

HIT-AND-RUN COMPETITION IN THE NEW OIL MARKET ORDER

Alessandro Mauro

INTRODUCTION

After a decade of continuously rising oil prices, culminated with the exceptional rollercoaster of 2008-2010, the oil markets seemed to have reached a long term balance. Prices were stable in the interval 90-125 \$/bbl starting from Jan 2011¹. Many were still predicting a resumption of the upward trend of the previous decade, and some were reiterating an oil price forecast at 200 \$/bbl on a time horizon of one-two years. The actual outcome saw an oil price that was continuously lowering its volatility, by trading in a price band more and more narrow.

This high price & low volatility environment started creeping in the middle of 2014, when prices progressively reduced, at a pace that became steeper after the summer. Although between ups and downs, prices have never recovered more than half way the old “normal” value of 110-120 \$/bbl and have closed the year 2015 lower than 40 \$/bbl.

The reduction of oil prices took the industry by surprise. A legion of experts, research institutes, national and international organizations produced lengthy analysis trying to explain why the price went down so much and so quickly. The diversity of views is an interesting topic by itself. Heated discussions were going on to ascertain if any specific oil price level, say 60 USD/bbl, would represent a ceiling (i.e. maximum price) or a floor (i.e. lowest price) for the months and years to come. Others denied, however, that we were facing new oil markets at all.

Analysts also started forecasting where prices would go in the future, if and when they could go further down or if and when they could come back higher and which level they would eventually reach. Obviously, there was no consensus on these forecasts and different expected values have been influencing and even determining actions that oil players have been taking in the market.

In order to assess the nature and the impact of recent events, it is important to understand the foundations of oil markets. Modern exploration and production of hydrocarbons are characterized by extremely long “time to market”². It takes years to perform the exploratory phase, i.e. to search for oil and gas. In the rare and lucky cases in which hydrocarbons are found in commercially meaningful quantities, it takes other years to develop them, i.e. to perform all projects and investments necessary for actually bringing oil and gas to the surface, treat and sell them. The reward consists of a production that will flow for many years to come. In fact, hydrocarbon production is inexorably subject to reduction as time goes by, but the pace of this reduction is normally slow. At the end, production levels will become so small that will not remunerate anymore the associated variable costs or new investments and the well will be abandoned.

These projects are characterized by very high risk levels in every phase: exploration, development and production. Geological risk continues to be a constant feature of the exploration phase, implying that

¹ US dollar per barrel is expressed as “\$/bbl” in this article. The price levels are referred to the Settlement price for the ICE Brent first maturity Future contract.

² We will refer in general to “hydrocarbons” when the analysis is applicable to both oil and gas resources.

even very promising plots can come out dry after proper expensive exploration is conducted³. Among others source of risks, commercial risks are also extremely important. After long developments periods⁴, new oil production could hit the market in a phase of low prices. The high risk levels have justified well-established structures for risk sharing among different companies exploiting same oil reserves (Joint Ventures).

High risk and enormous capital to be employed have naturally selected gigantism as the Darwinian critical success and evolution factor. Major players in the hydrocarbons markets are multinationals and national oil companies. Due to its peculiarity and its crucial role in modern World economy, oil market structure has been studied for decades. Oil companies' gigantism, the crucial role of the Organization of Petroleum Exporting Countries (OPEC) and oil prices behaviour have led to dismiss the association of oil market to a perfect competition model.

In fact, several specific models have been proposed to explain oil markets mechanisms. Many have put at the centre of the analysis the biggest oil producer inside OPEC, i.e. Saudi Arabia. According to a view accepted by many, Saudi Arabia has been acting as a "*swing producer*". In situation of weak demand, Saudi Arabia would reduce its own production, leaving to others a bigger percentage of World's production. At the opposite, in case of increasing demand, Saudi Arabia will be ready to increase its own production. In both cases, Saudi Arabia intervenes as a balancing factor, and this is allowed by the availability of spare production capacity and hefty wealth reserves to be used if needed.

As it generally happens in markets where capital expenses are relevant, oil markets have encountered phases of under and overcapacity. Low prices determine the exit of inefficient players and keep the efficient ones. Conversely, high prices attract new production and increase in supply. It has recently been reiterated that nothing cures low prices as low price (and vice versa). What it goes often forgot is that after every wave, the industry emerges as modified and different on the supply and/or the demand side. The 1970s, with the two oil prices shocks, changed forever the shape of the industry. On the demand side, robust measures for energy saving, purely determined by high prices (and still not by concerns about the state of the environment) were undertaken. On the supply side, only high prices could have justified the rush for exploring hydrocarbons offshore in deep sea or, later on, the commercial exploitation of tar sands. The progressive increase of prices in the first and second decade of this century is no exception and it is going to leave an indelible mark on the industry.

However, in an interesting case of collective amnesia, market players and commentators forgot the low prices that marked oil markets till the beginning of the new millennium. In fact, later on price levels between 100 and 120 \$/bbl had been considered more like a minimum level, a bottom line or, at best, a "reasonable" level. It was generally understood that this price level would encourage new exploration and production. This activity would look for new commercial reserves in more and more inhospitable places, and would need stably high oil prices in order to be justified. That would bode very well with the forecasted never ending increase in oil demand.

The reality is that nowadays oil prices is sizeably lower than 50 \$/bbl. Companies expecting price to increase and remain high in the medium-long term have been embarking in a buying spree, as they consider that currently assets and companies are undervalued. On the contrary Companies that, for whatever reason, have not taken action, have justified the inaction with their opposite forecast of prices staying for long time at the new low levels. Many, inside and outside OPEC, have tried to find out which

³ When wells do not come out dry, they still need to have enough reserves to justify further investments requested to start the production phase.

⁴ A symbolic, however extreme, example is the Kashagan oil field offshore the Caspian Sea. The field was discovered in the year 2000 but production did not start before year 2013.

course of action the Organization should take in order to put again the oil price on a rising path. Many have tried to explain and predict the future strategy of a crucial member of the Organization, the Kingdom of Saudi Arabia.

This introduction highlights the need for a detailed analysis of relatively recent events, in order to understand if we are in front of a structural change of the oil market, configuring a “new oil market order” or it is more like any other cyclical swing previously described. If the former is true, then the next question to answer is about what radically changed in a matter of some years. This paper represents an additional, but hopefully alternative, contribution aimed at giving an explanation of these events, which are crucial because they are reshaping the World’s economic and geopolitical equilibria.

The paper starts with the introduction to a market structure theory which is apparently very far from modern oil market setup. Next, the new oil market order is described and it is demonstrated that the theory of Contestable markets can explain recent modifications in the market. Later on, competitive strategies of traditional and new oil companies are explained and analysed. The last paragraph tries to forecast what we could expect for the oil market in the future, based on the framework of the Contestable markets theory.

THE THEORY OF CONTESTABLE MARKETS

Traditional economic theory has demonstrated long time ago the benefits of a market characterized by perfect competition. In such a framework, a large number of very small firms will produce the demanded quantity demanded and receive a price which is equal to the marginal cost of production. That implies that firms in perfectly competitive market will earn profits equal to zero⁵. At the beginning of the 1980s a new theory came to challenge some of the assumptions and results of the traditional perfect competition framework. This alternative came with the theory of Contestable Markets⁶.

