



Are India's Forex Reserves adequate?

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Abstract

An adequate level of foreign exchange reserves has become an important parameter for determining a country's ability to absorb external shocks. An attempt has been made in this paper to study the trends, composition and assess the adequacy of India's reserves. The trend in India's forex reserves revealed that despite liberalization of the economy and adoption of current account convertibility since the early 1990s, reserve level remained low during the 1990s. The pace of reserve buildup accelerated since 2000 due to various factors and increased manyfold during the study period from a meagre amount of US\$ 5.8 billion in 1991 to US\$ 561 billion as of February, 2023. A good amount of reserves also accumulated during the pandemic period. The analysis of composition of reserves indicated that the share of gold in total forex reserves has fallen drastically and consequently the share of foreign currency assets increased substantially as compared to the period prior to liberalization of the Indian economy. The different measures of estimating adequacy level of reserves applied in this study showed that the country holds reserves more than the adequate level. If any particular shock affects the economy, then it has a greater capacity to absorb the shock. In more extreme situations, even if the entire economy goes into depression and there is a sudden stop of foreign capital inflow, then also the country has sufficient reserves to endure the shock for certain periods. Moreover, reserves are only one part of a country's defense against shocks.

Key Words : Foreign Exchange Reserves, Current Account Deficit, Adequacy, Foreign Currency Assets

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I. INTRODCUTION

Accumulation in Foreign exchange reserves (FER) received large-scale interest in developing countries including India because of rapid increase in globalization, the acceleration of capital flows and the integration of capital markets domestically and globally as well. The expansion in the volume of trade activities and capital inflows in the form of investments and external commercial borrowings (ECBs) has led to the emergence of the importance of managing the foreign exchange reserves. Foreign exchange reserves are an important means for a country to carry out economic regulation and achieve internal and external balance. Conceptually, a unique definition of forex reserves is not available as there have been divergence of views in terms of coverage of items, ownership of assets, liquidity aspects and need for a distinction between owned and non-owned reserves.

IMF has defined forex reserves in its Balance of Payments Manual, and Guidelines on Foreign Exchange Reserve Management, (2001) as External assets that are readily available to and controlled by monetary authorities for direct financing of external payments imbalances, for indirectly regulating the magnitudes of such imbalances through intervention in exchange Markets and to affect the currency exchange rate, and/or for other purposes. For policy

and operational purposes, most countries including India have adopted the definition suggested by the International Monetary Fund. Some of the most commonly used foreign currencies in which the central banks maintain their foreign reserve include US dollars, euro, pound and yen. They are usually considered as assets because they are treated as investments that have been made in some other country.

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The standard approach for measuring international reserves considers the unencumbered international reserve assets of the monetary authority. Legal provisions governing management of forex reserves in India are set out in the RBI Act, 1934 and the Reserve Bank to act as the custodian of foreign reserves and it operates within the overall policy framework agreed upon with Government of India and manage reserves with defined objectives including to (a) Maintaining confidence in monetary and exchange rate policies, (b) Enhancing capacity to intervene in forex markets, (c) Limiting external vulnerability by maintaining foreign currency liquidity to absorb shocks during times of crisis including national disasters or emergencies; (d) Providing confidence to the markets especially credit rating agencies that external obligations can always be met, thus reducing the overall costs at which forex resources are available to all the market participants, and (e) Incidentally adding to the comfort of the market participants, by demonstrating the backing of domestic currency by external assets.

The foreign exchange reserves have reached an all-time high of US\$ 642 billion as of October 2021 and fallen by US\$ 110 billion by sept 2022. This sudden and significant rise and fall in foreign exchange reserves raising question: Does India's foreign exchange reserves are adequate, so it is felt therefore a need was felt to analyse various aspects of India's foreign exchange reserves.

II. OBJECTIVES

The objectives of the study are as follows.

1. To examine the general trend and growth of foreign exchange reserves in India and analyse the causes for the fluctuations in India's foreign exchange reserves.
2. To analyse the composition of India's foreign exchange reserves
3. To assess the adequacy level of foreign exchange reserves

III. RESEARCH METHODOLOGY

They study is based on secondary data as it requires aggregate time series data over a period of time. The secondary data has been collected from Reserve Bank of India Bulletins, RBI- report on Trends and progress in Banking, Hand Book of statistics on Indian Economy etc., The collected data have been processed with the help of the tabular, graphical analyses to arrive at the results. The period of the study taken for analysis is thirty-one years from 1991 to 2021-22. The time period for the study has been divided into four periods of major changes in Indian economy namely, Liberalization & Globalization, World recovery & Global financial crisis, Global financial crises and Post pandemic (Corona).

- a. Period I-Liberalization & Globalization :1990-91 to 1999-2000
- b. Period II - World Recovery & Global financial Crises : 2000-01 to 2009-10
- c. Period III- Global financial Crises : 2010-11 to 2019-20
- d. Period IV-Post Pandemic(Corona): 2020-21 onwards

IV. REVIEW OF LITERATURE

Number of empirical studies have been conducted previously on adequacy of foreign exchange reserves in India (Rane, K. 2006; Rajan, R.S. and Gopalan, S., 2008; Das, R. and Nath, S., 2015). Their studies found that India's stock of foreign exchange reserve was more than adequate and hold a much better position than other emerging economies.

Kapteyn(2001) suggested that reserves equal to 5-20% of M2, depending upon the exchange rate, are appropriate buffers.

Sinha S.L.N.(2002) had cautioned the authorities concerned with the foreign exchange reserves to be more cautious in the matter of reserves that have grown from the operation of foreign investors, institutions, as well as individuals. The institutional flows are much more important as these can lead to substantial instability because the flows of both directions will be large unlike in the case of individuals. The authorities must have an appropriate regulatory mechanism to ensure that the investment is of a reasonably long-term nature.

Polterovich and Popov (2003) stated that the accumulation of foreign exchange reserves (FER) contributes to the economic growth of a developing country by increasing both the Investment/GDP ratio and capital productivity rate (REER) constant, especially in the initial stages of the inflows when it was viewed as temporary. The purchase of foreign exchange reserves raises the monetary base but RBI neutralizes (sterilizes) through a contractionary open market operations, i.e., via the sale of government bonds.

Ozyildirim and Yaman (2005) questioned the appropriate level of reserves needed to protect against an exogenous shock. It was traditionally found by some of the economists that there are broadly two measures namely, reserves covering at least 3 months of import and reserves equal to 20% of broad money (Norris et. al, 2011).

Sen(2005) in his article, looked at the volatility that comes with the inflow of foreign capital. There are two types of inflows, Foreign Direct Investment (FDI) and Foreign Institutional Investment (FII).

FDI is considered to be less volatile as compared to FII, as it helps in enhancing the productive capacity and enables the upgradation of technology in any country. Whereas FII and NRI deposits can influence the strength of the economy since they are much more volatile in nature. FDI and FII both are considered to be important determinants of foreign exchange reserves.

