

Impact of Crude Oil Prices on Indian Energy Stocks
(Jan 2021 – Dec 2023)

Background:
The volatility of crude oil prices has historically influenced the financial performance of Indian oil refinery and drilling companies. With global events like the Russia-Ukraine war, the prices of crude oil underwent significant fluctuations, which directly affected the share prices and return on investment (ROI) of companies like IOC, ONGC, and Oil India Ltd. In order to better understand this dynamic relationship, a data-driven approach is required to quantify the impact of price shocks and market phases on these stocks. This study analyses the correlation of Share prices of Oil Refining companies and crude oil prices and derived an investment strategy wherein the entry and exit points in these shares are determined basis the oil prices. Understanding how Indian energy stock prices react to crude oil movements can offer critical insights for investors, policymakers, and financial analysts—especially within periods of geopolitical uncertainty and commodity price shocks.

Further, this analysis has been segregated into three phases based on the timeline of the disurbance caused by the Russia-Ukraine war (Shock period), viz, Pre-War/Shock Period, Shock period, Post- War/Shock Period.

Purpose:
1. Establish the correlation between share prices of oil refining and distribution businesses with crude oil prices.
2. Demonstrate the trading opportunities presented in oil refinery shares by following the crude oil prices.
3. Present the conclusions in a easy to understand manner by building Dashboards with dynamic charts and recognisable patterns.

Procedure:
1.Data Collection
Historical daily data for:
Crude Oil prices (₹ per barrel)
For lack of availability of day wise crude oil prices, we have relied on prices of crude oil futures.
Stock prices: Indian Oil Company (IOC), Oil and Natural Gas Corporation (ONGC), Oil India Ltd (OIL)
Time Frame: Jan 2021 – Dec 2023

2.Data Cleaning
Removed blank rows, ensure consistency in formatting
Formatted dates uniformly (DD-MM-YYYY)
Converted text to numeric (especially for volumes or prices)

3.Period Classification
Seggregated the dataset into the three phases as defined below :-
Pre-War (1st Jan '21- 23rd Feb '22)
Shock (War Onset- 24th Feb '22- 30th Dec '22)
Post-Shock (31st Dec '22- 31st Dec '23)

4.Establishing Correlation
Analysed the day wise prices of each share against the movement in oil prices on that day and have summarised the behaviour in Sec 'B' of the Dashboards by plotting the movement of prices of the share and crude oil separately for each phase.
Further, the reasons behind the behaviour of these share prices were noted and discussed in detail.

Below are the considerations taken while preparing the pricing charts :-
Use **primary Y-axis** for Crude Oil and **secondary Y-axis** for stock prices
Format axes, titles, and labels consistently
Calculate **correlation** between crude oil and each stock for each period
Run **linear regression** to capture slope/sensitivity
Logically analyze **trend reversals** (e.g., Post-Oct 2023 divergence)

5. Investment Opportunities
Based our investment theory on the notion that the prices of oil refinery companies follow the same pattern as the oil prices.
To test this hypothesis, a number of hypothetical trades based on the peak and bottom of oil prices were carried out and tested the possible gains if the purchase and sale of shares of the companies were done basis the oil prices.
Divided the trades and tested the same equally across all the three phases as defined above.
Presented the findings in section 'A' of Dashboards .

Below are the considerations taken while preparing the pricing charts :-

Used **primary Y-axis** for gains/(losses) and **secondary Y-axis** for phases.
Format axes, titles, and labels consistently
Documented our observations for each phases explaining the results and any deviations.

6. Conclusion
Successfully tested the correlation between oil prices and the shares prices of the companies dependent on the same.
Established that the correlation sustains in regular business conditions, and is disturbed when there are global or regulatory disturbances.
Further, tested and demonstrated these findings by building an investment model functioning on investment in these shares by observing movements in oil prices.
The findings have been effectively analysed in our Dashboards section with detailed charts and relevant observations.

Dashboard

Analysis of Trading Opportunities and Volatility with Dynamic Charts.

