



NSE CRUDE OIL
DERIVATIVES
Performance Review
2023-24

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Performance Review of Commodity Derivatives - FY 2023-24

WTI Crude Oil Futures, WTI Crude Oil Options on Futures, WTI Crude Oil Mini Futures and Brent Crude Oil Futures

1. Background

a. Brief about the commodity such as sample picture, lifecycle and various varieties/grade of the commodity found in India

Crude oil is a naturally occurring mixture of hydrocarbons found underground. It can appear in the range of a highly viscous liquid to a thick tar-like substance. The colour of crude oil can also range from light yellow to dark brown or black. It consists of a complex mixture of hydrocarbons of various molecular weights plus other organic compounds. The main characteristics of crude oil are generally classified according to its sulphur content and density, Crude is classified, based on density (which the petroleum industry measures by its American Petroleum Institute (API) gravity.), as light, medium, heavy, or extra heavy. Crude can also be classified, based on sulfur content, into a sour and sweet category. Crude oil is one of the most economically mature commodity markets in the world. Even though most crude oil is produced by a relatively small number of companies, and often in remote locations that are very far from the point of consumption, trade in crude oil is both robust and global. Nearly 80% of international crude oil is transported through waterways in super-tankers.

West Texas Intermediate (WTI) is a grade of crude oil and one of the main three benchmarks in oil pricing, along with Brent and Dubai Crude. WTI is considered a high-quality oil that is relatively easy to refine. WTI is known as a light sweet oil. It contains less than 0.50% sulfur, whereas the norm is about 0.24% to 0.34%, making it "sweet." It also has a low density, making it "light." WTI is the main oil benchmark for North America, as it is sourced from the United States. It originates mainly in the Permian Basin, the site of the nation's highest-producing oil field. The oil travels via pipeline from Texas to refineries in the Midwest and the Gulf of Mexico.

b. Commodity fundamentals and balance sheet as per the following format (to be prepared based on publicly available information on best effort basis):

Table – Fundamentals & Balance Sheet (Million barrels per day)

Global Scenario	2022-23	2023-24
Production	99.98	101.79
Consumption	99.95	101.92
Ending Stocks	-0.03	0.13

Note: All figures are in annual averages

Source: EIA.

Crude Oil India Balance Sheet (Million MT)

Indian Scenario	2022-23	2023-24
Opening Stocks	-	-
Production	27.83	27.17
Imports	232.73	233.13
Total Supply	260.56	260.95
Exports	-	-
Domestic Consumption	222.30	261.55
Closing Stocks	-	-

Source: Petroleum Planning and Analysis Cell, MoPNG, GOI

Top 10 major producing countries (Thousand barrels per day)

Name of the country	2022	2023
United States	17844	19358
Saudi Arabia	12191	11389
Russia	11202	11075
Canada	5575	5653
Iran	3945	4662
Iraq	4520	4355
China	4111	4198
United Arab Emirates	4020	3922
Brazil	3112	3502
Kuwait	3036	2908

Source: Statistical Review of World Energy 2024, Energy Institute

Top 10 major consuming countries (Thousand barrels per day)

Countries	2022	2023
United States	18862	18984
China	14970	16577
India	5209	5446
Saudi Arabia	3854	4052
Russia	3615	3635
Japan	3504	3366
South Korea	2856	2797
Brazil	2512	2567
Canada	2312	2351

Germany	2072	1955
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Source: Statistical Review of World Energy 2024, Energy Institute

Top 10 major exporting countries/regions (Thousand barrels per day)

Countries	2022	2023
Saudi Arabia	7386	7012
Russia	5275	4835
Canada	3994	4161
United States	3240	3716
Iraq	3838	3699
United Arab Emirates	3584	3429
West Africa	3440	3184
South & Central America	2245	2835
Other Middle East	1874	1806
Kuwait	1928	1629
North Africa	1537	1519

Source: Statistical Review of World Energy 2024, Energy Institute

Top 10 major importing countries/regions (Thousand barrels per day)

