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Investigating the Relationship between Current Account Deficit and Capital Flows of India Using ARDL Approach

KEYWORDS: current account deficit, capital flows, India, ARDL bound test JEL Classification code: O1, O160, H62

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ABSTRACT This study analyzes the relationship between current account deficit and capital flows in India for a period from 2005Q1 to 2016Q2. Augmented Dickey Fuller (ADF) unit root test was employed to examine the stability of Current Account deficit (CA) and capital flows (CF) series data. It was reported that CA was integrated at I(1) and CF was integrated at I(0).Auto regressive distributed lag (ARDL) model was used to estimate the co-integration between the series. The study revealed that there exist unidirectional relationship from capital flows to current deficit hence it is suggested that capital flow liberalization policies could give way to a deterioration of current account balance.

Introduction

India's effort on the Balance of Payments (BOP) started from the Second Five-Year Plan (1956), and continued till the crisis of 1991. The Balance of Payment crisis of 1991 forced India to open doors to foreign investments. After the reforms the economy saw a turnaround, from the ease of doing or starting a business to attract capital flows from abroad. The rise of global financial transactions and trade in the late-20th century drives Balance of Payment (BOP) .The Balance of Payments (BOP) is the method that a country uses to monitor all international monetary transactions at a specific period of time. All trades conducted by both the private and public sectors are accounted in the BOP, in order to determine how much money is going in and out of a country. If a country has received money, this is known as a credit, and if a country has paid or given money, the transaction is counted as a debit. Thus, the BOP can tell the observer if a country has deficit or surplus and from which part of the economy discrepancies originates. The BOP is divided into three main categories: the current account, the capital account and the financial account. Current account is used to mark the inflow and outflow of goods and services into a country. Earnings on investments, both public and private, are also included in the current account. The capital account is where all the international capital transfers are recorded. This refers to the acquisition or disposal of non-financial assets (for example, a physical asset such as land) and non-produced assets, which are needed for production but have not been produced, like a mine used for the extraction of diamonds. In the financial account, international monetary flows related to investment in business, real estate, bonds and stocks are documented.

Theoretically, the BOP should be zero, meaning that assets (credits) and liabilities (debits) should balance, but in practice this is rarely the case. Fluctuating exchange rates, the change in the value of money can add to BOP discrepancies. When there is a deficit in the current account, which is a balance of trade deficit, the difference can be borrowed or funded by the capital account. Indian economy has run a current deficit every year over 2002 to 2016. In the first half of the 2014-15, current account deficit (CAD) was at 1.9 per cent of the GDP (USD 18 billion). The CAD, which is the difference between the inflow and outflow of foreign exchange, was 1.7 percent of GDP (USD 32.4 billion) in 2013-14.

Literature Review

Yusuf Ekrem akbas,Mehmet Senturk and Canan Sancar (2014),their paper analyzed the relationship between current account deficit and capital flows in turkey over the period from 1990-2011.Auto regressive distributed lag(ARDL) bound test was used to check the co-integration between the series. The study revealed that there is a co-integration relationship between current deficit and capital flows in Turkey.

Omkar K and Shweta Pilla (2013), investigated the relationship between the Current account deficit, the Foreign Investment and the Exchange Rate of the Indian Rupee. By analysing the data of these variables and their movements for a period from 1999 to 2012, it is revealed that there is theoretically interdependence between these three variables. The CAD is affected by negative movements of the exchange rate and negative Foreign Investments.

Selen Sarisoy Guerin (2003), examined the relationship between net private capital inflows and the current account in a set of industrial and developing countries. Panel data regression and Granger causality test were used in the study. The result implies that inflows do not cause current account imbalances in the industrial countries, nor does the inflow volatility affect current account volatility.

