A Nomadic Journey – Simulating the Effect of COVID-19 and Production Shifts on Crude Oil Prices

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An unsettled market

Concurrent with financial turbulences and collapsing labour markets, the crude oil sector has been witnessing its most severe price drop to date. The slumping prices are a result of simultaneous shifts of demand and supply.

On the one hand, the COVID-19 pandemic has led to a substantial decrease in oil demand, as lockdown measures have put economies worldwide into hibernation. After oil demand growth in 2019 was already below expectations, closed factories are dampening industrial consumption. Closed retailers and cities double down on the demand for goods and services (and, therefore, their production). Oil demand from the traffic sector suffers immensely from remote work and closed international airways.

On the other hand, a showdown between some of the world's largest oil suppliers has led to sudden and ambiguous production shifts. In March, the breakdown of talks on an extension to the OPEC+ agreement finally caused prices to collapse: Saudi Arabia replied to Russia's decision not to participate in further negotiations with a price war. The Saudi oil company Aramco formally announced via the Kingdom's stock exchange *tadawul* that it would supply 12.3 million barrels daily – in January, this figure had still been below 10 million. In April, the OPEC+ group (mainly referring to the OPEC members with the addition of Russia and Mexico) decided to combat low prices and demand with production cuts. The announced measures amount to roughly 10 million barrels daily that shall be withheld by the suppliers to stabilise the market. At the time of writing this article, in mid-April 2020, the announced production cuts have just shown first effects with prices approaching 30 USD/bbl again. Whether a lasting price recovery and or successful implementation of reductions will eventually be achieved is still open at this point.

Simulating supply and demand shifts

We simulate the effects of recent (and potential) supply and demand shifts on the crude oil price to understand current developments and future paths. Our model depicts game-theoretical and techno-economic aspects of the global oil market and is frequently used for scientific publications and policy advisory (see Ansari, 2017; Huppmann, 2013; Zaklan et al., 2018). The simulations use early January as a reference point and estimate (equilibrium) prices for varying degrees of

- a decline in (reference)[1] demand;
- an increase in Saudi Arabia's oil production, as announced in March; and
- production cuts by the OPEC+ group, as announced in April.

The model considers (short-term) profit-maximizing adjustments of other producers, though restrictions ensure that a sufficient rigidity of oil production reflected as well.

Figure 1 visualises the results for combinations of these factors at various degrees. The chart illustrates how the unsettled oil price has been wandering continuously, crossing different situations and levels throughout recent months.

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For a discussion of the difference between reference demand and actual demand, see the Appendix of Ansari & Holz (2019).

Market conditions in January 2020 (bottom centre in the chart) previous to changes in demand or production led to prices between 65 and 70 USD/bbl. The intensifying decline in demand – initially from the Far East – caused prices to approach 40 USD/bbl (movement upwards in the chart). In the second week of March, Saudi Arabia's announcement to expand its own production by around 20% led to a sudden price slump of about 30% (centre right in the chart). Throughout March, the increasing spread of the virus in Europe (and, later, in North America) led to a further depression in demand for oil. As a result, the price reached 20 USD/bbl and even below in April (top right in the chart).

The figure suggests that COVID-19 has had a far more substantial effect on oil prices than the escalation between Saudi Arabia and Russia. The estimates reveal that a return to the production levels of January 2020 would yield prices still below 40 USD/bbl. A successful implementation of the production cuts announced by the OPEC+ group in April 2020, amounting to roughly 20% of OPEC's production, has the potential to lift prices back to a level of 60 USD/bbl (movement to the left in the chart). However, and besides the question of whether the pledges will eventually be implemented, further demand shifts have the potential to knock the price trajectory off course. Additional reductions of global demand could create excess pressure on the price, which even production cuts could hardly counterbalance (an upward movement in the chart). This case is not unlikely, since oil storages worldwide are approaching their capacity limits, and an end to the Corona crisis is still out of sight. Although China and some European countries are lifting part of their lockdown measures, it is becoming increasingly evident