In a contestable market there are no barriers to entry or exit and there are not non-recoverable (“sunk”) costs associated with the entry and the exit. In such a market the already active companies, the “incumbents”, have no specific competitive advantage vis-à-vis potential new entrants. Being entry and exit relatively open, incumbents reaping extra-profits will trigger the entrance of new competitors and bring profits again at the normal zero level. At that point, the new entrants will not have any more incentive in staying in the market, and could actually leave. This form of new entrant strategy has been named “Hit and Run competition” by contestable market theorists.

The important implication is that in a contestable market the level of price and the produced quantity will be at the perfect competition level. Contestable markets achieve perfect competition results even in a setup which does not resemble, and by far, the perfect competition one. In these markets even just one incumbent firm will not be able to act as a monopolist. At the contrary, the only incumbent will be forced to follow a perfectly competitive behavior, as the threat of potential entry will be sufficient to oblige that firm not to extract extra-profits. If the incumbent understands that the market is actually contestable, it will take action and, in that case, *“actual entry is redundant”*⁷.

⁵ Zero “economic profits” and no “extra-profits” in economic theory terminology.

⁶ The theory of contestable markets is associated with academic work of W.J. Baumol and J.C. Panzar. See William J. Baumol, John C. Panzar, & Robert D. Willig (1982).

⁷ Bailey, Panzar, (1982), pag.145.

The entry and exit setup is crucial. The entry does not need to be actual. Just potential entry, in the form of Hit-and-run competition, guarantees a contestable market setup. The incumbent, unless they can exploit some barrier to entry or exit, cannot limit the quantity they offer in the market to the levels associated with monopolistic or oligopolistic setups. Instead, they are forced to offer quantities associated with perfectly competitive markets in order to discourage new entrants. On the other side, the threat of Hit-and-run competition from potential entrants needs to be credible, i.e. possible. Not credible entry is equivalent to impossible entry, and will not be a concern for the incumbent(s), that will then behave as monopolist or oligopolists. In summary, in contestable markets we observe competition for the market and not competition inside the market.

On top of incumbent competitive strategies and market setup, the third crucial element in this framework is the potential entrants' characteristics, expectations and behaviour. In this respect, *"potential entrants evaluate the profitability of entry at the incumbent firms' pre-entry prices"*⁸ and they are price-takers, i.e. *"the entrant is not permitted to take account of the price reduction that its own output will produce when it assesses the profitability of entry"* or, equivalently, *"Hit-and-run entry is supposed to occur if the potential entrant could make a profit at the pre-entry price"*⁹.

This is valid in the short and medium term. In the long term a contestable market is characterized by zero economic profits similarly to a market in perfect competition. However, while perfect competitive markets request a homogeneous product, contestable markets allow the presence of firms producing products which are not precisely homogenous.

In order for Contestable markets not to be the result of prolific imagination or abstract economic theory, examples should be found in real markets. It has been discussed at length that the market for scheduled commercial airlines in the U.S.A., after the deregulation process which took place at the end of the 1970's¹⁰, represented a good example of contestable markets in real life¹¹. The market setup was quite straightforward. Potential entrants, by just using leased aircrafts, could start commercial services with limited capital requirements and in a matter of weeks. As a consequence, incumbent airlines would be forced to take action against this potential entry. The countermeasures would consist in trying to saturate capacity at airports/routes and by offering competitive pricing for their flights.

The economic policy implications of this market analysis were sufficiently clear. Local and Federal US authorities, if they wanted to shape a competitive commercial flight industry, had just to ensure that entry and exit barriers were very low. Other policy actions would be either redundant or counterproductive. Authorities needed to assure there was the possibility of "fluid entry" in the market.

The authors of the Contestable markets theory admit that the perfect contestable market does not exist in reality¹². Each market possesses a different degree of contestability, and a market can be more or less contestable than others. An example of very low contestable market is given by the taxi services market. This market is often not open to entry by new drivers, as it is regulated by granting licences. Entry is very difficult or very expensive (i.e. buying licences).

Markets are not static and the same market can develop in a direction of increased or reduced contestability. Coming back to our airlines examples, airport slots are limited as there cannot be an infinite number of planes landing or taking off from one airport in a unit of time. However, this setup is

⁸ Baumol et al., (1982), pag.5.

⁹ Martin, S., pag.10, (2000).

¹⁰ The process culminated with the "Airline deregulation act", passed in 1978.

¹¹ See Baley, E., Panzar, J., (1981), and Bailey, E., Graham, D.R., and Kaplan, D.P., (1985).

¹² For a critical assessment of Contestable markets theory, the reader can refer to Martin, S. (2000).

not static and changes can be introduced by external factors such as new technology or decisions taken by policy makers. The latter, for example, could decide to allocate the airport slots in a competitive way.

Summarizing the theory and the examples we discussed, it is evident that most of the Contestability market theory is founded on the absence of entry and exit barriers. These barriers can take different forms and importance in the extent they prevent entry and/or exit and should be analysed cases by case. One specific barrier is represented by *sunk costs*, i.e. costs that needs to be invested on by the entrant but cannot be recovered should the entrant later exit the market. In many cases, the absence of sunk costs can represent a heroic assumption.

For example, Hit and Run airlines in deregulated markets would need to lease airplanes for a period of time, sign contracts for luggage handling, and so on. These investments are simply lost should the airline leave the market at a later stage. Other examples of sunk costs are physical assets that cannot be resold in case of exit and immaterial assets as investments in know-how. The presence of sunk costs associated with exit could constitute a formidable barrier to Hit-and-run competition, making in turn entry less probable, hence reducing the contestability of markets.

However, it is difficult or impossible to identify in absolute terms entry of exit barriers as preventing real entry in the markets. In fact, *"whether barriers to entry are effective in deterring potential entrants depends on the resources of those potential entrants"*¹³. Potential entrants can often find resources in capital markets in order to overcome barriers and make a successful entry. Moreover, also entrants' expectations, either rational or irrational, are important. Coming back to sunk costs, if potential entrants *perceives* such costs as irrelevant, or even ignore them, then those costs will not represent a barrier to entry.

THE SHALE OIL REVOLUTION

The high price & low volatility environment that characterized years 2011-2014 has constituted a perfect environment for stimulating new projects in the oil sector. Behind this backdrop, a silent revolution was taking place and would drastically change competition in the oil market. In order to understand this revolution, we need to go back at the beginning of crude oil history.

From a geological point of view, crude oil was formed millions of years ago in specific rocks, generically identified as "source rocks". If porosity was sufficient, crude oil would later migrate to "Reservoir Rocks" where it would end up finally trapped, because surrounded by other "impermeable rocks". Traditional oil exploration has always targeted production of oil cumulated in these "traps". Commercial production of oil started in the 1860s in the USA. Due to limited technical resources, the traps that could initially be exploited were necessarily in the order of meters under the soil level. Later on these easy targets became depleted and oil companies went deeper and deeper, eventually starting digging under the sea bed.

