DETERMINANTS OF FDI – A COINTEGRATION APPROACH

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ABSTRACT

India has been encouraging the FDI (Foreign direct investment) not only for its role in the technological upgradation of a country but also for its contribution in the economic development in the hosting country. Inward Foreign Direct Investment (FDI) has become an essential component of economic growth particularly for developing countries. Mainly FDI inflow is from the developed countries which also give the technological and administrative shift to the developing countries. There are many macroeconomics factors which may boost the inflow of FDI in India. In this paper I have tried to find out the relation between the macroeconomic factors and the FDI inflow in India by using some econometric tests – Unit Root Test, Johanson co integrated test, VECM (vector error correction model).

Keywords: Macro economic factors, Vector error correction method (VECM), Johanson cointegration test,

Paper Type: Empirical Research Paper.

Area: Finance and Investment

Purpose:
This study aims to investigate the long term /short term association between Inflow of FDI and selected macroeconomic determinants namely GDP, trade openness, exchange rate and interest rate.

Design/methodology/approach:
Using the Johanson cointegration and VECM (Vector Error correction Model) I tried to find the causal linkage between the macroeconomic determinants Like GDP, trade openness, exchange rate and interest rate with Inward FDI in India.

Findings:
This study shows that all the time series of these macro economic factors except real effective interest rate is non-stationary and have a long cointegration relationship with inward FDI.

Research Implications:
In this paper annual Data is used for the econometric model. This study can be extended by using the monthly/ quarterly data for wider scope.

INTRODUCTION:

Foreign Direct Investment or FDI is considered to be a measure of development especially for the developing and underdeveloped economies. FDI is a measure of foreign ownership of domestic productive assets such as factories, land and organizations. The most profound effect has been seen in developing countries, where yearly foreign direct investment flows have increased from an average of less than $10 billion in the 1970s to a yearly average of less than $20 billion the 1980s. From 1998 to 1999 itself FDI grew from $179 billion to $ 208 billion and now comprises a large portion of global FDI. According to UNCTAD, spurred on by merger and acquisitions and the internationalization of production in a range of industries, inward FDI for developing countries rose from$481 billion in 1998 to $ 636 billion in 2006 (economic watch).

Foreign Direct Investment (FDI) is considered responsible for increased welfare in the host country as the FDI brings with itself the new technologies and innovations, new managerial techniques, development of additional skills, increased capital, job creation and improvement of working conditions and the development of industrial sector in the host country.

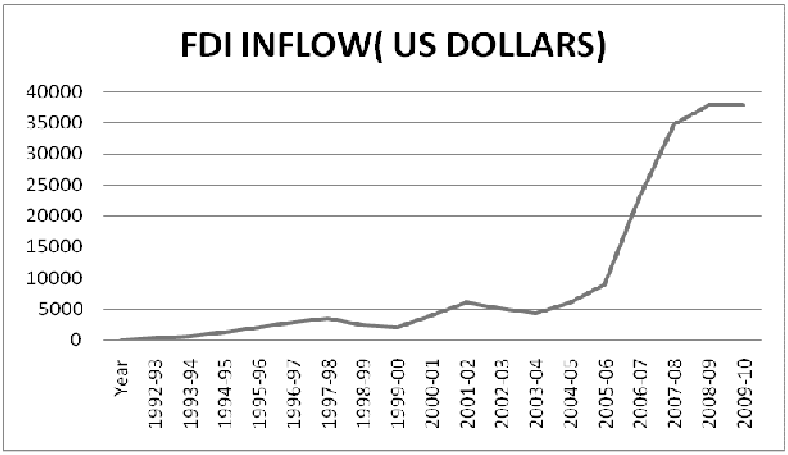
India is one of those developing countries that encourage FDI in order to accelerate the growth and development. Since 1991, the country has maintained an open policy towards trade and investment. As a result, FDI has played an important role in the capital formation and the development of the economy which has increased rapidly.

Since adopting the LPG (Liberalization, Privatization and Globalization) Model, India has made continuous steps for integrating with the world economies and become able to establish a mutually beneficial interlinkage with them. Inflow of FDI in India is increasing progressively since1991 taking the advantages of cheap resources- capital and labor, macroeconomic stability, liberal trade and resourceful legal infrastructure.