Countries	2022	2023
China	10206	11325
Europe	9817	8768
United States	6281	6502
Other Asia	5977	5794
India	4642	4640
Japan	2661	2521
Singapore	888	849
Canada	518	503
South & Central America	480	416
Other CIS	325	361
Other Middle East	304	294

Source: Statistical Review of World Energy 2024, Energy Institute

Top producing states in India (FY 2022-23)

State/UT	Production of Crude Oil (MMT)
Western Offshore	13.93
Rajasthan	5.07
Gujarat	4.85
Assam	4.16
Eastern Offshore	0.55
Tamil Nadu	0.32
Andhra Pradesh	0.24

Source: Energyportal.in; MMT: Million Metric Tonnes

c. Major changes in the policies governing trade in the spot markets of the commodity.

From April 2023 to March 2024, India implemented several changes in crude oil trade policies to enhance energy security and optimise economic benefits. The country introduced a new crude oil import strategy, diversifying sources to mitigate dependency on any single region. This strategy included increasing imports from non-OPEC countries and expanding deals with the United States, Russia, and African nations. Russia became the largest supplier, accounting for approximately 35% of India's total crude imports by December 2023. The Indian government revised its tax structure on crude oil and petroleum products to stabilise domestic markets.

A windfall tax on domestically produced crude oil was introduced when prices exceeded a certain threshold. The government also announced plans to expand strategic petroleum reserves (SPR) capacity by an additional 6.5 million MT to bolster national energy security against global supply disruptions. Environmental policy regulations were introduced to comply with global emission standards, with the sulphur content capped at 0.5% by weight for all imported crude starting in January 2024. India also launched initiatives to increase domestic oil exploration and production, offering new incentives under the Hydrocarbon Exploration and Licencing Policy (HELP), including reduced royalties and tax holidays for exploration activities.

d. Geopolitical issues in the commodity and its impact on Indian scenario

India's crude oil trade during April 2023 to March 2024 was heavily influenced by geopolitical concerns, requiring a multifaceted approach to ensure energy security and economic stability. The Russia-Ukraine conflict disrupted global oil supply chains, leading to volatility in crude oil prices. India's increasing reliance on Russian crude, which accounted for approximately 35% of its total imports by the end of 2023, highlighted geopolitical risks. Sanctions on Russian oil by Western nations created complexities in payment mechanisms and logistics, compelling India to explore alternative financial arrangements.

OPEC+ production cuts had direct implications for India, the world's third-largest oil importer. OPEC+ members implemented various output reductions to stabilize oil prices, affecting

global supply. These cuts forced India to diversify its import sources and increase purchases from non-OPEC countries like the United States and Africa. Middle East instability, including conflicts in Yemen and Iran's strained relations with the West, posed risks to the security of oil transit routes, particularly the Strait of Hormuz. The Indian government intensified diplomatic engagements with Gulf countries to secure stable supply lines and invested in insurance mechanisms for tankers navigating these high-risk areas.

U.S.-China trade tensions influenced global oil markets and India's trade strategies, impacting global economic growth forecasts and oil demand and prices. India prioritized crude oil imports while investing in renewable energy projects to gradually reduce its carbon footprint. To mitigate these risks, India strengthened regional cooperation through forums like BRICS and the Shanghai Cooperation Organisation (SCO) and pursued bilateral agreements with oil-producing nations.

2. Trading related parameter

NSE had the following Crude Oil derivatives available for trading on its Commodity Derivatives Segment in FY 2023-24.

- WTI Crude Oil Futures
- WTI Crude Oil Options on Futures
- WTI Crude Oil Mini Futures
- Brent Crude Oil Futures*

* Discontinued on January 12, 2024 (Last Trading day)

a. Monthly and Annual traded volume (quantity in appropriate units)

The traded volume for WTI Crude Oil Mini Futures & Brent Crude Oil Futures in FY 2023-24 was NIL.

