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Relationship between Foreign Capital Inflows and Macro-economic Aggregates: A Co-integration Approach

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Abstract

The present paper is attempted to examine the relationship between foreign capital inflows and selected macro-economic aggregates using Johansen Cointegration technique. The monthly data of the various selected macro-economic variables, namely, Foreign Capital Inflows (CI), Export, Import, Foreign Exchange Reserves, Wholesale Price Index, Index of Industrial Production as a proxy of GDP (IIP), Real Effective Exchange Rate (REER), BSE Sensex, Exchange Rate, Openness and Dummy for 2008 crisis for the period ranging from April 2000 to March 2015 were collected. The results confirm that long-run equilibrium exists between the capital inflows and selected macro-economic variables. It shows that the relationship between capital inflows and BSE Sensex, Foreign Exchange Reserve, Index of industrial production, Exchange rate, Openness is significantly positive. However, the relationship between capital inflows and Wholesale Price Index, Import, Export, and Dummy for 2008 is found significantly negative. Moreover, the coefficient of REER is found statistically insignificant. It is recommended that the Government of India should give focus on reducing the inflation rate, encourage trade openness in the market which would cause an increase in growth rate of the economy. The study also recommends that government should give focus more on policies that are investment friendly and will help in attracting large foreign investment.

Keywords: *Foreign Capital Inflows, Foreign Exchange Reserves, Inflation Rate, Stationarity, Co-integration, Macro-economic.*

1. Introduction

The link between financial developments and economic growth is well established. Financial developments can be best considered as a facilitator of economic growth, but a feedback relationship can exist between these two. The financial sector of most of the underdeveloped and developing economies were characterized by policies dubbed as financial repression until the seventies; i.e. they were often characterized by celling imposed upon interest rates, high reserve requirement on commercial bank and the presence of directed or preferential credit policies and by inflation taxes (Roy, 2017). All developing countries need to attract a flow of net inward foreign investment in some form and for an extended period as a supplement to domestic savings during the process of development. Thus, a nation must be able to generate inflow funds to supplement its sustainable development initiatives. Both direct and portfolio investment can promote sustainable growth in developing, and industrialized, economies, albeit in different ways with the right policies both can contribute to a strong and healthy economy (Evans, 2002). The eruption of the financial crisis in East Asia has raised a few important questions concerning the benefits of capital flows to emerging market economies (UNCTAD, 1999). After the opening up of the borders for capital movement these investments have grown in leaps and bounds. But it had varied effects across the countries. In developing countries, it has been perceived that foreign capital is one of the most important elements which increases the productivity and also constructs the foreign exchange reserve to meet trade deficits. At the end of January 2003, India had attracted a total foreign investment of around US$ 48 billion out of which US$ 23 billion is in the form of FPI. This shows the importance of FPI in the overall foreign investment programme (Rai and Bhanumurthy, 2004). Khanna (2002) opined that the due to increased short term capital flow, the overall cost of economy may be substantially higher than any current or potential benefits. There is almost a universal agreement on the importance of portfolio capital in the economic development of an emerging or developing economy. Capital flows affect the wide range of macroeconomic variables like exchange rates, interest rate, foreign reserves, domestic monetary conditions as well as savings and investment (Seth and Verma, 2007). In addition, the positive performance of macroeconomic variables attracts the huge number of global investors thereby increasing the capital flows in our economy. It follows from the earlier studies that in general large open economies with a higher growth rate attract more inflows than small closed economies with a sluggish growth rate (Singh, 2016). Considering the dominant role of capital inflows in growth of Indian economy, the present paper attempts to explore the

relationship between capital inflows and macro-economic variables. This paper is categorized into five sections. Section 1 introduces the background of the topic. Detailed methodology employed in the paper is explained in section 2. Section 3 deals with results and discussion of unit root test (ADF) and Johansen's Cointegration test. Last section 4 concludes the findings and implications of the paper.

2. Research Methodology

2.1 Objective

The purpose of this paper is to explore the relationship between capital inflows and macro-economic variables using Co-integration approach.

2.2 Database and Period of the study

To accomplish the research objective, the monthly data of the various selected macro-economic variables for the period ranging from April, 2000 to March, 2020 are collected. Data are gathered from the handbook of statistics in Indian economy (RBI). The present study has based on monthly data but monthly data of GDP is not available. The choice of IIP as a Proxy for economic growth has taken for two reasons. First, IIP is significantly correlated with GDP (0.97 with a significance level of 0.01) as well as with the real output of services as a robust proxy for economic growth. Second, IIP is found to be reliable leading indicator of business cycles in India (Mazumdar, 2005).

