and popular resource on the planet today. That is why the development and trend of the role of oil and gas is more relevant than ever in the modern world. **The purpose of work** is to develop areas of oil and gas industry in the world. **The Objective** is to present the current development and trends of the oil and gas industry in the world; Rate diversification, challenges and market segmentation; identify companies and countries that affect the world market and the oil and gas industry in the future. **Results:** That will probably hold true until, one day in the future, it will be more economical to leave the remaining oil in the earth's crust rather than extracting it. The necessary adjustments during this long period of transition will in any case bring great business opportunities for those who have the courage to innovate and try out new ways to produce and use oil and gas. «When you look at the growth in consumption, it quickly becomes clear that oil and gas will remain very important for the next few decades at least,” says Lisa Davis. “Of course we also need renewable energy sources. At least for the time being, we simply need everything we have. And that includes oil and gas.”*

Keywords: oil and gas industry, development and trends, challenges and market segmentation.

Oil is a dark brown or black oily liquid occurring in the sedimentary rocks of the earth. Oil has been known since ancient times. Then it was used for different purposes, mainly as oil for lamps. The exploitation of oil as an energy source, called fossil, is one of the pillars of the contemporary industrial economy. Dense, easily stored and transportable, petroleum supplies virtually all liquid fuels. It is also frequently used for petrochemicals (rubber, plastics, textiles, chemicals).

The origin of the second industrial revolution, oil has replaced the coal and quickly generated great economic interest in the producing countries. Source of energy or raw material, it is in transport that its dominance is the clearest. As far as power generation is concerned, oil has seen its share decline gradually over the past 30 years. It is often substituted natural gas, nuclear and renewables.

The discovery of oil reserves in a country is often perceived as a miracle for its economy. The main reason is the considerable influence of oil revenues on the budgets of the countries where deposits are found. Closely linked to important economic and energy stakes, oil has a strong geopolitical impact. The oil supply is free in a very open world market. However importing countries poses many problems, mainly political (dependence), financial (currency) and environmental (CO emissions 2, city pollution). Several countries (including European) have therefore initiated a policy of reducing their dependence on oil since the oil shocks of the 1970s.

World production reached 86.8 million barrels / day in 2013 (2). Nearly 42.1% of this production comes from the member countries of OPEC (Organization of Petroleum Exporting Countries):

In Africa: Algeria, Angola, Libya, Nigeria;

Middle East: Saudi Arabia, Iraq, Iran, Kuwait, Qatar, United Arab Emirates;

In the Americas: Ecuador, Venezuela.

Excluding OPEC, the main oil producing / exporting countries are Russia, the United States, China, Canada, Mexico, Brazil, Norway and Kazakhstan.

Petroleum has been used for centuries (eg caulking, heating, lighting, pharmaceuticals).

It's early in the XXth century it became a key component of the economy because of its use for the first lighting and as fuel for combustion engines (automobile).

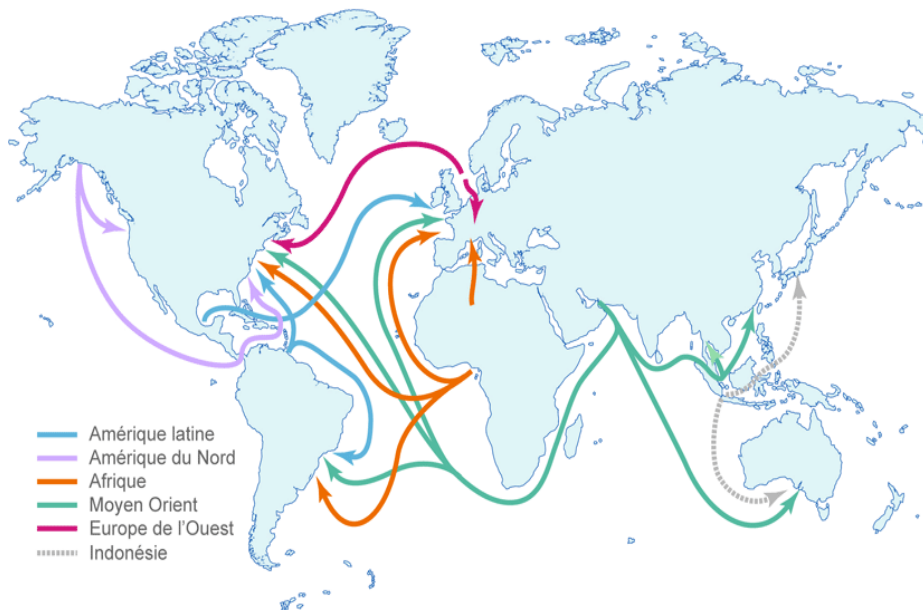


Fig. 1. Origin of oil

The period 1920-1970 is marked by a series of large discoveries of deposits, particularly in the Middle East. Meanwhile, oil-related markets develop: fuels (gasoline, diesel, heavy fuel oil) for transportation, industrial sectors of oil (petrochemicals), derivatives (plastics, rubber, etc.).