Problem Statement

The current account balance is one of the most important indicators of macroeconomic performance. Developing country like India have been facing current deficit problems for many years. They have to import the required technology, products, and investment goods so that they can sustain their economic development as it is impossible for them. India's growing oil import bill is seen as the main driver behind the large current account deficit(*V.Ramakrishnan*) .There are many ways to finance the current deficit in an economy such as official reserves, loan, net errors and omissions and capital flows. Capital flows are the most convenient solution among all the alternatives to finance the current deficit. India is running a current account deficit in the foreseeable future, needing net foreign financing (*Raghuram Rajan RBI Governor*). Hence the present study is to test if there is a relationship between current deficit and capital flows in the Indian economy.

Objectives of the study

- To examine the stability of time series current account and capital flows of India.
- To determine the co-integration between current account and capital flows.
- To estimate short run relationship between current accounts and capital flows of India.

Empirical Methodology

In the present study, to test the stability of current deficit and capital flow series, the ADF unit root test was applied. ARDL bound test was performed to detect whether there is a co-integration in these series

Stationarity tests:unit root testing is an important and prerequisite for any time series analysis to check whether the data is stationary or

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not. A series is said to be stationary if the mean and covariance of the series do not depend in time. To test the presence of unit root, Augmented Dickey Fuller (ADF) tests was employed in the study.

ARDL Bound Tests: In a model if some of the variables are integrated of *I(0)* and some of the variables are integrated of *I(1)* . In this situation Auto Regressive Distributed Lag model can be used to extract both long run and short run relationship between the variables. In regression analysis involving time series data, if the regression model includes not only the current but also the lagged (past) values of explanatory variables, it is called a distributed-lag model. If the model includes one or more lagged values of the dependent variable among its explanatory variables, it is called an autoregressive model (*Gujarati).* An ARDL regression model looks like:

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \beta_p Y_{t-p} + \alpha_0 X_t + \alpha_1 X_{t-1} + \alpha_2 X_{t-2} + \alpha_q X_{t-q} + \varepsilon_t \ldots\ldots (1)$$

The short term and long term correlations can be obtained from the ARDL models. After presenting the ARDL model, the current deficit and capital flow models are as follows:

$$\Delta CA_t = \beta_0 + \beta_1 CA_{t-1} + \beta_2 CF_{t-1} + \sum_{j=1}^{m} \beta_{3,j} \Delta CA_{t-j} + \sum_{j=0}^{m} \beta_{4,j} \Delta CF_{t-j} + v_t \ldots\ldots (2)^2$$

$$\Delta CF_t = \beta_0 + \beta_1 CF_{t-1} + \beta_2 CA_{t-1} + \sum_{j=1}^{n} \beta_{3,j} \Delta CF_{t-j} + \sum_{j=0}^{n} \beta_{4,j} \Delta CA_{t-j} + v_t \ldots\ldots\ldots (3)^3$$

The εt-1 in the equation (4) and (5) is the one period- delayed value of error term. It shows how much of the short term instability is corrected in the long term.

Data Analysis

In the study, the co-integration between the quarterly data of capital flows and current account deficit in India, covering the time period from 2005Q1 to 2016Q1 was analyzed using the unit root and ARDL bound tests. In this context, the researcher attempted to predict the direction of the relationship between the current account deficit and capital flows in the Indian domestic markets during the study period. In order to adjust the seasonality of the variables, Eviews program has been employed. Data has been procured from the International Monetary Fund data.

Results and Discussion

To determine the order of integration of the variables considered, Augmented Dickey Fuller (ADF) tests was used and the results are depicted in the table1.

Table 1:Unit Root Test statistic for select variables

Variables	Level		First difference	
	ADF Test statistic	Prob.	ADF Teststatistic	Prob.
LCA	-0.520331	0.9765	-14.59698*	0.0000
LCF	-5.995498*	0.0001		

Table 1 report the results of the unit root test applied to determine the order of integration among the time series data. The Augmented Dicker Fuller test was used at level and first difference under assumption of constant and trend. According to the results of the test, current account (LCA) contains unit root. The result shows that the CA variable is not stationary on level, but it became stationary when its first difference was taken. That is, the degree of integration of this series is I(1). The LCF variable is stationary on level, that is, the degree of integration appears as I(0).

