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Crude Oil, Gold, Forex Rate and Indian Equity Market Interdependencies

Dr. Pardeep Kumar[1], Dr. Satinderpal Singh[2], Dr. Charu Saxena[3]

[1]*Assistant Professor, USB-MBA, Chandigarh University, Mohali*
[2]*Professor, USB-MBA, Chandigarh University, Mohali*
[3]*Assistant Professor, USB-MBA, Chandigarh University, Mohali*

Abstract

In the modern era of Friedman's Flat World, investments are neither confined to a single economy nor to one type of investment. These days' global investors seek investment across the different countries and explore the diverse markets, including equity, commodities, currency, and oil markets around the globe. Interdependencies among these key markets play a vital role in the success or ultimate failure of any such markets. This current research paper focuses on demonstrating the interlinkages between Crude and Gold rates, forex-rates and equity prices of the emerging Indian economy from 1993 to 2019 by deploying the cointegration tests given by Johansen and tests of unrestricted univariate Vector Autoregressive Model (VAR). The results failed to establish any kind of cointegration amongst the selected macroeconomic variables. Further, the results positively confirm the significant influence of the gold and equity prices on the crude-oil rates; the noticeable significant influence of crude and forex on the gold-prices; and marked the effect of forex-rates and equity-prices on each-other.

Keywords: heritage tourism, Rajasthan

1. INTRODUCTION

In Crude oil and gold have emerged as the utmost widely traded options of the international markets. Oil being the most important form of energy is glaringly impacting the global economy. International financial integration, rising global markets' dependencies and the ever-growing financial process of commodity marketplaces has made the equity and forex markets sensitive to the various developments in the commodity markets, especially to the ones in the oil and gold marketplaces. Further, the foreign exchange rate also cuses a substantial bearing on the price movements. Any upward moment in the forex rate causes the devaluation of the home currency which ensues more and more foreign portfolio investments in the country. So, the demand and prices of shares in the stock markets rise, which reiterates good times for investment in the stock market. Devaluation of the currency also favors the export-oriented countries by increasing exports and decreasing imports. Furthermore, the two-way, supply-side and demand-side, consequence of oil prices is quite evident on various macroeconomic variables. On the supply side, crude being the major production input, prime

energy source, and a key factor in the distribution of goods impacts the cost of the production. This, in turn, discourages production output and reduces the aggregate supply. On the demand side, adverse crude oil prices results in fall in total demand due to less consumption and expenditures by the customers. Therefore, it may be established that in the recent past these four markets are increasingly interconnecting with each other. For an import reliant emerging economy like India, whose oil consumption stands at huge levels of 4.88 million barrels per day (mb/d) (OPEC, 2018), yearly gold consumption is whopping 760.4 tons (World Gold Council –WGC, 2018), the exchange rates are witnessing pretty high fluctuations and stock markets are demonstrating extraordinary volatility; investigating the dynamic interactions amongst crude, gold, forex and share market becomes of prime importance. The various possible interdependencies between these markets are as given below in the figure-1.1.