“The Stone Age did not end for lack of stone, and the Oil Age will end long before the world runs out of oil.” So said Sheikh Ahmed Zaki Yamani, former Saudi Arabian oil minister, in an interview in 2000. Sixteen years later, Yamani’s words neatly sum up the troubled state of the oil and gas (O&G) industry. Although the demise of oil is still some time away, it’s clear that the sector is going through one of the most transformative periods in its history, which will ultimately redefine the energy business as we know it. Navigating change of this scale will require smart, strategic judgment on the part of O&G company leaders. They must tackle cost and investment concerns in the short term while readying themselves to respond to the future impact of inevitable external environmental pressures.

The sensational drop in oil prices – below US\$40 per barrel at the end of 2015, down more than 60 percent from their high in the summer of 2014 – reflects rampant supply and weak global demand amid concerns over slowing economic growth around the world, especially in China. This imbalance is only going to worsen this year. Saudi Arabia continues to pump at full tilt, less concerned about propping up oil prices and more intent on securing market share, hoping to drive out marginal producers, particularly in the United States. As early as the second quarter of 2016, the flow of Iranian oil is likely to increase, adding to the glut. Even Middle East instability, such as the tension that erupted between Russia and Turkey in Syria toward the end of 2015, has not budged crude prices. Consequently, we expect oil prices to remain low for the near future, although it would not surprise us if volatility returns.

The impact of this situation on O&G producers has been rapid and dramatic. In the third quarter of 2014, when oil prices were still above \$100 per barrel, the supermajors posted aggregate net income of \$22.9 billion, according to Bloomberg. Twelve months later, upstream profits had been wiped out. In response, companies are slashing outlays. They are expected to cut capital expenditures by 30 percent in 2016. Already, some \$200 billion worth of projects have been canceled or postponed. Both international and national oil companies are negotiating aggressively for 10 to 30 percent discounts from oil-field service providers.

Head counts are affected as well. More than 200,000 employees have been or will be let go in the O&G industry, according to recent company announcements.

This reaction is not enough – or perhaps it is too much. Massive cost cutting may offer some short-term breathing space, but it is a myopic, panicky response that could leave businesses unequipped for the next turn of the business cycle. [2]

In 2014, global consumption of liquid hydrocarbons reached 4.5 bln. tons. A stable tendency of excess oil demand over supply, observed since the mid-2000s, reversed the situation of oversupply in 2012. The cumulative effect of long-term presence in the market oversupply has become one of the fundamental factors in oil prices and a sharp fall deep in the second half of 2014.

Table 1 – Global oil consumption by major region and country (million tones per year)

Countries	2012	2013	2014	2015	2016	2017
World consumption	4420	4475	4522	4587	4657	4731
USA	920,6	943,9	948,9	961,8	971,9	977,8
Europe (OECD)	685,9	678,0	669,7	664,2	671,4	678,2
OECD - all	2285	2294	2280	2287	2300	2318
Japan	233,8	225,7	215,5	211,2	204,1	207
China	511,6	528,1	546,7	562,5	588,1	613,2
India	180,3	183,5	188,4	195,4	200,3	206,5
Brazil	139,7	146,3	153,6	156,6	158,1	158,9
Russia	141,3	134,3	138,8	144,5	147,0	147,8
Countries – not OECD members	2134,8	2181	2242	2301	2357	2413

Since 2014 the share of the developing countries consumption of liquid hydrocarbons exceeded consumption in developed countries, with the structure of the global consumption of liquid energy will keep the trend of reducing the share of developed countries and the growing share of developing countries. OPEC will not reduce the level of production, their share in world production will amount to 38.8% in 2015 and remain consistently high until 2017.

Table 2 – Global oil production by main regions and countries (million tones per year)

Countries	2012	2013	2014	2015	2016	2017
World consumption	4476	4497	4570	4636	4695	4762
OECD	1122	1178	1259	1307	1311	1314
USA	603	664	747	789	827	830
Canada	192	204	2189	222	228	229
China	217	222	223	224	226	231
Brazil	114	121	127	128	142	150
OPIEK	1843	1793	1792	1799	1832	1850
Russia	519	522	525	525	525	521
Countries – not members OECD	1502	1512	1523	1522	1553	1569
Countries –not members OPEC	2055	1995	1945	1935	1942	1930

Countries such as the USA, Canada, and Brazil will periodically raise the level of production through the development of new deposits, production and transport technologies.

The main factors that can put pressure on the oil prices are increasing the supply of oil from the United States, Libya and Iraq, as well as the completion of the cycle of loose monetary policy in terms of key developed countries.

