Testing the Effectiveness of Johnsonian Approach Using India's Balance of Payments

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Abstract:

The main aim of the study is to test the relevance and effectiveness of Harry Johnson's monetary approach using Balance of Payments Account and Money supply in India. The study uses annual data from 1991 to 2018, especially since the execution of LERMS in 1991. This study uses the Augmented Dickey-Fuller and Philips-Perron test for stationary conditions. In order to detect the automatic equilibrium process under a flexible exchange rate system and to analyse the short-run and long-run relationship, the study employed Autoregressive Distributed Lag-Error Correction Model (ARDL-ECM) for analysis.

The test results from the ARDL model depicts that there is a long-run association between BOP and independent variables like Exchange rate, money supply and capital outflows. ARDL-ECM model did not found any causality in the short run. Also, the study did not find any automatic restoration process in India Balance of Payments since LERMS. So this study found less relevance of the monetary approach/Johnsonian approach in solving disequilibrium in India's Balance of Payments. Also, the study observed that the role of monetary policy is not effective in the context of India's BOP. In the present scenario, this may not be an issue for an emerging economy like India. But in the long run, to achieve external equilibrium based on the Mundell-Flemings assignment rule, the study strongly recommended Friedman's monetary rule for the effectiveness of the monetary policy.

Keywords: balance of payments; ARDL model; exchange rate; current account adjustment; capital movements; money supply.

JEL Classification: C32; E51; E52; F14; F31; F32.

Introduction

The Balance of Payments (BOP) is a statistical statement that systematically summarises overall economic transactions of the resident of the reporting country with the rest of the world, during a specific period of time, usually a year. The BOP account visibly points out the stability, sustainability and performances of the economy, especially in the external sector front. The surplus in the BOP account is mostly not an issue but the deficit is a major issue for all nations, which needs to be eliminated.

Many economists developed their models and theories to eliminate issues in the BOP. Among all the theories, three approaches occupy significance in the context of Balance of Payments and International Trade as a whole. The approaches are; Marshall-Lerner's Elasticity approach, Sydney Alexander's Absorption approach and Harry Johnson's Monetary approach.

The first two models suggested a devaluation of domestic currency for the problem of Balance of Payments. Marshall-Lerner's condition gave a solution to BOP problem via the price effects of devaluation by making imports costlier and exports cheaper, provided that there should be an appropriate level of elasticity of demand for exports and imports. Similarly, Sydney Alexander's Absorption approach gave a solution to the BOP problem via the income effect of devaluation by increasing the demand for domestic-made commodities in the reporting country as well as the rest of the world. Here, the problem of both of the approaches is that it focuses only on the current account, especially exports and imports of goods. So, the two models have their own limitations in solving the issues in BOP account.

Many empirical studies proved the importance and significance of Harry Johnson's monetary approach to the problem of the Balance of Payments. Several economists are also proved the superiority of the Monetary Approach over the Elasticity approach and Income approach due to its focus on overall Balance of Payments and not only on merchandise trade.

Monetary Approach to BOP is mainly associated with Harry Johnson, Jacob Frenkel, Robert Mundell and Marcus Fleming. Other economists also investigated the BOP problem via monetary approach includes Michael

Mussa, David Hume, Rudiger Dornbusch and D Kemp. The basic proposition of the monetary approach is that the problem of BOP is always and everywhere a monetary phenomenon.

According to Harry Johnson's Monetary approach, BOP disequilibrium is mainly because of changes in money supply or money demand. It can be stated as:

$$\Delta M^S / \Delta M^D = \Delta B \quad (1)$$

The process in which the changes in *money supply* affects BOP is stated as:

$$M^S = M^D = B \quad (2)$$

Suppose, the central bank increases in money supply which will lead to creating a deficit in the current account as well in the capital account. It can be stated as:

$$\uparrow M^S \rightarrow \uparrow P \rightarrow \uparrow M_S \;\&\; \downarrow X_S \rightarrow -CAD \rightarrow -B \quad (3)$$

Similarly:

$$\uparrow M^S \rightarrow \downarrow i \rightarrow \uparrow K_o \rightarrow -KA \rightarrow -B \quad (4)$$

$$-\,\mathrm{CAD}\;\&\;-\,\mathrm{KA} \rightarrow -B \quad (5)$$

Just the opposite case will occur when the central bank of the country decreases its money supply.

According to Harry Johnson, money demand is a stable function of the price level, income and interest rate. It can be expressed as:

$$M^D = \mathrm{f}\,(P, Y, i) \quad (6)$$

In the above equation, *P* and *Y* are denoted as price level and nominal income which is direct proportion to money demand. Whereas *i* is denoted as the interest rate which is inversely related to money demand. Since money demand is a stable function of the price level, income and interest rate, the Johnsonian approach did not give much importance to money demand in influencing the Balance of Payments but money supply occupies significance.

Johnson defined money supply is a multiple of a monetary base that consists of domestic money supply and the stock of foreign exchange reserves. It can be stated as:

$$M^S = \mathrm{DM} + \mathrm{RM} \quad (7)$$

Therefore, any changes in *P*, *Y*, *i*, *DM* and *RM* will affect money supply and money demand, which in turn affects the Balance of Payments.

The Johnsonian model can be applied to improve or correct disequilibrium in the Balance of Payments under fixed and flexible exchange rate systems. Under a fixed exchange rate system, the BOP is highly monitored and controlled by the Central Bank via accommodating flows. Whereas in the flexible exchange rate system, market forces play a significant role in determining the exchange rate, which in turn corrects BOP disequilibrium automatically through autonomous flows.

In the present scenario, the majority of the countries are following either a flexible exchange rate system or a managed float exchange rate system. So, the present study tries to test the relevance and effectiveness of Harry Johnson's monetary approach to the problem of balance of payments under a flexible exchange rate system.

