

# The Oil Games

## > The Good Old Days

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The Oil Games are as a series of interconnected episodes in which we will try to explain and predict market behavior using Kayrros' extensive knowledge of the energy industry, the world economy, mathematics and game theory in particular. The series' target audiences include the practitioners, investors, and observers of the oil industry who are interested in finding new ways of understanding this fascinating business. The authors are Jean-Michel Lasry, Antoine Halff and Antoine Rostand. This is an ongoing story with future episodes being published in sequence by Kayrros.

### Introduction

In the first episode of the Oil Games we met the Players and discovered the Rules of the Game.

A surprising discovery of that first episode was that a 'discovery', whether in the world of innovation or in the search for oil and gas, doesn't rhyme with 'surprise.' It might indeed come as a surprise that discoveries have nothing to do with the legend of the great scholar or the magic of serendipity. Oil and gas discoveries, like technological innovation, are first and foremost a matter of budget. In the search for underground deposits, just as in the race for the next disruptive technology, funding is the key. The business of discovery is a business like any other.

So what drives investors to allocate funding to the pursuit of discovery? As always, it is the expected return on investment. And the return on investment itself depends on the structure of the industry in

which we are working—monopolistic, competitive, or somewhere in between.

Which brings us back to game theory, and the strategies adopted by the various Players.

### The Old Game

As previously discussed, there is a striking similarity between R&D in the field of innovation and E&P in the oil industry. In both cases, growth is not only an endogenous response to market imbalances, but it is also affected by competition. While a little bit of competition does wonders for both R&D innovation and for E&P, too little or too much can stifle both.

### The Good Old Days

If growth in the oil industry is indeed endogenous and the entire supply chain dynamics stems from investment decisions, then the logical consequence

is that investors' expectations are the key to supply dynamics as a whole.

There are different kinds of oil investors. For many decades, investor-producers were divided into two types, OPEC and non-OPEC. Over many years, OPEC has followed a strategy that closely resembles that of a monopoly facing a competing fringe.

Monopolies are, by nature, in the profit maximization game. Taking advantage of their -price-making' position, their best bet, as long as demand remains sufficiently price inelastic, is to curb supply to lift prices, and thus increase profits.

How far they go in curbing supply depends on the elasticity of demand and on the size of the competing fringe. The more elastic demand is, the less room the monopoly has to lift prices without triggering an adverse demand response. Similarly, the larger the competing fringe, the more the monopoly has to worry about empowering it at its own expense. Conversely, the less elastic the demand, and the narrower the competing fringe, the more leverage accrues to the monopoly and the more elbow room it enjoys to let prices take off through comparatively small production cuts.

Note that this rather intuitive strategic reasoning only works for the short- to medium-term in a slow-moving world, where evolutions take time to unfold. Strategic analysis becomes more complicated if long-term effects are taken into account—a theme we'll return to later.

Profit maximization is OPEC's *raison d'être*. Oil demand is highly inelastic. This provides its members with a powerful rationale to coalesce around a monopoly strategy—keeping supply down to boost prices and squeezing the highest profits possible out of every barrel. Note that the competing fringe also benefits from the price increase, even though it's not part of the coalition.

## Breaking the Rules

From a producer standpoint, the optimal coalition is one that includes all producers. Global coalition equals maximum global profit. Such a coalition must, however, overcome two challenges. First it must agree on how to distribute windfall profits among its members—in practice this is done via production quotas—and second, it must block its members from jumping ships and joining the competing fringe. For coalition members, leaving the coalition can be

tempting. Breaking ranks can let them piggyback on the coalition's efforts without having to carry their share of the burden.

A look at the incentives to comply or not with the coalition's strategy shows that group discipline tends to depend on two factors—production volumes and demand inelasticity. For decades, the high inelasticity of oil demand has let OPEC cast a wide net and enabled it to enjoy a market share that has ranged from roughly 30 to 40% of global supply. Furthermore, the group has included several of the world's top oil producers, or as we shall call them, exporters.