In the last decades, oil companies have embarked in hydrocarbons exploration in areas of the World that presented higher geological, technological and geopolitical risk. They considered this strategy as crucial to maintain or increase their market share and competitive advantages. While this race was still

¹³ Grant, R., (2002), pag.77.

in full swing, most of oil companies did not see what was budding in the very place where oil was firstly commercially produced. Some exploration companies, mainly in the U.S.A., increased their attention to Shale¹⁴. These are the geological formations where hydrocarbons were initially formed and had been trapped there for millions of years because the low porosity did not allow the migration of hydrocarbons to other “reservoir” rocks. With a combination of horizontal drilling and high-pressure water injection, it became possible to create fractures in these rocks and allow oil to flow to the surface through the well. A number of minor and small exploration companies brought this new technology from an immature process to the commercial producing stage¹⁵.

It is worth remembering that, after a peak of production reached in 1970, the US conventional production has been continuously reducing during the following decades. This trend has now been abruptly reversed. Production from shale has been on a continuous rise in the U.S.A., contributing to a rebirth of the US oil industry.

Hydrocarbons production from shale formations has specific features that distinguish it from conventional production. In bullet points:

- Shale production has very short “time to market”. The business cycle exploration – development – production is very short. On the opposite, it takes years to bring in to production conventional hydrocarbons reserves.
- Shale developments reach maximum level of production in very short period of time, where conventional resources need months or even years to arrive to the maximum productivity levels.
- Shale production shows very fast depletion period, where conventional resources are normally exploited for many years and even decades.
- Shale production cost structure sees the predominance of variable costs, while for conventional oil production fixed costs are more important¹⁶.

The fast depletion period implies that a Shale company, in order to keep total production stable or even increasing, needs to constantly look for new oil, deploy drilling rigs and put it in to production as quick as possible¹⁷. This new strategy has led many to associate new shale oil developments to the manufacture industry, more than traditional hydrocarbons exploration and production. In the latter, every project has specific features and challenges. Shale oil business, at the contrary, is more predictable and repeatable, configuring it much closer to a manufacturing business process performing serial production of very similar goods.

Shale oil and gas is not a cheap way to look for and bring to production hydrocarbons. Digging underground wells with horizontal sections and then perform hydraulic fracturing is expensive. A proxy of these costs is represented by the oil market price necessary for these Shale developments to at least

¹⁴ The US Energy Information Administration (EIA), following terminology in place in US oil business, refers to “tight oil”, as a term more general than “shale oil”. In fact, “Tight oil is produced from low-permeability sandstones, carbonates (e.g., limestone), and shale formations”. See EIA (November 18, 2015). Here we prefer to use “Shale” oil and gas, differentiating it from “traditional” or “conventional” production.

¹⁵ For a brief chronology of the events, see EIA (November 18, 2015)

¹⁶ On this point see Dale, S., (October 2015).

¹⁷ This has brought many to approximate shale oil production changes with the weekly changes in the number of deployed drilling rigs. This approach is wrong because it assumes that all the rest is unchanged (rigs productivity, wells productivity, etc.) which has not been the case, as discussed later in this article.

breakeven, i.e. repay its costs with its revenues. For most of the projects the breakeven price interval is between 50 and 70 USD/bbl.

Producing Shale oil is more expensive than conventional production methods, both onshore and offshore and regardless of the production region. At the same time shale production is less expensive than other alternative technologies, namely tar sands exploited in Canada. It has been noted that Shale positioning in the middle of the cost curve has contributed to its disrupting market effect¹⁸.

It is not by chance that the new shale industry blossomed in the USA. The Shale oil and gas revolution came to commercial life in the right place. In fact, in the USA we find a combination of factors which were crucial for the budding and development of shale production. It is important analysing these factors, in order to better understand the pillars of this industry.

- Geology & natural resources

Similarly to conventional oil and gas, and to any other natural resource, shale resources are not equally distributed around the World¹⁹. The USA has a relevant endowment of hydrocarbons trapped in shale formations. Performing exploration where resources are abundant obviously reduce the geological risk. Additionally, it has been remarked that *“Unconventional oil and gas reduce exploration risk because of the probability of drilling a completely dry well is lower”*²⁰. Finally, crucial to hydraulic fracturing is obviously the abundant availability of water. Also this resource was not scarce in the USA. Compare that with possible exploitation of shale resources in the middle of the desert and see the difference.

- Resources exploitation legal framework

In the USA we find a very well consolidated and workable framework for exploration and production of oil and gas resources. Differently from many other Countries around the globe, ownership or exploitation of onshore mineral rights is not in the hands of State or Federal authorities. A company interested in prospecting for hydrocarbons in a particular area, will sign agreements (“leases”) with the landowners (or in general with the owner of the mineral rights on that land), and initiate the exploration phase. It is a negotiation process based exclusively on finding an agreement on the economic terms of the deal. Other provisions assure the efficient development of these natural resources (e.g. “compulsory pooling”, “top leasing”, etc.)²¹. This simple process can be activated also by small scale oil companies, which can focus on the exploitation of areas of limited extension.

That compares with the extremely lengthy and onerous process for allocating hydrocarbons exploration and production rights in most of the rest of the World. Normally long bidding rounds are requested before a company can be awarded an exploration licence. Just this stage can last for years, and only after that exploration can be initiated. Moreover, if and when resources are found, the process in place in the USA is incomparably faster than the concessions or joint ventures frameworks in place in most of the rest of the World.

¹⁸ See Thomson Reuters, February 2015, pag.11.

¹⁹ However, *“Shale resources are vast and distributed much more widely than conventional oil and gas fields”*, in J. Kemp (2013), pag.1.

²⁰ J. Kemp (2013), pag.5.

²¹ See Anderson, R., (2006).

In addition to this positive setup, shale production was favoured with specific incentives to producers. It is the case of the case of the Natural Gas Policy Act passed in 1978, which guaranteed higher market price for natural gas produced from shale resources²².

- Other legal conditions

Other legal conditions were important for shale development in the USA. To start with, the USA has very flexible labour regulation. That has allowed exploration, production and service companies to easily hire additional personnel when needed, luring them with attractive remunerations. Similarly, when shale-related companies have been in need of shrinking their operations, they have found it relatively easy to lay-off personnel.

The US oil export ban²³ has also played an important role. Oil shale producers have not been able to sell to the buyer willing to pay more, on a worldwide basis. They have instead been forced to sell in North America. This may have limited their revenues, in the measure that domestic markets have been disconnected from World's oil markets. However, this limitation has also forced shale players to constantly decrease their cost base and increase their productivity. These efforts have allowed shale to become a profitable business.

Last but certainly not least, “permissive”, or “balanced” according to different points of view, environmental regulation has helped a lot the budding of shale gas and oil development. The shale industry came to maturity before environmental impacts were fully discussed, understood or assessed. At the opposite, in other places outside the USA, hydraulic fracturing was banned even before any of this exploration technique has been actually put in place.