Lag selection for the model 2- dependent variable CA
Table 2: Defining optimal length for bound test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-206.1042	NA	1526.598	13.00651	13.09812	13.03688
1	-195.9178	18.46272	1038.170	12.61986	12.89469	12.71096
2	-191.5914	7.300927	1021.337	12.59946	13.05750	12.75129
3	-172.4025	29.98254*	398.9260*	11.65016*	12.29142*	11.86272*
4	-171.1592	1.787361	481.9539	11.82245	12.64692	12.09574

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 2 displays the lag length criteria for Auto Regressive Distribute Lag (ARDL) model with LCA as dependent model. The result shows that optimum lag length for the model is 3 based on FPE, AIC, SC and HQ.

Co-integration Results for the model 2

H_0: There is no co-integration between current deficit and capital flows of India.

Table 3: ARDL test results-Dependent variable LCA

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.075317	2.422616	-0.031089	0.9755
DLCA(-1)	-0.996340	0.277790	-3.586668	0.0016
DLCA(-2)	-0.858747	0.212405	-4.042964	0.0005
DLCA(-3)	-0.721026	0.134491	-5.361131	0.0000
DLCF	-0.231633	0.088462	-2.618432	0.0154
DLCF(-1)	-0.111186	0.109836	-1.012292	0.3219
DLCF(-2)	-0.087464	0.102930	-0.849744	0.4042
DLCF(-3)	-0.080773	0.086835	-0.930190	0.3619
LCA(-1)	0.103733	0.329119	0.315184	0.7555
LCF(-1)	-0.141767	0.127047	-1.115866	0.2760

Table 4: Bound Test Results –Model 2

k	F-statistic	Critical value of F statistics		
		1%	5%	10%
1	0.996235	6.84-7.84	4.94 – 5.73	4.04 – 4.78

Note: critical values from Pesaran et al Table (iii) Case III: Unrestricted intercept and no trend pp 300

According to the bound test results depicted in the Table 4, the F statistics value (0.996) is small as compared to the critical values. The F value is statistically meaningless. So there is no co-integration between the current account deficit and capital flows. This result can be inferred from the table 3. The probability value of LCA is 0.7555 which is more than 0.05. Therefore, the null hypothesis is accepted that means there is no co-integration between the two variables. In other words, capital flows in India between 2005 and 2016 did not really affect the current deficit in the long run.

Lag selection for the model 3-Dependent variable -LCF
Table 5: Defining optimal length for bound test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-209.4231	NA	1258.661	12.81352	12.90422	12.84404
1	-198.1886	20.42632	812.6662	12.37507	12.64716	12.46662
2	-194.1691	6.820979	814.7116	12.37389	12.82737	12.52647
3	-190.6452	5.552775	845.6186	12.40274	13.03762	12.61636
4	-174.2077	23.90918*	404.0418*	11.64895*	12.46523*	11.92360*

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* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

The lag length criteria for Auto Regressive Distribute Lag (ARDL) model with LCF as dependent model is presented in the table 5. Based on FPE, AIC, SC and HQ the result shows that optimum lag length for the model is 4.

Co-integration Results for the model 3
Table 6: ARDL test results-dependent variables LCF

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	12.04004	4.999817	2.408097	0.0258
LCA(-1)	1.910049	0.665424	2.870426	0.0095
LCF(-1)	-0.886688	0.256563	-3.456031	0.0025
DLCF(-1)	-0.047753	0.237888	-0.200738	0.8429
DLCF(-2)	-0.080569	0.220521	-0.365355	0.7187
DLCF(-3)	-0.101470	0.203790	-0.497917	0.6240
DLCF(-4)	0.288169	0.171501	1.680271	0.1085
DLCA	-0.932396	0.406434	-2.294091	0.0327
DLCA(-1)	-2.741171	0.812758	-3.372676	0.0030
DLCA(-2)	-2.114966	0.709270	-2.981893	0.0074
DLCA(-3)	-1.426017	0.579428	-2.461077	0.0231
DLCA(-4)	-0.357046	0.391972	-0.910896	0.3732