The government of India has introduced the Liberalised Exchange Rate Management System (LERMS) in 1991 and it came into effect from 1992. Since then the exchange rate of the rupee is mainly determined by the market forces. To test the effectiveness of Harry Johnson's monetary approach to BOP under a flexible exchange rate system, the study chooses India's BOP account since the implementation of LERMS (1992) occupies significance.

Several eminent economists tested monetary approach to Balance of Payments. Of which, some of them like Robert Mundell (1968, 1971), Mc Kinnon (1968), Jacob A. Frenkel (1971), Harry G. Johnson (1968, 1972, 1977) Swaboda (1973) and Michael Mussa (1974) are the significant approaches offers clear cut evidence that proved the effectiveness of monetary policy in the context of Balance of Payments disequilibrium. After the 1980s, especially under openness regime, the role of monetary policy on external sector equilibrium and Balance of Payment variables lacks significance and raises doubts about various theories offered by Robert Mundell, Harry Johnson, Michael Mussa and so on. In continuation of the above, the present study tries to estimate the relevance of the monetary approach to Balance of Payments. Especially, the study connects Harry Johnson's monetary

approach using India's Balance of Payments since the implementation of the Liberalised Exchange Rate Management System (LERMS 1992).

Milton Friedman, Harry Johnson, Mundell-Fleming, David Hume, Michael Mussa and others proved the relevance and effectiveness of macroeconomic policies (Monetary and Fiscal Policy) in achieving external and internal sector goals (BOP Equilibrium and Full Employment). Among all the approaches, Harry Johnson's approach occupies significance in the background of the Balance of Payments. In this context, the present study tries to test the effectiveness of Harry Johnson's monetary approach using India's Balance of Payments account.

Therefore, the present study attempts to answer the following research questions:

- To what extent India's Balance of payments account responds to the changes in the money supply?
- Does BOP disequilibrium restore automatically under a flexible exchange rate system, especially after the implementation of the Liberalised Exchange Rate Management System (LERMS) in India in 1992?
- Does the change in money supply have more impact on the capital account than in the current account?
- How effective the Harry Johnson's monetary approach in solving issues in India's Balance of Payments?

Against the background and research issues, the major objectives of the study are to evaluate the effectiveness of Monetary policy under a flexible exchange rate system, especially since the implementation of LERMS in India in 1992. It will be interesting to compare the effect of changes in the money supply on the current account as well as in the capital flows. So, that the relevance of Harry Johnson's Monetary Approach to BOP can be investigated. For this purpose, the present study uses twenty-seven years of secondary data since the inception of LERMS in India in 1992 to till date. The required data were collected from various national and international sources like Handbook of Statistics on the Indian Economy (RBI), Report on Currency and Finance (RBI), Global Financial Development Report of World Bank report and Balance of Payments manual of IMF.

1. Literature review

Friedman, Milton (1948) analysed the monetary and fiscal framework in the context of economic stability. He found that the explicit control of the quantity of money by the government and the explicit creation of money to meet fiscal deficit will influence inflationary effect in the economy. This problem cannot be rectified with fiscal discipline. Instead, eliminating government control on the quantity of money with the balanced budget will provide a solution to economic fluctuations. Also, he articulated several interesting questions relating to the effectiveness of the monetary policy. Some of them are: how important change in the supply of money compared with changes in the demand for money? Are transaction variables most important in determining the demand for money? How elastic is the demand for money concerning interest rates? When changes in demand or supply occur that produce discrepancies between the quantity of money that the public holds and the quantity it desires to hold, how rapidly do these discrepancies tend to be eliminated? Does the adjustment impinge mostly on prices or mostly on quantities? Is the adjustment to sharp changes over short periods different in kind or only in degree from the adjustment to slower changes over longer periods? For all the above questions, he concluded that full adjustment to monetary disturbances takes a very long time and affects many economic magnitudes. If the adjustment were swift, immediate, and mechanical, as some earlier quantity theorists may have believed, or, more likely, as was attributed to them by their critics, the role of money would be clearly and sharply etched even in the imperfect figures that have been available. But, if the adjustment is slow, delayed, and sophisticated, then crude evidence may be misleading, and a more suitable examination of the record may be needed to disentangle what is systematic from what is random and erratic (Milton Friedman 1970).

Johnson, Harry G. (1972) developed a new approach to the theory of Balance of Payments and BOP adjustment. This new approach plays a dominant role in the British Economy during the 70s when devaluation failed to produce the desired result. This new approach is originated from the original work of J.J. Koopmans and Robert A. Mundell. The new approach mainly focused at the forefront of analyzing the monetary aspects of adjusting BOP instead of price aspects. The new approach also focuses on relative price changes but not on the direct influence of excess demand for and supply of money on the balance between income and expenditure. Specifically, not on total acquisition and disposal of funds whether through production and consumption or borrowing and lending, and therefore on the overall BOP.

Mussa, Michael (1974) tested the efficacy of the monetary approach to Balance of Payments analysis. The study set forth the most relevant and important principles of monetary policy and tested the same in a simple model of trade and payment behavior. The study found that the money demand function and money supply process plays a central role in the balance of payments analysis, especially in the long run. The study concludes stating that the monetary approach is not identified with the view that "only money matters," nor is it asserted that the monetary

approach is encompassed in any single, specific, theoretical model. Reasonably, it is argued that the monetary approach incorporates an extensive course of models that share certain elementary features but can vary in many central respects, mainly about short-run processes of adjustment.

Frenkel, Jacob A. and Carlos A. Rodriguez (1975) correlated monetary approach to the Balance of Payments in the context of portfolio balances. They aimed to analyse the adjustment mechanism using a small country with the condition of full employment with trading commodities, securities and money. Frenkel and Rodriguez focused on both restricted and open economic perspectives, especially, the impact of money supply on inter-temporal trade, accumulation of real and financial assets in the balance of payments.