- Capital markets and funding

Although modern shale oil developments can rapidly get to the production stage, exploration is still a capital intensive business. Shale producers were able to secure funds in a market which was very positive about investing in these ventures. Funds came in the form of loans granted by domestic banks (e.g. credit revolving facilities). There have also been dozens of successful public share offerings. The extremely low interest rates have for sure helped shale producers to obtain funds, to obtain them at low cost and finance their growth.

Moreover, efficient investment structures have greatly helped in attracting additional capital. It is the case of the Master Limited Partnerships (“MLPs”) which are requested to raise their revenues mainly from energy businesses. MPLs have directed billions of US\$ in the shale infrastructure business²⁴.

- Technology, innovation and know-how

Shale deposits exploitation has its foundations in technological breakthroughs that transformed long-dated ideas in a commercially viable industry. First experiments are reported to have taken place as

²² See EIA (November 18, 2015).

²³ President Gerald Ford on Dec. 22, 1975 signed into law the Energy Policy and Conservation Act, a ban on most U.S. oil exports. Ford signed the bill after the 1973 Arab oil embargo that determined the first oil shock in the seventies.

²⁴ See Flood, C., (July 21, 2013).

early as the 1890s. Horizontal drilling entails complex operations, but it was already available for conventional oil. Hydraulic fracturing, now better known as “*fracking*”, has instead been developed specially to exploit shale formations. This is the fundamental innovation that has unlocked vast hydrocarbons resources that were known for more than a century. This innovation was built on the huge know-how of the American hydrocarbon industry and led to technological progress. We are not referring exclusively to fracking. In order to reduce uncertainty in the exploration phase and increase performance in the production phase, an intensive utilization of Information Technology and data analysis are performed.

- Market risk reduction

Many of the shale producers have been hedging their production one-two years out²⁵. They have been probably advised or requested to do so by financing banks. They have been able to do that efficiently because of the availability of an extremely liquid and developed derivative financial instrument, i.e. the WTI Light Oil Future. Prices at which they sell their production are very closely correlated to WTI. Hence the WTI Light Oil Future is a very efficient financial hedging instrument for shale producers.

By selling WTI futures, shale producers have become financially insensitive to oil price movements on a one-two year horizon²⁶. Fall in prices hurts profits from “physical” business, but determines positive payoffs on the financial Future side. Obviously, when the hedged period is over, producers are exposed to current oil prices as everybody else in the industry. There is also evidence that shale producers are paying more attention to systematically timing their hedging activity in correspondence of temporary Futures price increases²⁷.

- Infrastructure

The USA has an extremely well developed hydrocarbons industry, one of the most in the World. This means availability of infrastructure in every stage of the hydrocarbons supply chain. Ample supply of drilling rigs and all the material to perform exploration and production. Transportation logistics, with intermodal competition (pipelines, trains, barges, vessels), allows shipping goods efficiently and cheaply. Storage facilities and technologically advanced refining industry complete the framework. At the infancy of the shale revolution, new producers were able to exploit this ready available infrastructure. This was crucial for an industry that, as discussed before, is very similar to manufacturing standardized goods.

- Entrepreneurial culture

The USA is a country in which entrepreneurship as a positive value and it is encouraged. Just limiting our attention to natural resources, the USA saw the Gold rush in the 1850s. The US was the first country in the World to start systematic extraction of crude oil in the 1860’s, due to favourable geology but also

²⁵ At the contrary, hedging has been often neglected or avoided by conventional oil producers. In fact, risk management good practice has been surrogated by choosing “prudent” reference price levels in their budgets. When prices were at 110-120 USD/bbl, those companies were using an oil price at 80-90 \$/bbl in order to be “extremely conservative” in their financial forecasts. Those levels have been wiped out in the middle of 2014.

²⁶ If we exclude the residual risk due to the difference between shale oil prices and WTI.

²⁷ See for an example Thomson Reuters, October 12, 2015.

to entrepreneurial culture. The possibility for new comers to quickly become successful and rich is one of the pillars of the American dream.

This myth has found a renaissance with the hydrocarbons shale business. It is sufficient to remind that Harold Hamm, one of the shale pioneer and majority owner of Continental Resources, is the son of an Oklahoma sharecropper.

In summary, in the USA shale developments found the extremely benign simultaneous presence of all these crucial factors discussed above. Obviously the favourable geology is the most important one, as it represents the necessary condition. However, shale evolution needed also momentum. Obstacles in terms of financing, legal framework or infrastructure would have slowed or even chocked the budding revolution. Momentum was there due to the combined presence of the discussed benign factors. However, even the availability of all the benign factors, although already rare to be found at the same time and in the same place, would not be sufficient without another crucial element: the high and stable level of oil prices.

The timing for Shale oil to become commercial viable was fundamentally determined by conventional oil price. A low price environment would have never justified the quest for new sources of oil production. Production from Shale formations is not the cheapest available. This production needs a certain level of prices to justify their commercial development. In a low price environment, oil players start closing the most expensive production, and they do not look for new costly production. Instead prices were very high and for a long time span. Those prices guaranteed high profits to shale producers, enabling them to grow quantitatively and qualitatively. In fact, they were able to finance, or get financing for, new drilling and fracking activity. At the same time, they got resources to be invested in improving their operational efficiency.

Did shale oil change the market in the short, medium or long term? This is the question we will address in the next paragraph.

ARE NEW OIL MARKETS (MORE) CONTESTABLE?

At its inception in the 1860's, US oil markets resembled quite closely the structure of a highly contestable market and in the different stages of the supply chain. By using what at that time was "disrupting technology", never heard "wildcatters"²⁸ could successfully find their sweet spot in the oil extracting industry. The same was valid for transportation, storage, refining and distribution. Barriers to entry and exit were relatively low, and the entry and exit was a "fluid process" through Hit-and-run competition.

²⁸ The terms described early stages drillers that use to dig their wells in isolated places. See for example L. Maugeri (2006), pag.5.

That market was largely immature in terms of supply, demand and logistics. As a result, consuming centres could be deprived of enough oil for weeks, determining abrupt spikes in prices²⁹.

After a century and half of oil history, not much is left of that primordial contestable oil market. Probably the only remaining contestability feature is the non-homogeneity of the products, which we saw is one of the factors differentiating a contestable market from a perfectly competitive one³⁰. Crude oil continues to be a non-homogenous product due to a number of reasons: qualities, locations, pricing formula, destinations clauses and so on. This is coherent with a contestable market and implies that the market clearing price is not generically equal to marginal cost but it is equal to the marginal cost of the least efficient incumbent producer.

