FOREIGN EXCHANGE RESERVES: A CAUSAL STUDY WITH EMPIRICAL ANALYSIS IN INDIAN CONTEXT

Chandan Dehury[1*], Tripti [2], B.C Rout[3]

Abstract

Foreign exchange reserves are an important sign of a country's economic strength. This study has been conducted by doing an econometric analysis of the factors determining change in India's foreign exchange reserves using time series data from 1990-91 to 2020-21. In this research, we examine the effect of four factors on India's foreign exchange reserves: debt-to-GDP ratio, foreign exchange rate, FDI inflows, and trade balance. According to this research, FDI inflows and trade balance have a substantial link with changes in foreign currency reserves, although the other two variables are not as important. Finally, based on the findings of this analysis, this paper offers some policy approaches for improving forex reserves.

Keywords: Foreign exchange, econometric analysis

[1*]Department of Mathematics, University Institute of Sciences, Chandigarh University, Mohali, India
2chandandehury@gmail.com
[2]Centre for Economic Studies and Planning, Jawaharlal Nehru University, New Delhi, India
yadavtripti18@gmail.com
[3]Assistant Professor, Department of Mathematics, Chandigarh University, Mohali, India,
bishnu.rout1@gmail.com

*Corresponding Author: Chandan Dehury
*Department of Mathematics, University Institute of Sciences, Chandigarh University, India
2chandandehury@gmail.com

Introduction

Foreign exchange reserves are of paramount importance in maintaining a country's economic stability and sustainability. These reserves, constituted of multiple foreign currencies and global assets, can be affected by multiple factors impacting its economic progress as well as financial security. It is essential for policymakers, economists, and investors to be aware of the factors affecting foreign currency reserves; this helps them to have a better understanding of a country's capacity in managing economic issues and mitigating global financial risks. Holding foreign reserves is a must for any economy in order to combat any external pressures. It serves as a cushion against economic turbulence and provides much-needed stability when it is required. Foreign currency reserves are a country's international assets, and raising them is critical to the prosperity and growth of any country. Therefore, it should be a paramount priority to build up these reserves for use in times of need. Analysis of current economic figures indicates that Foreign Exchange (Forex) plays a crucial role in the Indian Economy. Gold, SDRs, foreign marketable securities, and IMF reserve positions are all held in foreign currencies and contribute to the country's forex reserves. Forex reserves are essential for making trades in the global market. Maintaining higher forex reserves can be beneficial to a country in terms of creating stability and further reinforcing the value of its currency. It is an indicator of greater economic health (Reddy YV. (2002)). Therefore, understanding the role of foreign exchange is crucial for policy & commerce decision-making.

Examining the factors that influence foreign exchange reserves is of tremendous importance, as these reserves have huge implications on a nation's economy. Thus, it is critical to investigate what impacts foreign exchange reserves. Investigating the causes & consequences of foreign exchange reserves is key to gaining a thorough understanding of macroeconomic trends, swap market rates, and global monetary systems. This can help one make better financial decisions. By carefully analyzing the stability and efficiency of an economy, economic indicators can help make informed policy decisions related to financial administration and exchange rate control. As seen in Figure 1, India's foreign exchange reserves have been rising since 1991. It is of key importance to note that India opened up trade with the rest of the world in 1991 after adopting New Economic Policy. Thus, the external sector became crucial after that for India's economic growth.

Figure1: Trends in Foreign Exchange Reserves of India
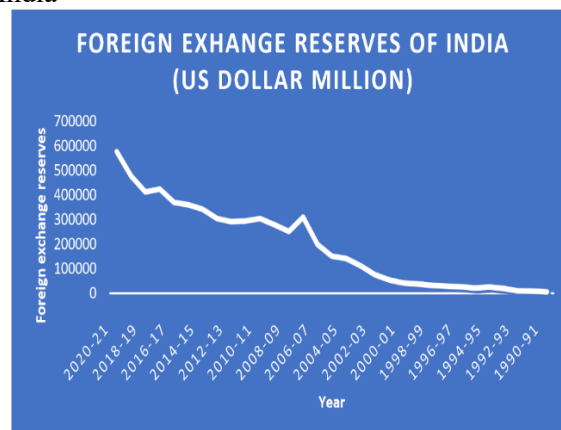
Source: Reserve Bank of India

By analysing the above trend, it is quite clear that foreign exchange reserves are quite important for India. Thus, it is necessary to know what determines the foreign exchange reserves of India. In the same direction, this study aims to look into variables that impact foreign exchange reserves in the Indian context. The paper begins with the study's objective and a review of the literature on various authors' points of view and findings, followed by a section on data sources used, dependent and independent variables, methodology, research question, and hypothesis, and then it moves on to the next section, which discusses the tests performed and the associated results with policy recommendations. Conclusion and references are included in the final two sections.