Magee, Stephen P. (1976) reviewed The Empirical Evidence of Monetary Approach to the Balance of Payments and Exchange Rates under fixed and flexible exchange rate system. This approach did not pay attention to a single country experience or single approach, it focuses the effect of monetary policy to BOP and exchange rate by considering the approaches of Robert Mundell (1968, 1971), Harry Johnson (1972), Arthur Laffer (1979), Ryutaro Komiya, Rodriguez Dornbusch (1971) and Jacob Frenkel (1971). Stephen Magee concluded by stating the demand for nominal money balance is mainly determined by the price level, real income and the interest rate. Similarly, the supply of money equals the money multiplier times the supply of high powered money. Also, he observed that the domestic supply and demand for money are equated and international reserves are separated from high powered money.

Johnson, Harry G. (1977) analysed Monetary Approach to Balance of Payments Theory and its Implications. The main aim of his analysis is to introduce to a wider audience an emerging approach to the balance of payments theory and policy, generally described as "the monetary approach", to describe the theoretical differences between this approach and previous approaches (See Johnson, Harry 1972).

Frenkel, Jacob A., Thorvaldur Gylfason and John F Helliwell (1980) correlated Monetary and Keynesian approaches in the context of Balance of Payments analysis and found the difficulties of empirical estimation in the short run. The study contrasted some principles of the Monetary and Keynesian approach and reformulated a more general model by taking essential features of both. The study observed that long term modeling is required to test the composition and growth of foreign and domestic portfolios. The short term model paid no attention to evaluate the role and expectations concerning interest rate, prices, GDP, taxes, government expenditure and so on. A more complete analysis would have to incorporate these features within modeling that considers the long-run effect.

Mayer, Thomas (1980) well-articulated the scholastic work of David Hume concerning Monetarism. The study focuses on twelve important propositions of monetarism on Hume's perceptions and found Hume is explicitly a monetarist on quantity theory, transmission process, the stability of the private sector, short term inflationary effect on output and private market economy. Also, the study found Hume is implicitly a monetarist in terms of the irrelevance of allocation and the focus on the price level as a unit rather than on individual prices. Hume was indifferent and strongly opposed the monetarist position to inflation.

Kannan R. (1989) applied the monetary approach to the balance of payments in the context of the Indian Economy from 1968 to 85. The study attempted to analyse whether the disequilibrium in the money market affects the balance of payments or not. The study has been done by using the Jonsonian Approach (1972) and Mundellian Approach (1968). Also, the study compares the Elasticity approach and monetary approach using India's BOP statistics from 1968 to 85 when India followed a restricted exchange rate system. The study has applied Granger and Sims causality test and found that an exogenous change in domestic credit led to causes a more than proportionate change in international reserves. Also, the study found that the central bank actively sterilizes the impact of the changes in forex reserves on the money supply. Finally, the study concluded by stating that the disequilibrium in the money market has a significant effect in the Balance of Payments.

Raghavan and Saggar (1989) tested the applicability of the Monetary Approach to Balance of Payments using India's BOP data from 1960 to 1981. By taking the inapplicable conditions from past studies, this study tries to verify the relevance of the monetary approach in the context of Indian Economy during the restricted exchange rate system. Like Kannan (1989), this study also uses Granger and Sins causality test and invalidated the core proposition of MBOP that domestic credit creation feeds to BOP deficit. Granger test proves a strong causal relationship between forex reserves with domestic credit.

Khatiwala, Yuba Raj (1992) tested the applicability and relevance of the monetary approach to the balance of payments in the context of the Nepalese economy. The study uses OLS method and found an inverse relationship between domestic credit and reserve flow. But the study also found a positive relationship between real income and prices with reserve flow, which is contradictory to the Keynesian approach on the balance of payments. Based on the observation that all goods are traded, the study inferred that the increase in domestic credit led to an increase in prices which in turn affects the balance of payments via increased transaction demand

for nominal money. Finally, the study concluded by suggesting that the monetary authorities should restrict domestic credit to counteract additional demand for nominal money so that the monetary policy objectives can be met without affecting the goods market, capital market and foreign exchange assets.

Bhattacharya, Indranil and Partha Ray (2007) assessed monetary policy stance by observing various monetary policy announcements in India from 1973 to 1998. This study used Vector Auto-Regressive (VAR) framework and found that the monetary policy seemed to have been more effective in price control than output growth. The impulse response from the VAR model depicted the success of monetary policy in inflation control rather than on GDP reflecting proactive monetary management in a regulated environment. So the study recommended the necessity of future analysis of monetary policy in the pre and post the 90s to trace causal impact on growth-inflation trade-off.

Hutchison, Michael M., Rajeswari Sengupta and Nirvikar Singh (2010) investigated the applicability of the discretionary monetary rule of the Reserve Bank of India in relation to Taylor-type rule. The study estimated an exchange-rate-augmented Taylor rule for India for a period of 28 years from 1980 to 2008. The study compares monetary policy effects during the pre- and post-liberalisation periods to capture the potential impact of macroeconomic structural changes on the RBI's monetary policy conduct. The study found that the output gap appears to be important to RBI rather than consumer price inflation and exchange rate changes.

Imoisi, Anthoni Ilegbinosa, Lekan Moses and Bosco Itoro Ekpenyong (2013) analysed monetary policy and its implications for the Balance of Payments stability in Nigeria. To evaluate the effectiveness of monetary policy on the Balance of Payments of Nigeria, the study uses 30 years of time series data and applied OLS technique. The study uses BOP as the dependent variable and money supply, Interest Rate and Exchange Rate as independent variables. The study found a positive relationship between the dependent and independent variables. Especially, Money supply and interest rates are highly significant and positive relation with BOP, whereas exchange rate was positive but not significant to the BOP.

Odili, Okwuchukwu (2014) correlated the exchange rate and balance of payments of Nigeria using Auto-Regressive Distributed Lag (ARDL) model. The main aim of the study is to detect the short-run and long-run dynamic relationship between BOP and other independent variables like exchange rate, exports and imports. The study has applied the Elasticity approach and monetary approach to Nigerian Balance of Payments. The study found a positive and significant relationship in the long run, whereas in the short run, the study found a positive coefficient but statistically insignificant.