2.3 Selection of the variables

To examine the relationship between foreign capital inflows and macro-economic aggregates, the variables of the study, namely, *capital inflows (CI), Export, Import, Foreign Exchange reserves, wholesale price Index, and Index of Industrial production as a proxy of GDP (IIP), Real Effective exchange Rate (REER), BSE Sensex, Exchange Rate, Openness, Dummy for 2008 crisis* are selected. The description of selected macro-economic variables is presented in **Table 1**. To make lesser order of integration as per description given about the variables under study these have been taken in logarithmic form to make them stationary. Further, the coefficients of log linear model provide elasticity's which can be interpreted in the form of percentages and free from quantification of variables under evaluation. Dummy variable has been incorporated for 2008 global financial crisis; value of 0 has been assigned for the period April 2000 to July 2008. Value of 1 has been assigned from August 2008 to March 2020.

2.4 Data Analytical Techniques

To analyze the collected data, advanced econometric models such as Unit Root test, Johansen Cointegration and VECM approaches have been employed.

Table 1. Description of Macro-economic Variables

Acronyms	Construction of variable	Data source
LNCI	Natural Log of Capital Inflows	www.rbi.org .in
LNBSE	Natural Log of BSE SENSEX	www.bse.nic .in
LNOP	Natural Log of Openness	www.rbi.org .in
LNIIP	Natural Log of Index of Industrial Production	www.rbi.org .in
LNER	Natural Log of Exchange Rate	www.rbi.org .in
LNFER	Natural Log of Foreign Exchange Reserves	www.rbi.org .in
LNWPI	Natural Log of Wholesale Price Index	www.rbi.org .in
LNREER	Natural Log of REER	www.rbi.org .in
LNIMP	Natural Log of Imports	www.rbi.org .in
LNEXP	Natural Log of Exports	www.rbi.org .in
D01	Dummy for 2008 global financial crisis	0 for April 2000 to July 2008 and 1 for August 2008 to March 2020.

3. Results and Discussion

The present section is dealt with results and discussion relating to Augmented Dickey Fuller Root test for stationarity and Johansen's *Cointegration technique as follows :*

3.1 Stationary Test Results (Augmented Dickey Fuller Unit Root Test)

In time series data analysis, the result might provide spurious regression results, if the data series are non–stationary. Thus the data series must obey the time series properties i.e. the time series should be stationary, meaning that, the mean and variance should be constant over time and the value of covariance between the two time periods depends only on the distance between the two time period and not the actual time at which the covariance is computed (Singh, 2016). Unit root test (ADF) is used to check the stationarity of each series before examining the long run relationship between capital inflows and macro-economic aggregates. The results of unit root test are presented in **Table 2**. It is depicted from table that on the basis of trend and intercept macro-economic variables viz. capital inflows, Wholesale Price Index, Export, Import, REER, Foreign Exchange Reserve, BSE Sensex, Exchange Rate, Openness and index of industrial production as a proxy of GDP are integrated of order I(1). The unit root test equation with intercept and trend has been preferred since trend and intercept has been observed to be significant for these variables. The order of integration for foreign investment variables viz., capital inflows has been determined by using the results of unit root test without intercept and trend since trend and intercept component for this variable turns out to be insignificant in unit root test equation whereas this variable are significant at their first difference. Similarly, Wholesale Price Index, Export, Import, REER, Foreign Exchange Reserve, BSE Sensex, Exchange rate, Openness and Index of industrial production as a proxy of GDP are significant at their first differences. Thus, all the

series are integrated of order I (1) and fulfill the condition of 'same order of integration to perform Johansen (1991) multivariate cointegration test. The results of Johansen and Jusilius multivariate Cointegration technique are discussed in next section.

