

Oil Speculation

by Jussi Keppo

July 8, 2008

The increase in the oil spot price seems to be mainly driven by the global demand. According to the U.S. Energy Information Administration, in 1999 the global consumption was 76 million barrels a day and today it's about 86 million barrels. At the same time, the surplus oil capacity decreased from 5 million barrels a day to 2 million barrels a day.

There seems to be a new asset class (long-only commodity index funds and ETFs) which speculates that commodity prices rise, i.e., they are long in these markets. Here I focus on oil and I have simple points:

- There are several ways how the speculation could raise the oil spot price. I'll discuss about these below.
- We don't necessary need to observe an increase in traditional inventories in order to have an increase in the spot price due to the speculation.

So, for instance, I'm not sure if we need an increase in the inventories in order to have a persistent effect from speculation on oil prices. Or actually what do we mean with inventories? To me, oil business is managing inventories: oil wells are inventories and the optimal pumping can be solved by stochastic dynamic programming (here we discuss mainly about oil wells that are in production). Usually the expected future cash flows in this optimization are calculated by using the oil forward curve (and its volatility). Therefore, we have quite different optimal pumping today if the oil forward curve is downward sloping than a situation where the forward curve is upward sloping: if the forward curve is upward sloping then waiting is more valuable and, therefore, some pumping is postponed (relative to the downward sloping case). Thus, for instance, if the oil spot price is "high" today and forward curve is downward sloping then I expect oil supply to respond quickly (supply up) or at least much faster than with an upward sloping forward curve.

Since oil speculation can affect the shape of the forward curve, it can also affect today's oil supply (by the argument above) and, therefore, today's oil spot price. This oil speculation seems to be significant. First, according to Citigroup, global investments in commodities rose by more than a fifth in the first quarter of 2008 to \$400 billion. Investments in commodity indexes were \$185 billion, commodity trading advisers accounted for \$94 billion, and hedge funds had \$75 billion in commodity holdings. Second, according to the US Commodity Futures Trading Commission, so called commercials are long over 800 million barrels of oil. In the early part of the decade this number was less than 400 million barrels. Supply hasn't doubled, so it seems that the long-only commodity index funds and ETFs (and other institutional investors) buy oil derivative instruments from investment banks that are classified as commercial investors. As we know, there are position limits for speculators but no for commercials who are

“hedging”. So, by buying the oil derivatives from the investment banks speculators are not bounded by the position limits (this must be a good business for the investment banks).

Counterparties

Below I discuss little more about the effects from oil speculation with different counterparties. First, let’s make the following simplifying assumptions:

- Oil consumption is constant. This is not known by the market participants.
- There is a new asset class: long-only commodity funds. These funds buy oil forwards.
- Oil forwards have physical delivery. If they have cash delivery then we only need arbitrageurs to force the forward and future prices with physical and cash delivery to be (almost) equal. After that the discussion is the same.

As we know, the oil derivative market is by definition a zero-sum game. However, its effect on spot market is not necessarily zero. Those who are taking long forward positions (long-only commodity funds) don’t hedge their positions, so they don’t sell spot or other forwards with different maturity dates. Those who are selling forwards are (i) speculators, (ii) producers and/or (iii) arbitrageurs who just implement the cost-of-carry model. Let’s discuss these different cases and how we can have an increasing spot price:

(i) If the forward sellers are also speculators then the long-only commodity funds just increase the demand of the forwards. This increases the forward prices and this way also the expected future spot prices that are used in the production optimization. Thus, by the optimization story above, the producers postpone some production and this increases spot price. As long as the forward curve steepens (e.g. the funds get new money), supply can fall (relative to the expected supply under “normal” forward curve) and the spot price can rise.

At the expiration date the long and short speculative positions are closed and this doesn’t change the spot price.

(ii) If the forward sellers are producers then the long-only commodity funds first increase the forward prices. Then producers start selling more forwards and pump less oil to the spot market (by the above optimization story). This decreases the forward prices and increases the spot.

At the expiration date, the long-only commodity funds close their positions, i.e., sell the oil at the spot market (we assume physical delivery, see above). This decreases the spot price. However, at the same time the long-only funds take new forward positions and this again increases the spot. If the funds get all the time enough new money, the spot price can continue to rise.

(iii) If the forward sellers are arbitrageurs who just use the cost-of-carry model then they hedge their short forward position by buying the spot and storing the oil. This naturally

pushes oil spot price up. Hence, the inventory level above “normal” is a sign of the speculation and its impact on the spot price. The problem here is that we probably don’t have correct inventory data since now e.g. hedge funds are able to rent oil tankers at about \$150,000 a week and this is not in the public inventory data.