Tijani, Julius O (2014) conducted an experimental study on the effect of various monetary instruments in the Balance of Payments account of Nigeria during 1970-2010. The study was done by using a linear regression model and found a positive relationship between BOP with domestic credit, exchange rate, and balance of trade. Whereas, the inflation rate and gross domestic output are inversely related to the BOP. Overall, the study observed that the monetary measures constitute immensely to BOP position causes disequilibrium. So, monetary measures can be used as an instrument to adjust Balance of Payments.

Osisanwo, Sheriffdeen and Bolade Abolaji Adesoye (2019) examined the impact of monetary policy on the Balance of Payments of Nigeria using annual data from 1980 to 2015. The dynamic econometric study observed a long-run relationship between monetary policy and BOP of Nigeria. Similarly, Onuchuku, Chukueggu, Nenber and Wosu (2018) also found a strong relationship between monetary policy and BOP of Nigeria. They confirmed apriori expectations between money supply, interest rate, exchange rate and GDP of Nigeria.

Senyefia, Oduro-Okyireh and Eunice (2019) observed that the BOP in Ghana is purely a monetary phenomenon, both short-run and long-run relationship exists between monetary policy variables and BOP variables. Exchange Rate, Net Domestic Credit, Inflation Rate and Interest Rate are found to have a significant influence on the BOP position in the long run. Also, Net Domestic Credit and Broad Money Supply have a highly significant effect on the BOP position in the short run.

Having adequate examination from the past studies, it is not easy to refuse the fact that the monetary approach to the balance of payments is still an unsolved phenomenon. From the literature survey, it is observed that some studies confirmed concrete evidence by establishing the effect of monetary policy on BOP. Several other studies, especially after the 1980s invalidated the effective role of monetary policy on the Balance of Payments. Theoretically (Robert Mundell, Michael Mussa, Jacob Frenkel, Harry Johnson and Milton Friedman), the expansionary monetary policy leads to create short-run deficit in BOP and LR surplus or equilibrium in BOP through price adjustment mechanism. The main objective of the study is to test the above relationship and offer appropriate evidence from the Indian context since the introduction of Liberalised Exchange Rate Management System (LERMS).

2. Research methodology

After reviewing extensive scholarly work in the past and the significance of co-integrating money supply with BOP variables, the present study chooses Autoregressive Distributed Lag-Error Correction Model (ARDL-ECM) model for analysis. This study mainly focuses on the impact of changes in money supply on the Balance of Payments account via the Exchange rate, Interest Rate, Inflation Rate and Openness in the short run as well as in the long run. The error correction approach is very useful and appropriate for estimating and comparing short term and long term effects of a one-time series with the other time series.

Therefore, ARDL-ECM approach occupies significance for this study. Before applying the ARDL-ECM approach, this study first uses the Augmented-Dickey Fuller unit root test to check whether the selected time series is stationary or not. After grasping the stationary conditions, the study ARDL bound test for co-integration. After that, the study will employ ECM framework to establish a link between the Dependent variable (Variables in BOP account) with several independent variables like Money Supply, Exchange Rate, Inflation Rate, Interest Rate and Openness of the Economy. Finally, the Granger Causality test will be applied to check the causal relation between Money supply and BOP variables in India. All the estimates and analysis will be done by using E-views 8 software.

2.1. Model specification

To test the effectiveness of the Johnsonian approach in the context of India's Balance of payments, the study uses the Balance of Payments as a Dependent variable and Money Supply as the major independent variable. Also, the study includes Exchange Rate, Interest rate, Inflation Rate and Openness as other explanatory variables for analysis. Based on the background and literature survey, the study will estimate the following functional form:

$$BOP = f(MS, ER, CAD, CO) \quad (8)$$

where: BOP is Balance of Payments, MS is Money Supply, ER is Exchange Rate, CAD is Current Account Deficit, and CO is Capital Outflows from India.

The model can be rewritten in a linear equation form:

$$BOP_t = \alpha_0 + \alpha_1 MS_t + \alpha_2 ER_t + \alpha_3 CAD_t + \alpha_4 CO_t + U_t \quad (9)$$

In order to evaluate the short-run and long-run relationship between money supply and balance of payments variables, this study uses the Autoregressive Distributed Lag-Error Correction model (ARDL-ECM). The ARDL model first verifies long-run causality between the variables and then it checks short-run causality and the speed of adjustment using the error correction term. Therefore, the present study uses ARDL-ECM approach using the transformed log-linear model which are as follows:

$$\begin{aligned} \Delta ln\, BOP_t = {} & \alpha_0 + \sum_{k=1}^{P1} \alpha_1\, \Delta ln\, BOP_{t-1} + \sum_{k=1}^{P2} \alpha_2\, \Delta ln\, MS_{t-1} + \sum_{k=1}^{P3} \alpha_3\, \Delta ln\, ER_{t-1} + \\ & \sum_{k=1}^{P4} \alpha_4\, \Delta ln\, CAD_{t-1} + \sum_{k=1}^{P5} \alpha_5\, \Delta ln\, CO_{t-1} + \Omega\, ECT_{t-1} + \beta_1\, ln\, BOP_{t-1} + \\ & \beta_2\, ln\, MS_{t-1} + \beta_3\, ln\, ER_{t-1} + \beta_4\, ln\, CAD_{t-1} + \beta_5\, ln\, CO_{t-1} + U_t \end{aligned} \quad (10)$$

In the equation, α_1, α_2, α_3, α_4 and α_5 are the short-run coefficients of the explanatory variables. Similarly, β_1, β_2, β_3, β_4 and β_5 are the long-run coefficients. Ω is the coefficient for measuring the speed of adjustment for equilibrium in the ECM model.