Objectives

• To create a regression model that demonstrates the relationship between foreign exchange reserves, FDI inflows, debt-to-GDP ratio, and trade balance.
• To determine the relative importance of various factors in determining foreign exchange reserves.

Hypothesis

H_O: $\beta0 = \beta1 = \beta2 = \beta3 = \beta4 = 0$ There exists no significant relationship between the independent variables to the dependent variable.

Literature Review

M. Kashif, P. Sridharan, and S. Thiyagarajan (2017) evaluated the impact of macroeconomic variables on India's foreign reserves using time series data. Economic growth (ECON) was determined to positively influence international reserves, meaning that as the economy expands, reserve holdings increase. Unlike previous studies, a negative connection for trade openness (TRDOP)

was observed, which was linked to India's ongoing trade deficits and economic issues since the early 1990s. The fundamental purpose of M. N. M. Chowdhury, M. J. Uddin, and M. S. Islam (2014) study, was to discover the factors influencing foreign currency reserves by constructing an adequate international reserves function. Through an analysis of variables such as export, inflation rate differential, exchange rate, home interest rate, remittance, broad money supply, import, and GDP, the study identified exchange rate, per capita GDP, volume of import and export, home interest rate, remittance, broad money supply, as potential determinants of foreign exchange reserves. The data reveal that these factors have a direct impact on foreign currency reserves. The study also discovered that, as a result of diminished help from rich countries and international organizations in recent years, foreign aid had no substantial influence on foreign reserves.

Bhakri Suman and Verma Aman (2021) attempted to identify the determinants of India's foreign exchange reserves using a double-log regression model. Bhakri and Verma's paper also highlighted the necessity of reserve and the optimal level of it. They considered ten factors that may potentially Foreign reserves: oil imports, exports, FDI, non-oil imports, external commercial borrowing, short-term debt, long-term debt, nominal exchange rate, rate of interest, and base money. Because of the extreme volatility of import prices, oil, and non-oil imports were considered negligible in this study. Bhakri and Verma have noticed that external commercial borrowings & money supply had negligible effects but did not explain this behavior. Aside from that, all factors were found to be significant. The nominal exchange rate was the most important variable in this study. Kashif, M., and P. Sridharan (2020) study the impact of macroeconomic determinants on foreign reserves using yearly data from 1984 to 2014. An econometric model was created to analyse the data using sophisticated econometric estimating methods and the E-views software. To determine the stationarity of the variables, they carried out the Augmented Dickey Fuller test and all results were indicating that they are integrated to the same order. The Johansen test for cointegration showed no evidence of a relationship between the variables, causing us to use a VAR model. All variables had statistical significance at the 5% level, as determined by the calculated model. Notably, trade openness (TRDOP) had a particularly large influence on reserve holdings, showing that the self-insurance incentive is becoming more important. The findings also demonstrated a positive association between international reserves and trade openness in Sri Lanka, emphasizing the necessity of developing trade policies that support export development while simultaneously retaining adequate international reserves to handle external payment imbalances. While the influence of economic growth on reserve holdings was relatively minor in comparison to other characteristics, the findings showed that as the economy grows, reserve holdings should grow as well, in line with a better quality of life.

