

Co-integration Analysis Between International Macroeconomic Factors and S&P Sensex Movements



Kafila , R. Vijaya Srinivas

Abstract: *The Indian stock market is fizzy and energetic; it has been going through many economic reforms since liberalization Indian economy (LPG) 1991 to till date. The Indian economy follows free market economic system, which enhance the scope of investing into stock market. Hence it prevailing significance of international macroeconomic factor on Indian Sensex movements, the present paper has investigate the long term relation and short term dynamics between international macro economic factors Capital account to Gross Domestic Production ratio (CAPGDPR), Crude oil Return (CRUDEOILR), Foreign Direct Investment return (FDIR), Foreign Institution Investment return (FIIR), Foreign Exchange Reserves growth rate (FOREXRESR) Gold return (GOLDR) Net Current account growth rate i.e (Exports divided by Imports) (NCAR) US Dollar Exchange rate to Indian Rupee returns (USDEXR) to Sensex return (SENSEXR) . The Sensex returns and International macroeconomic factors long term and short term analyzed through time series econometric tools Augmented Dickey Fuller (ADF) test check the stationarity, Johansen co integration for investigate long term relationship, Error correction Model for identify the short term dynamics. It is found that the long term co integration exists between these select international macroeconomic variables. Whereas USDEXR and FOREXRESR leads Sensex R and Sensex R corrects faster towards long run equilibrium. On the other hand CAPGDPR, CRUDEOILR, FDIR, FIIR, GOLDR, NCAR coefficients found the weak form of co movement to adjust for long run equilibrium.*

Key words: Sensex, Exchange rate, Crude oil return, Gold return, FII, FDI, Co-integration
Jel Classification: C1, C22, E44.

I. INTRODUCTION

The bloom of the economy measured through stock indices movement, the stock indices represents the composite progress of the stock market and it eventually represents the growth and development of industry and commerce of the country. Thereby the movement of stock indices influenced by fundamental of the macroeconomic factors such as Gross Domestic Production, Index of Industrial Production, Inflation, Interest rates are domestic macroeconomic factors and as well as the international macroeconomic factors as foreign exchange rate, crude oil, gold prices, balance of trade

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The domestic economies integrating with world economies and capital flows across the world. The flow of foreign investments in domestic stock markets and vice versa and free mobilization of funds has been influencing the investors' future expectations on global economic tendency. The countries domestic economic as well as world economic scenario has been bringing assortment of economic reforms into capital markets to upward movement of stock markets. The economic reforms have been change the economic fundamental like interest rates, tax structure, GDP growth, index of industrial production, inflation rate etc are some extent it plays a deterministic role in performance of the stock market, whereas the international economic factors such as interest rate, other countries GDP growth, global stock markets performance, crude oil prices, FDI, gold prices, capital and current account restrictions, balance of payments and foreign exchange rates are is not possible predict with accurate predictable.

The Indian economy was open its socialistic economic system to open and market driven economic system though LPG policy in 1991. This market driven economy brought many structural transformation in Indian capital markets, which is key to success of economic growth of the nation. Hence the stock market is key constituent to mobilize funds from lenders, investors to borrowers or corporate entities. Therefore existence of stock market played a significant role in promoting the growth of the economy, hence forth the stock market performance depends on corporate performance, whereas corporate performance depends on cash flows and opportunity cost of capital, market demand and supply, these factors influenced by underlying macroeconomic factors Gross Domestic Production (GDP), Foreign Exchange rates, Foreign Investments India (FII), Inflation, Gold Prices, Indian Industrial Production (IIP) etc, further it can be forecasted that the stock market performance influenced by not only domestic factors, but more predominate by international macro economic factors like FDI,FII, BoP, Crude oil, Gold, Foreign exchange rates and Forex reserves significantly, hence the present study focuses on co integration between Sensex to international macroeconomic factors. The macroeconomic factors and stock market performance as well relation exists among the factors measures through stock index movements in SENSEX and Nifty. The SENSEX used as proxy for assessing the performance indicator for economic efficiency of the country.

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The SENSEX composes in 1986 with the base index year 1978-79 as 100, this index compiled by selection of 30 scripts, which representing the 12 different industries, further sample selection considered highly liquid in every day trading and the true represent their respective industry with high market capitalization weightage in respective industry as a mirror for entire industrial performance thereby economy of India.