2.2. Granger causality

In the Granger Causality Test, the directional relationships between two variables are very sensitive which can be used efficiently by using the optimal number of lags in the model. It can be inferred from the computed statistical values, based on the given equations, if the beta coefficients become zero or less than the conventional value of 0.05 and the computed F statistic is low for the first hypothesis in the equation (8) indicate that the lagged MS do not possess in the regression (Accepting null hypothesis). This means Money Supply in India does not Granger cause Current Account Deficit, similarly for other beta coefficients in the first hypothesis of the rest of equations. When we move to the second hypothesis which states that the Current Account Deficit does not Granger cause Money Supply in India if the computed F statistic is low or P-value is less than the conventional value, we can reject the hypothesis and infer that the Current Account Deficit does not Granger cause Money Supply in India. Similar results can be derived for other beta coefficients in the second hypothesis of the rest of the equations.

2.2.1. Causality test for the changes in Money Supply and Balance of Payments variables in India

To test causality between the changes in Money Supply in India with the Variable in India's Balance of Payments, the following model developed by Engel and Granger, (1987) will be used. The models are:

- *Money Supply and Current Account Deficit in India*

$$MS_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\, MS_{t-i} + \sum_{i=1}^{n} \beta_{2i} CAD_{t-i} + u_{1t}$$

$$CAD_t = \beta_3 + \sum_{i=1}^{n} \beta_{4i}\, CAD_{t-i} + \sum_{i=1}^{n} \beta_{5i}\mathrm{MS} + u_{2t} \quad (11)$$

- *Money Supply and Capital Outflows from India*

$$MS_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\, MS_{t-i} + \sum_{i=1}^{n} \beta_{2i} CO_{t-i} + u_{1t}$$

$$CO_t = \beta_3 + \sum_{i=1}^{n} \beta_{4i}\, CO_{t-i} + \sum_{i=1}^{n} \beta_{5i} MS_{t-i} + u_{2t} \quad (12)$$

- *Money Supply and Balance of Payments (Net) in India*

$$MS_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\, MS_{t-i} + \sum_{i=1}^{n} \beta_{2i} BOP_{t-i} + u_{1t}$$

$$BOP_t = \beta_3 + \sum_{i=1}^{n} \beta_{4i}\ BOP + \sum_{i=1}^{n} \beta_{5i} MS_{t-i} + u_{2t} \quad (13)$$

- *Money Supply and Exchange Rate in India*

$$MS_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\, MS_{t-i} + \sum_{i=1}^{n} \beta_{2i} ER_{t-i} + u_{1t}$$

$$ER_t = \beta_3 + \sum_{i=1}^{n} \beta_{4i}\ ER + \sum_{i=1}^{n} \beta_{5i} MS_{t-i} + u_{2t} \quad (14)$$

- *Exchange Rate and Balance of Payments in India*

$$ER_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i}\, ER_{t-i} + \sum_{i=1}^{n} \beta_{2i} BOP_{t-i} + u_{1t}$$

$$BOP_t = \beta_3 + \sum_{i=1}^{n} \beta_{4i}\ BOP + \sum_{i=1}^{n} \beta_{5i} ER_{t-i} + u_{2t} \quad (15)$$

where: MS = Money Supply, CAD = Current Account Deficit, CO = Capital Outflows, BOP = Balance of payments and ER = Exchange Rate.

3. Empirical results

To analyse the relationship between money supply and balance of payments in India and to test the effectiveness/relevance of Harry Johnson's monetary approach to the balance of payments, this study is designed at four stages. The first stage verifies stationarity conditions using Augmented-Dicky Fuller (ADF) and Philips Perron's (PP) unit root test. Stage two uses ARDL bound test and long-run causality. Stage three uses error correction term to evaluate short-run causality and the speed of adjustment for equilibrium. Finally, Engel-Granger causality will be employed to verify directional causality between two variables separately.

3.1 Unit Root Test

The present study uses two popular unit root tests, namely, Augmented-Dickey Fuller Test and Philips Perron test for unit root and stationary conditions. The results are given in Table 1.

Table 1. Unit Root Test ADF & PP method

Variables	Augmented-Dickey Fuller		Philips-Perron	
	Level	First Difference	Level	First Difference
BOP	0.0001	0.0000	0.0001	0.0000
MS	0.6351	0.1121	0.6170	0.0011
ER	0.2218	0.0001	0.2318	0.0001
CAD	0.2458	0.0012	0.2000	0.0012
CO	0.8883	0.0009	0.8899	0.0009

Source: Computed from RBI data using E-Views 8th version

It is clear from the test results that the selected variables are almost non-stationary at level and stationary at first difference except money supply. Also, it is noted that the ADF and PP results revealed that the BOP variable is stationary at a level and first difference. So, it is observed from the unit root test that the study must employ the ARDL model for analysis.

3.2. Autoregressive Distributed Lag Model (ARDL Approach)

A literature survey reveals that the variables should be non-stationary at I(0) and Stationary at I(1) to apply major econometric techniques for analysis. Variables selected in this study are also fulfilled almost all criteria for the application of ARDL model. The ARDL model is highly appropriate for this study for two reasons. The first one is, the independent variables are a mixture of I(0) and I(1). The second reason is that the study will try to establish the short-run and long-run causality between money supply and BOP variables. The reason is to test Johnsonian notion on money supply and BOP variables *i.e..*, an increase in money will create temporary disequilibrium in BOP in the short run and it will be automatically restored in the long run under flexible exchange rate system.

First, the study uses the ARDL long-run model with various lags using Akaike Info Criterion (AIC) and Schwarz Criterion (SIC) for lag selection. Since the number of observations is less than 30 and low AIC and SIC value observed for lag 1, the study chooses lag 1 for analysis and the results are given in Table 2.