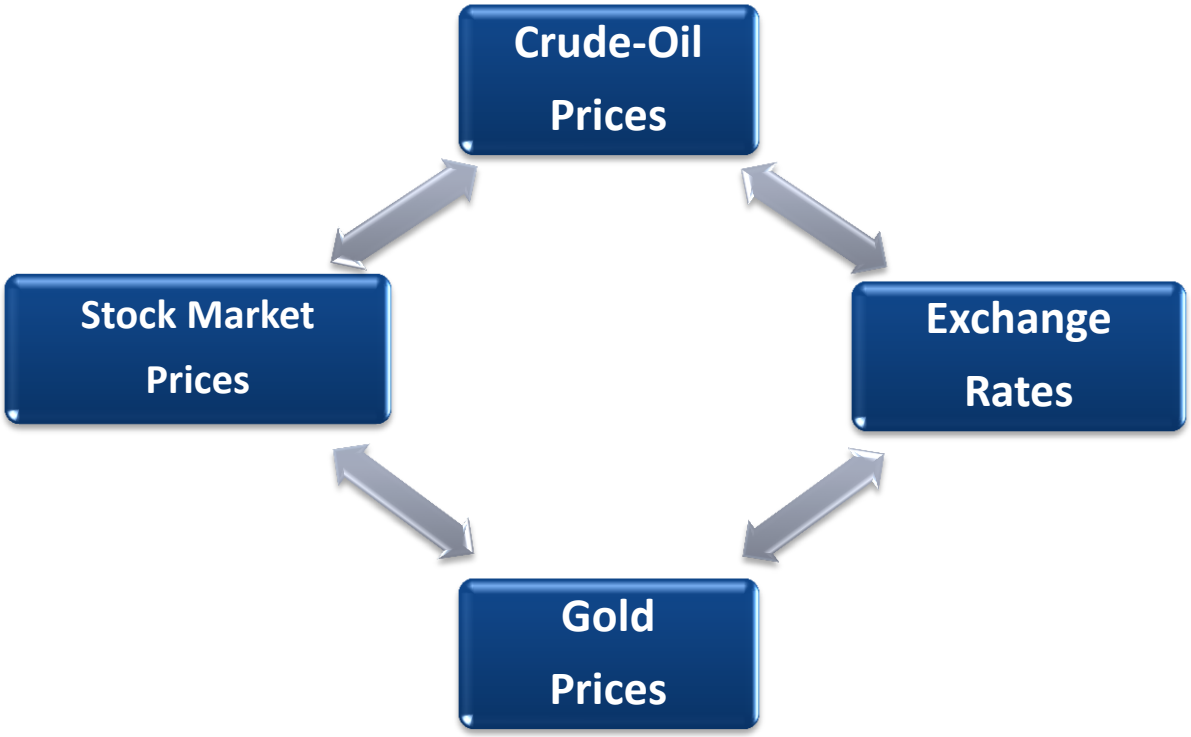


Fig.1: Different Interdependency Relationships between the selected market

The act of exploring the interdependencies between the Crude, Gold, forex and equity-market prices has been the topic of deliberation for many researchers, academicians, and private practitioners in the recent past. The present section examines the relevant related literature and theoretical framework on these relationships. Firstly, research works that concentrated predominantly upon two selected variables are studied. Next, the diverse studies simultaneously considering more than two variables are extensively researched.

The pioneer works by[1]–[3]inspect predictability of international share returns using many comprehensive economic risk influences, including crude-oil prices from 1970-1989 by employing single and multiple beta models on national stock market returns of selected 18

countries. The evidence shows that crude rates sustain remarkable impacts on the equity markets. Identically, many other studies confirm the interdependencies amongst the stock and oil [4]; [5];[6];[7];[8];[9];[10];[11]. [12]analyze the influence of crude on equity returns in developed markets of UK, US, Canada, and Japan; and conclude the undesirable reaction of equity markets to the shock waves in oil marketplaces. The same inverse relationship between these two variables was established in several other studies [13];[14];[15];[16]. In another landmark study, [17]investigate equity-indices of six OECD nations and detect that stocks react in the opposite direction to crude price movements. On the contrary, some of the researchers conclude an affirmative association between crude and equity[18];[19]; and[20]. Among the extensive researches that carefully explore sector-wise oil-equity linkage, [21]investigates the short term linkages in Europe and confirm noteworthy connections between oil-rate fluctuations and equity prices. Nevertheless, these relations generate diverse results for diverse sectors. [22]amply confirms nonlinear interdependencies amongst crude rate variations and equity markets. Some of the studies have also found no or slight association among crude oil and equity. [23] and [24]etc. inspect the crude and equity bazaars and confirm no signal of dependence between the crude oil and financial markets. Also, there are India specific studies in this regard too. [25]; [26];[27];[28]; explore the vibrant link between stock and oil marketplaces, and long-term association is confirmed. But, [29]conclude that fluctuations in crude values influence the equity market.

Empirical pieces of evidence on association midst equity and gold markets are inconsistent. Several published works conclude the significant interdependencies between the gold-markets and equity-markets [30]; [31];[32];[33]; [34]. On the other hand, some prominent research works [35];[36];[37];[38]validate the non-existence of any such interdependencies between these two macroeconomic variables. In a path-breaking research [39]confirms the opposite association among the stock prices and gold. Related discoveries are acknowledged in several other studies [40];[41];[42], whereas on the contrary [43]sufficiently establish that equity market is equally responsible for gold-price hikes. Markov-Switching Bayesian VAR models from 1986 to 2013 are utilized by [20]to validate different responses to gold price shocks. Moreover, in recent times, many research-works have concentrated fiercely upon discovering the occurrence of Granger interdependencies between the gold and equity market movements. [44]use the VECM for 2001-11 and indicate bidirectional causality i.e. the Gold rates lead to equity market returns. Further, equity market returns cause the variations in gold valuations. A one-directional causative starting from gold metal to impact equity is also confirmed by some of the studies including [45] and [46]. [47]depicts the cointegration relationship amongst the equity index and gold rates and indicates that gold rate movements are due to equity market ups and downs. No causal relationship among equity and gold is confirmed by [44] and [42].