Table 2. Result of Augmented-Dickey Fuller test at logarithmic level

Variable	At level		At first difference	
	Without trend and intercept	With trend and intercept	Without trend And intercept	With trend and intercept
LNCI	*-3.081296*	*-3.281296*	*-19.67525**	*-19.61346***
LNEXP	-0.786195	-3.002035	-14.46094*	-14.43350*
LNFER	-1.825254	-1.332109	-13.18967*	-13.29983*
LNIMP	-0.873331	-2.249674	-20.72990*	-20.69045*
LNREER	-1.993061	-0.667246	-15.40673*	-15.37125*
LNWPI	-0.242855	-0.346699	-24.06708*	-24.00891*
LNBSE	-0.490710	-2.476691	-11.37019*	-11.35261*
LNOP	-0.984729	-2.884454	-16.36876*	-16.35261*
LNIIP	-2.369819	-2.301302	-3.429493**	-3.474670*
LNER	-0.660229	-1.527128	-9.861823*	-9.875043*

Note:

a)* denotes acceptance of the null hypothesis of trend stationary at the 1%
b) ** denotes acceptance of the null hypothesis of trend stationary at the 5%

3.2 Results and Discussion related to Johansen's Cointegration technique

To examine the long run relationship between capital inflows and various macro-economic variables within the framework of Vector Error Correction Model (VECM) Johansen Cointegration technique was employed. This section is sub-divided into three sections. Section 1 deals with results of Akiake Information Criteria. Section 2 indicates the results of **Johansen and Juselius** Multivariate Co-integration test. The results of Vector Error Correction Model (VECM) are explained in Section 3.

3.3 Akaike Information Criteria (AIC)

Before applying cointegration analysis, lag length for Vector Autoregressive (VAR) system is selected based on minimum sequential modified LR test (Singh, 2016). *To select the lag order of an unrestricted VAR criterion lag length criteria have been used* (Lutkepohl, 1991). The results of VAR lag order selection *criterion* have been reported in **Table 3**. The Final Prediction Error and Akiake Information Criteria reported that lag 3 i.e. that three-year lag is the most suitable lag length for applying Johansen co integration test. AIC is better than other criteria because it minimizes the chance of under estimation and moreover it maximizes the chance of recovering the true lag length. It is also appropriate when sample size is large (Liew, 2004).

Table 3. VAR Lag Order Selection Criteria

Lag	Logl	LR	FPE	AIC	SC	HQ
0	1411.488	NA	2.28e-18	-15.08052	-14.92443	-15.01726
1	3103.815	3202.684	6.83e-26	-32.40661	-30.84577*	-31.77410*
2	3224.618	216.9250	4.47e-26	-32.83460	-29.86899	-31.63282
3	3314.252	152.2820	4.14e-26*	-32.92744*	-28.55708	-31.15640
4	3380.538	106.1995	4.98e-26	-32.76922	-26.99409	-30.42892
5	3451.851	107.3530	5.79e-26	-32.66506	-25.48517	-29.75550
6	3538.504	122.0593*	5.84e-26	-32.72584	-24.14120	-29.24702
7	3606.266	88.89276	7.44e-26	-32.58351	-22.59410	-28.53542
8	3680.430	90.11336	9.18e-26	-32.51000	-21.11583	-27.89265

Note : *indicates lag order selected by the criterion; LR: Sequential Modified LR Test Statistic; FPE: Final Prediction Error; AIC: Akaike Information Criterion; SC: Schwarz Information Criterion; HQ: Hannan – Quinn Information Criterion

3.4 Johansen and Juselius Multivariate Cointegration Test

Table 4 depicts the results of both Trace and the Maximum Eigen *statistics* of co integration test. Both the Trace and Max-Eigen *statistics* confirm the presence of long run equilibrium relationship among variables by indicating 3 co integrating equations. The results confirm that long run equilibrium exists between the capital inflows (LNCI) and various macro-economic variables viz. LNBSE, LNOP, LNIIP, LNER, LNEXP, LNFER, LNIMP, LNREER and LNWPI, D01.

3.5 Vector Error Correction Model (VECM)

The VECM has been estimated based on the Johanson cointegration methodology assuming one co-integrating vector (**Table 4**). The results are reported in **Table 5**. The results show that a long run equilibrium relationship found between capital inflows and selected macro-economic variables. The estimated co-integrating coefficients for the capital inflows are based on the first normalized Eigen vector as follows (Singh, 2016). With the help of these values, long term elasticity can be measured. Thus, the co-integrating relationship can be re-expressed as:

CI=115.2246+(-6.291201)*BSE+(-492.7551)*OP+(-400.0004)*IIP+ (-16.07772)*ER+(-13.80468)*FER+(13.67692)*WPI+(12.37554)* REER+(270.4002)*IMP+(207.4423)*EXP+(60.38288)*D01……(1)