Table 2. ARDL test results for long run Causality

Variable	Coefficient	Std. Error		t-Statistic	Prob.
C	-0.742213	0.841386		-2.267384	0.0397
LBOP(-1)	-0.145408	0.346632		-6.189291	0.0000
LM1(-1)	-0.948960	0.539731		-0.956368	0.3551
LER(-1)	0.115541	0.603784		3.791321	0.0020
LCAD(-1)	0.014550	0.206357		0.070507	0.9448
LCO(-1)	-0.197504	0.293664		-0.027079	0.9788
R-squared	0.903505		Mean dependent var		0.773106
Adjusted R-squared	0.834580		S.D. dependent var		11.14769
S.E. of regression	4.533977		Akaike info criterion		5.161257
F-statistic	13.10850		Schwarz criterion		6.697563
Prob(F-statistic)	0.000018		Hannan-Quinn criteria.		6.310006
Durbin-Watson stat	2.388935				

Source: Computed from RBI data using E-Views, 8th version

After getting results for the selected model, the study must check the stability of the model and the occurrence of serial correlation. For this purpose, the study uses Breusch-Godfrey's serial correlation technique and the results are given in Table.

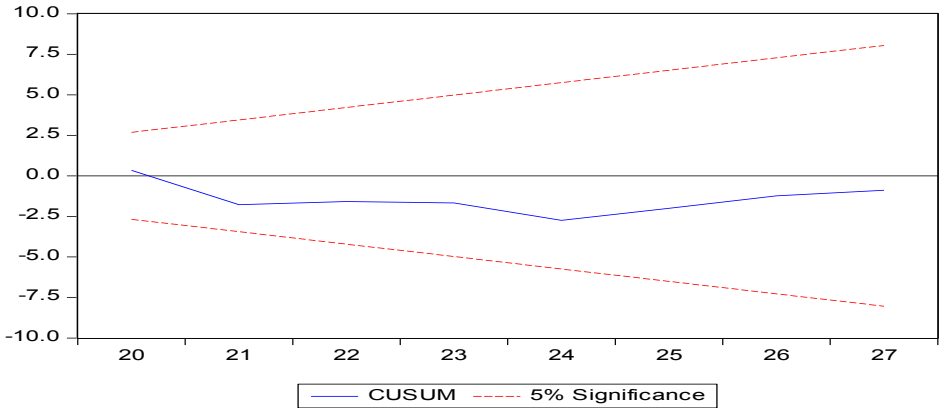
Table 3. Breusch-Godfrey Serial Correlation LM Test

F-statistic	1.166200	Prob. F(1,13)	0.2998
Obs*R-squared	2.058068	Prob. Chi-Square(1)	0.1514

Source: Computed using the information in table 2.

It is flawless from Table 3 that the probability for observed chi-squared value is 15.14 percent lead to the rejection of the null hypothesis. Meaning that the model does not have any serial correlation and it satisfied the criteria for a good model. After completing the serial correlation, the study also tried to check the stability of the model using CUSUM's stability test. The results are are shown in the Figure 3.

Figure 1. CUSUM's Stability Test



From Figure 1, it is clear that the blue line falls in between the two red lines (2 dotted lines: within ± 2 s.e bands). Meaning that the model is stable at 5% level of significance. So the study observed that the model is highly stable without any serial correlation.

Table 4. Wald test for long-run causality

Test Statistic	Value	df	Prob
F-statistic	4.693279	(4, 8)	0.0303
Chi-square	18.77312	4	0.0009

Source: Computed

Table 5. ARDL Bound test results

Variable	F-Statistic	Lower Bound	Upper Bound
Ln BOP	4.6932	2.86	4.01

Source: Computed

From Table 4, the observed F-statistic value is 4.7 and the probability value is less than 5% leads to the rejection of the hypothesis. Meaning that the selected variables are not equal to zero indicated that there is a causality between the variables. Also, it is clear from Table 5 that the observed F statistic value of 4.7 is greater than the Pesaran (2001) upper bound value of 4.01 leads to the acceptance of the alternative hypothesis. From the ARDL bound test and Wald test statistics, the study rejects the null hypothesis and inferred that the variables have long-run causality.

The long-run test statistics from Table 2 reveal that the exchange rate (LER) and current account deficit (LCAD) have a positive correlation and the other two variables like money supply (LM1) and capital outflows (LCO) have a negative coefficient. The only exchange rate has a positive coefficient (0.11554) and a statistically significant value (0.0020). It states that, in the long run, a 10 percent increase in exchange rate leads to improving India's BOP at a low rate of 1.15%. The positive coefficient for the current account value also supports this argument. All the other dependent variables are not statistically significant (high prob values) proves less relevancy of the Johnsonian approach. As per the Johnsonian approach, an increase in money supply leads to a decrease in BOP via trade deficit and capital outflows. But this study observed a negative coefficient and a statistically insignificant value of 35 percent for money supply and 94% for capital outflows also proves less relevance of the Johnsonian approach in India's Balance of Payments.

After observing the long run test results, the study must focus on short-run causality using the error correction term.

3.3. Error Correction Model

To correlate short-run and long-run relationships, the study needs the inclusion of Error Correction Term (ECT) using residuals of the model. The error correction model is more or less similar to the basic ARDL approach with ECT values and the results are given in Table 6.