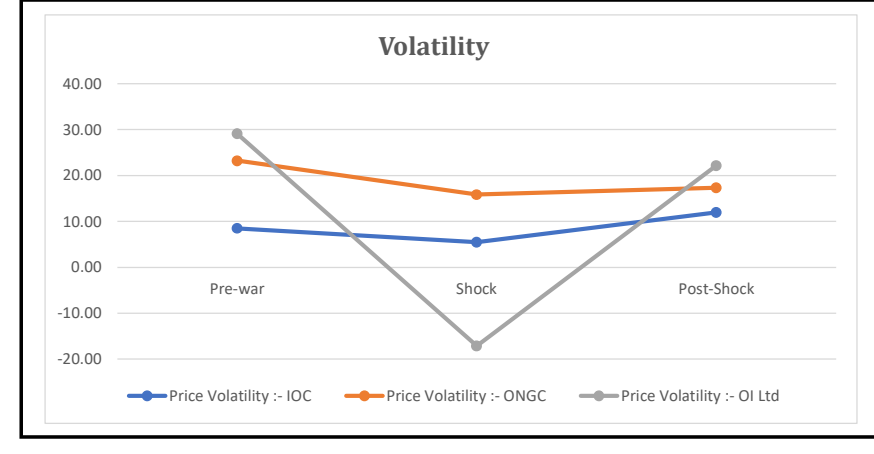
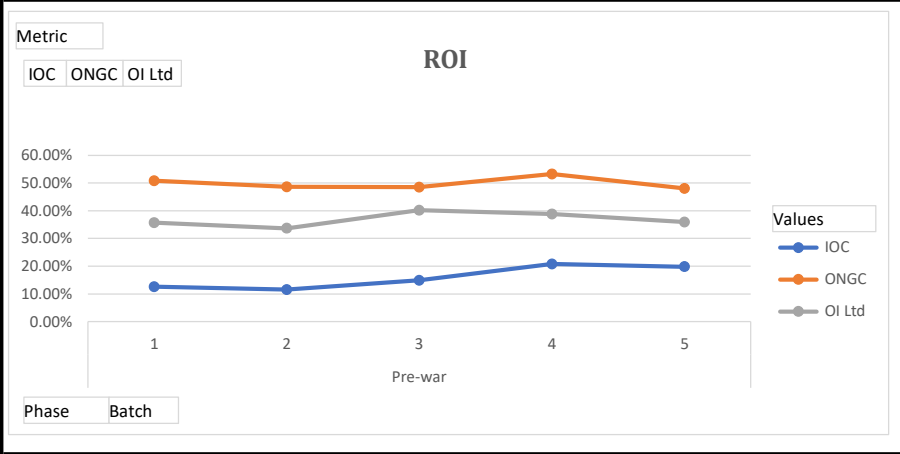
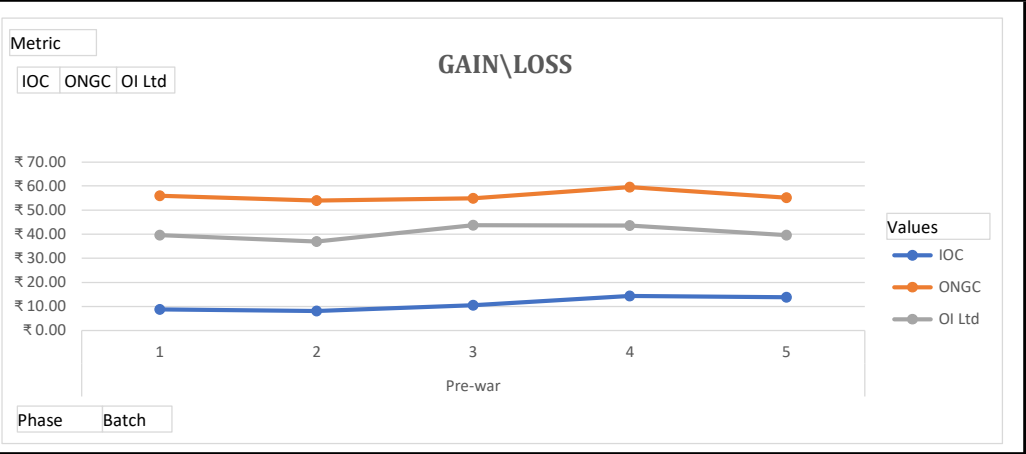
Average ROI- IOC 15.94%	Average ROI- ONGC 49.86%	Average ROI- OI Ltd 36.85%
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Average ROI- ONGC

49.86%

Average ROI- OI Ltd

36.85%



We observe a clear trend of share prices reflecting movements in line with oil prices and the trading margins reflect the same prior to the shock period, remaining consistent throughout the period, implying that the correlation between oil prices and the energy companies share prices holds good.