Table 7: Bound Test Result-Model 3

k	F-statistic	Critical value of F statistics		
		1%	5%	10%
1	6.067229	6.84-7.84	4.94 – 5.73	4.04 – 4.78

Note: critical values from Pesaran et al Table (iii) Case III: Unrestricted intercept and no trend pp 300

The bound test result is presented in table 7. The F statistics value calculated for the bound test is 6.067 which is more than the upper critical value at five percent significant level. The result indicates that there is a co-integrating relationship between current account and capital flows. This result can also be inferred from table 6. The prob-value of LCF is 0.0025, which is less than 0.05.Therefore the null hypothesis, that there is no co-integration between the variables is rejected. It can be concluded from the result that current deficit in India between 2005 and 2016 did really affect the capital flows in the long term.

Error Correction Model Results
In the model created, since only CF = f(CA) is meaningful for India, there is a one way relationship from LCA to LCF. ARDL bound test indicates that there is long run relationship between LCA and LCF. Therefore to estimate the short term dynamics an Error Correction Model is created.

H_0: There is no short run relationship between current deficit and capital flows of India.

Table 8: Error Correction Model Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.875947	1.225758	-0.714617	0.4824
DLCF(-2)	0.010903	0.186497	0.058463	0.9539
DLCF(-3)	0.013686	0.211127	0.064825	0.9489
DLCF(-4)	0.445450	0.188852	2.358727	0.0276
DLCA	-1.256325	0.483586	-2.597933	0.0164
DLCA(-1)	-0.750629	0.675791	-1.110741	0.2787
DLCA(-2)	-0.651568	0.679131	-0.959414	0.3478
DLCA(-3)	-0.495722	0.624432	-0.793876	0.4357
DLCA(-4)	0.190112	0.440395	0.431684	0.6702
ECT(-1)	-0.453462	0.164955	-2.748997	0.0117
R-squared	0.626482	Adjusted R-squared	0.473679	
F-statistic	4.099933	Durbin-Watson stat	2.284320	
Prob(F-statistic)	0.003312			

Dependent Variable: DLCF
Table 9: Wald Test result

Test Statistic	Value	df	Probability
F-statistic	0.909684	(4, 22)	0.4756
Chi-square	3.638737	4	0.4571

Table 8 displays the Error correction results of India for the period from 2005 Q1 to 2016 Q1. The significant value of F statistics in Wald test shown in table 9 proves that there is no short term relationship between capital flows and lagged values of capital deficit. The coefficient of the error correction term in the model is negative and statistically significant. The estimated coefficient value of -0.45 of the error correction mechanism implies that the system corrects its previous period's disequilibrium from the long-run estimates by 45 percent quarterly. The high significance of the coefficient of ECM term supports the existence of a long-run equilibrium relationship between capital flows and current deficit. The result also reveals that, R-squared value is 0.62, this indicates that 62 percent of the variations in the value of capital flows are explained by current account. The F-statistic is significant at all levels implying that the hypothesized relationship between variables is validated. The value of Durbin-Watson statistic is 2.28 implying that then model is not suffering from autocorrelation problem.

Implications and conclusion
The present study investigated the relationship between current deficit and capital flows in India over the period from 2005q1 to 2016 q1. In the study, as a result of the unit root tests done in order to test the stationarity of current account (LCA) and capital flows (LCF) series, it was observed that LCF series was stable at level whereas LCA was stationary when the first difference was taken. An ARDL bound test was done to test whether there is long term relationship between the variables and co-integration was found between LCA and LCF. The direction of causation was from LCF to LCA. Since there was a unidirectional causality running from LCF to LCA, then a capital flow liberalization policies could give way to a deterioration of current account balance.

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