Theoretical Concept

Foreign direct investment (FDI) is foreign entities' investment in the local economy, which can have a direct influence on currency reserves. Foreign capital inflows enhance the availability of foreign capital in the home economy, increasing the foreign exchange supply in the local market. This capital infusion may also cause the home currency to appreciate, putting downward pressure on foreign reserves. There has been evidence that FDI can help to economic growth in India since the 1991 FDI legislation by increasing investment, technical transfer, and job creation. Foreign direct investment (FDI) inflows can reflect confidence in the receiving country's economic prospects and investment climate, which can lead to increased portfolio investment inflows and contribute to an increase in forex reserve accumulation. A high debt-to-GDP ratio implies a large amount of outstanding debt in comparison to the size of the economy. This may result in a rise in foreign debt, placing downward pressure on foreign exchange reserves. It can also affect investor confidence and perceptions of a country's creditworthiness. High amounts of debt can put pressure on a country's currency and exchange rate, causing the indigenous currency to depreciate. This may increase the cost of repaying foreign debt, putting a strain on foreign exchange reserves. The trade balance is the difference between a country's products and services exports and imports. When a country has a positive trade balance, it increases export profits, which increases the country's foreign reserves. When a country's trade balance is negative, it means that payment has been made in foreign currency for imported goods and services. This places a strain on the country's currency reserves since the reserves must be used to fund the trade imbalance and cover the excess import payments. This explains why we anticipate a negative connection between the two variables. Exchange rate fluctuations can have an impact on the value of a country's foreign currency assets and liabilities. When the home currency value rises, the

value of foreign currency assets rises in terms of domestic currency. To impact the value of the home currency, central banks frequently interfere in the foreign exchange market. This intervention may result in a decline in foreign exchange reserves.

Data and Methodology

Reference Period: The study was conducted over a 31-year period, from 1990-91 to 2020-21. This reference period was chosen because it examines India's External Sector following the New Economic Policy of 1991. It was the time when India's Liberalization and Globalization Policy opened up commerce internationally. As a result, this time series is determined to be relevant for the study.

Data Source: This study is completely based on secondary data since it requires time series data of macro-economic variables. The secondary data has been retrieved from the Reserve Bank of India. To analyze India's External Sector, the time series data was available in the Reserve Bank of India's "Handbook of Statistics on Indian Economy".

Data Analysis under Tools Used: The data collected have been processed by using Computer Software System STATA for analyzing the data and testing the hypothesis. The tools that are used are appropriate according to the study conducted.

Methodology: In this study, a multiple regression has been conducted to establish a relationship between different determinants of the foreign exchange reserves in India.

Regression analysis:

$$FER = \beta_0 + \beta_1\,FDI + \beta_2\,DGPR + \beta_3\,TB + \beta_4\,ER + \varepsilon$$

FER = Change in Foreign Exchange Reserves
FDI = Foreign Direct Investment (Inflows)
DGPR = Debt-GDP ratio
TB = Trade Balance   ER = Exchange Rate
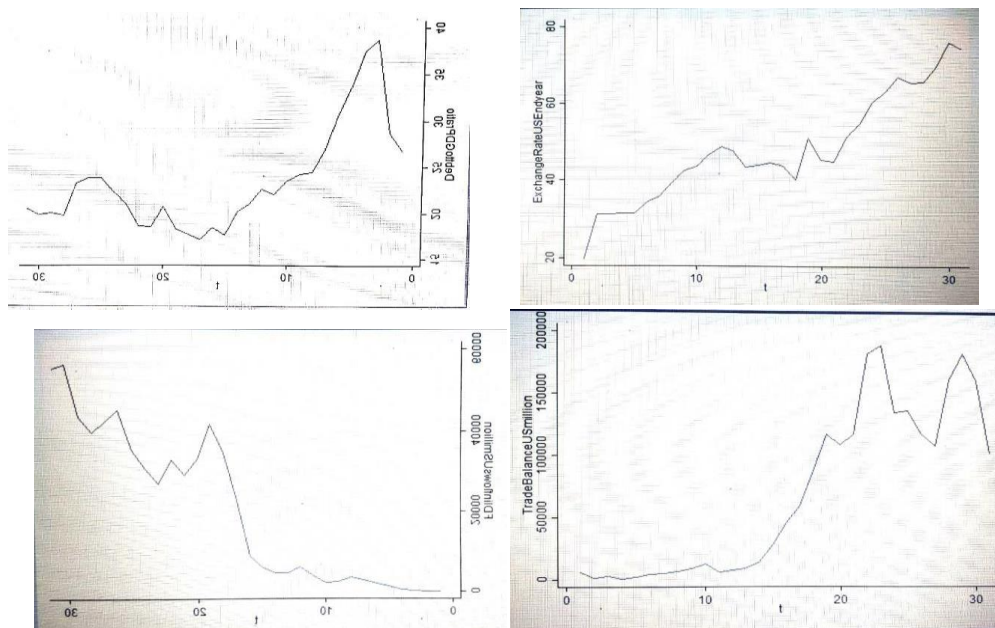ε = error term

Variables Description:

This study has 4 independent variables and one dependent variable.