Apart from this aspect, modern oil industry is far away from the early stages of the 1860s. Nowadays the supply chain is incomparably more complex and complete, and has evolved in what many now identify as the “conventional oil” industry. It is difficult to find an example of a market that is more distant from contestability than conventional oil market. In contestable markets theory jargon, we would say that the level of contestability of this market is close to zero. However, Entry and exit in traditional oil exploration and production are extremely difficult and represent long term projects. Much before actually entry can take place with the production stage, a lengthy development stage is requested, which normally spans some years. After that, years of productions will normally come. The production levels will gently go down as time goes by. At a certain point, production will reach a low level at which it would not be economically justified to continue production. At that point, the well will be plugged and abandoned. This will constitute the “Exit” from that specific oil well but will obviously not represent exit from the market for the oil companies. They embark in continuous exploration and development activities in order to keep production levels constant or growing, in this way preventing exit from the market. “No industry of the global economy works with the time horizons as lengthy or far-reaching as ours,” said recently Rex Tillerson, chief executive and chairman of Exxon.

Conventional oil projects have potentially huge sunk costs. The exploration phase, although greatly improved across the decades, it still a very uncertain and risky activity. It is frequent that, after millions of dollars are spent, the well comes out dry or with a low level of expected production, which does not warrant further investments. If this is the case, the well needs to be plugged and abandoned at this early stage, and the money are gone. Consequently, the huge exploration investments qualify as sunk costs, as they cannot be recovered on exit. That implies that total entry and exit costs are extremely relevant and represent formidable barriers to entry.

Conventional oil exploration and production are price sensitive in the medium and long term. These incredibly expensive projects are in need of high prices in the long term. They command a long time to repay and deliver an acceptable return on capital. A temporary spike in price should not trigger new expansions. These projects need sound expectations of high prices also because these investments are not “hedgeable” in financial oil markets and not insurable on the full production time horizon. They

²⁹ In “The Prize”, Daniel Yergin tells that in January 1861 the price for a barrel of crude oil was 10 dollars, but in June of same year was a mere 50 cents and not more than 10 cents at the end of the year. However, at the end of 1862 the price was back at 4 \$/bbl and more than 7 \$/bbl a year later. See Yergin, D., (1991).

³⁰ In reality, in the supply chain we find other elements of contestability. The possibility of storing crude oil and refined products in cargo tankers instead of land storage has made these markets more contestable. Such storages are mobile and can be redirected to areas where supply shortages are present or anticipated, hence representing potential “Hit-and-run” entry. Similarly, in the natural gas market the continuous increase of supply delivered by LNG ships, instead of traditional gas pipelines, has undoubtedly increased the contestability of regional gas markets.

are always at risk that, before or during the commercial phase, prices will be much lower than forecasted.

In order to answer to the question of this section, i.e. if new oil markets are contestable, it is important to analyse the nature of entry and exit barriers in the market. The crucial question to answer is: are entry barriers lower than before? Considering that not much has changed in conventional oil, the answer should focus on the new shale oil section of this industry.

Entry barriers is a crucial topic of discussion in industrial economics. In general, entry barriers in a market are constituted by one or more obstacles for new comers to enter and compete with incumbents. These barriers may take many forms: legal framework, access to financing sources, access to infrastructure and so on. It has been noted that economies of scale do not necessarily result, *per se*, in barriers to entry. A commonly agreed definition on what constitute a barrier to entry is not available. Authors who analysed contestability of US airline market agrees with the definition put forward by George J. Stigler: *"A barrier to entry may be defined as a cost of producing (at some or every level of output) which must be borne by a firm which seeks to enter an industry but is not borne by firms already in the industry"*.³¹

That is enlightening, as we should not consider all possible limitations and difficulties a potential entrant can cope with. Instead, in order to assess the possibility of entry, and its related credibility, we should focus on limitations ("costs" in Stigler's definition) which are not borne by incumbents but should be borne by potential entrants. Under this light, the list of barriers to entry in the oil markets faced by shale producers is not long.

Shale developers had to cope with considerably lower barriers to entry than for normal conventional oil developments. Small unknown exploration companies have been able to acquire exploration rights, secure financing from banks and rapidly start exploration and production. Exit is also rather simple. It is sufficient to stop putting in production new wells, waiting for the fast depletion of the productive ones, and exit is completed. The absence of the benign factors we have discussed in the previous paragraph could constitute barriers to entry. At the contrary, in the USA the presence of those factors has facilitated the budding and development of the new oil industry.

Oil Shale developments are radically different from conventional development of hydrocarbon resources. The former are extremely price-sensitive to short term price changes. Developments are fast and they can hit the markets at the right time, that is when price is high or high enough to at least repay the investments. At the same time, they can easily leave the market if conditions become adverse. The level of uncertainty faced by Shale producers is much lower than the one suffered by conventional oil players. Shale producers repay their investments and make their money in the short term.

Most of the factors that have guaranteed the development of shale oil (legal framework, infrastructures, etc. as discussed before) have dramatically changed oil market. The new market has many similarities with Contestable markets, where Hit-and-run competition determines outcomes close to perfect competition. We do not find any valid reason supporting the opposite: US oil markets are much more contestable now than 5 years ago. However, are in general World's oil markets more contestable than before? Successful entry did take place in large scale in the USA only. What about the rest of the World?

In fact, the technological part of the shale revolution is still as US story. However, there are high probabilities of the spreading out on a Worldwide scale of shale technology, and we will discuss that in

³¹ Stigler, G., (1968), quoted in Bailey, Elizabeth E. and John C. Panzar, (1981), pag.128.

the last part of this article. However, the market structure impact of shale has already been a global one. One may wonder why, considering the already discussed US export ban. The umpteenth coincidences saw the shale revolution coming to age in the World's oil major importing Country. The increasing shale production gradually crowded out import flows which were in place for decades. This is the way the "domestic" shale revolution took the global stage and its impact spread worldwide.

COMPETITIVE STRATEGIES OF CONVENTIONAL INCUMBENTS

We have seen that the successful entry of shale producers was due to the lucky coincidence of local benign factors and favourable global oil price environment. In every balanced market, where supply meets available demand, the availability of relevant increased production would normally start depressing market prices. Shale production brought in the US domestic oil market millions of additional barrels, bringing back domestic production to the record highs of the 1970's. This production substituted imports and still global oil price did not show any reduction trend till July 2014.

In fact, another element was crucial in sustaining growth of Shale production, sustaining high prices and sustaining profits for conventional and non-conventional producers. When Shale oil started arriving copiously on the US market, important long-time established conventional sources of crude oil were absent or reduced. In 2011 about 1.5 mill. bb/day of oil was out of the market, due to Libya uprising and South Sudan political situation. In 2012 that figure increased to more than 2 mill. bbl/day, with the addition of sanctions to Iran. Between Summer 2013 and year 2014, due to new turmoil in Libya and reduced exports from Iraq and Syria, more than 3 million bbl/day were absent from international oil markets.

Those missing barrels prepared a perfect stage and favoured the competitive strategies of shale developers. A pillar for successful entry in contestable markets is the new entrants' expectations that, after their entry, price will not be undercut by the incumbent(s). *"Hit-and-run entry is supposed to occur if the potential entrant could make a profit at the pre-entry price"*³². That was completely plausible at the beginning of this decade, as the said missing production was increasing the supply call on conventional producers. Those producers could not rationally cut their prices following the entrance of new producers. Worth mentioning that, at this stage, oil shale production was still of limited volume. *"If an entrant's output is "small" relative to that of the industry, the magnitude of these required adjustments may also be "small", and hence it may be justifiable for the entrant to ignore them"*³³.