The BSE SENSEX is observed as vital indicator to assess the change in the price of securities, the Sensex movement ups and downs cause the sensitive issues related to company and economic fundamentals of the country, hence the Sensex movements reflects by change in the macroeconomic factors, which helps the investors to assess the movement of stock market and corporate world too.

II. REVIEW OF LITERATURE

- 1 R Mookerjee and Q.Yu¹ (1997) analyzed the relationship between four macro economic factors M3 supply, Forex reserves, M1 and Forex rate and Singapore Stock return, they found Forex reserve, M3 and M1 money long-run relation exists with securities return, whereas Forex rate to stock return not found in long term relation
- 2 Pethe and Karthik (2000) their study on relationship between Indian stock market and macroeconomic factors by using monthly time series data, the study didn't reveal any long run relationship exists between stock market to macroeconomic factors.
- 3 Sangeeta Chakravarthy² (2005) study conducted to analyze the association exists among stock exchange return to macroeconomic determinants over a period of 1991 to 2005, she found the positive impact of inflation, money supply and IIP causality on index return, on the other hand no relationships exists in exchange rate, gold price with stock return
- 4 Wong et al³ (2005) their study results of co-integration shown there is no relationship exists with money supply and interest rates in US, whereas in Singapore it found long run equilibrium with macroeconomic factors.
- 5 K Pal and R Mittal⁴ (2011) had studied co-integration among macroeconomic factors forex rate, inflation rate, domestic savings and interest rates, the result found forex rate and inflation show significance impact on Sensex, whereas there is no integration between domestic and interest rates.
- 6 Pimenta Junior, Hironobu and Higuchi⁵ (2008) conducted a research on relationship among Portuguese index and macroeconomic determinants, it was found that exchange rate causes on Ibovespa, this results virtually true, rest of the factors not shown the significance.
- 7 Sezgin et al⁶ (2008) analyzed relationship of Istanbul exchange and macroeconomic dynamics, results of the study found that unidirectional relationship macroeconomic factors and stock exchange and as well as long run relationship.
- 8 Ngoc (2009) analyzed the relationship between Vietnam exchange stock prices to macroeconomic variable interest factor and further he extends study relationship between Vietnam stock prices and US stock prices, the study found not only the imperative relationship between money market, GDP of Vietnam on stock prices, but also US stock prices too.
- 9 Joseph Tagne Talla⁷ (2013) had analyzed the significance of macroeconomic dynamics on index return of Stockholm exchange, the outcome seen inverse relation between stock return and currency dilution as well as inflation, on the other hand interest rate had partial negative impact on the stock returns, similarly with money supply and stock returns, whereas bidirectional causality found in selected macroeconomic factors to stock returns
- 10 Mgamal⁸ (2012) analyzed the effect of various macroeconomic factors inflation, forex rate and interest rate on security prices of KSA and UAE, it found that short run stock price index of KSA is negatively influenced exchange rate, further it is positively influenced by the exchange rate, the long term shown stock price index of UAE is negatively affected by the exchange rate
- 11 Mahmood Yahyadehfar et al⁹ (2012) investigate significance of macroeconomic dynamics on Iranian stock prices, the study results that stock prices were auto correlated and house prices main cause of stock price fluctuation
- 12 Samanta. Subarna and Ali (2012) examined the co-movement of selected macroeconomic factors gold prices, stock prices, real exchange rate and crude oil prices by using twenty one year's period, the study results found co integration exists between the factors.

III. NEED AND SIGNIFICANCE OF THE STUDY

There are numerous research has been done so far on macroeconomic factors influencing on Stock market and as well as the association amongst them, but there all these studies were found different results, few studies found positive relation and few were found the inverse relation between stock market performance to macro economic factors, but still it is dynamic issue to resolve as the changes in technology, world economies are moving towards integration and globalizing capital market flows bringing the lot of changes into the stock markets. Hence the present study focuses dynamism of international macroeconomic determinants influence on the SENSEX performance and as well as relationship exists among them. This study can helps to investors and policy makers to manage and adjust to the international macroeconomic factors on stock market performance and investment environment.

IV. OBJECTIVE OF THE RESEARCH

To study the dynamic relationship and causality among S&P Sensex return to international macroeconomic factors Capital account to Gross Domestic Production ratio (CAPGDPR), Crude oil Return (CRUDEOILR),

Foreign Direct Investment return (FDIR), Foreign Institution Investment return (FIIR), Foreign Exchange Reserves growth rate (FOREXRESR) Gold return (GOLDR) Net Current account growth rate i.e (Exports divided by Imports) (NCAR) US Dollar Exchange rate to Indian Rupee returns (USDEXR).