Table 4. Result of Johansen's Co-integration Test

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**	Max-Eigen statistic	0.05 Critical Value	Prob.**
None *	0.388064	317.6540	239.2354	0.0000	74.50472	64.50472	0.0041
At most 1 *	0.358047	243.0027	197.3709	0.0000	67.37247	58.43354	0.0053
At most 2 *	0.312312	175.6303	159.5297	0.0049	56.36261	54.36261	0.0160
At most 3	0.256065	118.7185	125.6154	0.1219	46.23142	56.23142	0.0680
At most 4	0.209044	73.75673	95.75366	0.5895	40.07757	50.07757	0.1452
At most 5	0.097492	38.11079	69.81889	0.9708	33.87687	43.87687	0.9642
At most 6	0.061676	22.51892	47.85613	0.9682	27.58434	37.58434	0.9890
At most 7	0.040846	12.84266	29.79707	0.8986	21.13162	31.13162	0.9752
At most 8	0.039866	6.503716	15.49471	0.6360	14.26460	24.26460	0.5897
At most 9	0.002103	0.319935	3.841466	0.5716	3.841466	4.841466	0.5716
At most 10	0.001102	0.218824	2.731355	0.4615	2.731355	3.731355	0.4615

Note: *a) Both Trace and Max –Eigen statistics indicate 3 co-integrating equations at the 0.05 level*
*b) * denotes rejection of the hypothesis at the 0.05 level*
*c) **MacKinnon-Haug-Michelis (1999) p-values*

Table 5. Panel A: Results of Vector Error Correction Model: Normalized Cointegration Coefficients

LNCI(-1)	LNBSE(-1)	LNOP(-1)	LNIIP(-1)	LNER(-1)	LNFER(-1)	LNWPI(-1)	LNREER(-1)	LNIMP(-1)	LNEXP(-1)	D01(-1)
1.000	-6.291201	-492.7551	-400.0004	-16.07772	-13.80468	13.67692	12.37554	270.4002	207.4423	60.38288
Standard errors	(1.87685)	(124.896)	(124.826)	(4.12418)	(1.52413)	(2.89056)	(9.25126)	(73.0731)	(52.5773)	(3.19554)
t-tatistics	[-3.35201]	[3.94533]	[-3.20447]	[-3.89840]	[-9.05744]	[4.73158]	[1.33771]	[3.70041]	[3.94548]	[18.8960]

Panel B: Results of Error Correction Term

Error correction	D(LNC1)	D(LNBSE)	D(LNOP)	D(LNIIP)	D(LNER)	D(LNFER)	D(LNWPI)	D(LNREER)	D(LNIMP)	D(LNEXP)	D(D01)
Co in eq 1	-0.025160	0.000539	0.014884	-0.007295	0.000284	0.003183	-0.009802	-0.000220	-0.007332	-0.013214	-2.38E-05
Standard error	0.01311	0.00080	0.00094	0.00058	0.00019	0.00186	0.00244	0.00019	0.00108	0.03075	0.00091
t-statistics	-1.91925	-0.67424	15.9032	-12.6735	1.53515	1.71451	-4.01981	-1.14059	6.77125	-0.97560	-0.02618
f-statistics	2.577434	1.214476	14.43994	14.54934	3.162573	4.479517	4.663454	5.198291	5.914315	8.867027	0.450218

The error terms are given in brackets ( ) while the t-statistics are given in [ ] brackets. The coefficients of BSE Sensex, Foreign Exchange Reserve, Index of industrial production, Exchange rate, Openness are positive and statistically significant. It shows that the relationship between capital inflows and BSE Sensex, Foreign Exchange Reserve, Index of industrial production, Exchange rate, Openness is positive. The intercept term is positive. The coefficients of Wholesale Price Index, Import, Export and Dummy for 2008 are negative and statistically significant. It was found that the relationship between capital inflows and Wholesale Price Index, Import, Export, and Dummy for 2008 is negative. However, the coefficient of REER is found to be statistically insignificant.

The sign of the error correction coefficient of determination of CI is negative (-0.025160) and the corresponding t-value and f-statistics are (-1.91925) and (2.577434) respectively. This indicates that capital inflows in India respond significantly to re-establish the equilibrium relationship once deviation occurs. It allows us to compare the immediate and overall effects. It shows how fast adjustments will occur in case of short run disequilibrium.