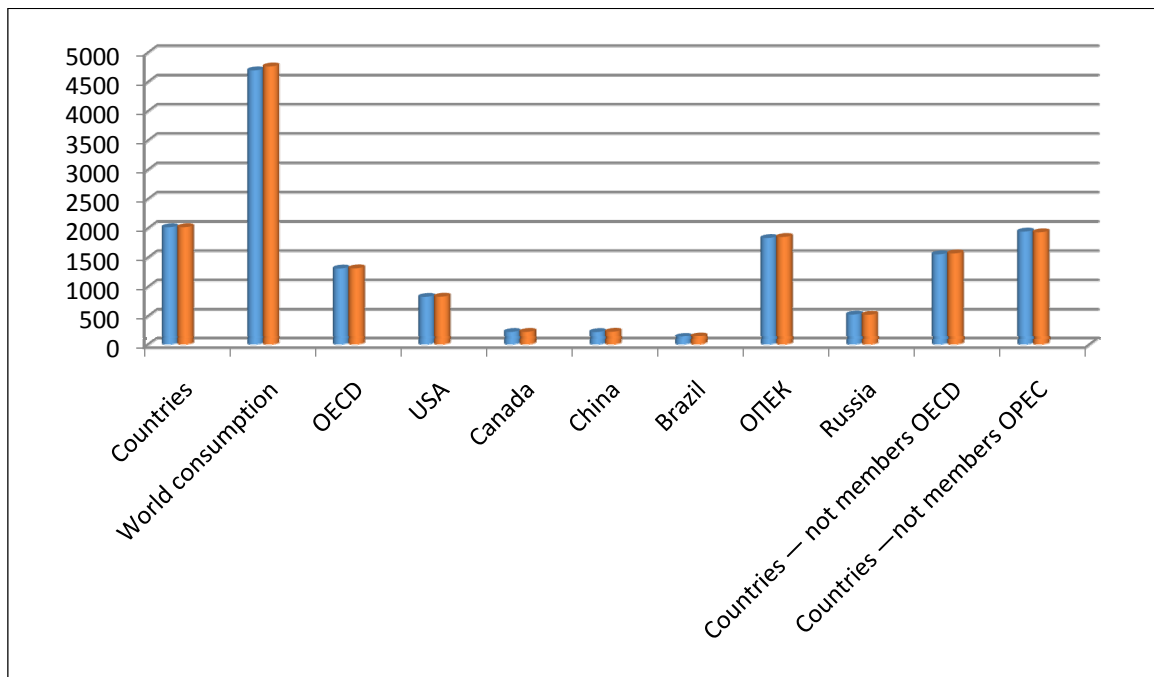


Fig. 2. Diagram of the global consumption by major region and country

Saudi Arabia and other OPEC countries have refused to consider steps to reduce the supply of oil for fear of losing market share, which in conditions of excess supply can be quickly occupied by exporters who have no commitments the Organization of Petroleum Exporting Countries. The share of crude oil the OPEC countries in the world decreased from 44.7% in 2010 to 39.9% in 2013, and the continued decline in the share of OPEC oil market against the background of the expected production growth in the United States will reduce the role and opportunities for integrating countries' exporters.

Reduced market concerns about supply disruptions in Iraq and Syria regions. It affects the possible lifting of economic sanctions on Iran, indicating that Europe and the United States trying to find alternative sources of oil and gas resources bypassing Russian supplies.

The sharp decline in oil prices in the last quarter of 2014 continued in January 2015, and is being had a significant impact on the drilling activity in the US. According to the US Energy Information Administration (EIA's Short-Term Energy Outlook (STEO)), noted 16% decrease in the number of active land rigs in 48 states during the period October 2014-end of January 2015.

However, a significant reduction in production that could provide support to oil prices, on the continental United States have occurred.

Dynamics of prices for gas and oil prices impact on the prices of long-term gas supply contracts will remain an important segmentation by region. The expansion of natural gas supply sources, including the use of technologies for shale gas production in the medium term would contribute to saturation of the market, and understated price dynamics. In this case the gas saturation of the market and the relatively restrained demand growth form the trajectory of gas prices, which may gradually decrease with respect to the price of oil. At the same time, despite the growing importance of liquefied natural gas projects and unconventional methods of extraction of shale gas and coal, in Europe the demand for gas main pipelines will be maintained.

There is a possibility of a sharper decline in the gas under the influence of growth in supply prices, worsening vendor competition, the development of new sources of fuel and gas technologies, the start of commercial operation of Japan's gas hydrate deposits.

The dynamics of the global economy has stabilized at a level of 3.3-3.4 per cent in the past three years, which is considerably below the average rate of the last ten years, when even with the crisis 2008 - 2009 growth was above 4 percent. In 2015, despite the marked decline in forecasts still expected acceleration of growth to 3.3% in 2014 to 3.5% in 2015. [4]

The growth of developed economies after the crisis recovery slowed to 3% in 2010 to 1.3% in 2013. In 2014, the observed acceleration of growth to 1.8% by maintaining a highly accommodative monetary policy, easing the impact of fiscal consolidation on economic growth, stabilization of the European debt markets.