V. DATA COLLECTION AND METHODOLOGY

Data collected through secondary source through Bombay Stock Exchange, SEBI and RBI, WTI council, World bank, IMF the data collected on annual basis for the period of twenty five years 1993-94 to 2017-18.

The factors consider for the study are BSE Sensex returns as depend factors and international macroeconomic factors Capital account to Gross Domestic Production ratio (CAPGDPR), Crude oil Return (CRUDEOILR), Foreign Direct Investment return (FDIR), Foreign Institution Investment return (FIIR), Foreign Exchange Reserves growth rate (FOREXRESR) Gold return (GOLDR) Net Current account growth rate i.e (Exports divided by Imports) (NCAR) US Dollar Exchange rate to Indian Rupee returns (USDEXR) as influencing factors (predictors).

VI. TOOLS USED FOR THE STUDY

Economic theories are often proving that a relationship exists in a series of economic factors, thus the series of economic factors follows a short dynamics in price movements due to economic and other forces influence on price movements, but over a due course of time the series of economic factors possess the long run equilibrium. The data analyzed through descriptive statistics and correlation and regression analysis, ADF test and Johansen Co-integration test used for measuring the objective of the study.

TEST OF STATIONARITY

The time series are by virtue random in nature, therefore it is prerequisite to test the stationarity of time series parameters before undertaking any econometric estimation, and it helps us to understand series that has a trend, volatility and economic relation between time series data. In order to determine the order of integration of each return series, in ADF test used test the stationarity at order I(0) level null hypothesis is existence of unit root, the null hypothesis at order level of unit root are proved to non stationarity then further test the with first level of difference to bring out the stationarity in time series, now it is amenable for estimation of economic relation.

JOHANSEN'S CO INTEGRATION

The Johansen's co integration has been carried out determine long term relationship exists between two or more economic series. If two or more series are themselves are non-stationary, but their linear combination is stationary, then the series is called to be co integrated. The co integration analysis made to know that how these parameters move together two wards long run equilibrium and level of divergence of respective parameters over a long run equilibrium in the short run. The co integrating vectors identifies the existence of long run equilibrium while error correction dynamics describes co movement process that helps achieve long run relation. The observed deviation caused not only stochastic process and random shocks in the economic system but other forces in market like arbitrage process. Co integration it implies linear combination of both series cancelling stochastic trend, there by producing stationarity among the series.

Vector Error Correction Model (VECM)

Once test for co integration performed between the economic series according granger representation or Johansen test, if two or more pairs of parameters co integrated, then the relationship between them expressed as Error Correction model (Guajarati, 2005). Therefore it employed to probe short term diffusions between them. The co efficient of Error Correction term indicates that the speed at which return series to equilibrium, if the series is less than zero that convergence to long run equilibrium and if it is positive and zero the series diverges from equilibrium.

1. DATA ANALYSIS AND DISCUSSION

VII. THE ANALYSIS OF RETURNS OF SENSEX AND CAPGDPR, CRUDEOILR, FDIR, FIIR, FOREXRESR, GOLDR, NCAR, USDEXR

The Analysis of Sensex return and international macroeconomic parameters Capital Account to Gross Domestic Production ratio (CAPGDPR), Crude oil Return (CRUDEOILR), Foreign Direct Investment return (FDIR), Foreign Institution Investment return (FIIR), Foreign Exchange Reserves growth rate (FOREXRESR) Gold return (GOLDR) Net Current account growth rate i.e (Exports divided by Imports) (NCAR) US Dollar Exchange rate ot Indian Rupee returns (USDEXR) over a period of twenty five years 1993-94 to 2017-18 presented through table 1

Co-integration Analysis Between International Macroeconomic Factors and S&P Sensex Movements

Table – 1
Return analysis of Sensex R and International macroeconomic parameters
(Returns in percentages)