At the time of the delivery (we assume physical delivery, see above), the long-only commodity funds and the arbitrageurs close their positions. The effect from the arbitrageurs is zero (they just deliver the oil they have) but the long-only funds increase supply in the spot market by selling the oil that is delivered. This decreases the spot price. However, at the same time the long-only commodity funds take new forward positions and this again pushes the oil spot price up. As long as the funds are able to collect enough new money the spot price can continue to rise.

Usually the cost-of-carry model is used as a pricing model for forward prices given the underlying spot price (and the interest rate, the storage cost and the convenience yield). However, it can also be understood as the spot price in terms of a forward price (and the interest rate, the storage cost and the convenience yield), especially in situations where the trading volume of the whole forward market is higher than the spot volume (“commercials” are long in the US derivative market almost 10 times the global daily oil consumption).

Example

Let’s illustrate the case (ii) above with a stylized discrete time model that has times 0, 1, and 2. There is one consumer who consumes at each time as follows (we need only these cases):

- 6 barrels if the price of a barrel is \$80
- 4 barrels if the price of a barrel is \$100
- 3 barrels if the price of a barrel is \$110
- 2 barrels if the price of a barrel is \$120
- 1 barrel if the price of a barrel is \$130

There is one producer that has an oil well that is able to produce total 9 barrels over the three times. The minimum and maximum productions at each time are 0 and 9 barrels. The producer doesn’t know exactly the demand curve but initially the plan is to produce 3 barrels at each time. There is a speculator who believes that the demand jumps up significantly (and therefore also the spot price) at time 1 or 2.

Time 0:

Initially the producer plans to sell 3 barrels at \$110 each (according to the demand curve). However, the speculator is willing to buy 1 barrel of time 1-maturity forward contract for forward price \$120. This changes the production plan: the producer decides to sell 1 barrel in the forward market and sell only 2 barrels at time 0. By the demand curve, this pushes the oil spot price up to \$120 at time 0 (thus, the forward price equals the spot price).

Time 1:

First, the producer plans to produce 3 + 1 barrels (3 for the spot market + 1 for the delivery of the forward contract). Since the speculator sells immediately the delivered oil, this would mean that the spot price falls to \$100 (by the demand curve). However, at time 1 the speculator also tries to buy 6 barrels of time 2-maturity forward contracts for forward price \$130. This changes the production plan: the producer decides not to sell at the spot market at time 1, it delivers 1 barrel for the forward contract that was sold at time 0 and sells 6 barrels in the forward market. By the demand curve, the realized spot price at time 1 is \$130 (the speculator sells 1 barrel at the spot market) and, therefore, the speculator makes \$10 profit (\$130-\$120). Note that again the next forward price equals the current spot price.

Time 2:

The producer has still 6 barrels in the oil well. Due to the forward contracts, it delivers all of them to the speculator who sells them in the spot market. Spot price collapses to \$80 and the speculator makes \$300 loss ($6 * (\$80 - \$130)$).

Without speculation in this example the spot price would be flat and equal to \$110. However, due to the speculator's actions, the spot price at time 0 is \$120, at time 1 it's \$130, and at the end \$80 (note that the forward price moves together with the spot). Thus, if the time difference in this example is e.g. one year then the speculation created a bubble that lasted two years even though the fundamentals (here the demand curve) didn't change. The speculator finally loses and the producer collects higher profits than without the speculator. This is because the demand didn't jump as the speculator believed. However, we would have opposite story if the demand had jumped high enough (so, it could be that the speculator is right and the producer wrong). I selected the story above, because it seems that almost everyone today hopes speculators are wrong.

The speculators' behavior creates a similar impact on the oil spot price as any other information signal on the future oil prices. If the speculators have better information about the future then this should be helpful, i.e., the price impact should help the oil market.

Summary

According to the three cases above, the long-only commodity funds and other institutional investors can increase the oil spot price. This doesn't necessary require an increase in the traditional oil inventories.

The increase in the spot price discussed here is due to the speculation on the long side (and the actions of the market participants on the other side of the contracts). So, it could be that the oil spot price has got an extra push from the speculation. However, this should be good if the market's expectation on the future spot price has been too low. Note also that the speculation works on the short side: if there is at some point more speculation on the short side then this can push the spot price down.

I didn't say anything about (because I don't know):

- How much has the speculation increased the oil spot price? Oil consumption has increased significantly (it seems faster than was expected) and this has been almost surely the main driver in the spot price (U.S. Energy Information Administration: in 1999 global consumption was 76 million barrels a day and today it's 86 million barrels. At the same time, the surplus oil capacity decreased from 5 million barrels a day to 2 million barrels a day.).
- Is the oil forward curve now more informative than before? At least, it's much more liquid (especially long maturity) and this helps market participants to hedge their cash flows.