Table 6. ARDL – ECM test results for long run Causality

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.433473	0.370222	1.904149	0.3779
D(SERIESLBOP(-1))	0.303488	0.167938	1.807146	0.0875
D(LM1(-1))	-0.880450	0.241126	-0.003651	0.9971
D(LEXC(-1))	0.462021	0.205621	2.246899	0.0374
D(LCAD(-1))	-0.949960	0.196754	-0.482816	0.6350
D(LKAOUT(-1))	0.690825	0.350418	1.526014	0.1444
ECT(-1)	**-0.559939**	0.318916	-4.891380	**0.0001**
R-squared	0.827529	Mean dependent var		0.773106
Adjusted R-squared	0.770038	S.D. dependent var		11.14769
S.E. of regression	5.345800	Akaike info criterion		6.421996
F-statistic	14.39420	Schwarz criterion		6.763281
Prob(F-statistic)	0.000005	Hannan-Quinn criteria.		6.516654
Durbin-Watson stat	2.096643			

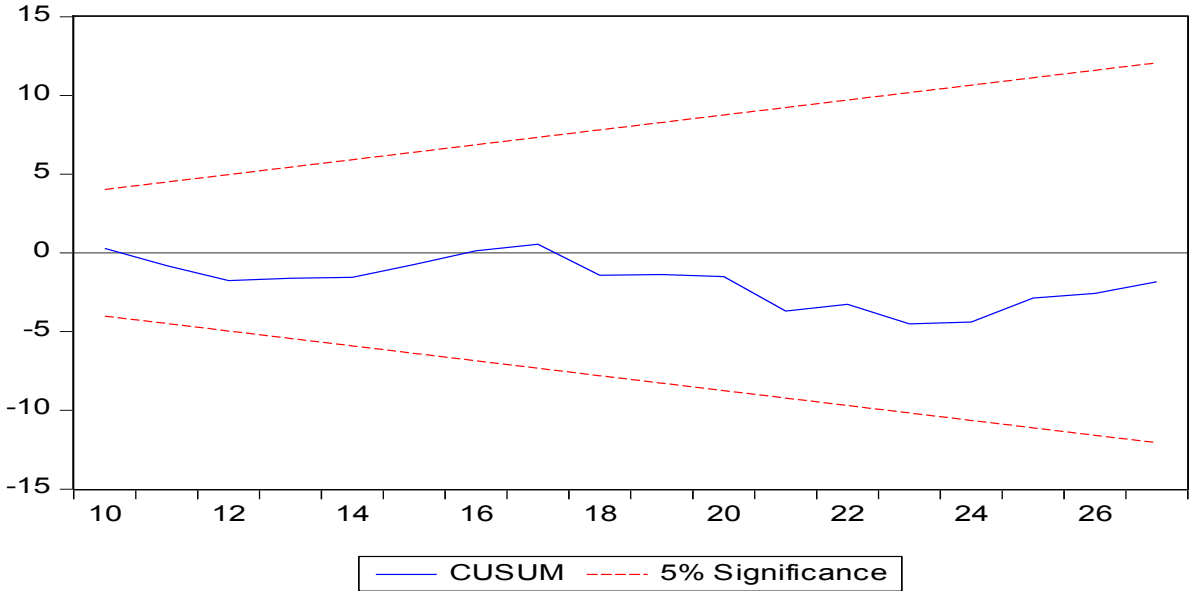
Source: Computed from RBI data using E-Views 8th version

In the first part of the ARDL analysis, the study observed long-run causality between the selected variables (at a low significant level). So the criteria for satisfaction of the ECM approach is that the ECT coefficient should be negative and the probability value for the error correction term should be less than 5%. It is clear from Table 6 that the observed ECT coefficient is negative (-0.559939) and the ECT prob value is less than 5% (0.0001) confirmed the efficiency of the model. Still, the study needs to check serial correlation and stability of the model. For this purpose, the study again uses Breusch-Godfrey's serial correlation technique and CUSUM's stability test at a 5% level of significance. The results are as follows:

Table 7. Breusch-Godfrey Serial Correlation LM Test

F-statistic	0.111157	Prob. F(1,17)	0.7429
Obs*R-squared	0.162405	Prob. Chi-Square(1)	0.6870

Figure 2. CUSUM's Stability Test



From Table 7, the study has observed the high chi-squared value of 68% leads to the rejection of the null hypothesis and confirms that the model has no serial correlation. Similarly, CUSUM's test also confirms the stability of the model which is seen from Figure 2 (blue line falls within ± 2 s.e bands). After observing the non-occurrence of serial correlation and stability test, the study has applied Wald test. The Wald test results 17% probability for F-statistic and 12% probability for Chi-Square value leads to the rejection of the null hypothesis. It states that there is no causality between money supply and balance of payments variables in the short run.

The ARDL-ECM test results from Table 6 pointed out that there is no causality in the short-run (high prob values) and there is causality in the long run (ECT prob 0.0001). The only exchange has low significant values in the short run. This means, in the short-run, a 10% increase in the exchange rate will lead to change BOP by 3%.

Except for the exchange rate, all the independent variables are statistically insignificant to India's BOP in the short run. Some variables established negative coefficients, but it doesn't matter when they are statistically insignificant. This means, the short-run relation invalidated the relevance of Johnsonian approach to India's Balance of Payments. But the ECT coefficient value of -0.559939 and ECT probability value of 0.0001 confirms the existence of long-run causality. It can be inferred that there is a long-run relationship exists in the whole system and getting adjusted at the speed of 55% towards the long-run equilibrium. The high R^2 value of 0.8275 shows the goodness of fit of the model. The Durbin Watson value of 2.1 confirms the non-existence of autocorrelation in the data series. The F-Statistic value of 14% and low pro value (0.000005) also proves that all the repressors in the model are statistically significant for analysis.

Table 8. Pairwise Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.	Result
LM1 does not Granger Cause LCAD	25	1.66592	0.2142	No causality
LCAD does not Granger Cause LM1		2.88111	0.0795	
LM1 does not Granger Cause LEXC	25	1.82798	0.1866	No causality
LEXC does not Granger Cause LM1		0.11754	0.8897	
SERIESLBOP does not Granger Cause LEXC	25	0.89768	0.4233	Unidirectional causality
LEXC does not Granger Cause SERIESLBOP		5.30074	0.0142	
LM1 does not Granger Cause LKAOUT	25	4.85208	0.0191	Unidirectional causality
LKAOUT does not Granger Cause LM1		0.08953	0.9147	
SERIESLBOP does not Granger Cause LM1	25	0.06804	0.9344	No causality
LM1 does not Granger Cause SERIESLBOP		0.91061	0.4183	

Source: Computed from RBI data using E-Views 8th version

This study also uses the Granger Causality test for a directional relationship between two variables separately, instead of overall results. The main purpose is to use forward and the backward relationship between money supply and balance of payments variables.