Month	100 Barrels	100 Barrels
	WTI Crude Oil Futures	WTI Crude Oil Options on Futures
April 2023	NA	NA
May 2023	13,005	NA
June 2023	17,410	NA
July 2023	12,513	NA
Aug 2023	12,815	NA
Sep 2023	6,160	NA
Oct 2023	2,811	9,251
Nov 2023	990	14,105
Dec 2023	410	1,85,796
Jan 2024	473	6,04,701
Feb 2024	249	10,79,768
Mar 2024	268	11,43,018
FY 2023-24	67,104	30,36,639

b. Annual traded volume as proportion of total deliverable supply (quantity in appropriate units)

The traded volume for WTI Crude Oil Mini Futures & Brent Crude Oil Futures in FY 2023-24 was NIL.

Contract	Annual Volume (Million MT)	Traded (Million MT)	Deliverable Supply (Million MT)	Annual traded volume as proportion of total deliverable supply (%)
WTI Crude Oil Futures	0.01		260.95	0.004
WTI Crude Oil Options on Futures	0.42		260.95	0.159

c. Annual traded volume as proportion of total annual production (quantity in appropriate units)

The traded volume for WTI Crude Oil Mini Futures & Brent Crude Oil Futures in FY 2023-24 was NIL.

Contract	Annual Volume (Million MT)	Traded (Million MT)	Annual Production (Million MT)	Annual traded volume as proportion of total annual production (%)
WTI Crude Oil Futures	0.01		27.17	0.034
WTI Crude Oil Options on Futures	0.42		27.17	1.525

d. Annual average Open interest as proportion of total production

The traded volume for WTI Crude Oil Mini Futures & Brent Crude Oil Futures in FY 2023-24 was NIL.

Contract	Annual Volume (Million MT)	Traded (Million MT)	Annual Production (Million MT)	Annual traded volume as proportion of total annual production (%)
WTI Crude Oil Futures	9.95		27.17	0.00
WTI Crude Oil Options on Futures	45.43		27.17	0.00

e. Annual average Open interest as proportion of total deliverable supply

The traded volume for WTI Crude Oil Mini Futures & Brent Crude Oil Futures in FY 2023-24 was NIL.

Contract	Annual Traded Volume (MT)	Annual Production (Million MT)	Annual traded volume as proportion of total deliverable supply (%)
WTI Crude Oil Futures	9.95	260.95	0.00
WTI Crude Oil Options on Futures	45.43	260.95	0.00

f. Monthly and Annual value of trade (in Rs. Crores)

The traded volume for WTI Crude Oil Mini Futures & Brent Crude Oil Futures in FY 2023-24 was NIL.

Month	Rs Crores	
	WTI Crude Oil Futures	WTI Crude Oil Options on Futures
April 2023	NA	NA
May 2023	774.18	NA
June 2023	1008.1	NA
July 2023	775.4	NA
Aug 2023	861.11	NA
Sep 2023	454.44	NA
Oct 2023	199.47	703.02
Nov 2023	64.49	993.46
Dec 2023	24.97	12,219.79
Jan 2024	28.72	37,868.85
Feb 2024	15.82	67,553.63
Mar 2024	17.86	70,801.79
FY 2023-24	4,224.56	1,90,140.54

g. Monthly and Annual quantity of delivery (in appropriate units)

Crude Oil derivatives are cash settled contracts. Thus, the same is not applicable.

h. Monthly and Annual value of delivery (in Rs. Crores)

Crude Oil derivatives are cash settled contracts. Thus, the same is not applicable.

i. Monthly and Annual Average Open Interest (OI) (in appropriate units)

The traded volume for WTI Crude Oil Mini Futures & Brent Crude Oil Futures in FY 2023-24 was NIL.

Month	100 Barrels	100 Barrels
	WTI Crude Oil Futures	WTI Crude Oil Options on Futures
April 2023	NA	NA
May 2023	79	NA
June 2023	252	NA
July 2023	138	NA
Aug 2023	34	NA
Sep 2023	21	NA
Oct 2023	36	211
Nov 2023	34	285
Dec 2023	51	361
Jan 2024	58	433
Feb 2024	50	365
Mar 2024	39	322
FY 2023-24	72	332

j. Annual average volume to open interest ratio

The traded volume for WTI Crude Oil Mini Futures & Brent Crude Oil Futures in FY 2023-24 was NIL.

