When Has OPEC Spare Capacity Mattered for Oil Prices?

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Oil prices usually “feed off multiple influences”, as noted in Büyüksahin (2011). The various influences on oil prices are illustrated in Exhibit 1. However, are there times when OPEC spare capacity is the most important factor for driving oil prices? This article will argue the answer is yes, and we will discuss the circumstances when this has been the case in the past.

**Exhibit 1**

![Diagram](https://via.placeholder.com/150)

*Diagram based on Büyüksahin (2011), Slide 25.*

**OPEC Spare Capacity Mattered in 2008**

The current definition of spare capacity is as follows. The U.S. Energy Information Administration (EIA) has defined “spare capacity as the volume of production that can be brought on within 30 days and sustained for at least 90 days. ... OPEC spare capacity has provided an indicator of the world oil market’s ability to respond to potential crises that reduce oil supplies”, according to EIA (2014).

As discussed in Till (2015), to motivate why the spare capacity situation might be quite important to the behaviour of crude oil prices, one can review the circumstances of 2008. We found out from the events of that year what can happen if the oil excess-capacity cushion becomes quite small. In July 2008, the role of the spot price of oil was arguably to find a level that would bring about sufficient demand destruction, after which the spot price of oil spectacularly dropped. This explanation is drawn from researchers from both the Federal Reserve Bank of Dallas and the U.S. Commodity Futures Trading Commission.

Exhibit 2 excerpts from a Federal Reserve Bank of Dallas paper. The red line shows WTI prices while the blue line is OPEC excess capacity. When OPEC excess capacity levels reached pinch-point levels, the price of crude oil responded by exploding.
Exhibit 2: Reduced OPEC Excess Capacity Helped Tighten the Market

Graph based on Plante and Yücel (2011), Chart 2.
[The red line is WTI prices while the blue line is OPEC excess capacity.]
Authors’ Notes: Oil prices are monthly averages.
Sources of Data: U.S. Energy Information Administration (EIA) and the Wall Street Journal.

Exhibit 3 provides another way of illustrating what happened to the price of crude oil as OPEC spare capacity collapsed in mid-2008.

Exhibit 3: WTI Spot Price vs. OPEC Spare Capacity (Jan 1995 to Aug 2008) Monthly Data

Source of Graph: Updated from Till (2014), Slide 19.
Sources of Data:
The WTI Spot Price is the “Bloomberg West Texas Intermediate Cushing Crude Oil Spot Price,” accessible from the Bloomberg using the following ticker: ‘USCRWTIC <index>’.
The following Bloomberg formula was used to create a monthly data set from daily prices:
bdh("USCRWTIC Index","px last","1/1/1995","8/31/2008","per=cm","quote=g")
The OPEC Spare Capacity data is from the U.S. Energy Information Administration’s website, which was accessed on 8/30/14 (for the 1995 data) and on 10/24/15 (for the 1996 through September 2015 data.)
Presenting data in this fashion is based on Büyüksahin et al. (2008), Figure 10, which has a similar, but not identical, graph. Their graph, instead, shows “Non-Saudi crude oil spare production capacity” on the x-axis.

Exhibit 3 shows WTI oil prices on the y-axis and OPEC spare capacity on the x-axis. The dark blue dots are data-points from January 1995 to February 2004, while the pink dots are from March 2004 to August 2008, as OPEC spare capacity dropped to ever lower levels. This graph is analogous to the typical economics-of-storage graph, as conceptually illustrated in Exhibit 4, where the price of a commodity can become exponentially high when there are low enough inventories. In the case of crude oil, though, the relevant variable on the x-axis had been spare capacity over the time frame represented by Exhibit 3.
Exhibit 4: Why is price much more sensitive to shocks when stocks are minimal?

Diagram based on Wright (2011), Slide 39.

Structural Break After 2008
In Büyüksahin (2011), the energy researcher shows that the relationship illustrated in Exhibit 3 structurally changed. This point is illustrated in Exhibit 5 with the addition of data from September 2008 through to September 2015; these data-points are in light blue. Using data through to September 2015, it is not clear what the relationship between WTI oil prices and OPEC spare capacity is, if any.

Exhibit 5: WTI spot Price vs. OPEC Spare Capacity (Jan 1995 to Sep 2015) Monthly Data

Sources of Data:
The WTI Spot Price is the “Bloomberg West Texas Intermediate Cushing Crude Oil Spot Price,” accessible from the Bloomberg using the following ticker: "USCRWTIC <index>.”
The following Bloomberg formula was used to create a monthly data set from daily prices: bdh("USCRWTIC Index","px last","1/1/1995","9/30/2015","per=cm","quote=g")
The OPEC Spare Capacity data is from the U.S. Energy Information Administration’s website, which was accessed on 8/30/14 (for the 1995 data) and on 10/24/15 (for the 1996 through September 2015 data.)
Presenting data in this fashion is based on Büyüksahin (2011), Slide 49, which has a similar, but not identical, graph. His graph, instead, shows “Non-Saudi crude oil spare production capacity” on the x-axis and is updated through August 2010.