However, during the shock period, we observe shifts in volatility levels for share prices of IOC and ONGC reflected in the asymmetrical returns of these shares, with the exception of Oil India Ltd, whose returns increase during the shock period, further rationalised by its volatility falling below 0, implying the share prices for this company were largely in line with the oil prices.

Further, we see a recovery in returns post the shock period as the market starts following the oil prices and has discounted for the initial volatility. We also observe an increase in volatility levels with increase in share prices post the shock period with policy changes affected by the government boosting the share prices.

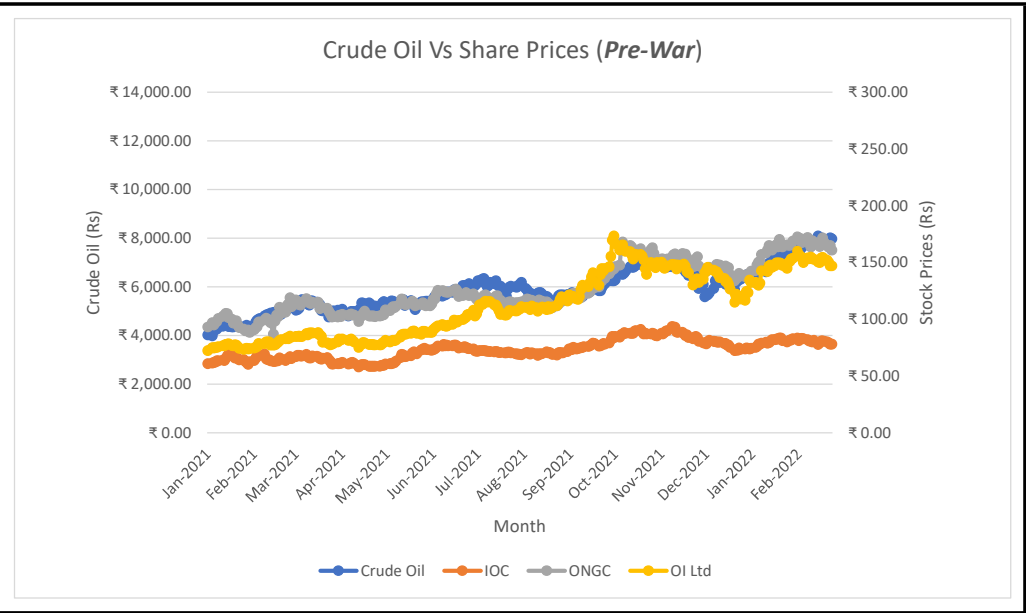
Accordingly, we have concluded it can be substantially proven that the share prices for companies involved in refining, can be traced to movements in the oil prices and have the same behaviour as the oil prices in a regular market, however this theory does not hold good when there are disturbances in supply chains, regulations, and drilling owing to external factors.

The trading strategy yields an average return of 34.22%, 8.09% and 15.35% across the three phases respectively. Oil India Ltd's share prices performed the best aided by minimal volatility in the shock period, and having a higher beta to Crude oil prices, compared to the share prices of the other two companies. While, we witness a negative yield in the returns during the shock period for ONGC and IOC, the losses aren't huge implying the market had absorbed a good deal of shock in the early stages of the war.

Comparative presentation and analysis of Share Prices and Oil Prices during the three stages of Pre War, Shock and Post War

Correlation of Prices			
Share	Pre War	Shock	Post Shock
IOC	0.805759663	0.168049005	-0.077052512
ONGC	0.934137408	0.252698224	0.361596436
OILtd	0.882991116	0.563424661	0.262552618

Correlation Slope			
Share	Pre War	Pre War	Pre War
IOC	0.007540240	0.001088043	-0.001473807
ONGC	0.023823055	0.004714965	0.010001930
OI Ltd	0.028201262	0.011340116	0.009301115