Mohanty and Turner (2006) noted that effective sterilization can bring fine results to a country. They emphasized ineffective sterilization may obstruct the growth of the economy and may also bring macroeconomic instability.

Green and Torgerson (2007) in their study emphasized three determinants of foreign exchange reserves, namely import, money supply and short term debt. They stated the fact that developing economies should hold reserves equal to a minimum of 3 months of import bill. However, they are also of the opinion that this determinant is not very relevant for economies with capital market access. As far as the short term debt is concerned, they have stated that a country should amass reserves equal to the total value of debt maturing in the next year. So they calculated the ratio of reserves/ short term debt, and based on their calculations, the ratio of reserves to short term debt should always be more than one. Countries with capital account convertibility should use money supply i.e., M2 as the determining factor for adequate level of reserves, and they have also emphasized on the fact that a country should hold reserves in a range of 5-20%. After that, Green and Torgerson put the relative weights on each of the variables and estimated the demand for foreign reserves in a multivariate setting.

Barnichon (2008) noted certain key parameters in the small states, namely, the size and persistence of shocks, the importance of export sector and the degree of risk average, which can have significant impact on the level of foreign exchange reserves.

Jeevan Kumar Khundrakpam (2008) had examined the behaviour of exchange rate pass-through to domestic prices in India after the reforms initiated in the early 1990s. Unlike observed in several countries it finds a rise in exchange rate pass-through to domestic prices until recent years. Besides economic factors typically associated with economic liberalisation, the persistence of higher inflation is an important factor for the rise in pass-through.

Dash and Narayanan (2011) have highlighted the key determinants as imports, nominal exchange rate of foreign exchange reserves in India by using Maximum Likelihood Vector Error Correction Model (VECM) of Johansen (1995) using monthly and annual data. They included the rupee-dollar bilateral nominal exchange rate and also the capital flows in India i.e. FDI and FII.

Dominguez, K., Hashimoto, Y., and Ito, T. (2011) argued that excess foreign exchange reserves before the crisis may protect a country from uneven speculative attacks and it can be used as lender of last resort facilities in central banks. Their findings support this argument that higher pre crisis reserves are related to higher post-crisis GDP growth.

Rizvi, S.K.A. et al. (2011) made a study on the accumulation and use of reserve as a monetary tool and they found that excessive reserve accumulation during the study period stimulate the economy in terms of GDP growth, stabilised exchange rate and less debt burden of debt and deficit.

Achille, C., Mezui, M. and Duru, U. (2013) compared holding of excess reserves or its use as infrastructural investment in African nations. They estimate that the gap between the actual reserves and adequate reserves are higher than the infrastructural gap in African countries and suggested proper management of reserves for investment in infrastructural growth.

According to Sahu (2015), India maintained the import coverage ratio, which far exceeded the global benchmark of 3 months. The commonly accepted ratio for covering short term external debt is 1 and in India, it was found that this ratio has always been more than 1. India's forex reserves have always been sufficient during his period of study. India not only covered its 100% short term external debt, but also more than 50% of total external debt (TED) as against globally accepted norm of at least 40% coverage.

Arslan, Y. and Cantu, C. (2019) argued that until 2000, precautionary motives were the main drive for reserve accumulation but in the recent time monetary and exchange rate policies play a more important role in reserve accumulation.

Kritika Agarwal et al (2020) observed that the country is holding sufficient amount of foreign exchange reserves which is much higher than the adequacy level. So, the government should take full advantage of growing excess foreign exchange reserves and use a portion of its reserves for the economic development of the nation during or after the pandemic crisis.

Marimuthu. R. (2022) Observed that the growth of foreign exchange reserves since liberalization of Indian economy has been showing impressive trend. The study has shown that much accretion of India's reserves is mostly contributed by surge in non-resident Indian deposits, followed by foreign portfolio investment and foreign direct investment. However, they suggested that the government keep check on inflation as the reserves are accumulating and may lead to inflation.

V. RESULTS & DISCUSSIONS

A. Objective 1: General trend and growth of foreign exchange reserves and analysis of the causes for the fluctuations in India's foreign exchange reserves.

a. Period I-Liberalization & Globalization :1990-91 to 1999-2000

During the 1991 financial crisis, India's forex reserves stood at \$5.8 billion as of March 1991 and dwindled further during that year, prompting the country to ship out its gold to avoid a default. This crisis eventually led to the liberalization of the country's economy. A by-product of those reforms was the gradual increase in reserves which were driven in large part by foreign direct investment in the early years. The year 1997 brought the Asian Financial crisis, the first forex reserve test since 1991. Large spot forex operations like selling forex, the building of reserves in

the period of calm has taken place. The FCNR-A scheme under which the forex risks were first borne by the RBI and then the government was introduced. By March 1997, India held the forex reserves to the tune of US \$29 billion. The reserves were again also tested by 1998 Pokhran Nuclear tests induced economic sanctions. The government

responded with the launch of the “Resurgent India bonds” which resulted in an accretion of foreign currency assets. It can be observed from table 1 that it grew at 55.24% on an average, during this period of Liberalization & Globalization and the forex reserves reached the level of US\$ 38 billion by March 2000.

b. Period II - World Recovery & Global financial Crises : 2000-01 to 2009-10

India’s foreign exchange reserves have grown substantially since 2000 and crossed the milestone of US\$ 100 billion in December 2003 and US\$ 200 billion in April 2007 and the reserves reached US\$ 300 billion by the end of 2007-08. Besides revaluation, the increase in reserves, from the early 2000s till the global financial crisis, was primarily on account of the increase in foreign portfolio investment (FPI) inflows, India’s Low Current account deficit during this period (on average about 0.1 per cent of GDP between 2001 and 2007), and therefore, increasing capital inflows were associated with the accumulation of reserves. India’s reserves increased by US\$ 232 billion between Q1 2001-02 and Q1 2008-09, a period of cumulative net FPI inflows of US\$ 66.3 billion. This period also evidenced with The global financial crisis of 2008- The sub-prime financial turmoil, and have fluctuated around this level since then.

c. Period III- New Global Crises 2010-11 to 2019-20

The Euro debt crisis in 2010-11 and The Fed’s ‘taper tantrum’ in 2013-14 resulted in the external sector under stress. As volatility hit the global markets, foreign investors saw the Indian market vulnerable. As the currency tumbled and the designed monetary policy response failed to act as protection, the RBI sold dollars heavily. The turmoil was followed by a number of interventions by the Government of India and the RBI. Such interventions by RBI include both Market-based (spot and forward sales of foreign exchange (US\$), tightening of domestic interest rates) that can influence reserves and Administered (Restrictions imposed on flexibilities of importers and exporters, stricter prudential norms on currency trade, curtailed freedom on the derivatives position like cancellation and rebooking of forward contracts or trading in currency futures and options), which aimed to minimize the impact of these crises on the country’s financial sector.