As additional supply was progressively absent from oil markets, US Shale oil producers were ramping up their own supply, marking a successfully entry and substituting foreign imported conventional oil with US domestic shale oil³⁴.

The "missing barrels" factor was very benign to Shale producers for two reasons. Firstly, it allowed a gradual and progressive entry in a market that was short oil. Secondly it postponed the time at which

³² Martin, S., (2000), pag.10. Otherwise, an immediate price cut will result in a zero-profit entry.

³³ Baumol, W.J. et al, (1982), pag.5.

³⁴ This displacement had other effects, notably on the US refining industry. Refinery runs were increased, investments in new expansions and splitters took place. US refiners needed also to adapt processing to the light crude produced by shale, where their technology was setup to refine heavy imported crudes. In total, the impact of shale on the refinery industry has been largely positive, as it has profited from low priced domestic source of feedstock.

heavyweight companies and countries in the supply side became fully aware of the fundamental change that was going on³⁵. The Shale revolution continued to consolidate and its full impact was not understood for 2-3 years. The fact that prices were still well above the 100 \$/bbl level helped a lot in wrongly downplaying the importance of Shale production. Many started waking up only in the second part of 2014, when prices finally started their descent, firmly headed to halving their value in a matter of months.

What did happen at that point in the oil market and in the strategies of conventional oil producing companies and Countries? How did they answer or try to answer to the Shale oil revolution? Were their strategies successful? In order to address these questions, it will be useful to briefly come back to the theory of contestable markets, as it will again shed light on these recent events.

According to the contestable markets theory the incumbent, in order to prevent Hit-and-run competition, needs to bring and maintain production levels at a level close to the perfect competition one. In this way, even a market where just a company is active (a monopoly) will necessarily deliver the final outcome normally associated with perfect competition in terms of prices and quantities. If the incumbent does not apply this strategy, it will ripe monopolist profits today but perfect competition levels (i.e. zero) tomorrow, after successful entry has taken place.

If we put oil markets in the contest of contestable markets theory and Hit-and-run competition, much of the recent analysis aimed at explaining what happened to oil markets needs to be revisited. Misunderstanding about the new features of the oil markets has brought respectable analysts in serious errors. In 2013 some of them predicted Saudi Arabia producing at a level of 7-8 million barrels a day. The real number stands at 9.5 Mbbbl/day in 2014, and increased to 10.3 Mbbbl/day in the second quarter of 2015³⁶. Why these macroscopic errors were done? Why Saudi Arabia is producing at full speed when prices are so low?

Saudi Arabia has often been made the “culprit” for the low level reached by oil prices. Under this view, Saudi Arabia would have acted irresponsibly when abandoned the role of “swing producer” and overblew the market with “excessive” production. Using the light of contestable market theory, recent Saudi Arabia actions are instead perfectly rational and in the Kingdom’s own interest. In fact, those actions represent the best available strategy as of now.

Only by saturating the market with the production levels requested by consumers, similarly to what we discussed for the airlines market, Saudi Arabia could deter new entry and competition. Only the much increased contestability of the oil markets and the currently correct strategy from the incumbent can fully explain recent developments in the market. Saudi Arabia needs to limit, as much as possible, Hit-and-run competition from US shale producers and would-be ones from other areas of the World. This strategy represents a tectonic shift, if we remember that for long time Saudi Arabia has been described as the swing producer inside OPEC. The new contestability regime of the oil market determines a deep fracture between Saudi Arabia and the rest of the OPEC members³⁷.

³⁵ Obviously many of the conventional oil producers were aware, but only a limited number took any decision in modifying their strategies. Among them there was Exxon, that in 2010 Exxon bought XTO, at that time the largest US natural gas producer specialized in shale hydraulic fracturing.

³⁶ Source: “Oil Market Report”, International Energy Agency.

³⁷ Saudi Arabia competitive strategy has been more complex than just maintaining production levels. Saudi Arabia has been for long time selling its crude oils at different prices in different macro-markets. In this case, it has used price discrimination to sell in the USA at prices that are lower than in other macro-regions. This strategy has been later followed by other players (Iraq, West Africa producers) in order to gain space in the US market.

The problem with the application of Saudi Arabia change in strategy has been its timing. It has been endorsed when new entry in the oil market had already taken place, as shale was producing millions of barrels each day. The fundamental error, from Saudi Arabia or OPEC more in general, was made in the previous years, when the high level of oil prices was maintained, tolerated, favored by not bringing on the market a higher oil supply. Major oil incumbents in the years of oil price bonanza crucially missed that their industry was changing in the direction of a much increased contestability. In the past decades, the major challenge conventional oil producers have seen to their supremacy has been related to environmental issues and the possibility of substitution by cleaner forms of energy. They did not imagine that the most formidable threat would actually come from inside the industry!

Saudi Arabia usually maintained spare capacity that, if actioned, would have lowered the price at that time. Indeed, a difficult decision to take: Saudi Arabia itself had no interest in a lower price when developed Economies were tolerating high prices. The inaction put the basis for the successful entry of the shale producers. The crucial point is that this “damage” for all conventional producers is permanent. If entry has happened once, it can happen again. It will be triggered by the level of oil prices and the benign presence of the factors we discussed before.

How conventional oil producers are coping with the new price levels? Which are their current competitive strategies? The sizeable and sudden reduction of World oil prices impacted all players, namely conventional and non-conventional producing companies and Nations. Conventional oil producers have been forced to postpone or cancel altogether new exploration and production projects. In fact, these projects became not justifiable on economic grounds if a low price environment is probable also in the future. Conventional oil companies do not have the financial resources to embark in this projects, as they are generating much less cash flows than before. The money already spent are to be considered as sunk costs. In September 2015 Shell communicated the decision to abandon offshore exploration in Alaska after having spent the respectable amount of 7 US billions. However, investments cutting has not been indiscriminate. On the contrary, in many cases conventional oil companies have instead invested in Shale oil exploration and production, either as greenfield or by acquiring shale producers³⁸.

The repercussions for oil producing Countries have been even bigger than for public oil companies. Low oil prices are detrimental not only for their national oil companies but also for Countries’ budgets in general. In fact, lower prices imply lower royalties received from foreign oil companies active in those Countries. These lower incomes reverberate in budgetary problems. It is well known that many oil producing Countries need oil prices between 80 and 110 \$/bbl in order to finance their current expenses and public investments plans. Below those price levels, those States need to go to the safe and withdraw funds they cumulated in past years of oil price bonanza. Cost cutting, in these case, it is not only at the level of the oil exploration and production but would need to reach, sooner or later, the State machine.