Table 3 – The growth rate of the world economy, %

Страна	2008г.	2009г.	2010г.	2011г.	2012г.	2013г.	2014г.	2015г.
World	3,0	0,0	5,4	4,1	3,4	3,3	3,3	3,5
USA	-0,3	-2,8	2,5	1,6	2,3	2,2	2,4	3,5
Eurozone	0,4	-4,5	2,0	1,6	-0,7	-0,4	0,8	1,1
Germany	0,8	-5,1	3,9	3,4	0,9	0,5	1,5	1,2
France	1,7	-2,9	2,0	2,1	0,3	0,3	0,4	0,9
Italy	-1,2	-5,5	1,7	0,5	-2,4	-1,9	-0,4	0,2
United Kingdom	-0,8	-5,2	1,7	1,1	0,3	1,7	2,6	2,7
Japan	-1,0	-5,5	4,7	-0,5	1,5	1,6	0,1	0,6
China	9,6	9,2	10,4	9,3	7,7	7,8	7,4	6,8
India	3,9	8,5	10,3	6,6	4,7	5,0	5,8	6,1
Brazil	5,2	-0,3	7,5	2,7	1,0	2,5	0,1	0,3

However, the positive dynamics of developed countries remains fragmented: in the Eurozone Japan still can not fully overcome the consequences of the financial crisis. In 2015, the projected acceleration of the growth of the developed countries to 2.4%, mainly due to the US economy, while the growth rate in the euro area and Japan will remain moderate.

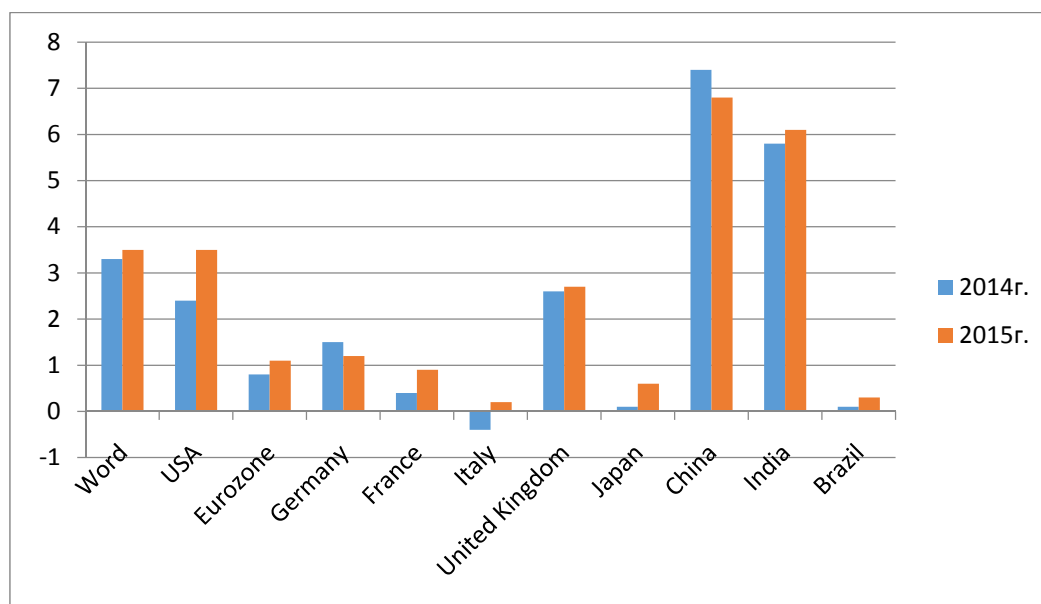


Fig. 3. Diagram of the growth rate of the world economy

Increased forecast for 2015 in the US economy due to the trend of faster growth in III – IV quarters, fixing employment growth trends, the lack of inflationary pressures, reinforced by lower oil prices and the growth of the dollar. Unlike the European economy transactional mechanisms could convey growth momentum of the US financial sector in the industry sector.

As a result, the industry shows more steady growth, significantly ahead of the average pre-crisis growth rate of the period 2003 - 2007 years. At the same time the real estate sector

growth remains quite unstable, and restrained dynamics of labor costs, contributing to productivity growth and competitiveness reserves subdued consumption growth.

The U.S. economic policy uncertainty index (put) is constructed by Baker et al. (2016).⁵ The index is a weighted average of four types of underlying components; that is, using weights of 1/2 on broad news-based policy uncertainty that quantifies the newspaper coverage of the policy-related economic uncertainty, 1/6 on tax legislation expiration uncertainty that reflects the number of federal tax code provisions set-to expire in the future years, and 1/6 on the economic forecast interquartile ranges about U.S. CPI and about federal state local government expenditures respectively. Each component is first normalized by its own standard deviation in order to construct the overall index of policy-related economy uncertainty. The oil market data include a global oil supply proxy variable given by the percent change in the world crude oil production (prodt), the real price of oil that is the U.S. refiner acquisition cost of imported crude oil deflated by the U.S. CPI, and the global real economic activity index (reat). The index of real economic activity is constructed by Kilian (2009) that reflects the single voyage bulk dry cargo ocean shipping freight rates. The crude oil price and production are drawn from the U.S. Department of Energy.

The past year hasn't been kind to oil and gas companies, as sliding oil prices have eaten sharply into bottom lines and caused layoffs and bankruptcies across the industry.