Analyzing oil producers' behavior purely in terms of their supply volumes can be misleading, however, as it wrongly assumes that they are guided solely by their self-interest as producers. In fact, many oil producers are also—and sometimes primarily—consumers. In this case, consumption, rather than supply, drives their strategy. Other non-oil factors can also come into play and this is perhaps why many large producers, not least the United States and Russia as well as Canada, China and others do not belong to OPEC.

Small producer countries have no reason to inflict supply cuts upon themselves. In most cases, given their small size, even a 50% cut in their national output would not really move the needle in terms of global prices. None of them would individually benefit from withholding barrels from the market. Since they still profit from OPEC's price support policy even without cutting their own production, joining the group would not bring them any advantage.

Non-OPEC producers thus typically produce as much as they can. In setting its own production and price policy, OPEC must take net demand for this non-OPEC supply capacity into account. During bouts of strong demand growth, such as the 2000-2008 Chinese oil consumption spurt, OPEC finds it naturally easier to set its production at a level that ensures high, even very high, prices.

## Knowing When to Stop

During these periods, however, OPEC seems to stop short from leveraging its full strategic potential. When oil was trading at \$140 per barrel, OPEC could easily have cut its production by, say, 5%, and lifted prices even more—perhaps to as much as \$200 per barrel—thereby increasing its export revenues and profit margins. Why did it not do so? There are probably several reasons, but one of them is that OPEC does not just base its decisions on short-term profits

but also takes the more distant future into account. This is perfectly rational. All monopolies—and all economic agents for that matter—factor in long-term considerations.

Price signals are the main driver of investment decisions. High oil prices give investors an incentive to boost oil production capacity. Ten years of sustained high oil prices between 2004 and 2014 convinced many actors to pour investment into oil production projects that made perfect sense at \$100 per barrel or more.

High prices were the key that unlocked US shale oil. Record oil prices—fed by market expectations that high prices had become the new norm and that cheap oil was over—enabled all the research needed to make shale oil flow and develop production capacity at breakneck speed from about 2008 until the price crash of 2014. High prices paid for the steepest and fastest rise in production ever recorded by a single country in oil history.

The windfall profits enjoyed by OPEC, and by all oil producers for that matter, during that decade sowed the seeds of its undoing. The prolonged period of high prices paved the way for the violent market correction of 2014 and OPEC's deep economic crisis. In hindsight, one might suggest that had OPEC let prices run up to \$200 per barrel, the crisis would have been even more violent, and would have come sooner.

Until 2014, Saudi Arabia's distinctive production profile with its superior supply volumes, production

capacity, and size of reserves helped cement and bolster the coalition of oil exporters. Not only did the Kingdom greatly benefit from the cartel's existence, but it was also able, by tweaking its own supply and export volumes, to compensate for any oversupply or undersupply from other coalition members—most of whom tended to produce at capacity in fact.