YEAR	SENSEX R	USD EX R	GOLD R	FOREXRE S R	FDI R	FII R	NCA R	CAP GDP R	CRUDE OIL R
1994	65.71	0.44	3.75	96.53	90.47	1395.72	9.01	1.5	-17.27
1995	-13.71	0.39	0.49	32.04	124.48	7.32	-4.08	1.5	5.12
1996	3.24	9.06	1.44	-6.76	73.82	-23.44	-3.16	1.3	3.87
1997	-0.17	4.56	4.89	27.62	39.64	27.92	3.15	1.6	21.73
1998	15.82	9.97	1.25	22.09	32	-42.22	-0.76	1.3	-17.24
1999	-3.92	7.44	1.36	19.07	-21.65	-103.78	2.53	0.6	-27.48
2000	33.73	2.76	2.75	20.22	-9.85	-5201.95	-0.21	1.2	69.02
2001	-27.93	6.96	2.75	18.86	97.11	-3.84	3.66	1.5	30.62
2002	-3.75	4.63	5.68	33.89	58.83	-23.55	7.68	1.7	-20.27
2003	-12.12	-2.65	4.48	36.9	-16.65	-50.85	2.7	1.2	20.99
2004	83.38	-8.55	10.19	35.59	-18.5	1003.4	5.82	2.6	7.46
2005	16.14	0.71	4.61	26.32	36.9	-19.94	-13.12	2.1	43.5
2006	73.73	1.94	28.7	9.25	45.92	32.14	-3.27	2.6	32.87
2007	15.89	-2.26	16.26	28.36	160.54	-42.66	1.27	3.1	8.1
2008	19.68	-8.28	34.82	42.59	35.61	246.04	-1.04	5	27.13
2009	-37.94	27.41	20.59	3.71	15.23	-157.97	-2.53	2.3	3.65
2010	80.54	-11.4	9.07	-1.88	9.14	-341.3	-2.92	4.8	-17.24
2011	10.94	-1.09	25.41	8.05	-99.07	-99.09	0.33	3.5	17.74
2012	-10.5	14.59	25.6	10.66	33.94	-38.61	-3.55	2.8	16.97
2013	8.23	6.31	6.44	5.46	-15.06	71.16	-1.49	3	-5.38
2014	18.85	10.5	3.25	15.11	16.98	-79.74	10.04	1.9	7.64
2015	24.89	4.14	0.13	16.91	26.44	768.76	1.17	3.8	-18.48
2016	-9.36	5.98	2.5	11.28	31.75	-110.55	0.31	2	-44.44
2017	16.88	-2.25	1.08	0.82	10.96	-285.57	1.67	2.2	6.58
2018	11.3	0.32	1.97	15.12	-2.75	182.54	-5.09	2.4	12.28
Avg R	15.18	3.27	8.78	21.11	30.25	-115.6	0.32	2.3	6.7

Source: RBI, WORLD BANK, SEBI, MOF and BSE

VIII. ANALYSIS AND DISCUSSION

The Table 1 presents the growth rate of Sensex return and international macroeconomic parameters Capital Account to Gross Domestic Production ratio (CAPGDP), Crude oil Return (CRUDEOILR), Foreign Direct Investment return (FDIR), Foreign Institution Investment return (FIIR), Foreign Exchange Reserves growth rate (FOREXRESR) Gold return (GOLDR) Net Current account growth rate i.e (Exports divided by Imports) (NCAR) US Dollar Exchange rate of Indian Rupee returns (USDEXR) over a period of 25 years from 1993-94 to 2017-18.

IX. EMPIRICAL ANALYSIS ON TEST OF STATIONARITY

The ADF test used test the stationarity at order I(0) level null hypothesis is existence of unit root, the null hypothesis at order level of unit root are proved to non stationarity then further test the with first level of difference to bring out the stationarity in time series, now it is amenable for estimation of economic relation.

Table 2

Stationarity Analysis of SENSEX R AND CAPGDP, CRUDEOILR, FDIR, FIIR, FOREXRESR, GOLDR, NCAR and USDEXR