As of August of 2013, forex reserves of were about \$275 billion and adequate to cover less than seven months of imports. On September 4 that year, the central bank announced a special swap scheme to draw in foreign currency non-resident deposits. The central bank offered a special swap window at a fixed rate of 3.5% per annum for FCNR(B) (Foreign Currency Non-Resident Account) funds mobilized for a minimum tenor of three years or more. Banks raised \$26 billion under the scheme. while there were cumulative net FPI inflows of US\$ 137 billion between Q4 2008-09 and Q3 2014-15, a large part of these inflows could not be accumulated as reserves due to large CAD. In fact, reserves increased only by US\$ 65 billion during these years owing to a high CAD, which on average was 3 per cent of GDP. As the current account deficit moderated during 2014-15, India’s reserves accumulated further. The level of foreign exchange reserves which stood at US\$ 350.3 billion as at end-September 2015 remained more or less constant before recording an improvement and stood at US\$ 360.2 billion as at end-March 2016 and reached US\$ 400 billion by September 2017 and stood at US\$ 412 billion and US\$ 477 billion as end March 2019 and 2020 respectively.

Table No.1 : Foreign Exchange Reserves (US\$ Billion)

Year	Foreign Currency Assets	Gold	SDR	Reserve Tranche Position	Total Forex reserves	Growth
1990-91	2.24	3.50	0.102		5.83	47.32
1991-92	5.63	3.50	0.090		9.22	58.04
1992-93	6.43	3.38	0.018		9.83	6.64
1993-94	15.07	4.08	0.108		19.25	95.83
1994-95	21.51	4.37	0.007		25.89	34.44
1995-96	17.04	4.56	0.082		21.69	-13.89
1996-97	22.37	4.05	0.002		26.42	21.84
1997-98	25.98	3.39	0.001		29.37	11.14
1998-99	29.52	2.96	0.008		32.49	10.63
1999-00	35.06	2.97	0.004		38.04	17.07
2000-01	39.55	2.73	0.002		42.28	11.16
2001-02	51.05	3.05	0.010		54.11	27.97
2002-03	71.89	3.53	0.004	0.67	76.10	40.65
2003-04	107.45	4.20	0.002	1.31	112.96	48.43
2004-05	135.57	4.50	0.005	1.44	141.51	25.28
2005-06	145.11	5.76	0.003	0.76	151.62	7.14
2006-07	191.92	6.78	0.002	0.47	199.18	31.37
2007-08	299.23	10.04	0.018	0.44	309.72	55.50
2008-09	241.43	9.58	0.001	0.98	251.99	-18.64
2009-10	254.69	17.99	5.006	1.38	279.06	10.74
2010-11	274.33	22.97	4.569	2.95	304.82	9.23
2011-12	260.07	27.02	4.469	2.84	294.40	-3.42
2012-13	259.73	25.69	4.328	2.30	292.05	-0.80
2013-14	276.36	21.57	4.464	1.83	304.22	4.17
2014-15	317.32	19.04	3.985	1.29	341.64	12.30
2015-16	336.10	20.12	1.502	2.46	360.18	5.43
2016-17	346.32	19.87	1.447	2.32	369.96	2.72
2017-18	399.44	21.48	1.540	2.08	424.55	14.76
2018-19	385.36	23.07	1.457	2.99	412.87	-2.75
2019-20	442.21	30.58	1.433	3.58	477.81	15.73
2020-21	536.69	33.88	1.486	4.93	576.98	20.76
Oct-21	578.46	39.01	19.301	5.24	642.02	11.20
2021-22	540.72	42.55	18.891	5.14	607.31	5.26
Feb-23	495.90	41.75	18.180	5.09	560.92	-7.64

Source: RBI

d. Period IV-Post Pandemic(Corona): 2020-21 onwards

The forex reserves crossed US\$ 500 by July 2020 and were up by 20 per cent to \$577 billion by March 2021 , from US\$ 477 billion in the previous fiscal—an addition of \$100 billion and reached peak level of US\$ 642 billion in October 2021. India increased its foreign exchange reserves by 35 per cent, or \$165 billion since the beginning of the pandemic. India was one of the recipient economies, which helped shore up its foreign exchange reserves by a whopping 33 percent from the pre-pandemic levels (US\$450 billion) to the October 2021 levels. If we were to look

closely at this spike in India's forex reserves, we would find that most of the accumulation happened between April 2020 and November 2020. The rise is because of a rise in the dollar value of assets held as reserves by the RBI, positive current account surplus. On the import bill side, sluggish import demand due to COVID-19 related restrictions on movement of people and the slowdown in the domestic economy, supplemented by lower oil prices, contributed to reducing the trade deficit during 2020-21 saving precious foreign exchange. On the other hand, invisibles remained broadly stable reflecting lockdown induced external demand for computer services and Net capital flows remained broadly strong in 2020-21. Consequently, India recorded a current account surplus in 2020-21 after a gap of 16 years. Depreciation of the US dollar, Capital Inflows as Foreign Direct Investment (FDI) Rise in investment in foreign portfolio investors (FPI) in Indian stocks and, Rise in gold prices, increased Overseas remittances and steeply fallen foreign travels are other reasons for rise in reserves. India's highest-ever forex reserves indicate market sentiments towards the Indian economy, though only partially. The rising forex reserves could bring some comfort to the government as well as the Reserve Bank in managing the nation's external and internal financial issues at a time when the economy is facing Covid stress once again. An increase in the forex kitty could also help strengthen the rupee against the US dollar. The forex reserves have played a huge roll in the post-pandemic economy building.

However, the foreign exchange reserves started decreasing from November, 2021 and stood at US\$ 607 billion as at March 2022 and further come down to US\$ 532 billion by September 2022. The drop is because of a fall in the dollar value of assets held as reserves by the RBI. The demand for dollars remained high as the Russia-Ukraine war led to a spike in oil and commodity prices resulting in Appreciation of the US dollar and valuation changes, increased Current Account deficit due to higher imports including crude oil, Use of Dollars for stabilizing the rupee, Capital outflows by foreign portfolio investors (FPIs), are reasons for the fall in reserves during this period.

FPIs pulled out \$21.43 billion since September 2021 as the US Federal Reserve started monetary policy tightening and interest rate hikes. But the foreign exchange reserves have shown increasing trend from the month of October 2022 to December 2022 and since then fluctuating and stood at US\$ 561 billion as at February 2023. In terms of hierarchy, India now has the 5th highest reserves, competing closely with Russia for fourth position after China, Japan, Switzerland who have higher reserves. During the 1991 India was economically crisis country, only had US\$.5.8 billion of reserves left which led to subsequent economic liberalisation. Since then the reserves have seen a 10,000% increase over 31 years.

