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Creating an Asian Benchmark for Crude Oil

On March 26, 2018, the Shanghai International Energy Exchange (INE) introduced futures trading on crude oil. The contracts were denominated in renminbi or Chinese yuan (CNY) and specified that market participants make or take delivery of a thousand barrels of medium sour crude oil at contract expiration at selected ports in mainland China. Unlike other commodity futures contracts traded on Chinese derivative exchanges, the new crude oil futures contracts were immediately open for foreigners to trade. Indeed, to encourage foreign participation and foreign trading in the new contract, the INE opened a marketing office in Singapore—one of the world's major physical crude oil trading hubs—in June 2018. While the INE was eager to attract foreign trading volume, it also hoped that active trading by foreign market participants would both promote greater price discovery and make the INE crude oil futures price the Asian benchmark price, or reference price, for crude oil. If so, the INE crude oil futures price could become a potential rival to the dominant benchmarks established by Brent North Sea Crude (Brent Crude) and West Texas Intermediate (WTI) light sweet crude oil futures prices.

Officials at the INE were well aware that past attempts by other exchanges to create an Asian benchmark price for crude oil had failed. However, they were confident that there was substantial domestic interest in the new crude oil futures contract and believed there would be significant foreign interest in trading it as well. That confidence was subsequently justified, as over 26.5 million contracts were traded in 2018, 34.65 million in 2019, 41.58 million in 2020, 42.64 million in 2021, and 53.58 million in 2022, making the INE's crude oil futures contracts the third-largest crude oil futures market, after the WTI and Brent Crude markets.[1] Moreover, foreign participants accounted for about 20% of the total trading volume each year. By 2019, INE trading volumes were about 10% of WTI and 14% of Brent Crude oil futures, traded on the two dominant competing crude oil futures markets.

Yet over five years after its introduction, the INE crude oil futures price was still not the Asian benchmark price for crude oil. Some industry observers contended that the INE crude oil futures contract would have a difficult time becoming a benchmark as long as it was denominated in renminbi, since it was not a freely floating currency, capital controls existed, and crude oil was commonly priced in US dollars. Other observers cited different reasons why the INE futures price was not the Asian benchmark price for crude oil, including that

[1] Comparisons of trading volumes across exchanges can be misleading. For instance, the total crude oil futures trading volume on the INE was less than the crude oil futures trading volume on the Chicago Mercantile Exchange (CME) Group, Intercontinental Exchange (ICE), Multi Commodity Exchange (MCX), or Moscow Exchange in 2019. However, the crude oil futures trading volumes on both the MCX in India and the Moscow Exchange in Russia were misleading because both exchanges traded smaller-size futures contracts. The Moscow Exchange traded over 600 million Brent Crude oil futures contracts in 2019, but the contract size was 10 barrels. The MCX traded over 135 million light sweet crude oil futures contracts in 2019, but the contract size was 100 barrels. These differences in size meant the MCX and Moscow Exchange were less important than they appeared in terms of the total number of barrels of crude oil traded. Interestingly, the MCX crude oil futures contract was linked at contract expiration to the WTI crude oil futures settlement price determined on the CME Group's New York Mercantile Exchange division, adjusted for the latest exchange rate between the Indian rupee and the US dollar.

This case was prepared by Robert I. Webb, Paul Tudor Jones II Eminent Research Professor, McIntire School of Commerce. It was written as a basis for class discussion rather than to illustrate effective or ineffective handling of an administrative situation.

the INE did not allow delivery locations outside mainland China and did not allow traders to hold larger outright futures positions. Still other observers believed that the INE crude oil futures market was not conducive to spread trading due to the way margin requirements were set on the INE. Was the failure of the INE crude oil futures price to become an Asian benchmark price due to a futures contract design issue, an INE policy issue, or something else? What steps could the INE take to improve price discovery and increase the probability that the INE crude oil futures price could become the Asian benchmark price? Answering that question would entail reexamining the current contract design and better understanding who traded the contract, why they traded it, how they traded it, where they traded it, and when they traded it.

China and Commodity Markets

The Chinese economy had grown tremendously since economic reforms were introduced in 1978. China had become the largest importer of various commodities including iron ore, copper, soybeans, and crude oil. At the same time, China was also a large producer of commodities such as copper (third largest), iron ore (largest), and crude oil (fifth largest). According to the US Energy Information Agency, in 2021 China extracted around 5 million barrels of crude oil per day, while its total daily consumption averaged 15.3 million barrels.[2] This made China the second-largest consumer and largest importer of crude oil in the world. Yet despite its outsize role in both the consumption and production of commodities, many commodity prices, including those for crude oil, were largely determined outside of China.

The Importance of Chinese Futures Markets

The sharp growth of the Chinese economy and volatile commodity prices led to rapid growth in Chinese commodity futures markets. According to the Futures Industry Association, the three principal mainland Chinese commodity futures markets—the Zhengzhou Commodity Exchange, the Dalian Commodity Exchange, and the Shanghai Futures Exchange—ranked 8th, 9th, and 12th, respectively, in trading volume during 2022.[3] (The Hong Kong Exchange ranked 17th in 2022.[4]) Because rank was determined by trading volume, the ranking was distorted due to three of the top seven exchanges (i.e., National Stock Exchange, B3, and Borsa Istanbul) trading smaller-size futures contracts. Moreover, this ranking understated the importance of Chinese commodity futures markets, because the Dalian Commodity Exchange, the Shanghai Futures Exchange, and the Zhengzhou Commodity Exchange were all commodity futures exchanges, while the much larger Chicago Mercantile Exchange (CME) Group, Intercontinental Exchange (ICE), and Eurex Exchange all traded significant volumes of financial futures and options. If the three principal mainland Chinese commodity futures exchanges were ranked by trading volume only with the other exchanges that traded similar commodities, they would have ranked far higher. For instance, the Dalian Commodity Exchange and Zhengzhou Commodity Exchange ranked as the top two futures exchanges for agriculture. One important difference from other futures markets was the domination of trading by retail traders on the Chinese commodity futures markets.