Augmented Dickey Fuller (ADF) test

SNo		ADF test at level difference I(0) order			ADF test at first difference I(1) order	
		Test critical values	t-Statistic	Prob.* I (0) order	t-Statistic	Prob.* I (1) order
1	SENSEX R	ADF test statistic	-6.570951	0.0000	-5.192081	0.0005
		1% level	-3.737853		-3.788030	
		5% level	-2.991878		-3.012363	
		10% level	-2.635542		-2.646119	
2	CAP_GDP_R	ADF test statistic	-1.431567	0.5491	-10.25974	0.0000
		1% level	-3.752946		-3.752946	
		5% level	-2.998064		-2.998064	
		10% level	-2.638752		-2.638752	
3	CRUDEOIL_R	ADF test statistic	-4.512021	0.0017	-5.097361	0.0006
		1% level	-3.737853		-3.808546	
		5% level	-2.991878		-3.020686	
		10% level	-2.635542		-2.650413	
4	FDI_R	ADF test statistic	-3.591741	0.0139	-6.620756	0.0000
		1% level	-3.737853		-3.752946	
		5% level	-2.991878		-2.998064	
		10% level	-2.635542		-2.638752	
5	FIIR	ADF test statistic	-4.905454	0.0007	-4.905454	0.0001
		1% level	-3.737853		-3.955671	
		5% level	-2.991878		-2.931878	
		10% level	-2.635542		-2.345216	
6	FOREX_RES_R	ADF test statistic	-6.235594	0.0000	-9.083329	0.0000
		1% level	-3.737853		-3.769597	
		5% level	-2.991878		-3.004861	
		10% level	-2.635542		-2.642242	
7	GOLD_R	ADF test statistic	-2.494865	0.1290	-7.312995	0.0000
		1% level	-3.737853		-3.752946	

Co-integration Analysis Between International Macroeconomic Factors and S&P Sensex Movements

		5% level	-2.991878		-2.998064	
		10% level	-2.635542		-2.638752	
8	NCA_R	ADF test statistic	-1.960636	0.3009	-4.403247	0.0023
		1% level	-3.737853		-3.752946	
		5% level	-2.991878		-2.998064	
		10% level	-2.635542		-2.638752	
9	USD_EX_R	ADF test statistic	-5.922650	0.0001	-7.312358	0.0000
		1% level	-3.737853		-3.769597	
		5% level	-2.991878		-3.004861	
		10% level	-2.635542		-2.642242	

*MacKinnon (1996) one-sided p-values.

Automatic lag length selection based on SIC: 0 to 4

Null Hypothesis: Ho: There is Unit root exists in SENSEX R AND CAPGDPR, CRUDEOILR, FDIR, FIIR, FOREXRESR, GOLDR, NCAR and USDEXR

Table 3
Analysis of stationarity among Cross –sections of international macroeconomic parameters

Null Hypothesis: Unit root	Method	At Level Difference		I(1) difference	
		Statistic	Prob.**	Statistic	Prob.**
	ADF - Fisher Chi-square	213.244	0.0000	186.254	0.0000
	ADF - Choi Z-stat	-12.7566	0.0000	-11.6436	0.0000

Automatic lag length selection based on SIC: 0 to 3

Cross-sections included: 9

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality

ANALYSIS AND DISCUSSION

The table 2 presents the stationarity analysis of SENSEX R and CAPGDPR, CRUDEOILR, FDIR, FIIR, FOREXRESR, GOLDR, NCAR and USDEXR, it is observed that CAPGDPR, GOLDR and NCAR non stationary at I(0) order that the null hypothesis rejects at critical values of t test results at 1%,5% and 10% significance level, whereas SENSEX R AND CRUDEOILR, FDIR, FIIR, FOREXRESR and USDEXR, at I(0) order level only attains the stationarity. After first difference order level I(1) all the parameter were attain the stationarity at 1%,5% and 10% level of significance, now these time series makes possible for investigate the existence of long term economic relation as well as co-integration and short term dynamics among the series.

It is also found from the table 3 cross-section parameters SENSEX R and CAPGDPR, CRUDEOILR, FDIR, FIIR, FOREXRESR, GOLDR, NCAR and USDEXR were

attains the stationarity at I(0) order and first difference I(1) order level with chi-square and z statistics.

2. LONG TERM CO INTEGRATION ANALYSIS BETWEEN SENSEX R and CAPGDPR, CRUDEOILR, FDIR, FIIR, FOREXRESR, GOLDR, NCAR and USDEXR

The long run relation among the macroeconomic variable and their co movement measure to find the efficiency and inter relationship, the co-integration analysis used to investigate the long run relation exists between Sensex R and international macroeconomic parameters CAPGDPR, CRUDEOILR, FDIR, FIIR, FOREXRESR, GOLDR, NCAR and USDEXR, if there is at least one co integration vector exists then it can confirms long run relation establish between the Sensex R and macroeconomic factors and vice-versa.

X. JOHANSEN’S CO INTEGRATION

CAPGDPR, CRUDEOILR, FDIR, FIIR, FOREXRESR, GOLDR, NCAR and USDEXR.