On perusal of table no.1, it can be observed that there has been an accumulation in foreign exchange reserves in all years Since 1991, except five years, viz., 1995-96, 2008-09, 2011-12 and 2012-13, and 2018-19 and decreasing trend after October 2021. Usually, the occurrence of a

depletion or large accumulation coincides with abnormal global economic and financial developments. For example, the reduction in 2008-09 reflected the use of foreign exchange reserves to ease the external financing conditions during Global Financial Crisis, when India recorded FPI outflows; and in 2011-12 and 2012-13, the reduction was caused by higher Current Account Deficit due to increase in oil prices and gold imports and during the year 2021-22 (from October 2021 onwards) due to increase in oil prices, Global financial certainties, Geo political situation and portfolio outflow. India has witnessed outflows of \$29 billion in 2022 (\$27 billion in equity and \$2 billion in debt).



Similarly, large accretions to reserves in 2007-08 and 2020-21 were an outcome of abundant supply of global liquidity. The reserves built out of a current account surplus indicate the nation's income earned from foreign countries while reserves contributed by a capital account surplus indicate net incurrence of liabilities. During the last 20 years, India had current account surplus only in four years i.e., 2001-02 to 2003-04 and in 2020-21. Therefore, India's reserve accumulation has been contributed mainly by capital account surplus.

B. Objective 2. Composition of foreign exchange reserves

Foreign exchange reserves include Foreign currency assets (FCA), Gold, Special Drawing Rights (SDR) and Reserve Tranche Position (RTP). The RBI Act, 1934 provides the overarching legal framework for deployment of reserves in different foreign currency assets and gold within the broad parameters of currencies, instruments, issuers and counterparties. From the operational perspective, central bank interventions, income on reserve assets and allocation of SDRs by the IMF could be the major sources of accumulation of official foreign exchange reserves. From the economic point of view, reserve accretion can be decomposed into contribution of balance of payments and valuation effect.

a. Foreign Currency Assets (FCA)

Foreign currency assets include investment in foreign government treasury bills and deposits with other central banks. Expressed in dollar terms, the foreign currency assets include the effect of appreciation or depreciation of non-US units like the euro, pound and yen held in the foreign exchange reserves.

Table2: Composition of Foreign Exchange Reserves as on February 24, 2023

Item	Total Reserves	Foreign Currency Assets	Gold	SDRs	Reserve Position in the IMF
In US\$ billion	560.94	495.91	41.75	18.19	5.10
In Percentage	100.00	88.41	7.44	3.24	0.91
Variation YOY in US\$ billion	70.59	68.93	0.72	0.85	0.01

Source: RBI

The foreign currency assets as on February 24, 2023 amounted to US\$495.91billion. The share of FCA in total reserves has increased to about 89 per cent from just two-thirds in 1992-93. As at end-September 2022, out of the total FCA of USD 472.81 billion, as much as 76.5 % (US\$ 361.84 billion) of the foreign currency reserves are held in securities like Treasury bills of foreign countries, mainly the US; 17.3%(US\$ 81.64)is deposited in foreign central banks; and 6.2 % (US\$ 29.33 billion)is deposited in commercial banks abroad, according to RBI data. Since reserves are maintained as risk buffers, India's reserves are kept in major convertible currencies and reserve management is

guided by the principle of safety, liquidity and return. However, appropriate emphasis on diversification of reserves was given from time to time. Variations in the composition of foreign exchange reserves during the last three decades between 1991-2023 are depicted in chart no.2.

b. Gold Reserve

Gold reserves went up from US\$ 10 billion during the GFC year of 2008 to US\$ 18 billion in 2009-10. (RBI purchased 200 metric tonnes of gold from the IMF in November 2009). The RBI continued to build up gold reserves in the subsequent years at a gradual pace and reached 558 tonnes at end-March 2010 and further increased to 785.35 metric tonnes of gold (including gold deposits of 41.57 metric tonnes) at end-September 2022 valued US\$ 38 billion with 447.30 metric tonnes of Gold held overseas in safe custody with the Bank of England and the BIS. The value of gold reserves held, stood at US\$ 41.75 billion constituting about 7.44 % of the total reserve as at February 24, 2023. Even though India is the largest gold-consuming nation, the share of gold in total forex reserves is much less than most developed nations.

The share of gold in total forex reserves has fallen from 78% prior to liberalization of the Indian economy to around 7.4% at present. In July 1991, as a part of reserve management policy, and as a means of raising resources, the Reserve Bank temporarily pledged gold to raise loans. The gold holdings thus have played a crucial role in reserve management at a time of external crisis.

Since then, Gold has played a passive role in reserve management. Additions of gold to foreign exchange reserves in an environment of low/negative international interest rates is beneficial and can benefit a country in terms of sovereign creditworthiness during episodes of financial market volatility and crisis.

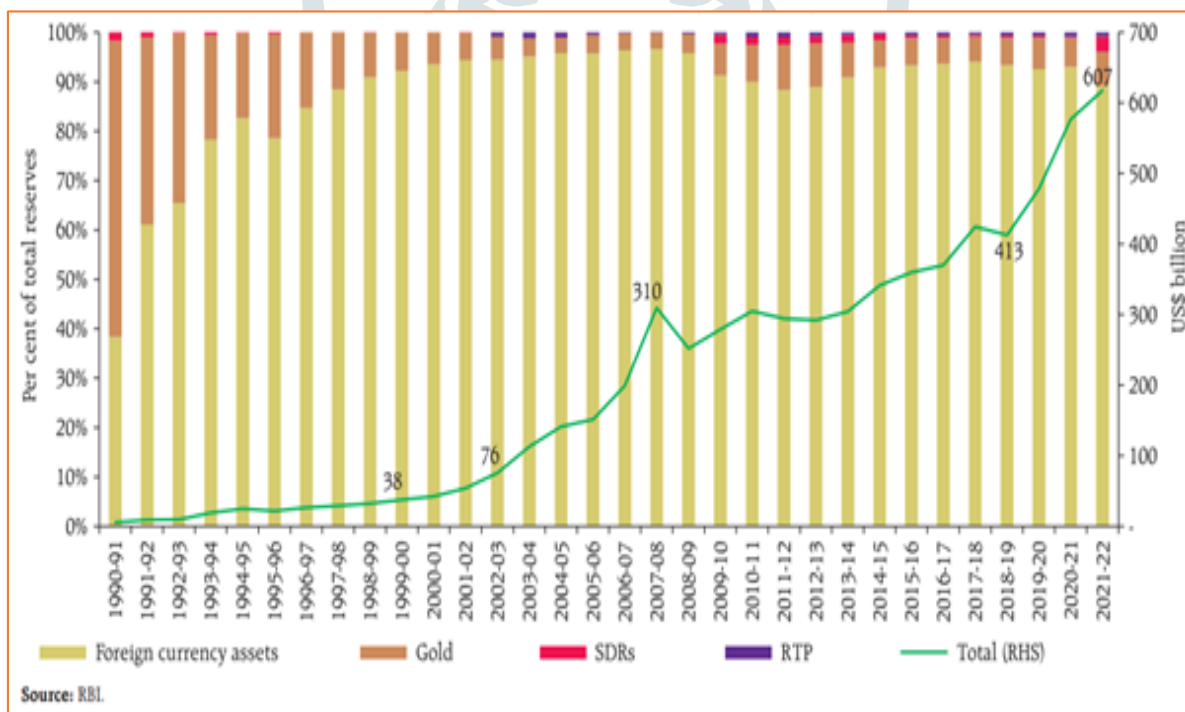


Chart 2: Composition of India's Foreign Exchange Reserves

c. Special Drawing Rights

The SDR is an international reserve asset, created by the IMF in 1969 to supplement its member countries' official reserves. It is a potential claim on the freely usable currencies of IMF members. SDRs can be exchanged for these currencies. The value of the SDR is calculated from a weighted basket of major currencies, including the US dollar, the euro, Japanese yen, Chinese yuan, and British pound. Allocations of SDR by the IMF in 2009 and 2021 also