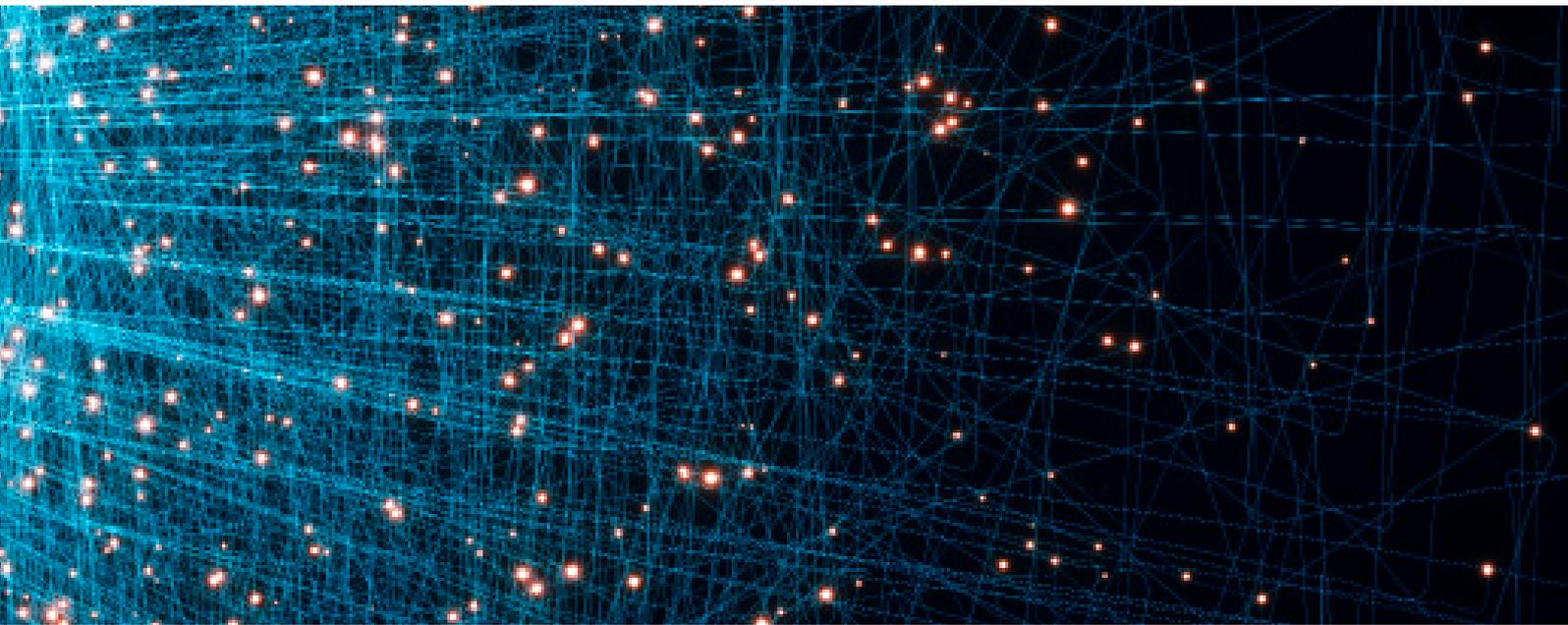
## Return Players

Another major stabilizing factor for OPEC came from its members' awareness during this protracted period of high oil prices of what game theorists call the "repeated game" aspect of their strategy.

This concept goes beyond the idea of simply taking the future into account. Players behave differently whether the game in which they participate is single-shot, played just once, or a repeated game, played multiple times—for example every year or every few months. The very nature of a repeated game elicits from its players the strategies of cooperation, loyalty, and devotion to the very idea of cooperation that fail to occur in a single-shot game.

In setting their production policy, OPEC members know full well that they are in the market for the long run and that their moves may have long-term consequences. Perhaps more importantly, they also realize that their decisions and behavior as OPEC members may affect their future relations with the other players and their ability to play the game again. In other words, they have gained a reputation for a certain way of behavior.





The cyclical aspect of the oil market, the predictable recurrence of regular OPEC meetings typically set at six-month intervals, and the institutionalization of the OPEC club and its strategy all act as a powerful cement that binds the players together. Until the years from 2008 to 2014, the competing fringe facing OPEC was largely made up of relatively high-cost producers whose production techniques were not fundamentally different from those of OPEC.

### **Changing the Rules**

All producers shared long lead times between their investment decision and the start of production. Ten years would often go by between initial exploration spending and first oil from new fields.

Shale oil, with its short lead times, short pay-back times and low initial capital requirements, changed all that. Its emergence as a new type of production has rocked the strategic landscape and structure of the industry.

Is shale oil the ultimate realization of Schumpeter's promise? Is it a prime example of creative destruction, a break from the past, disruptive innovation in action? Or is it a flash in the pan, a footnote of history, just another source of oil?

Back in 2014, this was a crucial and highly legitimate question. To find the answer to that question, the Players will have to pay dearly. That will be story of Episode 3.

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