The Johansen’s co integration has been carried out to determine long term relationship exists between Sensex R and

. Table 4

JOHANSEN’S CO INTEGRATION ANALYSIS BETWEEN SENSEXR AND CAPGDPR, CRUDEOILR, FDIR, FIIR, FOREXRESR, GOLDR, NCAR and USDEXR

Rank	Eigenvalue	Trace test	P value	Lmax test	p value
USDEXR	0.96278	299.86	[0.0000]	78.979	[0.0002]
GOLDR	0.92475	220.88	[0.0000]	62.086	[0.0070]
FOREXRESR	0.81227	158.80	[0.0018]	40.146	[0.3505]
FDIR	0.79762	118.65	[0.0063]	38.343	[0.1636]
FIIR	0.72402	80.310	[0.0400]	30.898	[0.2258]
NCAR	0.61818	49.412	[0.1479]	23.107	[0.3330]
CapGDPR	0.46117	26.305	[0.3180]	14.841	[0.5274]
CRUDEOILR	0.23500	11.464	[0.3571]	6.4292	[0.7732]
SENSEX	0.18924	5.0349	[0.0248]	5.0349	[0.0248]

Number of equations = 9
Lag order = 1
Estimation period: 1995 - 2018 (T = 24)
Unrestricted trend and constant
Log-likelihood = -729.174 (including constant term: -797.283)
H0: there is no co-integration between international macroeconomic and Sensex
Ha: there is co-integration between international macroeconomic and Sensex

hypotheses tests for no co integration equation exists between them are rejected. The analysis shows that more than one co integration equation; there are nine equations of international macroeconomic factors USDEXR, GOLDR, FOREXRESR, FDIR, FIIR and Sensex exhibits presence of co-integration equation between them. The other hand NCAR CapGDP and Crude oil didn’t found the co integration existence. With the co integration established, error correction model applied to understand the short term dynamism, which factor corrects faster the equilibrium of convergence in long run between the international macroeconomic factors to Sensex.

The table 4 shows Trace and Eigen value tests for international macroeconomic factors and Sensex, both null

Co-integration Analysis Between International Macroeconomic Factors and S&P Sensex Movements

Table 5

SENSEX AND CAPGDP, CRUDEOILR, FDIR, FIIR, FOREXRESR, GOLDR, NCAR, USDEXR

Beta (co integrating vectors)

	USDEXR	GOLDR	FOREXRESR	FDIR	FIIR	NCAR	CapGDP	CRUDEOILR	SENSEX
USDEXR	-0.035989	0.11595	0.030286	-0.05494	-0.10899	0.012655	-0.11721	-0.039609	0.014029
GOLDR	-0.0074917	0.042637	0.021298	0.038863	0.078364	0.0069344	0.099940	-0.071821	-0.00693
FOREXRESR	-0.032468	-0.011523	0.016565	-0.047296	0.026156	-0.0083663	-0.013624	0.0036024	0.002748
FDIR	-0.0067028	0.001235	-0.00151	0.000496	-0.011109	-0.0087496	0.015477	0.000122	0.001430
FIIR	0.000424	3.8680	-0.00017	-0.000363	-0.000160	0.000902	0.000259	0.000543	-7.99561
NCAR	0.019181	0.058179	-0.01952	0.045675	-0.065904	-0.018728	-0.050929	-0.073750	0.182754
CapGDP	-0.034377	-0.39637	-0.59251	-0.45173	-1.0238	-0.013309	-1.3123	-0.81795	0.208001
CRUDEOILR	0.027687	-0.012538	0.025720	-0.026966	-0.023757	0.013873	-0.000996	0.017170	-0.0010965
SENSEX	-0.020138	0.010310	0.021599	0.015005	-0.015332	0.015802	-0.000100	0.0071172	-0.0052700

Table 6 SENSEXR AND CAPGDP, CRUDEOILR, FDIR, FIIR, FOREXRESR, GOLDR, NCAR, USDEXR

Alpha (adjustment vectors)