Variable Symbol	Variable Name	About the Variable
FER	Change in Foreign Exchange Reserve	Changes in foreign exchange reserves refers to any alterations took place in the foreign currencies held by the central bank.
FDI	Foreign Direct Investment (Inflows)	The influx of foreign direct investment into a nation is referred to as FDI inflow. A foreign entity (person or firm) invests funds, resources, and skills in a business or project in another nation through FDI
DGPR	Debt-GDP ratio	The debt to GDP ratio is a metric that establishes the proportion of a country's total debt in comparison to its overall economic output. This figure reflects the ability of a nation to effectively manage its finances.
TB	Trade Balance	Trade balance is the difference between exports and imports of an economy. Positive trade balance implies higher exports and vice versa.
ER	Exchange Rate	The foreign exchange rate denotes how much one currency is worth in terms of another. It helps in measuring the value of one nation's currency against another.

Unit Root/ Stationarity Test

Stationarity of time series is that property in which mean, variance and covariance are same overtime. (Gujarti,1995). It helps to maintain consistency of the time series model. The variables' stationary property was checked using both formal and informal methods in this study. The informal test for stationarity is to plot the data on a graph and acquire knowledge from it before completing any formal testing. This data study is critical because it permits detection, provides a concept of variable stationarity, and eventually checks for structural defects and data errors.

**Figure 2:** The Determinants of Foreign Exchange Reserves

Stationarity of Error term:
We also used the Dickey-Fuller test to determine the stationarity of our error term. The table shows that the null hypothesis is rejected, and the graph shows the stationarity of the error component in our model.

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Dickey-Fuller test for unit root                    Number of obs    =        28

                                   ——————— Interpolated Dickey-Fuller ———————
                    Test          1% Critical         5% Critical        10% Critical
                  Statistic          Value               Value               Value

  Z(t)             -5.866           -3.730              -2.992              -2.626

MacKinnon approximate p-value for Z(t) = 0.0000
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Figure 3: Stationarity Test
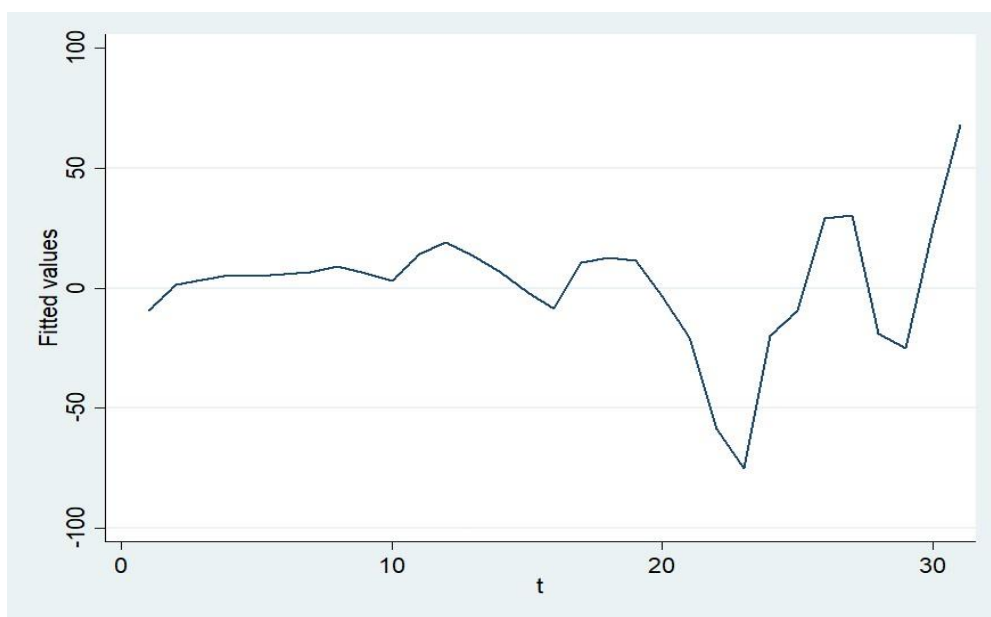
Figure 4: Stationarity of the Residuals

Multicollinearity: It happens when independent variables are associated with one another. A high Variance Inflation Factor, often larger than 10, can be used to detect multicollinearity. According to the results, the mean VIF is 4.12, and the individual VIFs are likewise less than 10 for the corresponding independent variables. As a result, our model is devoid of multicollinearity.