Contract	Unit	Annual Average Traded Volume	Annual Average Open Interest	Annual average OI as a proportion of Annual average volume (%)
WTI Crude Oil Futures	100 Barrels	298	72	24.16
WTI Crude Oil Options on Futures	100 Barrels	24,890	332	1.33

k. Total number of unique members and clients who have traded during the financial year.

The traded volume for WTI Crude Oil Mini Futures & Brent Crude Oil Futures in FY 2023-24 was NIL.

Contract	Unique Member Count	Unique Client Count
WTI Crude Oil Futures	109	201
WTI Crude Oil Options on Futures	121	644

l. Ratio of open interest by FPOs/farmers/Hedge/VCP positions to total open interest (Annual average as well as maximum daily value)

The traded volume by FPOs / farmers and VCPs/hedgers* for Crude Oil Derivatives in FY 2023-24 was NIL/Negligible.

* Based on the self-declaration available for the categorization of clients/members

m. Number of unique FPOs / farmers and VCPs/hedgers who traded in the financial year.

The traded volume by FPOs / farmers and VCPs/hedgers* for Crude Oil Derivatives in FY 2023-24 was NIL/Negligible.

Based on the self-declaration available for the categorization of clients/members

n. Algorithmic trading as percentage of total trading

The traded volume for WTI Crude Oil Mini Futures & Brent Crude Oil Futures in FY 2023-24 was NIL.

Contract	Algorithmic trading as percentage of total trading (%)
WTI Crude Oil Futures	56.07
WTI Crude Oil Options on Futures	53.10

o. Delivery defaults

i. Number of instances

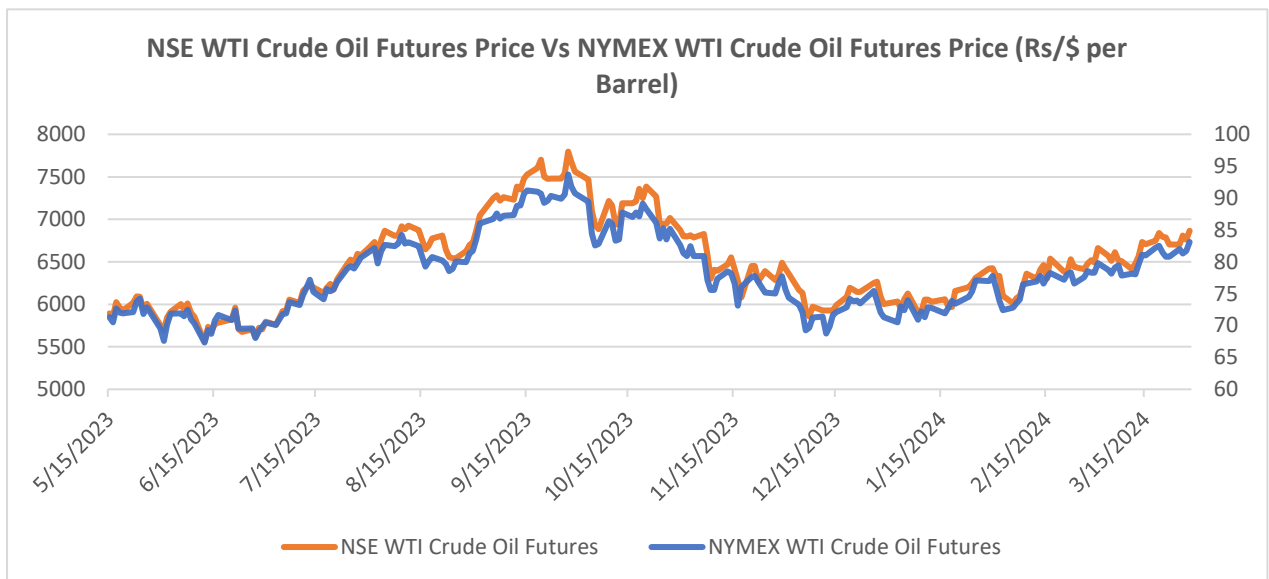
ii. Quantity involved

iii. Value involved

Crude Oil derivatives are cash settled contracts. Thus, the same is not applicable.