However, the titans of energy are still standing tall, even as their businesses are pressured. ExxonMobil XOM +1.25% remains the world's largest oil company and No. 9 on Forbes' Global 2000 list of the world's biggest and most powerful public companies, as measured by a composite score of revenues, profits, assets and market value. While Exxon has slid two spots on our list and recently lost its perfect credit rating for the first time since the Great Depression, it has still managed to maintain its massive dividend program.

China's state-controlled oil company Petro China is the second-largest on our list and Chevron CVX +1.42% takes third place. Both companies have dropped considerably, though, falling nine spots and 12 spots on the Global 2000, respectively.

The abundance of cheap oil is the culprit. While a barrel of crude has gone up and down in price this year, recently breaking \$50 per barrel, it's still a far cry from the \$100-plus that it fetched in 2014. Earlier this year, oil bottomed in the low \$30s.

This has been particularly bad news for countries that depend on oil. State-owned oil companies are getting squeezed and in Russia, for instance, Gazprom (No. 53) has dropped a staggering 26 spots and Rosneft (No. 75) has fallen 16 spots. The biggest decliner on the list is BP, which used to sit in the top 50 but has since plunged 329 spots. It has shelled out billions to put the 2010 oil spill behind it, sold off assets and cut spending. CEO Bob Dudley has attempted to frame this in a positive light: "Big is not necessarily beautiful." There's certainly more than enough oil to go around. Members of OPEC pumped 31.5 million barrels a day in 2015, according to EIA, and have thus far been unsuccessful in coming to an agreement to slow production.

It's still a massive business, after all. The top 25 oil and gas companies on the Global 2000 reaped \$2.6 trillion in sales during our 12-month measurement period, and pocketed \$81 billion in profit.

We investigate now the real stock return responses of major integrated oil and gas companies to the structural shocks. Fig. 4 presents the return responses to a structural shock, when the estimates use the real stock returns of four oil and gas corporations as the fifth variable in the VAR model. Upon an unanticipated aggregate demand shock, the return responses of the four integrated oil and gas companies in Fig. 4 presents similar results of the return responses with that of the oil and gas industry in Fig. 2. However, the magnitude of return responses of BP Corporation is relatively larger to the oil supply shocks and oil-market specific demand shocks. In Panel D of Table 1, oil-market specific demand shocks account for the largest 16.5% of the variation in the BP real stock return. The magnitude of return

responses of Exxon Mobil Corporation is relatively larger to the economic policy uncertainty shocks. In Panel C of Table 1, economic policy uncertainty shocks account for the largest 13% of the variation in the real stock return of Exxon Mobil Corporation, indicating that Exxon Mobil Corporation stock returns are relatively more vulnerable to the economic policy uncertainty shocks (Fig. 4).

These results are intuitive showing that individual stock prices in the oil and gas industry co-vary with the oil price fluctuations and economic policy uncertainty and capture the firm specific risks in the responses to the aggregate macroeconomic shocks [8].

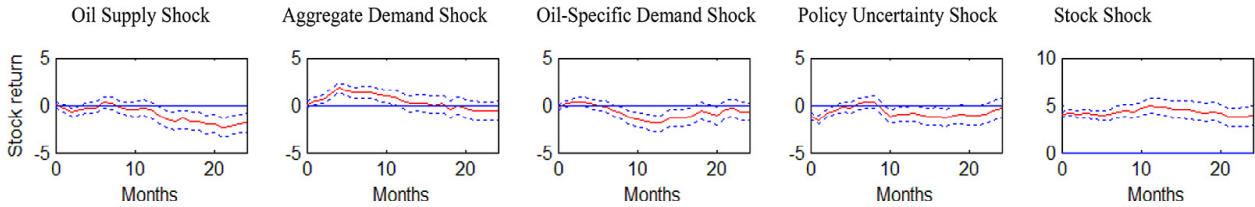


Fig. 4. Stock market return responses to one standard deviation structural shocks: 1985:01–2015:12

The figure shows the impulse response functions to one standard deviation structural shock, using the economic policy uncertainty index and the real stock market returns of all firms listed in the NYSE, NASDAQ and AMEX in the VAR model described in the text. Point estimates are reported with one-standard error bands constructed using a recursive-design wild bootstrap.