The relationship between capital inflows and BSE Sensex is found positive. X coefficient of BSE Sensex estimated as 6.291201 is found to give positive and statistically significant relationship indicating 1% increase in BSE Sensex will raise capital inflows by 6.291201% and vice-versa. The global investors are actually ready to invest where return on equity, earnings growth and other measures of value creation are higher. The return from investment in the BSE Sensex is high as compared to investing in the S&P 500 index and other indices in the U.K and Japan. The rise in stock market and associated drop in the cost of equity in the Indian market influences the foreign investors to invest in India (Chakraborty, 2001). Santis and Ehling (2007) evidenced that the most important factor determining equity capital flows is the stock market. The correlation measures between portfolio capital flows and the BSE Index is positively significant (Kohli, 2001).

Openness is found to be important variable having positive and significant relationship with capital inflows as the coefficient of this variable is registered as 492.7551 which shows the that 1 % increase in this variable has tendency to bring 492.7551 rise in capital inflows and vice-versa. The more developing countries try to open its economy to external trade, the more country can attract capital inflows. Liberal trade policies mirrored in openness of the country as the TNC is not interested in market seeking behaviour initially and openness helps it in importing components, capital goods, and raw material (Kaur and Sharma, 2013).

X coefficient of IIP is estimated to be 400.0004 found to give positive and statistically significant relationship indicating 1% increase in IIP will raise capital inflows by 400.0004% and vice-versa. Chopra (2003) found that index of Industrial production as a proxy of GDP had a significant impact on capital inflow in India. Rangarajan (2001), Sethi and Patnaik (2007) investigates the capital flows into India have positive impact on the capital formation and economic growth.

Exchange rate also revealed a positive and significant relationship with capital inflows. The coefficient of this variable is found as16.07772 indicating that 1% increase in exchange rate would cause the capital inflows to rise by16.07772% and vice-versa. Combes et al., (2010) revealed that capital inflows resulted in the appreciation of exchange rate. Among private inflows, portfolio investment has the biggest impact on appreciation, while foreign direct investment or bank loans have the smallest effect.

The relationship between Foreign Exchange Reserves and Capital inflows is found to be positive and statistically significant. The coefficient of this variable is determined as 13.80468 indicating that 1% increase in reserves would cause the capital inflows to rise by 13.80468 and vice-versa. "As high level of foreign exchange reserves reflects the strength of external payments position and helps to improve the confidence of the prospective investors" (Kaur and Sharma, 2013).

Wholesale price index coefficient is estimated to be -13.67692 depicts negative relationship between inflation and Capital inflows. High cost of raw material and wages result in rising cost of production of goods. Demand of the product at the domestic and at international level is adversely affected due to high prices. All these factors discourage foreign investors to invest in India.

The coefficient of REER is found to be -12.37554 indicating negative and insignificant relationship with capital inflows in India.

Import is found to be significant variable having negative relationship with capital inflows as the coefficient of this variable found to be -270.4002 which show that 1% increase in import has a tendency to bring 270.4002% decrease in capital inflows and vice-versa. "If FDI is concentrated in import substituting industries, then it is expected to affect imports negatively because the goods that were imported earlier would now be produced in the host country by foreign investors" (Jayakumar et al, 2014).

Export is found to be important variable having negative and significant relationship with capital inflows as the coefficient of this variable found to be -207.4423 which show that 1% increase in exports has a tendency to bring 207.4423% fall in capital inflows and vice-versa. "If the intention for capital inflows is to bypass the trade barriers (high tariff) of the host countries, to increase access to large foreign market and to earn the benefits of economies of scale, this may not promote export" (Jayakumar et al, 2014).
Dummy coefficient is estimated to be -60.38288 indicating negative relationship with capital inflows. It indicates that the crisis in 2008 have negative and significant effect on capital inflows in India.

4. Conclusions and Implications

The objective of the study is to examine the long-term relationship of capital inflows with the macroeconomic variables. The result of VECM suggests that BSE Sensex, Openness, Exchange Rate, Foreign Exchange Reserve and Index of Industrial Production have positive and significant relationship with Capital Inflows in India. While Import, Export, Wholesale Price Index and Dummy for 2008 have negative and significant relationship with Capital Inflows in India. The study found that REER have insignificant negative relationship with Capital Inflows in India. It is recommended that the regulators of the financial system viz Securities and Exchange Board of India (SEBI), RBI etc. should create more conducive and healthier environment comparable to international standards so as to encourage the foreign investors to be a part of the journey of economic development of the country. It is also suggested that government of India should reduce inflation rate and encourage trade openness to economic growth in India. It is also recommended that government of India should provide risk free environment to investors for attracting s more investment in India. The study also recommends that government should give focus more on policies that are investment friendly and will help in attracting large foreign investment.

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