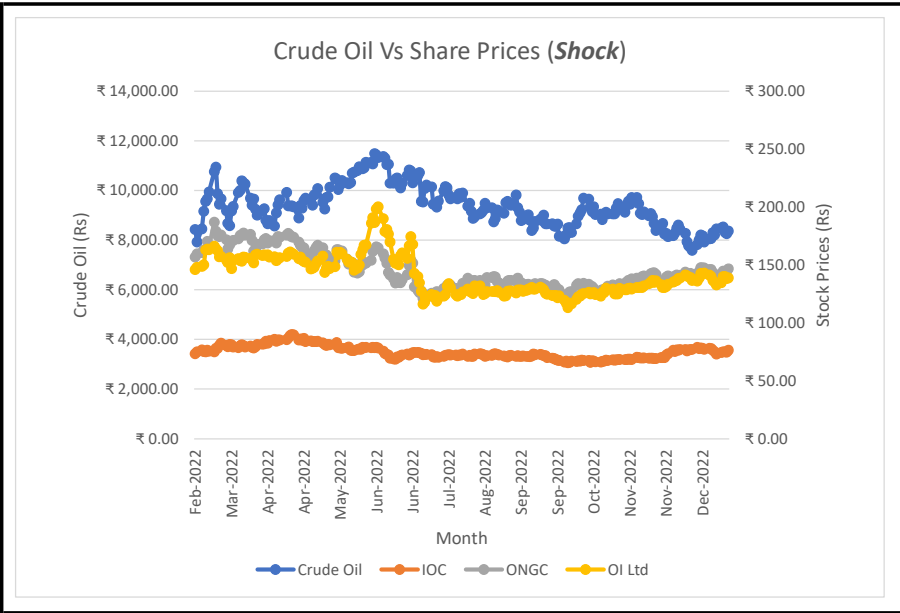


Pre War

1. We can witness a strong correlation between the Share prices and the corresponding oil prices.

2. The Share prices rise commensurate to the trend with oil prices upto Nov '21 and then declines in line with oil prices.

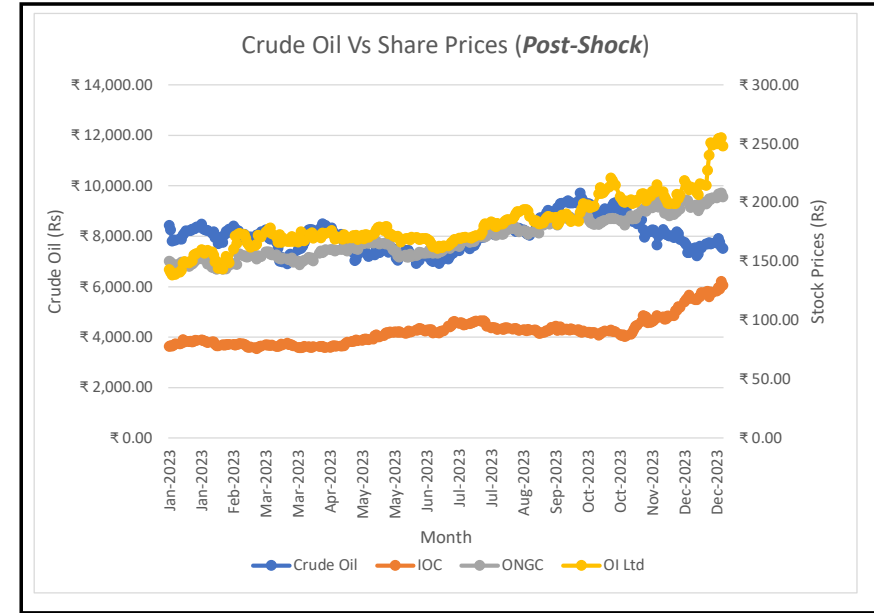
Note:- Please refer Excel Workbook for day wise prices



Shock

1. We continue to witness the correlation as the oil prices enter a turbulent phase with the Russia- Ukraine war causing supply chain and production disruptions.

2. The prices rise during the initial phase of the shock period due to supply shortage upto Apr-May '22. However, we observe that the Share prices stabilise post this period and the responses to shifts in oil prices are less volatile.



Post War

1. While the war continues with sporadic events spread across these months, the shock effect had declined, and we notice the oil prices gradually rise in line with less speculation in the market.

2. Further, the Share prices continue to move in line with oil upto Oct '23, post which we observe the inflexion point, where oil prices fell however share prices rose going against the trend. We have been able to trace back the reason for this improvements in volume of oil production and stabilisation in the "Windfall tax" introduced in July '22, along with better retail margins.