A number of studies adequately investigate the presence of any interdependency amid world equity-markets and forex rates. However, the empirical evidence is mixed. In one of the preliminary studies in this field, [8]study 1984-93 data. They conclude the non-existence of any co-integrating association amongst the forex rate and Singapore equity market. [48]; [49];

[50]; [51]; [52];[53]; [8]; [54]etc. confirm a substantial association between equity and forex rates. However,[55]conclude no association between equity & forex markets.[56]unanimously confirm an undesirable association between these two key variables. [57] and [58] find one-way connectedness from forex to equity market valuations. In the Indian context, several studies do not detect any noteworthy association between forex and equity prices [32]; [59]; [60], [61]. On the contrary, few researchers have confirmed co-integration between forex rate and stock prices [62].

Investigators have also shown a keen interest in the past to discover the existence of any relationship amongst crude and forex rates. [63]contend that crude prices influence forex rates. [64]; [65]; [66]; [33]; [67];etc. also confirm the relationship. [68]; [69]; and [70]observe a certain connection between oil and exchange rates, whereas the negative association is detected in several other studies[71]; and [63]. [72]confirm the existence of interdependencies from forex to crude rates. But, [73]conclude no connectedness associations amongst oil and forex rates, whereas [74]observes that crude rates cause forex valuations.

Only a few of the studies have carefully examined interdependencies between gold and forex, and established that forex and gold rates are interlinked [75];[76]; [77]; [78]. [75]confirms the causality from dollar movements to the gold prices. On the contradictory, gold is prominent in causing volatility spillovers to the exchange rate. In India, [79]confirm a link between the USD/INR exchange and gold prices.

Association between crude and gold rates has also been focused on by many academic researchers. A causal relationship between these two macroeconomic indicators is observed in many predominant research works [80]; [81]; [82]. An effective relationship is established by [83]; [84]; etc. The absence of any interdependencies among oil and gold prices is validated.

There have in addition been many leading researchers who have included more than two variables in the exclusive purview of their studies out of crude oil prices, gold-rates, forex-rate, and equity-prices. [85], in the US-based study of 2000-08, find that fluctuations in crude rates and forex rates affect adversely to the US equity market. [86]shows that oil and forex rate fluctuations influence the South African equity market in a big way. [23]find interdependency between variations in oil, gold, forex, and equity. [87]observe the equity of BRICS display reliance on oil and gold valuations. [37]recognize a long-run association of gold and equity with the forex rate but there is no sign of interdependencies between equity and gold rates. [88]reasonably conclude that a plunge in gold and oil valuation leads to gradual descent in equity markets in India. [89]examines the interdependencies between gold, crude, and the Indian equity market and supports cointegration relationships. [90]also conclude that changes in equity markets influence forex and gold. In contrast, the exchange rate is positively influenced by variations in oil & gold prices. The interdependencies of oil, forex, and equity market in India during 1995-2018 and recommend the presence of long-run interdependencies among crude, forex and equity marketplaces.

While summarizing the comprehensive review of the above empirical studies, it is observed that there are many studies available on the interdependencies between any two of the identified variables, but there is the lacuna of research work done on exploring the impact of all of these four variables on each other. Further, most of the researches in this field are devoted exclusively to review the potential impact on the developed countries rather than on developing countries like India. Furthermore, several peculiar features of the Indian economy, such as high rates of inflation, ever-changing exchange rates, and interest rates, rapidly growing economy, very high dependence on crude oil and gold imports, etc., calls for studying the interdependencies in the Indian context.

2. RESEARCH OBJECTIVES

The core objectives of the present research are as given below:

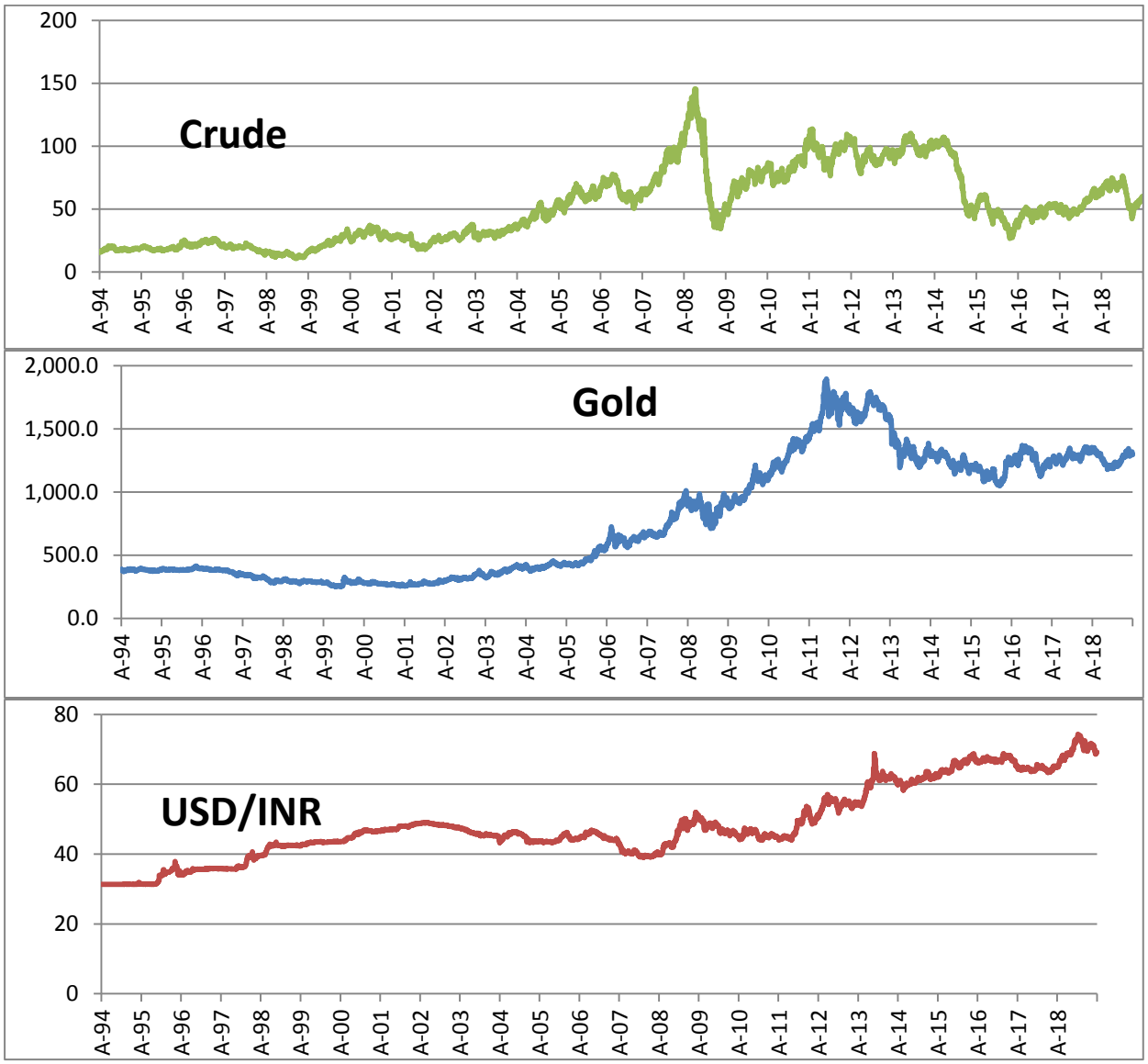
1. To find the interdependencies between crude oil prices, gold prices, forex rates, and equity market prices in India.
2. To inspect the bearing of each of the selected four variables on the other three variables.

3. DATA AND METHODOLOGY

The present empirical research is efficiently conducted by taking day-to-day data from April 1993 to March 2019. The S&P BSE Sensex has traditionally represented the Indian equity markets and historical data is collected from the BSE website. One barrel crude rate in dollars as is given by the West Texas Intermediate is taken as a substitute for crude-oil prices. The US Dollar being the most favored currencies is utilized as the foreign-currency w.r.t. INR for forex rates. The gold-rates figures are obtained from the World Gold Council. E-Views software is utilized for properly conducting several econometric tests on the selected time series.

4. RESEARCH OUTCOMES AND DISCUSSIONS

Table 1.1 depicts the summary statistics of four series of data each having the 6387 data points. Next, figure 1 portrays the graphical representations of these time-series.



