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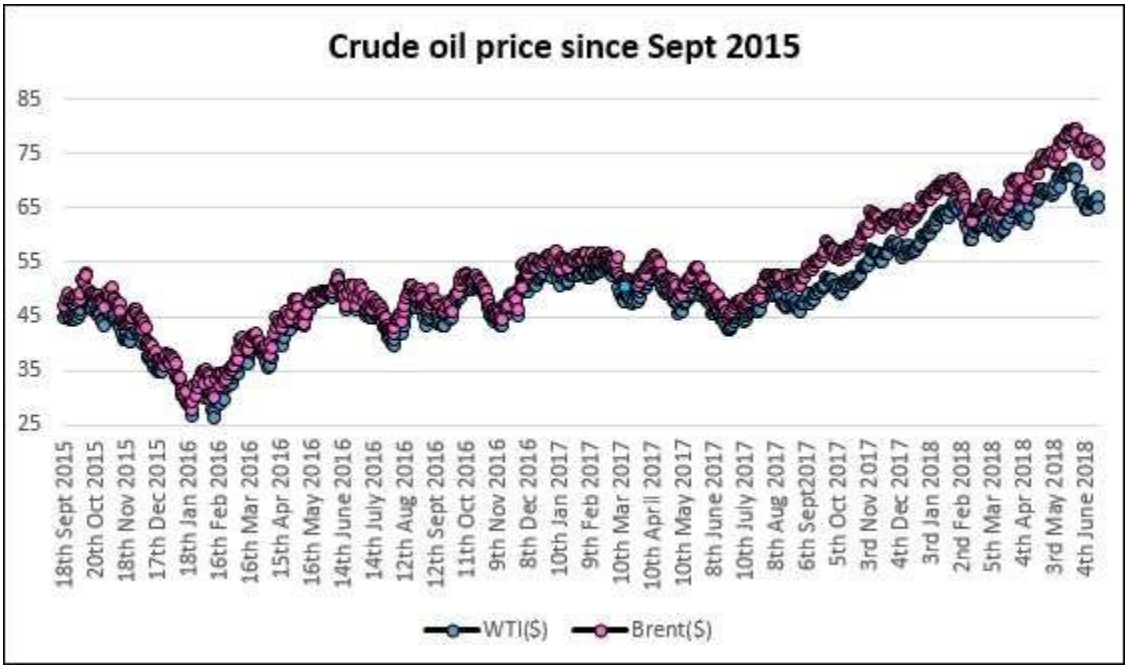

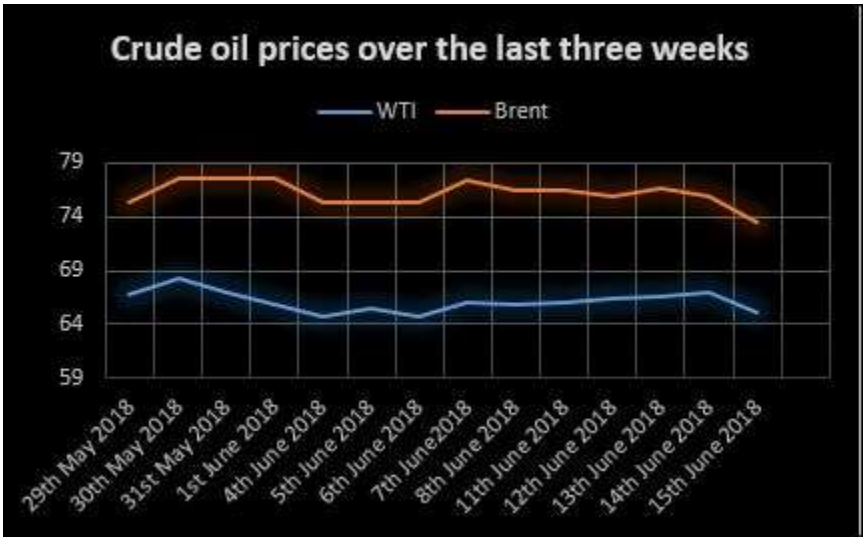

- Crude oil price slipped last week in anticipation of the meeting between OPEC members and its allies in the coming week. Besides, the US stockpiles declined by 4.14 mb last week, as per Bloomberg data, even though its production rose to 10.9 mb/d, and has been topping 10 mb every week since early February 2018. Oil prices also slipped as Russia was said to have increased before it meets with OPEC next week.
- After talks with Russia on Wednesday night, the Saudi Arabian Energy Minister, Khalid Al-Falih, said he expected OPEC to reach a deal to gradually boost production. The Russian Energy Minister, Alexander Novak agrees for an increase in output, but by how much and when, still need to be discussed. The OPEC members and its allies meet in Vienna next week, where this

issue will be discussed. While Russia and Saudi Arabia are in favour of an increase in output, Iran, Iraq and Venezuela are opposed to any such production increase. It was reported recently that the US had unofficially asked Saudi Arabia to boost the production by 1 mb/d. Saudi Arabia has been considering various scenarios for raising supplies, which include an immediate increase of 500,000 b/d followed by a similar increase in Q4 of this year.