Investment Analysis

Average ROI:-	19.22%
Best Performing stock	OI Ltd
Worst Performing stock	IOC
Least Volatile	IOC
Most Volatile	OI Ltd

Trading Margin

Total Gain/(Loss) :-			
Phase	IOC	ONGC	OI Ltd
Pre-war	₹ 55.44	₹ 279.70	₹ 203.54
Shock	-₹ 7.16	-₹ 6.20	₹ 197.94
Post-Shock	₹ 35.87	₹ 189.65	₹ 148.10

Lowest Oil Price During (Batch 1):-					
Period	Date	Crude Oil Price	IOC Price	ONGC Price	OI Ltd Price
Pre-War	20-Aug-21	₹ 5,201.84	₹ 69.00	₹ 110.20	₹ 110.90
Shock	25-Feb-22	₹ 7,924.28	₹ 74.90	₹ 159.50	₹ 147.97
Post-Shock	20-Mar-23	₹ 6,913.33	₹ 80.60	₹ 152.30	₹ 167.10

Lowest Oil Price During (Batch 2):-					
Period	Date	Crude Oil Price	IOC Price	ONGC Price	OI Ltd Price
Pre-War	19-Aug-21	₹ 5,293.77	₹ 70.00	₹ 111.00	₹ 110.00
Shock	24-Feb-22	₹ 8,429.47	₹ 73.33	₹ 156.65	₹ 145.83
Post-Shock	27-Jun-23	₹ 6,929.24	₹ 89.35	₹ 157.85	₹ 163.03

Lowest Oil Price During (Batch 3):-					
Period	Date	Crude Oil Price	IOC Price	ONGC Price	OI Ltd Price
Pre-War	18-Aug-21	₹ 5,464.17	₹ 70.80	₹ 113.20	₹ 109.03
Shock	28-Feb-22	₹ 8,448.01	₹ 76.67	₹ 160.65	₹ 148.63
Post-Shock	17-Mar-23	₹ 6,978.32	₹ 79.30	₹ 153.15	₹ 170.27

Lowest Oil Price During (Batch 4):-					
Period	Date	Crude Oil Price	IOC Price	ONGC Price	OI Ltd Price
Pre-War	23-Aug-21	₹ 5,478.75	₹ 68.67	₹ 111.75	₹ 112.10
Shock	11-Apr-22	₹ 8,561.45	₹ 85.90	₹ 171.20	₹ 157.00
Post-Shock	23-Jun-23	₹ 7,000.79	₹ 89.30	₹ 156.90	₹ 162.50

Lowest Oil Price During (Batch 5):-					
Period	Date	Crude Oil Price	IOC Price	ONGC Price	OI Ltd Price
Pre-War	09-Aug-21	₹ 5,553.86	₹ 69.60	₹ 115.00	₹ 110.33
Shock	16-Mar-22	₹ 8,571.36	₹ 81.30	₹ 167.30	₹ 156.20
Post-Shock	15-Mar-23	₹ 7,015.81	₹ 78.60	₹ 152.55	₹ 172.87

Average ROI:-				Average ROI
Phase	IOC	ONGC	OI Ltd	
Pre-War	15.94%	49.86%	36.85%	34.22%
Shock	-1.45%	-0.63%	26.34%	8.09%
Post-Shock	9.56%	21.85%	14.63%	15.35%

Highest Oil Price During (Batch 1) :-					
Period	Date	Crude Oil Price	IOC Price	ONGC Price	OI Ltd Price
Pre-War	14-Feb-22	₹ 8,091.14	₹ 77.70	₹ 166.20	₹ 150.50
Shock	08-Jun-22	₹ 11,488.71	₹ 78.67	₹ 163.40	₹ 186.70
Post-Shock	27-Sep-23	₹ 9,716.78	₹ 90.40	₹ 187.25	₹ 191.67

Highest Oil Price During (Batch 2) :-					
Period	Date	Crude Oil Price	IOC Price	ONGC Price	OI Ltd Price
Pre-War	22-Feb-22	₹ 8,014.66	₹ 78.07	₹ 164.95	₹ 147.00
Shock	09-Jun-22	₹ 11,429.67	₹ 78.87	₹ 165.55	₹ 198.20
Post-Shock	28-Sep-23	₹ 9,506.03	₹ 89.80	₹ 187.45	₹ 194.83