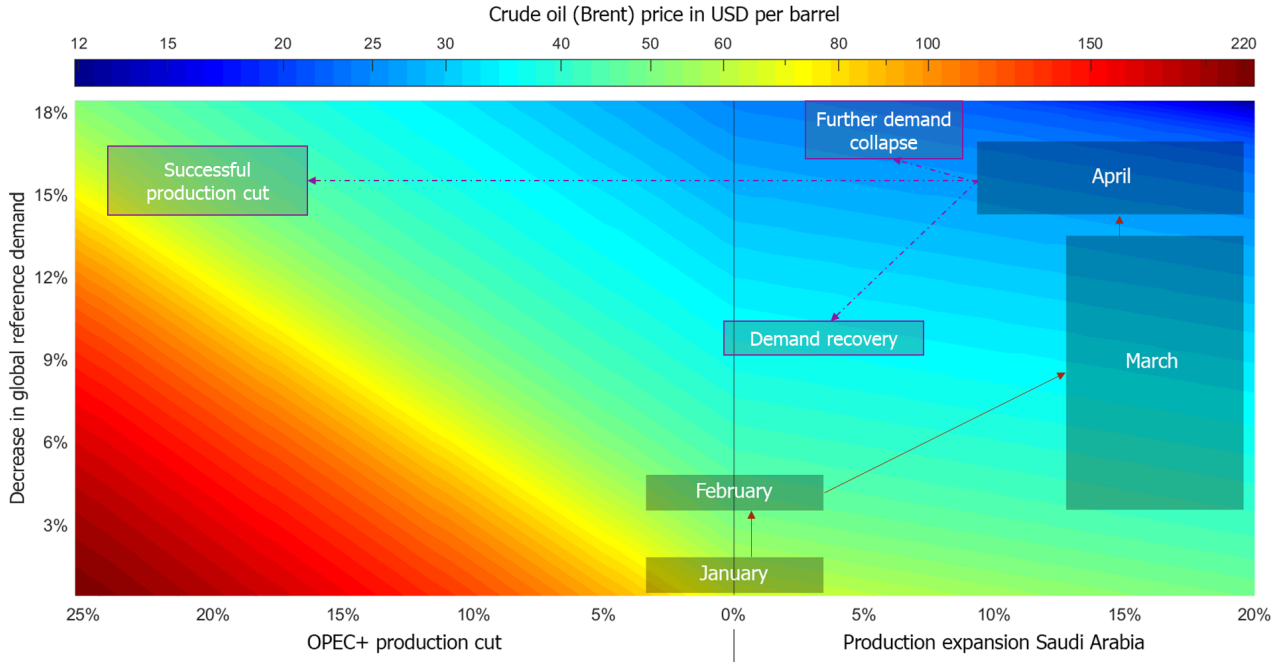

Figure 1: Estimates of the oil price in US dollars per barrel of Brent crude for various levels of an expansion of Saudi Arabian oil production, oil production cuts of the OPEC+ group, and a global decline in (reference) oil demand

Note: Production expansion / cuts and reference demand decline are relative to reference values (early January 2020). Strategic, profit-maximising production adjustments of other producers are included in the values.

Source: Own calculations based on data from Ansari (2017), the International Energy Agency, and the U.S. Energy Information Administration.

that some slowdown of economy and traffic demand might persist throughout the year. In the unlikely case of a sudden demand recovery (downward movement in the chart), prices could return quickly to higher levels, and most of the production cuts would not be necessary after all.

Of course, readers should note that the model is based on static competition, stable demand patterns, and stylised market assumptions. Eventual prices may, hence, differ from the estimates. In particular, the adjustment behaviour of other market participants does not reflect any medium-term changes, for example, due to capacity expansions or shutdowns.

Conclusions

The recent plunge in oil prices results from a drop in demand – a result of the Corona crisis – and an initial failure to conclude a new OPEC+ deal. Although only the simultaneous shift in demand and supply made this rapid fall possible, our simulations suggest that the decrease in demand was the more significant contributor to the developments.

The future price trajectory is mostly uncertain, as both supply and demand trends are still highly dynamic. A full implementation of the production cuts announced by the OPEC+ group has the potential to lift prices back to 50 USD/bbl and even beyond that. However, until now, is not clear to what extent the measures will actually be realised, and further demand shifts can knock the price path off course. Even the announced cuts will not allow exporters to regain ground if oil demand further collapses. Since oil storages around the globe are increasingly filled, this is a strong possibility; and the longer the corona crisis lasts, the more permanent the price effect will be. As long as supply and demand are still exposed to sudden turbulence, the oil price might continue to wander around, waiting for the world to come to rest.

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