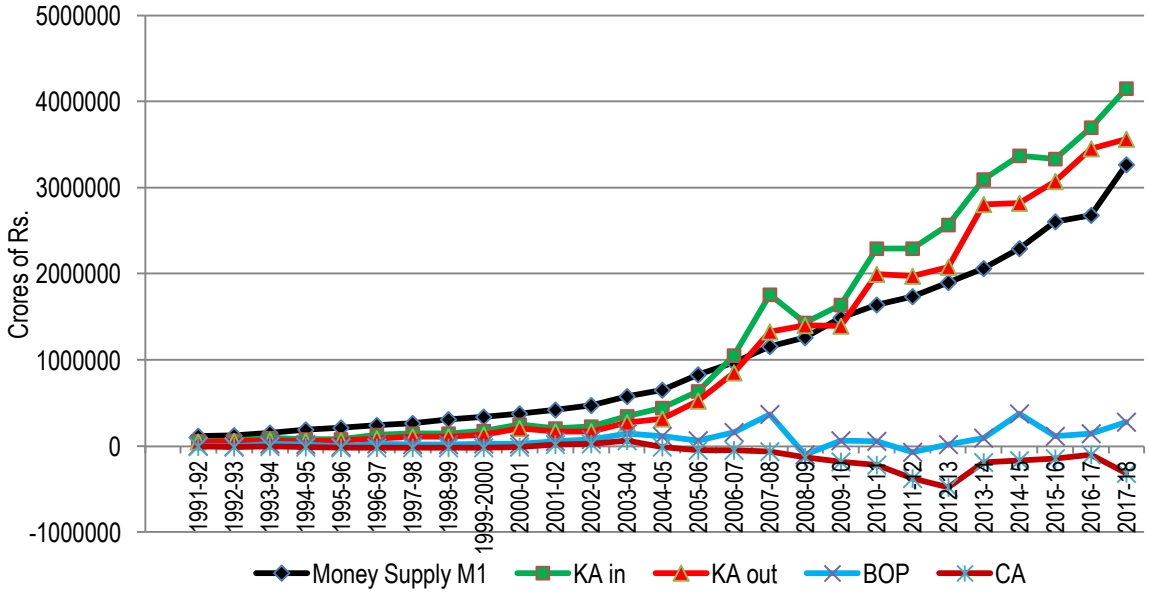
Pairwise Granger Causality test results from Table 8 support the inferences drawn from the ARDL-ECM model. Granger Causality test result observed no causality for equations 4, 6 and 7. Which means that there is no correlation between money supply, current account deficit and exchange rate in India. As per the Johnsonian approach, an increase in money supply leads to increase current account deficit and exchange rate through price effect. This observation validated/supports ARDL-ECM results of no correlation in the short run. Similarly, the Pairwise Granger Causality test results observed unidirectional causality for equations 5 and 8 meaning that there is a unidirectional causality between money supply, capital outflows and balance of payments. It can be inferred that the increase in money supply leads to increase capital outflows (by decreasing interest rate) which causes the exchange rate to rise. The rise in exchange rate will create a deficit in the balance of payments. This observation validated/supports ARDL-ECM results of correlation in the long run.

Interestingly, the Granger Causality test result validated the test results of the ARDL-ECM approach used in this study.

Finally, the study also uses descriptive statistical data for supportive evidence/confirmations. Based on the raw data, the study has established trend lines for the money supply, capital inflows and outflows, current account flows and overall balance in India.

The study has observed several interesting results in Figure 3. It is clear from the figure that there is a positive correlation that prevails between money supply and capital flows in India since 1991. The increasing money supply is also affecting the current account inversely. These two results validate the relevance of the Johnsonian approach to India's Balance of Payments. But the simultaneous increase in capital inflows and failure in the restoration of current account flows strongly invalidates Johnson's perspectives. That's why the empirical results also yield mixed implications.

Figure 3. Trends in Money Supply and Balance of Payments in India Since 1991



Conclusions

The central theme of the study is to test the effectiveness and relevance of Harry Johnson's monetary approach using India's Balance of Payments account from 1991, especially in the context of liberalized exchanged rate regimes (Since LERMS 1992). The main findings of the study can be observed in three dimensions.

First, the study answers to what extent India's BOP responds to changes in the money supply. The empirical findings from the ARDL approach revealed that there is a long-run causality in the model. It implies that the log BOP responds to overall explanatory variables. When the study correlates BOP with every independent variable alone, the majority of variables are statistically insignificant. Granger Causality test results from table 8 are the evidence. Findings from ARDL-ECM and Granger Causality observed no correlation in the short run.

Secondly, the study observed the effect of changes in money supply on capital outflows are always higher than the current account deficit. Coefficient values from the ARDL approach and Granger causality test are the evidence for the above inferences. The trends in Money supply and capital outflows are almost similar but it is not true when the study compares it with the current account (Figure 3).

Thirdly, the study answers the commanding question called the relevance of the Johnsonian approach and the automatic restoration process in the flexible exchange rate system. Based on the ARDL-ECM approach, Granger Causality test and descriptive statistics, the study observed the Johnsonian approach has less relevance in the Indian context even though there is a long-run causality. Moreover, the study did not find any shreds of evidence that support the automatic restoration process in India's Balance of Payments. Especially, during the LERMS regime since 1992, money supply and trade deficit is increasing endlessly. It can be inferred that India is an importing nation that does not have market access globally led to the failure of the automatic restoration process.

Finally, the study observed that the role of monetary policy is not effective in the context of India's BOP. In the present scenario, this may not be an issue for an emerging economy like India. But in the long run, to achieve external equilibrium based on the Mundell-Flemings assignment rule, the study strongly recommended Friedman's monetary rule for the effectiveness of monetary policy in India.

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