Highest Oil Price During (Batch 3) :-					
Period	Date	Crude Oil Price	IOC Price	ONGC Price	OI Ltd Price
Pre-War	11-Feb-22	₹ 7,899.95	₹ 81.37	₹ 168.15	₹ 152.80
Shock	13-Jun-22	₹ 11,364.56	₹ 75.73	₹ 159.55	₹ 189.77
Post-Shock	19-Sep-23	₹ 9,410.01	₹ 92.30	₹ 187.00	₹ 188.00

Highest Oil Price During (Batch 4) :-					
Period	Date	Crude Oil Price	IOC Price	ONGC Price	OI Ltd Price
Pre-War	02-Feb-22	₹ 7,547.77	₹ 82.97	₹ 171.30	₹ 155.67
Shock	10-Jun-22	₹ 11,317.89	₹ 78.17	₹ 164.65	₹ 200.13
Post-Shock	26-Sep-23	₹ 9,406.27	₹ 92.00	₹ 187.75	₹ 184.10

Highest Oil Price During (Batch 5) :-					
Period	Date	Crude Oil Price	IOC Price	ONGC Price	OI Ltd Price
Pre-War	19-Jan-22	₹ 7,334.32	₹ 83.40	₹ 170.25	₹ 149.93
Shock	14-Jun-22	₹ 11,304.37	₹ 73.50	₹ 155.95	₹ 178.77
Post-Shock	29-Sep-23	₹ 9,405.02	₹ 90.95	₹ 191.85	₹ 199.23

Price Volatility :-			
Phase	IOC	ONGC	OI Ltd
Pre-war	8.53	23.25	29.12
Shock	5.51	15.87	-17.12
Post-Shock	11.99	17.34	22.21

Gain/(Loss):-			
Phase	IOC	ONGC	OI Ltd
Pre-war	₹ 8.70	₹ 56.00	₹ 39.60
Shock	₹ 3.77	₹ 3.90	₹ 38.73
Post-Shock	₹ 9.80	₹ 34.95	₹ 24.57

Gain/(Loss):-			
Phase	IOC	ONGC	OI Ltd
Pre-war	₹ 8.07	₹ 53.95	₹ 37.00
Shock	₹ 5.54	₹ 8.90	₹ 52.37
Post-Shock	₹ 0.45	₹ 29.60	₹ 31.80

Gain/(Loss):-			
Phase	IOC	ONGC	OI Ltd
Pre-war	₹ 10.57	₹ 54.95	₹ 43.77
Shock	-₹ 0.94	-₹ 1.10	₹ 41.14
Post-Shock	₹ 13.00	₹ 33.85	₹ 17.73

Gain/(Loss):-			
Phase	IOC	ONGC	OI Ltd
Pre-war	₹ 14.30	₹ 59.55	₹ 43.57
Shock	-₹ 7.73	-₹ 6.55	₹ 43.13
Post-Shock	₹ 2.70	₹ 30.85	₹ 21.60

Gain/(Loss):-			
Phase	IOC	ONGC	OI Ltd
Pre-war	₹ 13.80	₹ 55.25	₹ 39.60
Shock	-₹ 7.80	-₹ 11.35	₹ 22.57
Post-Shock	₹ 12.35	₹ 39.30	₹ 26.36

ROI:-			
Phase	IOC	ONGC	IOC
Pre-War	12.61%	50.82%	35.71%
Shock	5.03%	2.45%	26.17%
Post-Shock	12.16%	22.95%	14.70%

ROI:-			
Phase	IOC	ONGC	IOC
Pre-War	11.53%	48.60%	33.64%
Shock	7.55%	5.68%	35.91%
Post-Shock	0.50%	18.75%	19.51%

ROI:-			
Phase	IOC	ONGC	IOC
Pre-War	14.93%	48.54%	40.14%
Shock	-1.23%	-0.68%	27.68%
Post-Shock	16.39%	22.10%	10.41%

ROI:-			
Phase	IOC	ONGC	IOC
Pre-War	20.82%	53.29%	38.87%
Shock	-9.00%	-3.83%	27.47%
Post-Shock	3.02%	19.66%	13.29%

ROI:-			
Phase	IOC	ONGC	IOC
Pre-War	19.83%	48.04%	35.89%
Shock	-9.59%	-6.78%	14.45%
Post-Shock	15.71%	25.76%	15.25%