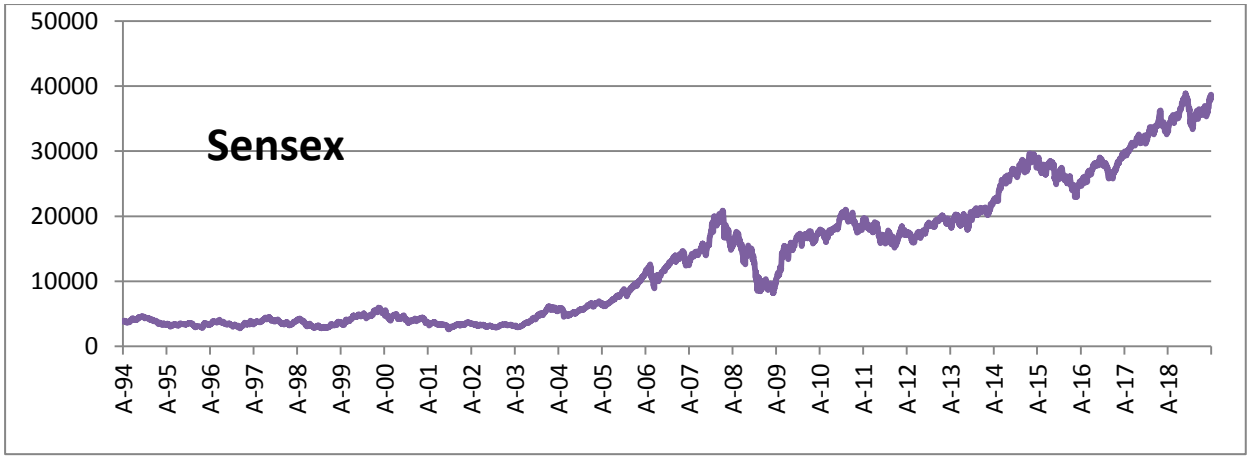


Figure 1: Graphical depiction of the chosen variables during the period of study

Table: 1.1 Descriptive Statistics

Statistic	Crude	Gold	USD/INR	Sensex
Mean	52.27	788.69	48.73	13390.60
Median	48.38	639.50	46.12	10840.59
Maximum	145.41	1895.00	74.34	38896.63
Minimum	10.66	252.80	31.35	2600.12
Skewness	0.51	0.40	0.52	0.67
Kurtosis	2.195	1.67	2.405	2.26
Observations	6387	6387	6387	6387

Firstly, the stationarity of the different series is examined. To inspect the presence of unit-root in the time series distribution ADF (1981) and PP (1988) tests are employed. The null hypothesis for the first series of data is that the crude-oil series has no unit root. The outcomes are as depicted in the table 1.2

Table 1.2: Series Stationary Test Results

Variable	Unit Root at	ADF		PP	
		t-statistic	p-values	Adj. t-Stat	Prob.*
Crude-Oil	Level	-1.863	0.3503	-1.889	0.3377
	First Diff.	-85.514	0.0000*	-85.420	0.0001*
Gold	Level	-0.707	0.8431	-0.707	0.8431
	First Diff.	-80.075	0.0001*	-80.075	0.0001*
Stock Price	Level	1.002	0.9967	1.145	0.9979
	First Diff.	-74.986	0.0000*	-74.986	0.0000*
Exchange Rate	Level	-0.520	0.8850	-0.436	0.6627
	First Diff.	-32.904	0.0000*	-78.276	0.0001*

*Significant (5%)

While analyzing outcomes of the ADF test, it is sufficiently evident from the table-2 that the observed 'p'= 0.3503 is more than 0.05. So, in this case, the null hypothesis is acknowledged whereas alternative one is overruled. This implies this series is non-stationary at 'level'. Further, it can be also be carefully observed that at the first difference series is inactive as the 'p' value is significant, and is 0.0001. This means the 'Crude-oil' series is inactive at 'first difference.' Similarly, all other variables Gold, Exchange–Rate & Stock-price at the level are non-stationary but at the leading difference these all are stationary. Furthermore, the Phillips and Perron test statistic for the crude-oil series is confirming the same. This implies the series is level-non-significant & first difference significant. Therefore, we can promptly proceed for using the Johansen co-integration test, as the specific requirement of having all the variables being level-non-significant, & first difference significant is being satisfied.

Table 1.3: Lag-Order Selection

Lag	LogL	LR	AIC	FPE	HQ	SC
0	-156379.8	-	50.16	7.17e+16	50.16	50.17
1	-72882.32	166861.0	23.38	168275.5	23.39	23.41
2	-72793.35	177.6932	23.36	164382.3	23.37	23.40*
3	-72751.18	84.15054	23.35	163008.5	23.37	23.41
4	-72730.64	40.96563	23.35	162771.3	23.38	23.43
5	-72682.51	95.94200	23.34	161102.2	23.37	23.43
6	-72642.66	79.38169	23.33	159874.4	23.37*	23.44
7	-72617.72	49.64518*	23.33*	159416.7*	23.37	23.456

* selected lag order

From the above table 1.3, it is clear that different criteria, are providing different lag lengths. We choose Schwarz criteria for further analysis and the corresponding lag length is of order 2. Subsequently, the co-integration is assessed through the application of the Johansen Cointegration Test and the outcomes are as specified in the table 1.4 and table 1.5.

Table 1.4 Trace Test Results

Hyp. CE (s)	EV	Max-Eigen	Prob.
None	0.001945	26.50	0.87
At most 1	0.001215	14.18	0.83
At most 2	0.000917	6.48	0.64
At most 3	0.000107	0.68	0.41

Table 1.5 Maximum Eigenvalue Test Results

Hyp. CE (s)	EV	Max-Eigen	Prob.
None	0.001945	12.32	0.92

At most 1	0.001215	7.69	0.92
At most 2	0.000917	5.80	0.64
At most 3	0.000107	0.68	0.41

It is explicit from the 'trace test outcomes in table 1.4 that the prob. statistic for the null hypothesis of none cointegration is 0.92 and is insignificant at a 95% level of confidence. Hence, the null hypothesis is accepted implying no co-integration. In the same way, the 'max-eigenvalue' test signifies the absence of any long-term cointegration amongst the chosen macroeconomic parameters. Therefore, an unrestricted VAR test at a lag length of 2 is properly conducted for further analysis.