COMPETITIVE COUNTERMEASURES OF NEW SHALE OIL ENTRANTS

As for any other good, oil supply is positively correlated to market price. If prices go down, global supply is reduced. This adjustment is achieved by the exit from the market of the most expensive production. Other producers stay in the market but their profitability is reduced. Shale oil is not the most expensive

³⁸ See, for some examples, Carrol, J., (September 18, 2015) and Carrol, J., (October 30, 2015).

production, being amply surpassed by tar sands and many offshore developments. It is clear then that lower price would reduce shale profits and make payback periods longer. At the end, if price would remain stably lower than breakeven price, then shale oil will start exiting the market, starting from the most expensive developments³⁹. This has become evident during the course of 2015, as demonstrated by the reducing production in the core Share production regions.

It is evident that new market entrants, the bold Shale oil companies, have been impacted by the new low oil prices that they crucially contributed to determine. The impact came at a moment in which the new industry and the technology was still not completely mature. A mentality and organizational setup much closer to start-up companies rather than to oil majors have helped a lot in weathering the storm.

US Shale producers, facing declining prices, have put in place a series of strategies to counterbalance this effect. Obviously, not being able to influence on the upside oil prices, all their actions have been necessarily in the direction of producing more by spending less, in order to lower the level at which they breakeven.

Most of these strategies were already being pursued well before the oil price slide, as they were necessary in order to bring shale production to commercial viability. In their efforts to lower entry barriers in the oil market, shale players were already in need to increase the profitability of their operations. They were striving to improve technology, reduce costs and increase operational efficiency. Their efforts have reached remarkable results, some of them summarized as follows:

- Developments time and costs went steeply down.
- Drilling days and completion costs were drastically reduced⁴⁰.
- Improvements achieved on other parameters: longer horizontal length, higher average number of fracking stages. This determined increased oil production per well and higher Estimated Ultimate Recovery.
- Re-fracturing of wells, after production from first fracturing becomes too low.

These technical improvements, coped with organizational ones, have resulted in unexpected resilience. The generally predicted reduction in shale production has taken many months to become manifest after the price decline started. Should prices go up again, we may expect a renewed increase in shale oil production. Actually an upward inversion of the trend would find shale producers ready and well prepared. In fact, they have been building a “reserve of wells” i.e. a backlog of wells which are drilled but not hydraulically fractured⁴¹.

Could we conclude that the USA are the new swing producer, after Saudi Arabia abdicated from this role? The idea is seductive and somehow reassuring, and has found supporters and critics⁴². A monolithic swing producer, as Saudi Arabia was, modulates its production in order to rebalance supply and demand in a market. To this purpose, it maintains spare capacity ready available to produce more

³⁹ The rapid production decline of hydraulically fractured shale wells would imply, without the addition of new wells, a fast decline of the overall production and exit of shale producers. However, different Shale producing areas and company have different cost structure which diversify their breakeven prices and, consequently, the incentive to entry and exit the market.

⁴⁰ One rig can drill much more wells per year than before. It has been reported that, between 2009 and 2012, drilling days and completion costs have halved for some producers. This evolution had started some years before in the shale gas sector, and then transposed in Shale oil. See NETL (2013).

⁴¹ To give a gauge of the relevance of this new strategy, it is sufficient to remark that the number of “nearly-completed” wells reached the record number of 1000 in North Dakota alone in September, 2015 (Thomson Reuters, November 16, 2015)

⁴² For a supporting view, see for example The Economist (2015).

if necessary. In the case of shale oil, the situation is different. Capacity is not ready available, but can be made available in a time lag much shorter than for traditional production. Shale oil lays in the middle, between the ready available capacity of a swing producer and the long-time development needed by a conventional producer.

Shale oil production does not rebalance the market immediately, but it represents the threat to enter the market with additional production in a matter of months, i.e. activate Hit-and-run competition. Exit or downscaling for a shale producer is determined by purely economic considerations: market price is below the breakeven price. Instead a swing producer will retain production for strategical reasons and not because it is losing money. Finally, shale oil production is not a monolithic, centrally managed entity as it is the case for Saudi Arabia. Shale production comes from a number of producers which are differentiated under many points of view.

THE FUTURE AHEAD

After more than a century-long quest, a benign combination of factors has allowed successful entry of shale production in the oil Gotha. In this article we have tried to clarify that it would be essentially wrong to relegate the impact of shale industry to the technological side of the story. Shale oil is far from representing just additional volumes on the supply side of World oil markets. Shale oil constitutes a revolution because it has changed the structure of oil markets. Under the benign conditions and in presence of sufficient demand, shale oil represents quickly actionable production. In this way shale oil has put a long term cap to the level oil prices can reach in the future. Forecasts predicting oil prices at a level of 100 \$/bbl and more in some years' time could be just an illusion to be consummated by clients of renowned think tanks. Shale oil producers can successfully replicate entry and pressure supply and prices in the long term.

Saudi Arabia, OPEC, other producing Countries and majors can keep their production at the high level we have seen recently. This strategy will protect their market share. However, that strategy cannot do much to reverse the increase in market contestability brought by shale producers. That would request erecting new and higher entry barriers in the market, but this is outside the power of conventional oil producers.

The new market structure will persist as long as the benign factors will be in place. Entry barriers will be crucial in order to define if the market will present a high or low level of contestability. Until now, barriers to entry have not been high enough to discourage new shale-based production. In order to try to predict the future ahead, we would need to analyse the evolution of entry/exit barriers in the market. Raising barriers would obviously reduce possibility of entry, *ceteris paribus*. Lower barriers will instead further increase the contestability of oil markets.

Limiting our attention to the USA, the probability of adverse changes to the shale oil favourable setup is relatively low. After scanning the list of benign factors, we can conclude that some limitation could come by changes in laws regulating the supply chain, from exploration to production and transportation, in particular environmental preservation laws. Opponents to fracking developments have affirmed that this practice is severely damaging the environment, mainly by creating "earthquakes", but also by wasting and polluting water. It is possible that these issues will be addressed with more attention in the years to come. However, the probability that the final result will be a serious limit to fracking operations in the USA is low.

Other obstacles to US Shale production could come from worsening financing conditions which are linked to the level of interest rates and oil prices. A substantial increase in the rates, although improbable at the time of writing, would imply that financiers request a higher return on the capital invested in the Shale industry. Also a reduction of oil prices would limit the access to financing resources. In fact, lower oil prices would reduce the value and the dimension of shale oil reserves, and these represent the guaranties to the loans received. In both cases, the Shale breakeven price would move higher, but again that would not kill the industry⁴³.

On the other side, other benign factors could reinforce Shale oil production. It is certain that technology behind the revolution has ample room for further improvements. Those would allow producing more, faster and at lower costs. Also infrastructure is bound to improve, allowing to transport bigger volumes faster and cheaper. Finally, a more and more probable lifting of the US crude oil export ban could have a beneficial impact⁴⁴. It would allow shale producers to target World oil markets and sell at higher prices, *ceteris paribus*. At the same time, that would blow the price discrimination strategy of Saudi Arabia and other major producing Countries and companies. If those players will pursue a strategy of selling at lower price in the USA, then US Shale producers will just target other markets around the globe. Obviously freight costs need to be part of the equation.