augmented the SDR component of reserves which valued US\$ 18.19 billion as at end-February 2023 which constitutes about 3.24 % of total foreign exchange reserve.

d. Reserve Tranche- IMF

The reserve tranche position implies a portion of the required quota of currency each member country must provide to the IMF that can be utilized for its own purposes.

C. Objective 3 : Adequacy level of foreign exchange reserve and assessment

a. Motives for holding Reserves.

Technically, it is possible to consider three motives i.e., transaction, speculative and precautionary motives for holding reserves.

- i. **Transaction Motive** – International trade gives rise to currency flows to be handled by private banks . The accumulation of foreign exchange reserves for mercantile purposes is closely related to the pursuance of policies to promote exports and to attract foreign direct investment inflows.
- ii. **Speculative Motive** – Individual and / or Corporate entities for gains.
- iii. **Precautionary** – Central banks hold stock of foreign currency for unpredictable flows. Precautionary motives reflect the need for protection against external shocks and to provide sufficient coverage for crisis prevention and management (Sehgal and Sharma, 2008).
Precautionary motive for holding foreign currency can be positively related to wealth and the cost of covering an unplanned deficit, and negatively related to the return from alternative assets. Official reserves are held for precautionary and transaction motives keeping in view the aggregate of national interests, to achieve balance between demand for and supply of foreign currencies, for intervention, and to preserve confidence in the country's ability to carry out external transactions.

b. Measures to assess adequacy of Reserves.

Assessing the appropriate level of reserves to hold is challenging—not just because of the multiple roles played by reserves, but also because of the complexity of quantifying external risks and vulnerabilities, and the opportunity cost each country faces. As such, the assessment should be based on the specific characteristics (including economic flexibility and financial integration and maturity) and vulnerabilities. A reserve adequacy metric is a measure of a country's potential FX liquidity needs in adverse circumstances against which reserves could be held as a precautionary buffer. Its size relative to reserves could be a measure of a country's vulnerabilities and hence provide an indication of adequacy. As there is no universally accepted definition of reserve adequacy, several benchmarks have been used by policymakers to determine the appropriate or optimal level of reserves and remain relevant for particular sets of countries, typically capturing individual risks.

Traditional indicators

It is possible to identify a few sets of traditional indicators to assess adequacy of reserves, and each of them do provide an insight into adequacy though none of them may by itself fully explain adequacy. Trade based indicators, Debt based indicators , Money based indicators, Combined metric and Economic based indicator.

i. Trade based indicator (Import coverage ratio)

This ratio is defined in terms of reserves in months of imports to provide a simple way of scaling the level of reserves by the size and openness of the economy. It has a straightforward interpretation- a number of months a country can continue to support its current level of imports if all other inflows and outflows cease. It protects the country from

the short term external shock of import payment. As the measure focuses on current account, it is relevant for small economies, which have limited access and vulnerabilities to capital markets. For substantially open economies with a sizable capital account, the import cover measure may not be appropriate. The literature assumes three months' worth of imports to be adequate, which corresponds to an imports-reserves ratio of 0.25.

$$\text{AFR} = \text{FR/IM}$$

ii. Debt based indicators

Debt-based indicators are useful for gauging risks associated with adverse developments in international capital markets.

- 1) **Reserves to short term debt** by remaining maturity is a better indicator of identifying financial crises. Since short-term debt by remaining maturity provides a measure of all debt repayments to nonresidents over the coming year, it constitutes a useful measure of how quickly a country would be forced to adjust in the face of capital market distortion. Applying the Greenspan- Guiotti (1999) rule of 100% coverage of short-term debt for one year means that a ratio of unity or above is adequate. This measure is particularly relevant for a country with large short-term cross-border financial transactions.

$$\text{AFR} = \text{FR/STED}$$

- 2) **Reserves to External Debt Ratio:** It is a debt-based measure to determine the adequacy level. This measure is required to protect the country from external capital flight. According to this measure, it was assumed that the reserves should not fall below 40% of total external debt.

$$\text{AFR} = \text{FR/TED}$$

iii. Money based indicators(Ratio of Reserves to Broad Money -M2) Include reserve to broad money or reserves to base money provides a measure of potential for resident based capital flight from currency. This ratio is used as a financial crisis precaution indicator. Broad money (M2) indicates resident, corporates as well as individuals' foreign assets purchasing power. When resident investor's confidence in domestic economy drops, capital flows out of the country as residents starts investing abroad. According to 'Currency Supply Determinism (Caves, RE, HG Johnson & PB Kenen)' in order to prevent excessive decrease in foreign exchange reserves, the optimal foreign exchange reserve should be equal to broad money (M2). It is noted that holding an excess foreign exchange reserve is associated with some cost. Therefore, maintaining FR/M2 ratio to 1 depends on the exchange rate system of a country. Kapteyn (2001), suggests reserves equivalent to 5%-20% of M2, depending on the exchange rate regime, as an appropriate buffer. In general, countries having pegged and fixed exchange rate systems, ratio should be maintained within 10%-20% of M2, while countries having market determined floating exchange rate system should maintain ratio within 5% to 10% .As India maintains market determined exchange rate. i.e., the ratio of Reserves to Broad Money ratio has a conventionally accepted range of between 0.05 and 0.10,

iv. Combined metric

The measures like Import coverage ratio, Reserves to Short-term Debt Ratio and Reserves to Broad Money (M2) Ratio show the adequacy level of reserves required for a particular and specific event. Despite its popular use as a reserve adequacy indicator, import coverage ratio has got some serious practical limitations like it is purely based on merchandise trade and does not include other components of current account such as services, transfers and invisibles. Also, the adequacy of reserves is influenced by the economic situation of a country. Short term debts may result in sudden and sharp capital outflows which are excluded in this method. Reserves to Short-term Debt Ratio does not take into account the main source of reserve demand, i.e., imports. Without trade element, debt-based rules are believed to underestimate the ideal reserve requirements of a country. Money based indicators also suffer from several drawbacks. In countries where money demand is stable and confidence in domestic currency high, domestic money demand tends to be larger and reserves over money ratios, relatively small. Therefore, while a sizable money stock in relation to reserves, prima facie, suggests a large potential for capital flight out of money, it is not necessarily a good predictor of actual capital flight. Money based indicators also do not capture comprehensively the potential for

domestic capital flight. Moreover, empirical studies find a weak relationship between money based indicator and occurrence and depth of international crises.