In the VAR model, four equations are carefully set for the four variables. In the first equation, the Oil price represents the dependent variable, whereas crude-oil, gold, Stock-index (Sensex), and forex-rate (USD/INR) at first difference and second difference levels are taken as the independent variables. The corresponding equation is equation (1). Similarly, in the 2nd equation, the initial gold series is taken as dependent variables and all variables at the first and second difference are taken as independent variables and so on. The various equations are as provided below:

CRUDE = C(1)*CRUDE(-1) + C(2)*GOLD(-1) + C(3)*SENSEX(-1) + C(4)*USD_INR(-1) +
C(5)*CRUDE(-2) + C(6)*GOLD(-2) + C(7)*SENSEX(-2) + C(8)*USD_INR(-2) + C(9) ...(1)

GOLD = C(10)*CRUDE(-1) + C(11)*GOLD(-1) + C(12)*SENSEX(-1) + C(13)*USD_INR(-1) +
C(14)*CRUDE(-2) + C(15)*GOLD(-2) + C(16)*SENSEX(-2) + C(17)*USD_INR(-2) + C(18) ...(2)

SENSEX = C(19)*CRUDE(-1) + C(20)*GOLD(-1) + C(21)*SENSEX(-1) + C(22)*USD_INR(-1) +
C(23)*CRUDE(-2) + C(24)*GOLD(-2) + C(25)*SENSEX(-2) + C(26)*USD_INR(-2) + C(27) ...(3)

USD_INR = C(28)*CRUDE(-1) + C(29)*GOLD(-1) + C(30)*SENSEX(-1) + C(31)*USD_INR(-1) +
C(32)*CRUDE(-2) + C(33)*GOLD(-2) + C(34)*SENSEX(-2) + C(35)*USD_INR(-2) + C(36) ...(4)

Here C (1), C (2), C (3) & C (4) are first difference coefficients for the variables Crude-oil, Gold, equity-prices (Sensex) and forex (USD/INR) impacting the crude-oil prices and C (9) is the constant. Similarly, C (5), C (6), C (7) & C (8) are the corresponding second difference

level coefficients, and so on.

The values of these coefficients as resulted from applying the unrestricted VAR are as given next in table 1.6.

Table 1.6: Unrestricted VAR coefficients

Coefficient	Value	SE	t	P	Coefficient	Value	SE	T	P
C (1)	.923	.013	72.33	.000	C (19)	-.988	1.820	-0.543	.587
C (2)	.004	.002	2.271	.023	C (20)	-.329	.232	-1.421	.155
C (3)	.000	.000	3.454	.001	C (21)	1.041	.013	77.427	.000
C (4)	.090	.084	1.075	.283	C (22)	-57.48	11.96	-4.807	.000
C (5)	.075	.013	5.882	.000	C (23)	.957	1.82	0.526	.599
C (6)	-.004	.002	-2.195	.028	C (24)	.337	.232	1.455	.146
C (7)	.000	.000	-3.420	.001	C (25)	-.042	.013	-3.113	.002
C (8)	-.095	.084	-1.139	.255	C (26)	58.26	11.96	4.872	.000
C (9)	.255	.116	2.203	.028	C (27)	-27.18	16.55	-1.642	.101
C (10)	.777	.101	7.701	.000	C (28)	-.002	.002	-1.003	.316
C (11)	.981	.013	76.39	.000	C (29)	.000	.000	1.487	.137
C (12)	.000	.001	0.195	.845	C (30)	.000	.000	-2.259	.024
C (13)	-1.54	.663	-2.318	.020	C (31)	1.01	.014	73.904	.000
C (14)	-.771	.101	-7.652	.000	C (32)	.002	.002	1.026	.305
C (15)	.018	.013	1.415	.157	C (33)	.000	.000	-1.453	.146
C (16)	.000	.001	-0.123	.902	C (34)	.000	.000	2.293	.022

C (17)	1.51	.662	2.286	.022	C (35)	-.012	.014	-0.855	.393
C (18)	1.07	.917	1.165	.244	C (36)	.030	.019	1.587	.113

Impact on Crude Prices

While considering the relationship of oil rates with other variables as given in the equation (1) and observing the different coefficients as depicted in table 6, it can be discerned that C (1) and C (5) coefficients with prob. Values 0.000, are significant at 5%. This infers that crude-oil prices cause a notable effect on oil rates at first order and second-order difference levels. Further, C (2) and C (6) are in addition possessing significant values, which amply confirm that the value of gold has a substantial bearing on crude-oil prices. Furthermore, the coefficients C (3) and C (7) are also significant which means equity-prices (Sensex) have a substantial effect on crude prices at both levels of differences. Ultimately, C (4) and C (8) do not retain significant values which signify that the forex rates (USD/INR) do not exercise substantial influence on crude-oil rates.