	USDEXR	GOLDR	FOREXRESR	FDIR	FIIR	NCAR	CapGDP	CRUDEOILR	SENSEX
USDEXR	0.022323	-10.495	0.21585	0.43923	1.8578	3.0977	0.23924	-1.7693	-0.69609
GOLDR	0.49999	-4.2123	-1.8839	1.7527	-2.3567	-1.5887	-0.23711	3.2235	1.1241
FOREXRESR	9.3016	4.2853	-0.46476	11.397	-5.6878	-1.9167	2.1581	1.6957	-2.7485
FDIR	9.3444	2.5012	41.630	2.8698	19.575	18.137	-14.478	1.9966	-3.3747
FIIR	207.59	-383.12	830.40	46.388	-387.90	-793.89	-150.02	-164.61	-11.065
NCAR	0.81172	0.17042	-0.54856	-0.24223	0.05848	-1.9907	-0.19901	0.57330	-1.5143
CapGDP	0.16877	0.64787	0.29347	-0.044525	-0.0384	-0.31053	0.29765	0.24021	0.15548
CRUDEOILR	-11.699	2.7985	-14.196	16.434	13.391	2.8090	1.0108	3.5525	3.5485
SENSEX	27.014	21.864	-12.808	-14.934	5.8128	-12.862	0.90459	7.2953	4.7844

Table 7 SENSEXR AND CAPGDP, CRUDEOILR, FDIR, FIIR, FOREXRESR, GOLDR, NCAR, USDEXR

Long-run matrix (alpha * beta')

	USDEXR	GOLDR	FOREXRESR	FDIR	FIIR	NCAR	CapGDP	CRUDEOILR	SENSEX
USDEXR	-1.3663	-0.10310	0.11414	-0.058479	0.0010626	-0.78368	2.8781	0.094896	-0.085888
GOLDR	-0.50712	-0.61405	-0.11222	0.033582	0.00027598	0.046201	2.3192	0.059241	-0.039821
FOREXRESR	-0.24117	0.19999	-1.0617	0.058947	0.00093083	0.63086	-5.8334	0.023031	0.10110
FDIR	0.72352	1.1276	0.77707	-0.72602	0.0067766	-2.0134	-30.893	1.0597	0.79979
FIIR	26.887	-37.399	7.1530	5.7971	-0.86698	25.787	368.67	26.195	2.8057
NCAR	-0.064950	-0.0797	-0.00715	0.0070727	-0.0008931	-0.25032	-0.21711	-0.004542	-0.050346
CapGDP	0.038419	0.03713	-0.00715	0.0072053	-1.5974e-0	0.037056	-0.92762	0.005561	0.0054949
CRUDEOILR	-2.2206	1.4334	-0.32932	-0.040637	-0.0061143	0.36614	-16.961	-1.3903	0.049991
SENSEX	0.87125	-0.22373	-0.34811	-0.072360	0.011192	1.5062	-7.1984	0.34969	-1.0851



ANALYSIS AND DISCUSSION

The co integration long run matrix table 7 shows the product of Alpha and Beta that adjustment vector (speed of information) correction and co integrating vector between the parameters, the FDIR, FIIR and CAPGDPR weak adjustment vector to lag information, but speed of adjustment integration happened through USDEXR, , GOLDR, FOREXRESR, NCAR and CRUDEOILR to Sensex R (vertical Colum of Sensex R), on the other hand the speed of co integrating vector happened between USDEXR, GOLDR, FDIR,NCAR and Sensex R, whereas speed of co integrating vector found very poor in case of FOREXRESR, FIIR, CAPGDPR and CRUDEOILR to Sensex R . Hence it can conclude that the long term co integration exists between these select international macroeconomic variables.

3. EFFICIENCY IN CO MOVEMENT BETWEEN SENSEX R AND CAPGDPR, CRUDEOILR, FDIR,

FIIR, FOREXRESR, GOLDR, NCAR and USDEXR IN SHORT TERM (VECTOR ERROR CORRECTION MODEL)

Once test for co integration performed between SENSEX R and CAPGDPR, CRUDEOILR, FDIR, FIIR, FOREXRESR, GOLDR, NCAR and USDEXR according granger representation or Johansen test, It has estimated error correction in international macroeconomic series is negative or positive, it indicates that decrease (increase) in the previous period’s equilibrium error leads to a decrease (increase) in the current period Sensex R, in same way if the Sensex R series coefficient is positive (negative), it implies that increase (decrease) in previous period equilibrium error leads to an increase (decrease) in macroeconomic series. The both error correction coefficient suggests that sustainable long run equilibrium is achieved by filling the gap between Sensex R and macroeconomic series persuades itself.