FDI INFLOW

Year	FDI Inflow (in US Million Dollars)
1992-93	315
1993-94	586
1994-95	1314
1995-96	2144
1996-97	2821
1997-98	3557
1998-99	2462
1999-00	2155
2000-01	4029
2001-02	6130
2002-03	5035
2003-04	4322
2004-05	6051
2005-06	8961
2006-07	22826
2007-08	34835
2008-09	37838
2009-10	37763
2010-11	30380

FIGURE 1:



As shown in the table 1, FDI has increased from 315 million dollars to 30380 million dollars in 20 year which is 96 times. Figure 1 shows that the increasing trend of FDI in India with some stagnancy from year 2008 reason being the Global Crisis. The reason for this commendable increase in FDI inflow since 1991 is cheap resources- capital and labor, macroeconomic stability, liberal trade and resourceful legal infrastructure. In addition, several other factors contributed toward increase in the FDI inflow growth like economic growth above global average, fast growing population with increasing young population and consumers, lower interests rates and stable financial systems, lower wages and production costs, low inflation rate and increasingly reformed exchange rate system, etc

LITERATURE REVIEW:

There are several critical macroeconomic determinants of FDI inflow such as the income of a country, trade openness, Inflations etc. In term of the income, the economic structure of a country will experience modification along with the growth of the income. Subsequently, country will move towards capital-intensive industry and has the capability to increase production despite become more efficient. This is due to the effect of economies of scale and adoption of new technologies.

Using the data of 60 developing countries over the period of 2003 to 2005, **Mottaleb** (2007) incorporated the market size variable by analyzing the data and used GDP as proxy for market size and study further explored that corruption deteriorate FDI inflows toward developing Countries.

Sahoo (2006) analyzed the data for five South Asian countries and highlighted the importance of economic factors for FDI flows and used panel co integration technique to examine long run relationship between economic variables and FDI inflows and identified that market size; trade openness, infrastructure index and labor force growth rate were major determinants.

The association of higher degree openness led to higher level of FDI outflow is mainly due to the acquisition of knowledge on the foreign market. This valuable knowledge includes skills related to operating or managing production abroad. Eventually, this will become the driving force for the firms to engage in the foreign investment rather than relying on exportation. Firms will be able to gain advantage in term of internalization (Dunning, 1993)

Moran, et al. (2005) has concluded in his paper that the Inflow of FDI is largely depending on the trade policies of the host country. The more liberalized trade policies of the economy, the more possibility of the positive benefits of FDI to be transferred to the host country. Similarly, the more restricted the economy, the more likely negative the impact of FDI on growth.

Seetanah and Khadaroo (2007) found that when compared with other growth factors, the contribution of FDI is small; it not only contributes to economic growth but also follows from economic growth.

Carkovic and Levine (2002) find that FDI does not contribute to the economic growth independently but also some microeconomic conditions of the country such as the host country's competitive advantage and its business environment are also important in the relationship between FDI and growth.

METHODOLOGY:

This study employs annually data range from 1990 to 2008. The data set consists of FDI inflow of India as dependent variable while GDP of India, trade openness, Real interest rate of India and Inflation (consumer price index is used as proxy) as independent variables. Trade openness is proxied by summation of aggregate export and

import of India divided by the total GDP of India, meanwhile interest rate refers to real effective interest rate.
All the data are obtained from World Bank data, RBI annual hand books statistics and UNTACD.
All the variables in the data set are transformed into natural logarithms for statistical purpose.
Equation (1) represents the assumption that FDI inflow of India is determined by several factors as shown:

$$LAFDI = f\ (LAGDP + LTO + LINT + LCPI)$$

(AFDI = Foreign direct investment adjusted with GDP deflator
AGDP = GDP adjusted for deflator,
Trade openness = Sum total of imports and exports as percentage of GDP)

Where *LAFDI* signifies logarithm of GDP deflator adjusted FDI inflow in India, *LAGDP* denotes logarithm of adjusted GDP of India, *LTO* represents logarithm of trade openness of India, *LINT* denotes Logarithm of Real effective interest rate, *LCPI* denotes logarithm of Consumer Price Index.