We have already remarked that this “local” revolution had a global impact because it happened in the World’s biggest oil importing country⁴⁵. Apart from the export ban lifting, in the future there is another way in which the shale revolution could maintain and reinforce its global impact. In fact, shale development technology could be applied in other Countries and the production sold on international markets.

Shale formations are not equally widespread all over the World, but they are not present in the USA alone. Analysts have suggested that shale revolution could take a more global stage because of probable shale deposits in other Countries⁴⁶. The presence of hydrocarbons trapped in shale formations is a necessary but not sufficient condition for the spreading of the revolution on a worldwide scale. The benign factors we have previously described needs to be there all together, in the same Country and at the same time, to allow the replica of the US shale revolution.

There is a high probability that, in some other Country outside the USA, shale production will be successful initiated. That would increase the percentage of World’s crude oil produced from Shale and, in turn, could further augment contestability of oil markets. However, it is important to highlight that more oil produced from shale does not automatically imply an increase in market contestability. Should shale resources be developed in centralized economies and by National Oil Companies, then the setup and the outcome could be different from the Hit-and-run competition we observed in the USA.

⁴³ The value of shale projects has been calculated exclusively as Net Present Value and Internal Rate of Return of the assets. These are erroneous valuation methods, as shale resources have a relevant Optionality Value. For an exemplification applied to the energy sector, see Mauro, A., Sgarioto, R., (2001).

⁴⁴ We refer to the already mentioned ban included in the Energy Policy and Conservation Act of 1975.

⁴⁵ Till 2013, when China reclaimed the first place.

⁴⁶ The first four Countries in terms of recoverable shale resources are Russia, USA, China and Argentina. It should be noted that in some Countries where shale exploration has been initiated, it is delivering unsuccessful and disappointing results. Other Countries have banned altogether the possibility of hydraulically fracturing shale formations in order to explore, develop and produce hydrocarbons.

Moreover, it is very probable that conventional oil producers will increase their attention to shale developments. This lean form of production would allow them to generate cash-flows while reducing the amount of capital employed and limiting the amount of risks they need to bear⁴⁷.

It has been argued by a number of oil market analysts and commentators that new oil markets will be characterized by higher unpredictability and volatility⁴⁸. Although this view could hold true, that should not be charged to Shale producers and their competitive strategies. Other factors, on the supply and on the demand side, could warrant increased unpredictability in the oil produced, oil traded and its price. It is sufficient to consider the precarious state of geopolitical equilibria in crucial parts of the World to guarantee a probability much higher than zero for oil supply disruptions in the future.

However, instability and volatility will not come from shale oil producers. As it happened in the 1980s with the US airlines industry deregulation, shale oil producers have drastically lowered barrier to entry in their industry. Even if they could be relegated to a marginal role in a low price environment, they will still constitute a threat of potential entry that will force conventional oil actors to produce and offer quantities close to the perfect competition level. In the future, due to reduced global supply and/or increased demand, oil prices could still show again a tendency to increase. However, the levels at which markets got used to in the pre-2014 environment are unrealistic. In fact, prices much lower than before would guarantee the successful reappearance of Shale oil producers that previously left the market. They will act as a fundamental balancing actor in the market.

The new contestable oil market is here to stay.

Alessandro Mauro (FRM) is a commodity risk professional and a member of the GARP's Energy Oversight Committee.

alessandro.mauro@gmail.com

⁴⁷ The risks levels conventional oil producers were prepared to accept are not anymore justifiable under the new market structure. There are also signs that those risks are growing. As an example, it has been reported that in 2015 only 10% of conventional oil discoveries will be profitable. That number stood at 40% in year 2010. See Carrol, J., (October 30, 2015.).

⁴⁸ See for example Tonhaugen, B., (October 28, 2015). Among other issues, these conclusions rest on partial views regarding price risks. Modern risk measures, such as Value-at-Risk, are also dependent on the absolute level of prices. Consequently, a lower price does reduce market price risk, *ceteris paribus*.

BIBLIOGRAPHY

- Anderson, R., (2006), *“North Dakota Oil & Gas Leasing Considerations”*, North Dakota State University, October 2006.
- Bailey, E.E., Graham, D.R., Kaplan, D.P., (1985), *“Deregulating the Airlines”*. Cambridge, Massachusetts, MIT Press, 1985.
- Bailey, E.E., Panzar, J.C., (1981), *“The contestability of airline markets during the transition to deregulation”*, Law and Contemporary Problems 44, Winter 1981, pp. 125-145.
- Baumol, W.J., Panzar, J.C., Willig, R.D., (1982), *“Contestable Markets and the Theory of Industry Structure”*, New York, Harcourt Brace Jovanovich, 1982.
- Carrol, J., *“Exxon Said to Be on the Hunt for West Texas Shale Bargains”*, Bloomberg, September 18, 2015.
- Carrol, J., *“Oil Producers Curb Megaproject Ambitions to Focus on U.S. Shale”*, Bloomberg, October 30, 2015.
- EIA (2014), *“EIA, Annual Energy Outlook 2014 Early Release”*, 2014.
- EIA (November 2015), *“Monthly Energy Review”*, November 2015.
- EIA (November 18, 2015), *“Shale in the United States”*, November 18, 2015
- Flood, C., (2013), *“Energy MLPs tap into US shale boom”*, Financial Times, July 21, 2013.
- Grant, R., (2002), *“Contemporary Strategy Analysis”*, Blackwell Business, fourth edition, 2002.
- Kemp, J., (2013), *“Shale: the unfinished revolution”*, June 2013.
- Maugeri, L., (2006), *“The Age of Oil”*, Praeger Publishers, 2006.
- Mauro, A., Sgarito, R., (2001), *“An Evaluation of Italian Electricity Generation Assets Using a Spark Spread Option Model”*, 2001. Available at http://bit.ly/amauro_articles
- NETL (2013), *“Modern Shale Gas Development in the United States: An Update”*, September 2013.
- Ngai, C., Resnick-Ault, J., (2015), *“U.S. shale firms snap up \$50 oil hedges, risking rally reversal”*, Thomson Reuters, October 12, 2015.
- Spencer, D., (2015), *“The New Economics of Oil”*, The Oxford Institute for Energy Studies, October 2015.
- Stephen, M., (2000), *“The Theory of Contestable Markets”*, Purdue University, July 2000.
- Stigler, G.J., (1968), *“The Organization of Industry”*, Irwin, Homewood III, 1968.
- The Economist, (2015), *“The Oil Industry after OPEC. American Shale Oil firms are now the oil market’s swing producers”*, May 16th, 2015.
- Thomson Reuters, (Feb. 2015), *“A Brief History of the Oil Crash”*, February 2015.
- Thomson Reuters, (Nov. 2015), *“North Dakota oil well backlog eclipses 1,000 for first time”*, in *“Inside Commodities”*, November 16th, 2015.
- Tonhaugen, B., (2015), *“Resilient US oil production will prompt additional volatility in the market”*, Rystad Energy, October 28, 2015.
- Yergin, D., (1991), *“The Prize: The Epic Quest for Oil, Money & Power”*, Simon & Schuster, 1991.