Moreover, the holding of foreign exchange reserves is not based on a single economic factor. The external shock due to the financial crisis may impact each and every aspect of foreign exchange reserves. Thus, estimating the combined adequate level of reserves is crucial to determine the overall absorption capacity of India's foreign exchange reserves. Hence, the adequacy level of three measures have been clubbed together to arrive at combined adequate level.

$$\text{AFR} = \text{IM} + \text{STED} + \text{M2} \quad (0.10)$$

v. Reserves to volatile flows Ratio.

Some academicians and economists have used another metric which is the ratio of reserves to volatile capital flows (including cumulative portfolio inflows and outstanding short term debt) to determine adequacy of reserves. In fact, Tarapore committee on capital account convertibility also suggested this metric. This metric suggests that volatile capital flow not to exceed 60% to reserves.

$$\text{AFR} = \text{STED} + \text{CPI (cumulative portfolio inflows)}$$

vi. **Reserve Drainer Approach (Combined metric)** - Apart from all the indicators mentioned above, there's one more metric which was suggested by Shcherbakov in 2002 after he examined the Russian foreign exchange outflows experience. He combined all the above explained determinants of reserves which are import bills, short term foreign debt and broad money to measure foreign exchange reserve holdings. Shcherbakov (2002) suggested that once these variables are matched by available external reserves, then external shocks would be cushioned in any economy.

$$\text{AFR} = \text{FR} \div (\text{IM} + \text{STED} + \text{M2})$$

The advantages of this approach over all the above ones are its simplistic nature and, therefore, ease of adoptability, and its comprehensiveness, as not only does it measure trade financing but combined short term debts and the monetary base also. However, in countries, where money demand is stable and confidence in domestic currency high, domestic money demand tends to be larger and reserves compared to money supply, relatively small. Therefore considering total M2 for arriving adequate reserves appears to be on higher side.

vii. **Economic based indicator** (Romero, A., 2005) it's a Foreign Exchange Reserves to GDP Ratio. It represents the country's capacity to purchase foreign reserves whenever it is required. Higher the reserves to GDP ratio higher is the purchasing capacity. The recommended adequacy level of reserves is 10% of GDP.

$$\text{AFR} = 10\% \text{ OF GDP}$$

Liquidity risks indicators

More recent approaches to reserve adequacy have suggested a combination of current - capital accounts as the meaningful metrics to capture a range of risks.

i. **Expanded Greenspan-Guidotti rule** It's the most common metric consisting of ST Debt plus the current account deficit (if it is in deficit), which is intended to reflect the full potential 12-month financing need. It could serve useful as an indicator of how long a country can sustain external imbalance without resorting to foreign borrowing.

It suggests that the countries should hold reserves sufficient to meet ST Debt plus the current account deficit and it ensures that they could manage without access to new foreign borrowings up to twelve months.

$$\text{AFR} = \text{STED} + \text{CAD}$$

ii. Optimal Reserve Models

1) **Jeanne and Rancière model** Optimal reserve models were developed to integrate cost and benefit considerations. A widely used model is that of **Jeanne and Rancière (2006)**, where the optimal level of reserves is determined by balancing the economic cost (the potential loss in output and consumption, given the size and probability of the sudden stop) with the opportunity cost of holding reserves, and reflecting the degree of risk. This model describes reserve accumulation as an optimization problem in which risk-averse policy makers choose the level of reserves to provide optimal insurance against a sudden stop in consumption, given the cost of holding reserves. When a sudden stop occurs, external debt cannot be rolled over and output falls below its long-run growth path. More reserves mitigate the fall in output and help smooth national consumption. However, there is a cost to holding reserves as they yield a lower return than other assets in the economy. An issue with this approach is that it can result in a wide range of estimated optimal reserve holdings, depending upon its calibration. A “baseline” calibration of this model suggests that many EMs would optimally hold reserves at around 80-100 percent of short-term debt plus the current account deficit and between 75 to 150 percent of the ARA EM metric.

$$\text{AFR} = \text{STED (80-100\%)} + \text{CAD}$$

2) IMF's Assessing reserve adequacy (ARA) metric

Based on the experience of past balance of payments crises which were characterized by multiple market pressure channels, IMF proposed an additional metric encompassing a broad set of risks in early 2011 (and refined it in 2013). The ARA EM metric developed by the IMF aims to balance simplicity and completeness, while permitting comparability across countries. Given the broad coverage of the ARA EM metric—which covers rollover risks (short-term debt), the risk of resident outflows (broad money), the potential loss of export income, and the risk of non-resident equity and MLT debt outflows (other liabilities)

This measure comprises four components reflecting potential drains on the balance of payments:

- (i) Short-term debt - to reflect debt rollover risks,
- (ii) Broad money - to capture potential residents' capital flight through the liquidation of their highly liquid domestic assets.
- (iii) Export income - to reflect the potential loss from a drop in external demand or a terms of trade shock and,
- (iv) Other liabilities to reflect other portfolio outflows.

The weights proposed for the individual components (amended in ARA (2013)) are as follows:

Composite Metric

Fixed exchange rate regime, $\text{AFR} = \text{STD} \times 0.30 + \text{BM} \times 0.10 + \text{E} \times 0.10 + \text{OL} \times 0.20$

Flexible exchange rate regime, $\text{AFR} = \text{STD} \times 0.30 + \text{BM} \times 0.05 + \text{E} \times 0.05 + \text{OL} \times 0.15$