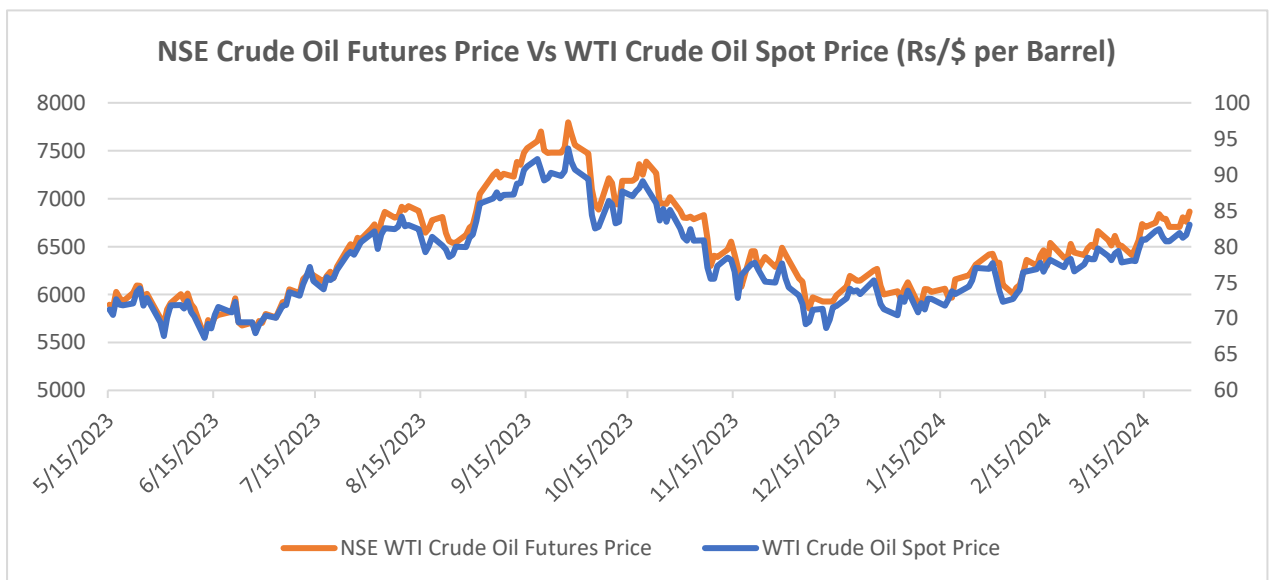
3. Price movements

a. Comparison, correlation and ratio of standard deviation of Exchange futures price vis-à-vis international futures price (wherever relevant comparable are available)