Variable	VIF	1/VIF
FDIinflows~n	7.39	0.135282
TradeBalan~n	6.49	0.154031
ExchangeRa~r	3.64	0.274480
DebttoGDPr~o	1.40	0.712438
Mean VIF	4.73	

Figure 5: Stata Output for VIF, Multicollinearity Test

Autocorrelation: Because we are working with time series data, we must check autocorrelation in the model. When error terms are correlated, autocorrelation arises. The Durbin Watson 'd' statistic is used to check for autocorrelation in data. The table shows that the Durbin-Watson d-statistic is 1.774286, which is within the permissible range of 1.6 to 2.4. It denotes that the data has no autocorrelation. In this case, we accept the null hypothesis stating the absence of autocorrelation.

Durbin-Watson d-statistic(5, 28) = 1.774286

Figure 6: The Durbin-Watson Test for Autocorrelation

Heteroscedasticity: When the error term variance is not constant, we say heteroscedasticity is present. To evaluate heteroskedasticity, we used the Breush-Pagan test. The null hypothesis, Ho: No Heteroscedasticity, was rejected. As a result, heteroscedasticity exists in the data. Then, after performing regression, we corrected the problem by utilizing the vce(robust) test. Standard errors are now more resilient. As a result, FDI inflows and trade balance are important variables.

Regression Results
We conducted our regression after making the variables stationary and obtained the table shown below.

Linear regression

Number of obs	=	28
F(4, 23)	=	1.69
Prob > F	=	0.1869
R-squared	=	0.5609
Root MSE	=	19.757

fr1	Coef.	Robust Std. Err.	t	P>|t|	[95% Conf. Interval]	
FDIinflowsUSmillion	.0022376	.0009345	2.39	0.025	.0003044	.0041708
DebttoGDPratio	.283466	.5421332	0.52	0.606	-.8380219	1.404954
TradeBalanceUSmillion	-.000786	.0003105	-2.53	0.019	-.0014283	-.0001438
ExchangeRateUSEndyear	.5985713	.5481724	1.09	0.286	-.5354097	1.732552
_cons	-24.36049	31.02077	-0.79	0.440	-88.53184	39.81085

Figure 7: STATA Output of the Regression

From the Stata output, it has resulted that variables FDI Inflow and Trade Balance were found to be significant by analyzing their t-statistic. While the other two variables were insignificant. The results of FDI inflow being significant are in line with Bhakri and Verma (2021). The trade balance is found to be a statistically significant element for India's forex reserves. It implies that a larger trade imbalance (imports exceeding exports) leads to a decrease in foreign exchange reserves. This suggests that a greater trade imbalance strains the country's foreign exchange reserves. (M. Kashif, P. Sridharan, and S. Thiyagarajan (2017)).

Conclusion

The path from the misery of 1991 to the comfort of today appears to be a wonderful achievement, based on data the last 30 years, foreign exchange reserves levels have been on an increasing path. The current paper has focused on four major key macroeconomic variables that, according to the theoretical framework, are expected to affect the change in level of foreign exchange reserves, namely, FDI inflows, trade balance, Debt to GDP ratio, and the Exchange rate, where FDI flows positively affect the change in level of reserves and trade balance negatively affects the same with both variables. The other two factors are shown to have a favorable effect on the change in reserve level, although they are statistically insignificant. The logical conclusion we can draw from the current analysis is that to manage foreign exchange reserves more efficiently, FDI-supportive policies should be implemented to improve the long-term flow of funds into the country, and trade policy should be implemented in such a way that the trade balance is kept as low as possible due to the negative significant relationship between the change in the level of forex reserves and the trade balance.

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