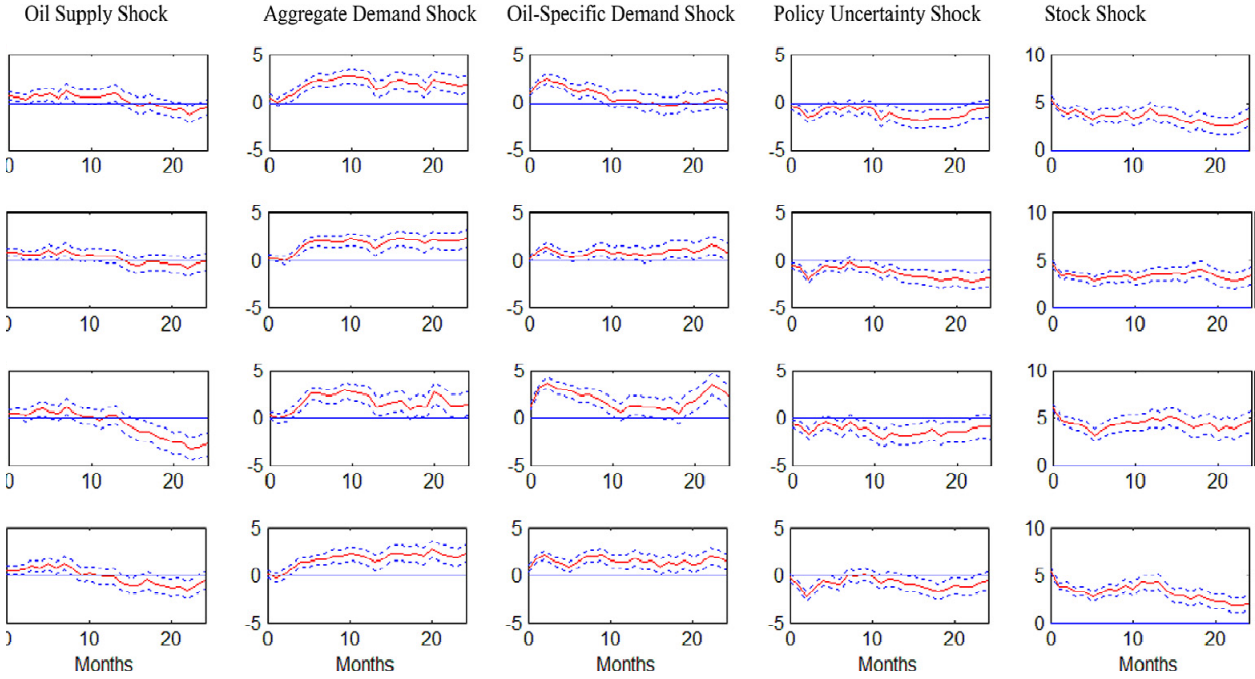


Fig. 5. Return responses of major integrated oil companies to one standard deviation structural shocks: 1985:01–2015:12

The figure shows the impulse response function of real stock return of oil and gas companies to one standard deviation structural shock, using the economic policy uncertainty index and the real stock returns of an oil company in the VAR model described in the text.

Point estimates are reported with one-standard error bands constructed using a recursive-design wild bootstrap.

The RDS, XOM, BP and CVX are Royal Dutch Shell, Exxon Mobil, BP and Chevron Corporation respectively [8].

Oil and gas industry is generally divided into three major components: upstream for the petroleum exploration and extraction, midstream for the transportation and services, and the downstream for the refining and marketing oil and gas products. It motivates us to analyze whether investors' portfolio adjustment depends on the characteristics of the variety of different companies and organizations. The investigation also helps us understand how oil price shocks along with the economic policy uncertainty are transmitted to the stock return of different oil and gas companies.

As for the countries who own the oil and gas industry, there is a list of the 10 countries sitting on the greatest amounts of crude oil.

1. Venezuela Oil well operated by Venezuela's state company PDVSA. Reuters/Carlos Garcia Rawlins. Proven crude oil reserves (bbl.): 297.7 billion.

"Venezuela remains highly dependent on oil revenues, which account for roughly 96% of export earnings, about 40% of government revenues, and 11% of GDP," according to the CIA Factbook. Consequently, the plunging oil prices in late 2014, combined with a recession, crushed the Venezuelan economy. And now the country is looking for allies outside of OPEC in hopes of stabilizing its oil prices.

2. Saudi Arabia: Ali bin Ibrahim Al-Naimi, Saudi Arabian Minister of Petroleum. REUTERS. Proven crude oil reserves (bbl.): 268.4 billion.

Saudi Arabia was a big player in the oil game in the past year. Most recently, the Kingdom – along with the rest of OPEC – refused to cut oil prices. (Although, notably, the Saudis' rhetoric here has slightly softened.) Additionally, Iran wants "to double crude exports soon after sanctions are lifted and is pushing other members of [OPEC] to renew the cartel's quota system" – which could soon shake up things for the Saudis.

3. Canada: Pipelines at the McKay River Suncor oil sands. Reuters/Todd Korol. Proven crude oil reserves (bbl.): 173.2 billion.

Canada exports most of its oil to the US and Europe. Notably, it's the US's largest foreign supplier of oil. However, a recent reports shows that the oil from Canada's oil sands is about 20% more carbon intensive on average than others. That means that, "if Canada exports more oil sands to the US over time, greenhouse gas emissions from US drivers would rise, even if gasoline consumption remained flat," according to OilPrice.com.

4. Iran: Oil refinery in Tehran. A.P. Proven crude oil reserves (bbl.): 157.3 billion.

Iran's crude oil is the wild card right now. Analysts believe that the return of Iranian oil to the global market could drive prices down. Additionally, there could be increased tension between Iran and Saudi Arabia as well as Iran and Russia.