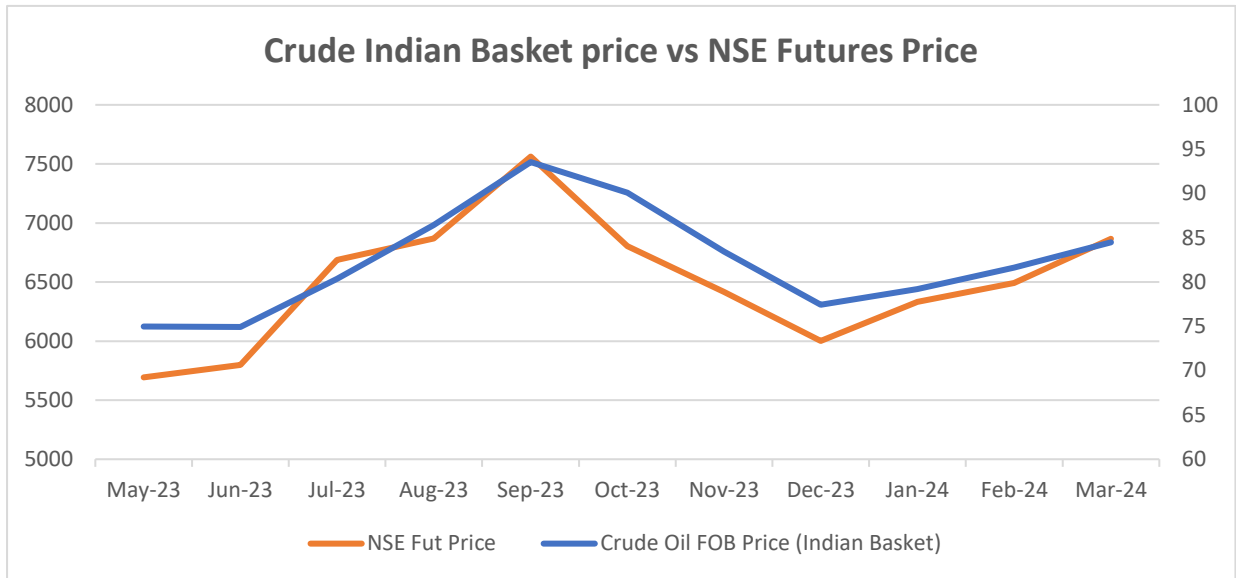
Correlation: 99% | Ratio of Std Deviation: 0.96

b. Comparison, correlation and ratio of standard deviation of Exchange futures price vis-à-vis international spot price (wherever relevant comparable are available) and domestic spot price (exchange polled price).



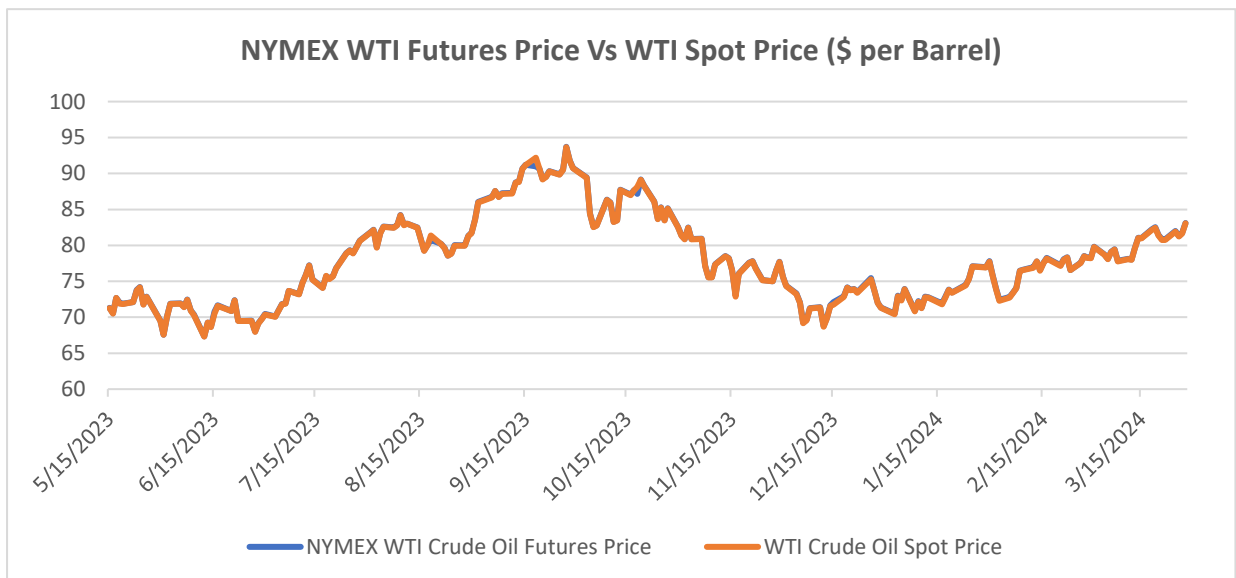
Correlation: 99% | Ratio of Std Deviation: 0.95

c. Correlation between exchange futures & domestic spot prices along with the ratio of standard deviation.