R = Reserves Required

E = Exports

STD = Short-term Debt

OL = Other Liabilities

BM = Broad Money

Table No.3 : Adequacy indicators

Year	Forex Reserves	Import coverage ratio	Money based (FX:M2) Ratio	Debt based (FX:STED) Ratio	Ratio of volatile flows FX:(STED+ Other Liabilities)	Ratio of FX Total External Debt	Economic Indicator FX : GDP
Bench Mark		3 Months	10 %	100%	60%	40%	10%
1990-91	5.8	2.9	12.29	68.3		7.0	1.9
1991-92	9.2	5.7	20.85	130.4		10.8	3.5
1992-93	9.8	5.4	24.78	155.1		10.9	4.0
1993-94	19.3	9.9	40.07	530.9		20.8	6.8
1994-95	25.2	10.5	41.50	590.0		25.4	7.6
1995-96	21.7	7.1	34.62	430.8		23.1	6.1
1996-97	26.4	8.1	39.45	392.8		28.3	6.7
1997-98	29.4	8.5	43.27	582.0		31.4	7.4
1998-99	32.5	9.2	44.65	760.2		33.5	7.7
1999-00	38.0	9.2	48.54	966.4		38.7	8.2
2000-01	42.3	10.0	51.97	1165.4		41.7	9.1
2001-02	54.1	12.6	61.00	1971.1		54.7	11.2
2002-03	76.1	14.9	74.51	1629.9	46.6	72.5	14.3
2003-04	113.0	17.3	82.78	2549.3	42.8	100.3	17.2
2004-05	141.5	15.2	93.09	798.5	51.7	105.6	19.1
2005-06	151.6	12.2	80.22	776.0	61.4	109.0	18.3
2006-07	199.2	12.9	88.01	708.1	76.7	115.6	20.2
2007-08	309.7	14.8	105.30	677.2	44.9	138.0	24.8
2008-09	252.0	10.0	100.12	581.8	59.3	112.2	22.8
2009-10	279.1	11.6	83.11	533.3	66.6	106.9	19.4
2010-11	304.8	9.9	81.57	469.0	78.4	95.9	17.5
2011-12	294.4	7.2	85.06	376.6	81.9	81.6	16.7
2012-13	292.0	7.1	82.07	302.0	95.8	71.3	16.
2013-14	304.2	8.1	87.19	331.8	93.6	68.2	16.3
2014-15	341.6	9.2	96.34	399.6	102.7	72.0	17.1
2015-16	360.2	11.3	91.40	431.3	84.6	74.3	17.3
2016-17	370.0	11.6	89.42	419.8	96.2	78.5	15.6
2017-18	424.5	10.9	84.50	415.5	82.0	80.2	16.2
2018-19	412.9	9.6	76.97	380.8	90.9	76.0	15.1
2019-20	477.8	12.1	87.30	447.1	78.9	85.6	17.9
2020-21	577.0	17.6	88.00	570.8	65.6	100.6	21.3
2021-22	607.3	11.9	86.65	499.1	60.6	97.8	19.4
Feb-23	560.9	9.1	83.66	428.2	67.0	92.0	—

Source: RBI and Own Computation

It reflects the relative risk levels of different potential sources of balance of payments pressure—the relative risk weights are based on tail event outflows associated with periods of exchange market pressure in different countries—and assess how large a stock of reserves might be needed relative to this risk weighted measure to cover for outflows from different sources.

From the perspective of precautionary motive, reserve adequacy levels are suggested to be higher for fixed exchange rate countries relative to flexible exchange rate countries. As India practises flexible exchange rate, this measure is calculated by combining 30% of short-term external debt + 5% of broad money+ 5% of exports of goods and services + 15% of other Liabilities. Reserves in the range of 100-150 percent of the composite metric are considered broadly adequate for precautionary purposes.

The selection of a range—rather than of a point estimate for the adequacy level—reflects the intention to be cautious in view of the uncertainty inherent in the estimation of various balance of payments risks. It is also preferable to consider a range of risk weights for the individual components of the metric. This metric can capture better the risks resulting from rising external liabilities driven by surges in capital inflows than traditional metrics, and hence indirectly the impact of systemic/global external factors.).

India's approach to reserve management, until the BOP crisis of 1991 was essentially based on the traditional approach, i.e., to maintain an appropriate level of import cover (defined in terms of number of months of imports equivalent to reserves). With the adoption of the recommendations of the High Level Committee on Balance of Payments chaired by Dr.C.Rangarajan the focus shifted to an integrated view of the issues covering payment obligations (discharging short term debt obligations or servicing medium term debt) in addition. Since then, Indian approach to determining adequacy of forex reserves has been evolving over the years.

Therefore, we have obtained the adequacy level of foreign exchange reserves by Computing different ratios and compared to the specific benchmark levels of reserve adequacy proposed in the existing literature to determine whether reserves were adequate. The details are furnished in table no. 3 & 4.

a) Import coverage ratio.

In 1990-91 the months of import cover was just 2.9 months lower than the benchmark of 3 months.

This trend was reversed dramatically with the ratio reaching a peak of 10.5 months in 1994-95 (Period I) and then to 17.5 months in 2003-04 (Period II) and peak of 12.1 months in 2019-20 (Period III) and it reached maximum of 17.6 months in 2020-21(Period IV)(Table No.3).

The import coverage for the year 2021-22 was 11.9 months, that's less than the 39 months cover offered by Switzerland's reserves, 22 by Japan's, 20 by Russia's and 16 months by China's pile, according to the RBI researchers. It is observed that the country holds excess reserves of US\$ 377 billion above the bench mark as at February23. (Table No. 5)

Table 4: Adequacy indicators (Cont.)

Year	Expanded Greenspan-Guidotti [FX: (STED + CAD)] Ratio	Jeanne and Rancière (FX: (75%STED+CAD) Ratio	IMF Metric (FX:RFX) Ratio #
Bench Mark	100%	75-150%	100-150%
1990-91	32.0	36.2	
1991-92	111.5	141.8	
1992-93	100.0	119.1	
1993-94	398.9	491.1	
1994-95	328.4	381.5	
1995-96	198.3	224.1	
1996-97	233.3	274.0	
1997-98	278.5	316.3	
1998-99	392.7	450.9	
1999-00	467.5	531.8	1.12

2000-01	678.9	794.6	1.34
2001-02	880.5	991.2	1.64
2002-03	693.8	776.4	2.14
2003-04	609.6	648.3	2.16
2004-05	699.8	896.1	2.01
2005-06	515.0	617.5	2.2
2006-07	527.9	648.8	2.6
2007-08	504.1	619.4	2.1
2008-09	353.8	417.3	2.0
2009-10	307.9	359.9	1.75
2010-11	267.6	312.2	1.56
2011-12	188.3	215.1	1.43
2012-13	158.0	181.7	1.44
2013-14	245.4	301.0	1.51
2014-15	304.0	375.3	1.57
2015-16	341.1	425.1	1.55
2016-17	358.1	455.1	1.59
2017-18	281.4	338.7	1.51
2018-19	249.3	298.1	1.7
2019-20	363.4	456.1	2.0
2020-21	461.3	578.1	1.85
2021-22	378.7	467.3	1.59
Feb-23	232.7	269.3	1.56

Source: RBI and Own Computation

Source: IMF

b) Reserves to Short-term Debt Ratio

This measure reflects the country's ability to repay the short-term debt liabilities. It can be seen from table no. 5 that the country holds reserves more than that of benchmark level and it has increased from 68% 1990-91 to 500% in 2021-22 and shown fluctuating trend and it stood at 422 % as at February 2023. (Table No.3). As far as the excess level is concerned, it has been seen that country holds excess reserves of US\$. 430 billion as of February 2023 (Table No.5).

c) Reserves to Broad Money (M2) Ratio

The proportion of foreign exchange reserves to broad money rose from 4 per cent in 1991-92 to 22.4 per cent in 2021-22. The higher the ratio higher is the confidence in the value of the local currency. It has been observed that the country's stock of reserves is always more than the adequate level of 10% of M2 .