- In an interesting development, two of Asia's largest crude oil buyers, India and China are considering to team up to buy US crude supplies, so as to reduce their dependence on imports from OPEC members. This step would be to increase competitiveness amongst the oil producers. Since the lifting of the four-decade old band on oil exports, the US has been exporting crude oil, and sending cargoes all the way to Asia, and is trying hard to get a market share there. Both the energy-hungry nations, India and China are making an effort to procure oil at the cheapest price in the interest of economy. This oil-buying alliance may be between India and China initially, but South Korea and Japan may also join the club later.
- Two of Libya's biggest oil export terminals (Es Sider and Ras Lanuf) stopped loading crude after armed forces clashed nearby. Fighting erupted 20 km close to the Es Sider terminal, and consequently the workers were evacuated from the two terminals, wherefrom 40% of the Libyan crude oil is exported.
- According to a recent estimate by IHS Markit, the oil production in the Permian Basin in the US will increase to 5.4 mb/d in the next five years, which is more than the production by any OPEC member except Saudi Arabia. The challenge however is the necessary infrastructure (pipelines, etc.) in the area to transport the oil to the coast for export.
- The IEA has said that OPEC members Iran and Venezuela could lose 30% of their output next year by way of US sanctions and other economic factors. While the US shale oil could probably cover part of the demand, these would require extra production in the market. Iranian output could be curbed by about 900,000 b/d, which is a forecast IEA said, and the Venezuelan production could fall by a further 550,000 b/d as the economic crisis is unable to handle old oil infrastructure.

For the lighter side this week

As I mentioned in my last post, these days I am trying to understand some of the machine learning techniques, and their applications to seismic data. Various kinds of data encountered in different situations exhibit different types of frequency distributions. All statistical analysis tools make assumptions about the type of frequency distribution that the data being considered, follow. These are the basic things that we learned at school in our lessons on statistics. I tried to brush up some of those things which I share in this post (in the absence of anything better that I could write this week).

When an experiment is conducted, the spread of the measured values as a function of frequency is referred as a *distribution*. The shape of the distribution depends on the type of experiment conducted and helps with the statistical interpretation of the data. In most situations, the shape of the distribution curve is bell-shaped, with an equal number of measurements or values above and below the mean value, and is referred to as a *'normal' distribution*, or more specifically, a *'Gaussian' distribution*. In statistics, the terms *mean*, *median* and *mode* are commonly used, the mean being the arithmetic average of all the values, the median being the middle point of the distribution, and the mode, the value with the maximum frequency of occurrence. The variability of values about the mean is measured by computing the *standard deviation* – a smaller value indicating that the values are closer to the mean, and a larger

value implying that the values are father away from the mean. The measured value of the standard deviation depends on the lowest and highest values in the distribution. The way it is calculated, it is always a positive number. In a normal distribution, the mean, median and mode are the same. And interestingly, the spread of the mean ± 1SD contains 68.2% of all values in the distribution, the mean ± 2SD contains 95.5% of all values, and 99.7% of all values are contained in mean ± 3SD.

When statistical data from different Gaussian distributions are to be compared, and as the values in different distributions could be in different units, they are all reduced to a standardized *Z-score*. This is done by subtracting the mean of the distribution from the values to be standardized, and divide that by the standard deviation. For example, a value of 7 in a distribution with a mean of 5, and standard deviation 2 has a Z-score of (7-5)/2=1. It means that the value of 7 in the distribution is 1 standard deviation above the mean.

Besides the normal distribution, there are other distributions that arise in different situations. For example, in a 'Heads or Tails', or 'True or False' type of an experiment, the outcome is either the one or the other. Such a distribution is called *binomial distribution,* and is used for calculating the probability of a sample in the distribution to go one way or the other.

There is yet another distribution, called *Poisson distribution* (after French mathematician, Siméon Denis Poisson). Consider situations such as receiving letters in the mail each day, or the number of phone calls received at a shop in an hour, or the number of babies born at a hospital in a day. In each of these situations, the events occur independently, as in the case of arrival of one letter in the mail; it is in no way dependent on the arrival of another.

The shape of Poisson distribution curve can be similar or quite different from the shape of a Gaussian distribution curve. The shape of a Poisson distribution with a low mean and 0 as the mode will be skewed towards the 0 and tailing in the other direction. Such a distribution with a higher mean could exhibit a more symmetric shape. Thus, the shape of a Poisson's distribution could change with the data being considered, unlike a normal distribution, which always has a symmetric shape.

It is important to mention here that the *numerical variables* that we talk about in different example situations may be either *continuous* or *discrete*. While a continuous variable may take up any value (fractional or otherwise) within a range, discrete values can only be whole numbers. Thus, count variables are numerical and discrete, have a lower bound as 0, and no upper bound.

Unlike the binomial and Poisson distribution, the Gaussian distribution is the most widely used distribution in science. In the case of seismic data, usually the spread of amplitude values is seen to have a Gaussian distribution. Similarly, when the amplitude values are transformed into impedance, again they exhibit a Gaussian distribution. But that is not true of many other attributes derived from seismic data, and their distributions may simply be termed as non-Gaussian.

Such distributions will have a bearing on the applicability of some of the machine learning techniques, and should be done carefully.

I hope you find these interesting.

So much for this week! Till the next post, stay safe and happy!