For further in-depth insights, the joint impact of crude at first difference, and second difference on crude-oil prices at the level is adequately explored by carefully conducting Wald's test. The hypotheses set are as given under.
H0: C(1)=C(5) equals zero
H1: C(1)=C(5) does not equal zero
From the table 1.7, while considering that Wald Test results, since the sig value is less than .05, it is concluded that crude-oil is contributing both at first and second difference levels to the crude-oil prices.
Next, let us check the joint impact of gold-prices at first and second difference levels on the crude-oil prices. The hypotheses are:
H0: C(2) = C(6) = 0
H1: C(2) = C(6) $\neq$ 0
Again, the results depicts that the p-value is less than .05, which implies that the gold-prices are contributing jointly both at the first level and second difference level to the crude rates.
Further, the combined impact of the stock-prices (Sensex) at first and second difference levels on the crude-oil is studied by setting the hypotheses:
H0: C(3) = C(7) = 0
H1: C(3)= C(7) $\neq$ 0

From table 1.7 it is clear that the stock-prices (Sensex) are also jointly contributing to crude-oil prices.

Table 1.7: Wald Test Results for different hypotheses

Equation	Hypothesis	χ^2 Value	Probability	Norm. Res.	Value	SE
Equation (1)	H0: C(1)=C(5)=0	1311229	0.000	C(1)	0.922583	0.012755
				C(5)	0.075003	0.012751
	H0: C(2)=C(6)=0	16.26530	0.003	C(2)	0.003687	0.001624
				C(6)	-0.000323	9.43E-05
	H0: C(3)=C(7)=0	12.49772	0.002	C(3)	0.000326	9.43E-05
				C(7)	-0.000323	9.43E-05
Equation (2)	H0: C(10)=C(14)=0	59.52582	0.000	C(10)	0.776707	0.100854
				C(14)	-0.771473	0.100824
	H0: C(11)=C(15)=0	2560512	0.000	C(11)	0.980716	0.012839
				C(15)	0.018173	0.012839
	H0: C(12)=C(16)=0	3.112532	0.211	C(12)	0.000146	0.000745
				C(16)	-9.16E-05	0.000746
	H0: C(13)=C(17)=0	6.201518	0.045	C(13)	-1.535856	0.662509
				C(17)	1.514270	0.662456
Equation (3)	H0: C(19)=C(23)=0	0.348238	0.840	C(19)	-0.988038	1.820223
				C(23)	0.956675	1.819673
	H0: C(20)=C(24)=0	2.578577	0.275	C(20)	-0.329104	0.231655
				C(24)	0.337160	0.231661
	H0: C(21)=C(25)=0	3231655	0.000	C(21)	1.041176	0.013447
				C(25)	-0.041874	0.013453
	H0: C(22)=C(26)=0	27.04607	0.000	C(22)	-57.48276	11.95756
				C(26)	58.25476	11.95664
Equation (4)	H0: C(28)=C(32)=0	6.69379	0.0352	C(28)	-0.002088	0.002082
				C(32)	-3.48E-05	1.54E-05
	H0: C(29)=C(33)=0	2.641401	0.267	C(29)	0.000394	0.000265
				C(33)	-0.000385	0.000265
	H0: C(30)=C(34)=0	5.839404	0.045	C(30)	-3.48E-05	1.53E-05
				C(34)	3.54E-05	1.55E-05
	H0: C(31)=C(35)=0	4579715.	0.000	C(31)	1.010858	0.013678
				C(35)	-0.011695	0.013677

The study From the above results, it can be inferred that there is a substantial effect of crude, gold and equity prices at first order and second-order difference levels on the crude-oil price. There is undoubtedly non-existence of any noteworthy influence of the forex rates on crude prices at first and second-order difference levels. Also, the joint effect of crude-oil prices at

first and second difference levels, experience a significant effect on crude-oil. Moreover, jointly both stock and gold-rates managed a profound impact on crude-oil rates.

Impact on Gold Prices

In this distinct section, the notable effect of gold-rates on other selected variables is examined. From table 1.6, it can be determined that both C (10) and C (14) are contributing significantly to the prices of gold. This shows that crude at first difference and the second difference has a significant impact on the gold-rates. Further, C (11) is significant whereas C (15) is not significant this confirms that gold-prices at the first difference are contributing to the gold-rates at the level. But, the gold at the second difference level is not contributing to gold-prices. Furthermore, the stock-prices at both the levels are not at all causative to gold-prices as both the coefficients C (12) and C (16) are non-significant. Finally, the exchange rates are undoubtedly contributing to the gold prices at both the levels of difference as the values of C (13) and C (17) are significant.