5. Iraq : Al Tuba. REUTERS/Essam Al-Sudani. Proven crude oil reserves (bbl.): 140.3 billion.

Iraq's largely state-run economy runs on oil. Consequently, as oil prices fell in late 2014, government revenues fell by 30%. As of 2015, Iraq, one of the biggest producers in OPEC, was pumping at record highs.

6. Kuwait Proven crude oil reserves (bbl.): 104 billion.

Petroleum accounts for over half of Kuwait's GDP, and the country plans to increase oil production to 4 million barrels a day by 2020. After the sanctions on Iran in 2012, Kuwait (along with Saudi Arabia) took most of Tehran's "Asian trade."

7. United Arab Emirates: United Arab Emirates' Oil Minister Suhail Mohamed Al Mazrouei (center). Reuters/Faisal Al Nasser. Proven crude oil reserves (bbl.): 97.8 billion.

UAE is another energy-dependent state that modernized after the discovery of oil over 30 years ago. Following the late 2014 plunge in oil prices, UAE – one of the biggest producers in OPEC – has been producing record amounts of crude.

8. Russia: Rosneft's oil field. REUTERS/Sergei Karpukhin.

Proven crude oil reserves (bbl.): 80 billion.

Although Moscow stands to benefit geopolitically following the Iran deal, the return of Iranian oil to the markets is bad news for them as Tehran could go after one of Russia's European markets.

"Iran is going to be competing in Europe head-on with Russia," Ed Morse, the head of commodities research at Citigroup, told Bloomberg.

9. Libya: Zawiya refinery. REUTERS/Ismail Zitouny. Proven crude oil reserves (bbl.): 48.47 billion.

Libya's economy is almost completely dependent on energy. Sales of oil and gas plunged sharply in 2014 after huge protest disruptions at oil ports.

10. Nigeria: Joseph Thlama Dawha (right).REUTERS/Afolabi Sotunde. Proven crude oil reserves (bbl.): 37.14 billion. [14]

Oil has been the dominant source of government revenues in Nigeria since the 1970s. However, the country struggled following last year's collapse in oil prices. And now Nigeria stands to "face extra competition" from the reintroduction of Iranian oil on the markets.

Nevertheless, Rystad still puts the U.S. ahead of Saudi Arabia in oil reserves, at 264 billion barrels compared to Saudi's 212 billion barrels. The rankings change when simply looking at oil reserves from Proved + Probable (commonly referred to as "2P"), an estimate from existing oil fields. Saudi Arabia has 120 billion barrels of 2P oil reserves, compared to the U.S.' 40 billion barrels.

On a global basis, Rystad estimates that the world has about 2,092 billion barrels of reserves, or about 70 years' worth of oil at today's production rate of 30 billion barrels per year. That compares to the 1,300 billion barrels produced around the world in history. While there is a lot of oil left then, according to this estimate, most of it is of the unconventional variety – whether shale or oil sands or other difficult-to-produce forms of oil. In short, Rystad concludes: "this data confirms that there is a relatively limited amount of recoverable oil left on the planet." It goes on to caution that business-as-usual won't work. "With the global car-park possibly doubling from 1 billion to 2 billion cars over the next 30 years, it becomes very clear that oil alone cannot satisfy the growing need for individual transport."

In the years 2009–2014 more than 30 refineries with a total capacity of about 120 million tons/year were closed in Europe. This occurred primarily as a result of the recession and the economic crisis that began in 2009. Not without the significance was the development of renewable energy and the policy based on reducing the consumption of petroleum fuels. In addition, the competitiveness of European companies, including European refineries, considerably decreases (due to the high costs of energy production). As a consequence, the least profitable refineries are closed or converted to the production of biofuels. Sometimes they are used only as storage facilities. The gap in the demand for fuel is met by imports, mainly from the Gulf countries.

The production capacity was also reduced in the United States. However, it was the result of switching from imported heavy oil to light oil from unconventional sources. In the United States, the reduced production capacity amounts to about 80 million tons per year. Currently, tens of thousands of exploration and production wells are being drilled each year in the area covering a large part of Canada and the United States. It is worth recalling that the US production of hydrocarbons from unconventional sources – shale oil and tight oil – has been taking place for several years now, and the first production wells for shale gas were drilled in 1996. According to EIA, 95% of the increase in oil production comes from seven of the unconventional resources (tight oil) in the United States. The increase in the production is

closely related to the increase in the number of wells and the effective increase of their productivity. As a result, crude oil production in the United States in the years 2008–2014 increased from about 5 Mboe/d to 8.57 Mboe/d in 2014 (over 70%) and 9.5 Mboe/d in 2015. According to the EIA, the upward trend in the production is expected to maintain in 2016. [13].