The INE was formed in November 2013 as a derivatives market venue to facilitate international trading in crude oil and other energy derivatives. It was located in the Shanghai Pilot Free Trade Zone, and it was a wholly owned subsidiary of the Shanghai Futures Exchange.

[2] "China: Overview," US Energy Information Administration, August 2022, https://www.eia.gov/international/analysis/country/CHN (accessed Jun. 7, 2023).

[3] "Annual Review of 2022 ETD Trading Trends," Futures Industry Association, https://www.fia.org/sites/default/files/2023-02/2022%20Annual%20Review%20ETD%20Trading%20Trends_updated%20v2%5B15%5D_0.pdf (accessed Jun. 7, 2023).

[4] Will Acworth, "2019 Market Data – Derivatives Volume Grows BRIC by BRIC," FIA Market Voice, Futures Industry Association, March 3, 2020, https://www.fia.org/articles/2019-market-data-derivatives-volume-grows-bric-bric (accessed Jun. 27, 2023).

Although the INE crude oil futures contracts were the first commodity futures listed on Chinese derivative exchanges to be opened to foreign participants, other commodity futures contracts soon followed. Iron ore futures on the Dalian Commodity Exchange and purified terephthalic acid (PTA) futures on the Zhengzhou Commodity Exchange were opened to foreign market participants on May 4, 2018, and November 30, 2018, respectively. The INE opened three additional futures contracts to foreign traders: rubber futures on August 12, 2019; low-sulfur fuel oil futures on June 21, 2020; and bonded copper futures on November 19, 2020.[5] Palm olein (oil) futures contracts traded on the Dalian Commodity Exchange were opened to foreign market participants on December 22, 2020.

All Chinese commodity futures exchanges were state-owned enterprises. This meant that the decisions of Chinese futures markets to open existing or new futures markets to foreign participants also reflected the Chinese government policy to gradually open derivatives markets to foreigners. Some observers argued that this policy reflected a desire to increase the influence of Chinese derivative markets on commodity prices, and in some cases, to facilitate the price of a futures contract traded on a Chinese exchange becoming a benchmark price.[6] All the contracts were also denominated in renminbi. Thus, the policy was also consistent with the Chinese government's long-term goal of making the renminbi more widely used in international commercial transactions.

Crude Oil, Crude Oil Derivatives, and Benchmarks

Crude oil is refined to produce various petroleum products. As of 2021, a typical 42–US gallon barrel of crude oil would yield about 45 US gallons of petroleum derivatives such as gasoline and jet fuel, due to gains from the refinery process (see **Exhibit 1**).

There are numerous types of crude oil. The types differ in terms of their physical characteristics, especially sulfur content and density, which, in turn, impact their desirability and price. Crude oils range from sweet to sour in terms of sulfur content, and from heavy to light in terms of density, as measured by their American Petroleum Institute (API) gravity level (meaning how heavy the oil is relative to water). Other things equal, lighter, sweeter oils are more valuable than heavier, more sour (higher sulfur content) oils, because it is easier to refine higher-value petroleum products like gasoline and jet fuel from them. (The tradeoff is depicted in **Exhibit 2**, which is reproduced from the US Energy Information Agency crude oil handbook.) As illustrated in **Exhibit 2**, both WTI and Brent Crude are light sweet crude oils, each with an API gravity reading of around 39 degrees and a sulfur content of around 0.3%; WTI crude oil has a slightly higher API gravity reading and a slightly lower sulfur content than Brent Crude oil.[7]

While the two leading crude oil benchmarks were classified as both *light* and *sweet*, the INE's crude oil futures contract was for *medium sour* oil with an API of 32 degrees and a sulfur content of 1.5%—similar to Dubai crude oil, which has an API of around 31 degrees and a sulfur content of about 2%.

Crude oil futures were introduced on the New York Mercantile Exchange (NYMEX) in 1983. For many years, the price of WTI light sweet crude oil was the principal benchmark price, on which other crude oil prices (including Brent Crude) were based. Given that the futures market routinely led the corresponding spot market

[5] The INE launched a bonded copper futures contract even though its parent, the Shanghai Futures Exchange, already traded copper futures.

[6] Kirsten Hyde, "China Opens Futures Markets Further to Outside World," FIA, November 25, 2020, https://www.fia.org/articles/china-opens-futures-markets-further-outside-world (accessed Apr. 13, 2021).

[7] There is variation in the gravity and sulfur content metrics for WTI and Brent crude oil. According to a report by Kimray, an oil and gas control equipment firm, their densities, as measured by their API numbers, are 39.6 degrees and 38.3 degrees for WTI and Brent, respectively, while their sulfur contents are 0.24% and 0.37%, respectively. "Types of Crude Oil: Heavy vs. Light, Sweet vs. Sour, and TAN Count," Kimray Inc., https://kimray.com/training/types-crude-oil-heavy-vs-light-sweet-vs-sour-and-tan-count#:~:text=WTI%20stands%20for%20West%20Texas,sweeter%20end%20of%20the%20spectrum (accessed Jul. 20, 2023).