While carefully ascertaining the joint impact of different contributing variables over the valuation of gold, Wald's test outcomes for the hypothesis C (11) = C (15) = 0 in the table-7, imply the joint impact of gold-rates at both the difference levels has a strong impact on gold-rates at the level. For discovering the consequence of crude-oil rates on gold, C(10)=C(14) = 0, since the value is significant, so it shows that crude-oil jointly have a key influence on gold. Further, the joint impact of both the levels of the difference of stock-prices on gold-rates is missing, as the value is non-significant one. There is a marked joint impact of exchange rates at both difference levels on the gold-prices as confirmed by the significant Wald test value.

From the above outcomes, it can be satisfactorily established that there is a substantial influence of crude rates and forex-rates at first order and second-order difference levels on the gold price. There is nonexistence of any considerable influence of the equity prices on the gold. Also, the joint effect of crude-oil prices at first and second difference levels, and forex rates at both levels of difference sustain a significant impact on gold-rates.

Impact on Stock Prices

In this distinct section, the possible influence of equity-prices on the other selected variables is tested. From table 1.6, it can be discerned that the values of the coefficients C (19) and C (23) are not significant at 95% confidence level, so crude rates exert no notable influence on the equity-prices. Further, the determined values of C (20) and C (24) are equally non-significant which effectively means that the gold-prices at both levels of difference experience no significant impact on the valuation of equity. But both C (21) and C (25) are significant, it means the stock-prices assuredly have a significant impact on both of its own levels of difference. Ultimately, C (22) and C (26) are both significant this shows that forex rates have a substantial bearing on the equity-prices.
Now, while carefully establishing the joint effect of diverse causal variables on the equity-

prices by employing the Wald's test results as given in the table 1.7 for the hypothesis C(21)=C(25) = 0, it can be established that the joint impact of stock-prices at both the difference levels has an important influence on equity-prices at level. Moreover, the value of C(19)=C(23) = 0 is non-significant which means that the crude-oil prices at both levels of difference retain insignificant influence on the equity-index movements. Furthermore, the gold prices at both levels of difference cause no substantial effect on the equity-prices. Therefore, it is evidently clear that only the equity prices at both levels and the forex rates at both levels exert joint considerable effects on equity prices.

Impact on Forex Rates:

In this specific segment, the lasting impact of selected variables on the forex rate is comprehensively examined. From table 6, it can be resolutely determined that the coefficient C(31) is significant, but C(35) is non-significant. This indicates precisely that the forex rates at first difference have significant control on forex rates at level, but the forex rates at the second difference do not impact it considerably. Further, C 28) and C(32) both are non-significant, which implies that crude has no bearing on the exchange-rates. Similarly, both C(29) and C(33) are non-significant, so gold-rates also have no effect on the exchange-rates. Furthermore, C(30) and C(34) are having significant values, convincingly showing that the stock-prices impact the exchange rates.

Now, while carefully probing the joint impact of different levels of variables on the exchange-rates, Wald's test outcomes as given in the table 1.7 for the hypothesis C(31)=C(35)= 0 indicate that the joint impact of forex-rates at both the difference levels has a substantial impact on the forex-rates at level.

Further, the value of C (22) =C (26) = 0 is non-significant which means that the crude prices at both levels of difference have no substantial bearing on the forex-rates. Similarly, the gold-prices have no influence on the forex rates. But, the equity-prices impact the exchange-rates as the value is significant.

The above study of the effect of different variables on each other is summarized in the table 1.8. From this it may be concluded that gold-rates and equity prices are impacting the crude rates; crude and forex-rates are having a bearing on gold-rates; forex-rates are influencing equity-prices which inturn impacting the forex prices. Clearly, the forex movements are uncorrelated and insensitive to the crude-oil changes. This implies a global investor may use any one of these two assets to 'hedge' or 'diversify' against the other asset. This finding is in line with several previous research outcomes including [91] and [73]. Further, gold and equity markets are found to be unresponsive to the volatilities in each other's markets and turn out to be the best hedges for the investors as concluded by many past studies [36]; [37]; [38].

5. CONCLUSION

The study explored the presence of any vibrant interdependencies between crude price, gold rate, forex rate and equity market in India during 1993-2019 with the help of the Johansen test and unrestrictive Vector Autoregressive tests. The long-term cointegration between the prudently chosen macroeconomic parameters is seen to be absconding during the duration of study. It is also witnessed that the gold and equity rates are impacting the crude prices; crude and forex-rates are impacting the gold-prices; forex-rates are impacting equity-prices, which in impacting the forex-rates.

6. REFERENCES

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