The vector error-correction model (VECM) is adopted with the purpose to examine the long run relationship between the endogenous variable, FDI inflow in India and its determinants.

HYPOTHESIS:

The paper is based on the following hypotheses for testing the causality and co-integration between FDI and the macro economic factors – GDP, Trade openness, Interest rate, Inflation.

UNIT ROOT TEST:

Unit Root test is used for the purpose of ensuring the variables are integrated as non-stationary series. For testing the stationarity of time series many test can be used named Dicky Fuller Test, Philips-Perron Test, Augmented Dicky Fuller tests. In this paper I am using the Augmented Dickey Fuller test. Dickey Fuller test may create a problem of autocorrelation. To tackle the problem of autocorrelation, Dicky fuller has adopted a test Called Augmented Dicky Fuller test.

The ADF test is based on the regression equation with the inclusion of a constant and a trend of the form:

$$\Delta X_t = \beta_0 + \mu_t + \gamma X_{t-1} + \alpha_i \Delta X_{t-1} + \varepsilon_t \text{---------- Equation (2)}$$

Where Xt= variables of interest in the logarithm forms at time trend t, Xt-1 expresses the first differences with k lags, ε is the white noise residual of zero mean and constant variance. The coefficients are the parameters being estimated. The null and the alternative hypothesis for the existence of unit root in variable Xt is as follows:

The null hypothesis of the Augmented Dickey-Fuller t-test is
H0: θ=0 (i.e. the data needs to be differenced to make it stationary

Alternative hypothesis:
H1: θ<0 (i.e. the data is stationary and doesn't need to be differenced)
If the probability (p-value) is less than the level of significance, we can reject the null hypothesis, vice verca.
If the variable is not stationary, then we should go for first differencing to make the time series stationary.
The series of two- tails T test at 1%,5%,and 10% level of significance have been assessed on each independent variable.

JOHANSON COINTEGRATION TEST:

The cointegration test is a method of cointegration testing based on the maximum likelihood estimation of the VAR model to determine the number of cointegration vectors in the analysis. The Johanson Cointegration Test is employed to test for the long term association between the variables in a multivariate model. The analysis is based on the following equations:

$$\Delta Y_t = b_0 + \Delta Y_{t-1} + \mu_1 \Delta Y_{t-1} + \mu_2 \Delta Y_{t-2} + \ldots + \mu_p \Delta Y t_{-p} + e_{t-p} \text{----------equation(4)}$$

Where Yt is a k-vector of non stationary 1(1) variables, μ with i= 1,2,_____,p is a lag operator and εt is a the

white noise residual of zero mean and constant variance. The lag order p is determined using Schwartz info criterion (SIC).
After that we conduct the test of null hypothesis that is r power or fewer cointegrating vectors using the following two likelihood ratio tests statistics:

TRACE TEST:

The trace statistic tests the null hypothesis: "there are at most r cointegrating relations" against the alternative of " m cointegrating relations" (i.e., the series are stationary),

$r = 0, 1, \ldots, m - 1.$

$J_{trace} = -N \sum_{I=r+1}^{m} \ln\{1-(r_i^*)2\}$ ---------- Equation (5)

Where N is the total number of observations, m is the number of variables and r_i*is the correlation between i-th pair variables, J_{trace} has a chi-square distribution with M-r degree of freedom. Large value of J_{trace} gives evidence against the hypothesis of r or $_{fewer}$ cointegration vectors.

MAXIMAL EIGENVALUE TEST:

The maximum eigenvalue statistic test the null hypothesis:"there are *r* coinegrating relations"
against the alternative:"there are *r* +1 cointegrating relations".