Table 8

The SHORT TERM EFFICIENCY IN CO MOVEMENT BETWEEN SENSEX R AND CAPGDPR, CRUDEOILR, FDIR, FIIR, FOREXRESR, GOLDR, NCAR and USDEXR (VECTOR ERROR CORRECTION MODEL)

		<i>Coefficient</i>	<i>Std. Error</i>	<i>t-ratio</i>	<i>p-value</i>
Equation 1: d_USDEXR	const	5.39408	2.53493	2.128	0.0460**
	EC1	-5.73434e+012	1.77049e+012	-3.239	0.0041***
Equation 2: d_GOLDR	const	-1.62012	2.95011	-0.5492	0.5890
	EC1	-8.62484e+011	2.06046e+012	-0.4186	0.6800
Equation 3: d_FOREXRESR	const	3.20376	5.80354	0.5520	0.5870
	EC1	-9.68540e+012	4.05341e+012	-2.389	0.0268**
Equation 4: d_FDIR	const	1.23760	18.3817	0.06733	0.9470
	EC1	-1.98915e+013	1.28385e+013	-1.549	0.1370
Equation 5: d_FIIR	const	403.958	484.830	0.8332	0.4146
	EC1	-4.75539e+014	3.38623e+014	-1.404	0.1756
Equation 6: d_NCAR	const	1.15475	1.35892	0.8498	0.4055
	EC1	-3.70256e+010	9.49120e+011	-0.03901	0.9693
Equation 7: d_CapGDPR	const	-0.381182	0.265419	-1.436	0.1664
	EC1	2.62238e+011	1.85378e+011	1.415	0.1726
Equation 8: d_CRUDEOILR	const	-12.3994	10.0322	-1.236	0.2308
	EC1	1.21417e+013	7.00682e+012	1.733	0.0985*

Sensex Dependent factor

OLS, using observations 1996-2018 (T = 23) EC Error Correction

H0: there is no co-movement between international macroeconomic and sensex

Ha: there is co-movement between international macroeconomic and sensex

ANALYSIS AND DISCUSSION

Table 8 presents the short term dynamics between SENSEX R and CAPGDPR, CRUDEOILR, FDIR, FIIR, FOREXRESR, GOLDR, NCAR and USDEXR, the error correction (EC) coefficient between USDEXR and FOREXRESR to Sensex R found negative value -5.73434

and -9.68540 respectively, it is observed that the P value was found significant to reject null hypothesis, it indicates that USDEXR and FOREXRESR leads Sensex R and Sensex R corrects faster towards long run equilibrium. Whereas CAPGDPR, CRUDEOILR, FDIR, FIIR, GOLDR, NCAR coefficients found were positive and their P Value also not significant to reject Null hypothesis, hence it can concludes that weak form of co movement to adjust for long run equilibrium.



XI. SUMMARY AND CONCLUSION

The summary of findings presented through analysis

It is found more than one co integration equation exists from the nine equations of international macroeconomic factors USDEXR, GOLDR, FOREXRESR, FDIR, FIIR and Sensex exhibits presence of co-integration equation between them. The other hand NCAR CapGDP and Crude oil didn't found the co integration existence. The presence of co integration establishment indicate to check the short term dynamism through error correction model, which factor corrects faster the equilibrium of convergence in long run between the international macroeconomic factors to Sensex.

The adjustment vector (speed of information) correction and co integrating vector between the parameters, the FDIR, FIIR and CAPGDPR weak adjustment vector to lag information, but speed of adjustment integration happened through USDEXR, , GOLDR, FOREXRESR, NCAR and CRUDEOILR to Sensex R, on the other hand the speed of co integrating vector happened between USDEXR, GOLDR, FDIR,NCAR and Sensex R, whereas speed of co integrating vector found very poor in case of FOREXRESR, FIIR, CAPGDPR and CRUDEOILR to Sensex R . Hence it can conclude that the long term co integration exists between these select international macroeconomic variables.

The short term dynamics between SENSEX R and CAPGDPR, CRUDEOILR, FDIR, FIIR, FOREXRESR, GOLDR, NCAR and USDEXR, the error correction (EC) coefficient between USDEXR and FOREXRESR to Sensex R found negative indicates that USDEXR and FOREXRESR leads Sensex R and Sensex R corrects faster towards long run equilibrium. Whereas CAPGDPR, CRUDEOILR, FDIR, FIIR, GOLDR, NCAR coefficients found positive, hence it can concludes that weak form of co movement to adjust for long run equilibrium.

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