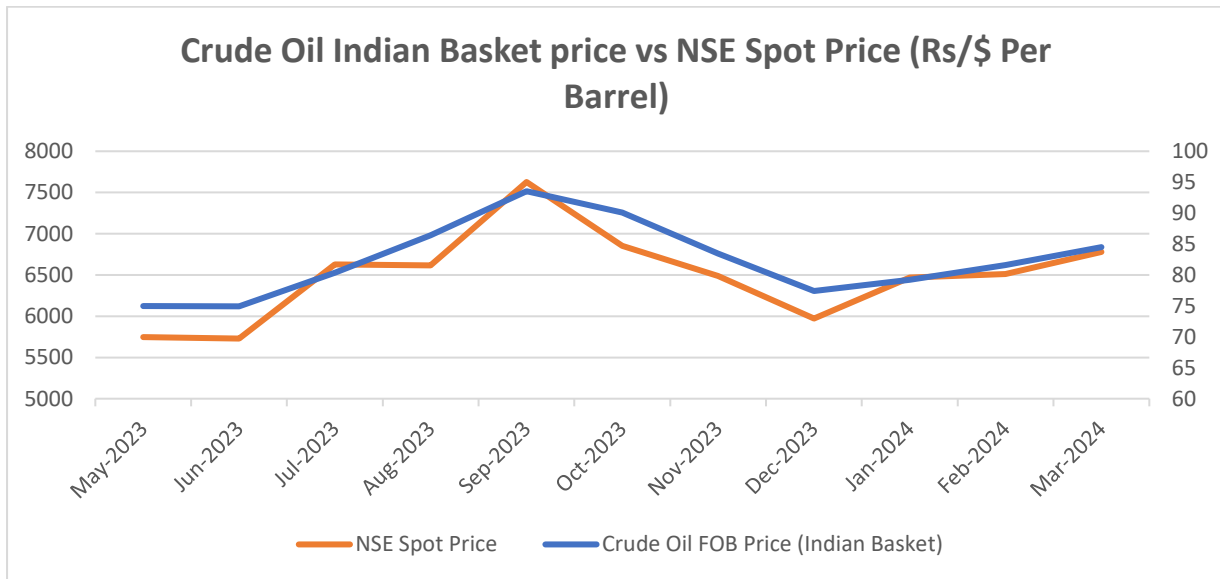
Correlation: 93% | Ratio of Std Deviation: 1.33

d. Correlation between international futures & international spot prices along with ratio of standard deviation (wherever relevant comparable are available).



Correlation: 100% | Ratio of Std Deviation: 1.00

e. Comparison of Exchange polled price and mandi price (in case of agricultural commodities) / other relevant price (in case non-agricultural commodities) at basis centre.



Correlation: 93% | Ratio of Std Deviation: 1.53

f. Maximum & Minimum value of daily futures price volatility and spot price volatility along with disclosure of methodology adopted for computing the volatility.

The traded volume for WTI Crude Oil Mini Futures and Brent Crude Oil Futures in FY 22-23 was NIL.

Commodity	Max Volatility in Futures Prices (%)	Min Volatility in Futures Prices (%)	Max Volatility in Spot Prices (%)	Min Volatility in Spot Prices (%)
WTI Crude Oil	6.08	0	6.52	0

Volatility calculation: $(\text{Day} - \text{Previous day's price}) / \text{Previous day's price}$

g. Number of times the futures contract was in backwardation/contango by more than 4% for the near month contract in the period under review.

No instance has been observed where the backwardation or contango exceed 4% for the near month contract.

Sources for this section: Tradingview, Petroleum Planning and Analysis Cell, MoPNG, GOI and NSE

4. Other parameters

- a. Qualitative and quantitative measure for Hedge effectiveness ratio and basis Risk (Volatility of Basis) along with disclosure of methodology adopted for such calculations.