$J_{max} = -T \ln(1-\gamma_{r+1})$ ---------- equation (6)

EMPIRICAL RESULTS AND ANALYSIS:

In this paper, firstly the test for stochastic trends in the autoregressive representation of each individual time series will be conducted prior cointegration test. The Augmented Dickey-Fuller (ADF) unit root test proposed by Dickey and Fuller is used to find out the stationarity of the time series.
The selection of optimal lag length of *p* is based on Schwartz Information Criteria (SIC). The null hypothesis can be rejected when t value statistically significant. Table 1 depicts the results of the ADF unit root test. The results indicate that the null hypothesis of a unit root cannot be rejected at level at 1%, 5% and 10% significance level except LINT which is significant at 1% which concludes that LINT is a stationary time series at level whereas LAGDP, LTO, LCPI are non-stationary time series. Nevertheless, the null hypothesis can be rejected after first differencing. This implies that all time series of macroeconomic variables are non-stationary at level *I* (0), but stationary at first difference *I* (1).
LAFDI, LAGDP, LTO, LCPI are the variables which are non-stationary at level which becomes stationary at the first difference at 5% critical value. Since the variables are stationary at first difference, then we can proceed with the cointegration test as introduced by Johansen (1988) and Johansen and Juselius (1990). The main purpose of this test is to investigate the existence of a long run association among the variables which are integrated with same order.
The crucial approach which is used in this study to test r cointegration is called the Johansen cointegration approach. The Johanson approach can determine the number of cointegrated vectors for any given number of non-stationary variables of the same order.
Table 2 indicates the results of Johanson cointegration test with Trace and Max-Eigen test which suggest that the null hypothesis of no cointegrating vectors can be rejected at the 5% level of significance. It can be seen from the Likelihood Ratio (L.R.) that we have a single co-integration. In other words, there exists one linear combination of the variables.
The null hypothesis of r = 0 can be rejected as both trace and Max-Eigen statistical value exceed t value. Null hypothesis r=1 is accepted as both trace and Max-Eigen statistical value which indicates that there is one cointegration equation between all the variables
Thus the result shows that there is a long term association between FDI and the endogenous variables.

CONCLUSION:

This paper tries to assess empirically, the relationship between macro economic variables and FDI using the annual data over the period of 1991 to 2008. The unit root properties of the data were examined using the Augmented Dickey Fuller test (ADF) after which the cointegration test was conducted. The major findings

included the followings:

The unit root test (Augmented Dicky Fuller test) defined that all the macro economic variables except the Real interest rate is non stationary and become stationary at the first level. This result also evidenced the truth that the macro economic variables are non stationary (I_0) and becomes stationary after the first difference or at the first level.

The cointegration test (Johanson Cointegration test) confirmed that FDI and the macro economic factors like GDP, Trade openness, Exchange rate are co integrated, indicating an existence of long run equilibrium relationship between the them as confirmed by the Johansen cointegration test results. This study concludes that the cointegration shows that the FDI inflow in any country is depend upon the GDP growth, Trade openness policies and the Exchange rate. But the Real effective rate is having a shot term association with the FDI.

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ANNEXURE:

TABLE 1. AUGMENTED DICKEY-FULLER UNIT ROOT TESTS RESULTS

Variable	Level	First Difference
LAFDI	-2.353072(0.1682)	-3.657773(0.0165)
LAGDP	0.477892(0.9802)	-4.021656(0.0082)
LTO	-0.460348(0.8769)	-5.035303(0.0012)
LCPI	-2.252936(0.1967)	-5.090547(0.0011)
LINT	-4.907995(0.0013)	-6.786766(0.000)

Notes: LAFDI = natural log of adjusted FDI inflow, LAGDP = natural log of adjusted GDP, LTO = natural log of openness of the economy, LCPI = natural log of exchange rate. LINT= natural log of real effective interest. Figure in ( ) shows p-value

TABLE: 2 JOHANSON COINTEGRATION TEST

Series: LAFDI LCPI LGDP LOPE

Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.937502	68.68740	47.85613	0.0002
At most 1	0.601691	24.32546	29.79707	0.1870
At most 2	0.450205	9.597029	15.49471	0.3130
At most 3	0.001604	0.025686	3.841466	0.8726

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.937502	44.36194	27.58434	0.0002
At most 1	0.601691	14.72843	21.13162	0.3084
At most 2	0.450205	9.571343	14.26460	0.2416
At most 3	0.001604	0.025686	3.841466	0.8726

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values