More recently, Kibsgaard (2015) also pointed out that the established relationship between oil prices and OPEC spare capacity had broken down, as illustrated in Exhibit 6. In this particular graph, Brent prices are used instead of WTI prices and are represented by the blue line while OPEC spare capacity is presented in terms of percentage-of-global-oil-demand and is represented by the green line.
When Has OPEC Spare Capacity Mattered?

We can conclude from the previous section that it may only be in a certain states-of-the-world that OPEC spare capacity matters. That said what precisely describes that particular state-of-the-world?

Ori (2015) essentially provides the answer. *OPEC spare capacity should only matter if one is in a state of low inventories.* Exhibit 7 shows how low levels of current and expected OPEC spare capacity are mirrored by increases in current and expected global crude oil inventories.

Exhibit 7

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Sources of Data: International Energy Agency and Schlumberger Analytics.

Charts based on Ori (2015). Source of Data: EIA.
We can now re-examine Exhibit 5 based on Ori (2015)’s insight. Let us examine the relationship between WTI oil prices and OPEC spare capacity from January 1995 through to September 2015, but only when crude oil inventories are low. We will check if there might be a clear relationship using U.S. oil inventories. This particular conditional examination is illustrated in Exhibit 8. At least over the period, January 1995 through to September 2015, it is apparent that tight levels of OPEC spare capacity had only mattered when U.S. oil inventories were low. Here, we define low levels of inventories as being under 22.4 days-of-forward-supply-of-crude-oil in the U.S.

![Exhibit 8: WTI Spot Price vs. OPEC Spare Capacity but only if days forward supply < 22.4 days (Jan 1995 to Sep 2015) Monthly Data](image)

Sources of Data:
The WTI Spot Price is the "Bloomberg West Texas Intermediate Cushing Crude Oil Spot Price," accessible from the Bloomberg using the following ticker: "USCRWTIC<index>".

The following Bloomberg formula was used to create a monthly data set from daily prices:
bdh("USCRWTIC Index","px last","1/1/1995","9/30/2015","per=cm","quote=g")

The OPEC Spare Capacity data is from the U.S. Energy Information Administration’s website, which was accessed on 8/30/14 (for the 1995 data) and on 10/24/15 (for the 1996 through September 2015 data.)

“Days Forward Supply” refers to the U.S. Department of Energy’s U.S. Days-of-Supply-for-Crude-Oil, accessible from the Bloomberg using the following ticker: "DSUPCRUD<index>".

The following Bloomberg formula was used to create a monthly data set from weekly data:
bdh("DSUPCRUD Index","px last","1/1/1995","9/30/2015","per=cm","quote=g")

Presenting data in this fashion is based on Büyüksahin et al. (2008) and Büyüksahin (2011).

Economics of Price Volatility for Crude Oil
Harrington (2005) would not be surprised by Exhibit 8. This author noted that the true buffer against crude-oil price shocks should be represented as not just above-ground stocks, but also spare-production capacity. In the absence of being able to draw on inventories or exploit surplus capacity, price is the only lever that can balance supply-and-demand in such a scenario.

We can now note the conditions under which the generalised economics-of-price-volatility diagram shown in Exhibit 4 may apply to crude oil: when inventories are sufficiently low, decreasing OPEC spare capacity has produced the same pattern as in this conceptual diagram.

Caveats
Now, a careful reader may note a particular emphasis on OPEC spare capacity, ignoring non-OPEC producers. According to the IMF (2005), “non-OPEC producers do not have the incentive to maintain spare capacity as they individually lack the necessary market power to influence oil prices.” If this changes, this paper will have to be correspondingly updated.

Another caveat is that in this paper, we have only examined the historical relationship between the price of WTI crude oil and EIA’s OPEC spare capacity data, conditional on U.S. crude oil inventories. A future paper will examine this relationship, conditional on global inventory data.
Conclusion
At least from an examination of data over the past 20 years, OPEC spare capacity has only mattered when (U.S.) crude oil inventories have been below a threshold level. We would caveat our results by noting this conclusion only has a practical use if the states-of-the-world that occurred historically will continue to be the case going forward.

References
• [IMF] International Monetary Fund, 2005, “Will the Oil Market Continue to be Tight?”, World Economic Outlook, Chapter IV, April, pp. 157-183.
• Ori, S., 2015, ”@EIAgov #oil market balances 2011-2016. Yes, spare cap is low in ’15 and ’16, but pumping straight to inventories!” [SamOri8 Tweet], September 23. [Mr. Ori is the Executive Director at the Energy Policy Institute at the University of Chicago.]
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