Date	Price				Price Change				Hedge Effectiveness
	NSE Crudeoil Price	WTI Spot	NSE Crudeoil Futures	WTI	NSE Crudeoil Price	WTI Spot	NSE Crudeoil Futures	WTI	
5/16/2023	5851		5864		96		-31		409.68
6/30/2023	5729		5797		180		72		-150.00
7/14/2023	6314		6200		81		-32		353.13
7/31/2023	6627		6687		60		113		46.90
8/16/2023	6718		6646		-168		-227		25.99
8/31/2023	6756		6869		48		144		66.67
9/29/2023	7627		7562		-169		-115		-46.96
11/16/2023	6373		6280		-148		-134		-10.45
12/29/2023	5973		6001		-202		-89		-126.97
1/16/2024	6022		6060		49		31		-58.06

1/31/2024	6468	6333	84	-91	192.31
2/16/2024	6477	6539	109	236	53.81
2/29/2024	6512	6492	-26	-28	7.14
3/15/2024	6734	6706	125	-28	546.43
3/28/2024	6779	6865	-25	105	123.81
			Overall Average		137.14

The Dollar Offset Method of determining Hedge Effectiveness is one of the quantitative methods used extensively. It involves comparing the ratio of the change in fair value or present value of future expected cash flows of the hedging instrument (NSE Futures) with the change in the fair value or present value of future cash flows of the hedged item (Spot Price) attributable to the hedged risk.

Methodology

To examine the hedge effectiveness twelve random dates were chosen with minimum gap between the period as 15 days and maximum being 3 months period (matching various operating cycles of the bullion value chain participants). For each of these chosen dates, Spot Price and Futures closing rates were recorded. The change in value of Spot rates as well as Futures closing rates for two consecutive periods was recorded. Hedge effectiveness is the ratio of change in the value of Spot prices to the change in Futures value

Values between 80% to 125% indicate the hedge effectiveness is good. Values below 80% indicate that the hedge effective is not good. Based on the observations, it can be noticed that overall hedge effectiveness is over 137.14%.

Longer period hedge tends to be less effective. It could be due to roll-over and related contango issues or liquidity issues. Second aspect is when there is a disruptive change in the underlying market, hedge effectiveness declines.

Basis risk:

Basis is the difference between the spot price and the futures price at a particular point in time. Basis is usually very small and tends to decrease as futures contract moves towards expiry.

b. Details about major physical markets of the commodity vis-à-vis market reach in terms of availability of delivery centers (information to be provided state-wise and UT-wise).

In the case of Crude oil, apart from major refiners, industries related to Plastic, Tyres, Rubber, Petrochemicals, Paint, Glass, etc. across the country, have exposure to Crude Oil as they use its refined products extensively. Crude Oil derivatives contracts are offered as cash settled products which such industry players can use to hedge their exposures without the necessity of taking physical delivery of Crude oil.

c. Details about major physical markets of the commodity and average Open Interest for each month generated from those regions.

In the case of Crude oil, apart from major refiners, industries related to Plastic, Tyres, Rubber, Petrochemicals, Paint, Glass, etc. across the country, have exposure to Crude Oil as they use its refined products extensively. The region wise OI data is not available.

d. Details, such as number and target audience, of stakeholders' awareness programs carried out by the exchange.

For education initiatives, the exchange has conducted 411 awareness campaigns across INDIA covering all the commodities available on the NSE platform. These programs were attended by more than 15,000 stakeholders.

e. Steps taken / to be undertaken to improve hedging effectiveness of the contracts as well as to improve the performance of illiquid contracts.

NSE is constantly striving to encourage hedgers to participate in the Crude Oil contracts. We have value chain participants such as Bharat Petroleum Corporation Ltd (BPCL), Oil & Natural Gas Corporation (ONGC), Indian Oil Corporation (IOCL), Hindustan Petroleum Corporation Ltd (HPCL), Chennai Petroleum Corporation Ltd (CPCL), etc. as part of our Energy PAC, who guide us on how to get more participation from physical as well as other market participants.

5. Any other information to be disclosed as deemed important by the exchange or as suggested by the PAC.