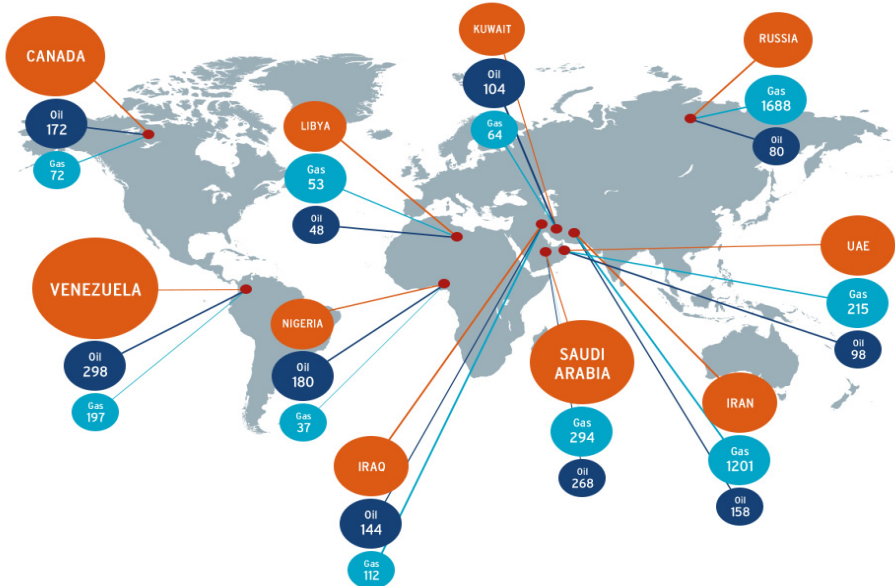


Fig. 6. Oil and gas industry reserves by nation (All oil numbers are in million barrels (MMbbl), gas numbers are in trillion cubic feet (Tcf))

The global energy demand has been increasing rapidly due to depletion of fossil fuels, continuous growth of world population and industrialized economy.

The increased consumption of imported oil could lead to turbulence in economic growth. Due to increasing demand of oil fuels and consequent impact of global warming issues, development of alternate energy is a top priority in research and developments sector. The bioenergy produced from the biomass is being a sustainable alternate energy source which received high acceptance in various sectors include public, industries and government policies. from the Government, public, industries and researches for its sustainability.

It’s likely that in future oil fields will be designed to be used for longer and their longevity will be boosted by an injection of water or gas into the oil supply to enhance its pressure. Decommissioning is also set to be a focus for the next 40 years – figures suggest that by the 2050s some 470 platforms, 6,000 miles of pipeline and 5,000 wells will need to be removed from the North Sea, as well as the estimated 40,000 concrete blocks that help to keep offshore operations steady. Decommissioning itself could open up an area of employment for those entering the sector or seeking a new challenge.

To demonstrate that it can maintain the value creation proposition for investors in the face of growing uncertainties, the oil and gas industry will need to embrace strategies that can create value in any scenario, including shortening project cycle times, minimizing product losses (including methane leakage), and increasing recycling and reuse of inputs such as water, heat and steel. Such strategies align industry more closely with technical solutions that will be attractive to society as a whole. But fundamentally, in order for the oil and gas industry to be seen as a partner in energy solutions and economic prosperity – rather than a source of environmental damage and driver of sectarian conflict – the industry will need to address the serious trust challenges created by the failures of its worst ranks. A 2013 Gallop poll, for example, ranked the oil and gas industry as the least trusted industry, tied for last place with the tobacco industry, despite the pivotal importance of energy in daily life. This

loss of trust has been amplified by the industry's linkages to controversial lobbying and law suits against climate change policies and other environmental and safety regulations. The industry tends to see the solution as better communication of technical issues. However, the public is seeking both measurable improvement in performance and greater transparency and disclosure.

On the whole, it is becoming harder to produce oil and gas. But there is also good news: this needn't make oil and gas more expensive, as long as production methods are being continuously improved. In the past, technological innovations and more efficient processes have made production cost-effective under increasingly challenging conditions. A number of trends are already taking shape:

1. In the future, existing fields will operate longer and their yield will be increased by injecting water or gas, such as CO₂, which boost the pressure of the reserve.
2. Unconventional extraction methods such as the hydraulic fracturing of stone formations containing oil or gas (fracking) is likely to spread beyond the U.S.
3. The production of heavy oil from oil sands will become more environmentally friendly and less energy-intensive.
4. The global market for liquefied natural gas (LNG) will continue to grow strongly. As a result, gas that is being flared, and thus wasted, today can be used and marketed in the future.
5. One day the vision of automated oil fields at the bottom of the sea, working maintenance-free over decades at depths of several thousand meters, may be realized.

At the same time, alternatives to oil and gas are becoming increasingly viable. Electric cars may become more commonplace in the future. And renewable energy sources such as wind power are becoming more economical and could partially crowd out fossil fuels. According to British Petroleum (BP), four fifths of the current growth of worldwide energy consumption is taking place in emerging economies. But even these countries' growing appetite for energy may subside at some point.

With less "easy oil" available and interesting alternatives to oil and gas becoming more viable, the way forward is clear: O&G companies need to reduce their production costs. Some are leading the way by bringing more automation to oil fields and using data analysis in smarter ways. Simply put, in the future more valves will be opened and closed by machines than by people. And it will more often be machines, not humans, that decide when to open or close the valves. Flying workers to offshore oil platforms in helicopters may one day be the exception rather than the rule.

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