This ratio in percentage term has lowest value of 12.3% in 1990-91 and maximum of 105% in the year 20007-08. (Table No.3). The country holds a higher level of excess reserves of US\$ 494 billion (Table No.5).

d) Combined metric

It is observed that the country is holding a sufficient amount of foreign exchange reserves which is higher by US\$179 billion than the combined adequacy level of US\$ 382 billion which covers all the three short-term obligations. During the period between 1994 and 2022, the country's stock of foreign exchange reserves was always higher than the adequacy level of reserves. It has also been noticed that the gap between adequate level and the actual level increased in recent years though it stood at 179 as of February 2023 (Table No.5).

e) Reserves to volatile flows Ratio

This ratio has been mostly above the threshold level of 60 %of reserves except a few years. The volatile capital flows constitute about 60.6% and 67% of reserves as of March 2022 and February 2023 respectively. This is mainly on account of increased portfolio inflow(Table No.3).

f) Reserves to External Debt Ratio

It has been observed from table no. 3 that the country has adequate foreign exchange reserves and is able to maintain more than the bench mark of 40% from the year 2001-02, though the reserves were much less than the threshold limit during period I. At the end of February2023, foreign exchange reserves were equal to 92% of India's total external debt(Table No.3). This is a very large proportion. This is particularly true when short-term debt is only 21.5 % of the total debt. This indicator shows that India holds reserves of US\$ 317 billion in excess over and above the threshold level US\$ 255 billion as of February 2023(Table No.5).

Table No. 5 : Adequacy of Reserves (absolute) and Gap in US\$ billion

	FXR	Import coverage		STED		M2		Combined Metric		TED*0.40		10 % GDP	
		ARR	GAP	ARR	GAP	ARR	GAP	ARR	GAP	ARR	GAP	ARR	GAP
1991	5.8	6.0	-0.2	8.5	-2.7	4.7	1.1	19.3	-13.5	33.5	-27.7	30.0	-24.1
1992	9.2	4.9	4.4	7.1	2.2	4.4	4.8	16.3	-7.1	34.1	-24.9	26.1	-16.8
1993	9.8	5.5	4.4	6.3	3.5	4.0	5.9	15.8	-5.9	36.0	-26.2	24.8	-14.9
1994	19.3	5.8	13.4	3.6	15.6	4.8	14.4	14.3	5.0	37.1	-17.8	28.4	-9.2
1995	25.2	7.2	18.0	4.3	20.9	6.1	19.1	17.5	7.7	39.6	-14.4	33.0	-7.8
1996	21.7	9.2	12.5	5.0	16.7	6.3	15.4	20.5	1.2	37.5	-15.8	35.8	-14.1
1997	26.4	9.8	16.6	6.7	19.7	6.7	19.7	23.2	3.2	37.4	-11.0	39.5	-13.1
1998	29.4	10.4	19.0	5.0	24.3	6.8	22.6	22.2	7.2	37.4	-8.0	39.8	-10.5
1999	32.5	10.6	21.9	4.3	28.2	7.3	25.2	22.1	10.3	38.8	-6.3	42.5	-10.0
2000	38.0	12.4	25.6	3.9	34.1	7.8	30.2	24.2	13.8	39.3	-1.3	46.4	-8.3
2001	42.3	12.6	29.6	3.6	38.7	8.1	34.1	24.4	17.9	40.5	1.8	46.7	-4.4
2002	54.1	12.9	41.3	2.7	51.4	8.9	45.2	24.5	29.6	39.5	14.6	48.3	5.8
2003	76.1	15.4	60.7	4.7	71.4	10.2	65.9	30.2	45.9	42.0	34.1	53.4	22.7
2004	113.0	19.5	93.4	4.4	108.5	13.6	99.3	37.6	75.3	45.1	67.9	65.5	47.5
2005	141.5	27.9	113.6	17.7	123.8	15.2	126.3	60.8	80.7	53.6	87.9	74.1	67.4
2006	151.6	37.3	114.3	19.5	132.1	18.9	132.7	75.7	75.9	55.6	96.0	82.8	68.8
2007	199.2	46.4	152.7	28.1	171.0	22.6	176.5	97.2	102.0	68.9	130.2	98.5	100.7
2008	309.7	62.9	246.9	45.7	264.0	29.4	280.3	138.0	171.7	89.8	220.0	124.8	185.0
2009	252.0	75.9	176.1	43.3	208.7	25.2	226.8	144.4	107.6	89.8	162.2	110.5	141.5
2010	279.1	72.1	207.0	52.3	226.7	33.6	245.5	158.0	121.1	104.4	174.7	143.5	135.6
2011	304.8	92.4	212.4	65.0	239.8	37.4	267.5	194.8	110.0	127.2	177.7	174.3	130.5
2012	294.4	122.3	172.1	78.2	216.2	34.6	259.8	235.1	59.3	144.3	150.1	176.1	118.3
2013	292.0	122.7	169.4	96.7	195.4	35.6	256.5	255.0	37.1	163.7	128.3	182.8	109.2
2014	304.2	112.6	191.7	91.7	212.5	34.9	269.3	239.1	65.1	178.5	125.8	186.9	117.3
2015	341.6	112.0	229.6	85.5	256.1	35.5	306.2	233.0	108.7	189.9	151.8	199.3	142.4
2016	360.2	95.3	264.9	83.5	276.7	39.4	320.8	218.2	142.0	193.9	166.3	208.5	151.7
2017	370.0	96.1	273.9	88.1	281.8	41.4	328.6	225.6	144.4	188.4	181.6	237.4	132.5
2018	424.5	116.4	308.1	102.2	322.4	50.2	374.3	268.8	155.7	211.7	212.8	262.8	161.7
2019	412.9	128.5	284.4	108.4	304.5	53.6	359.2	290.6	122.3	217.3	195.6	273.2	139.6

2020	477.8	118.7	359.1	106.9	370.9	54.7	423.1	280.3	197.5	223.3	254.5	266.3	211.5
2021	577.0	98.6	478.4	101.1	475.9	65.6	511.4	265.3	311.7	229.5	347.5	270.8	306.2
2022	607.3	153.3	454.0	121.7	485.6	70.1	537.2	345.0	262.3	248.3	359.0	312.5	294.8
23-Feb	560.9	183.8	377.2	131.0	429.9	67.0	493.9	381.8	179.1	244.0	316.9	---	---

Source: RBI and Own Computation

g) Reserve Drainer Approach:

Table 6 below shows that trend foreign exchange reserve gap. Gap is estimated by taking the difference between estimated foreign exchange reserve by taking sum of year end imports, short-term external debt and broad money and actual foreign exchange reserve holdings. The required foreign exchange reserves estimated using this method reveal that there has been a regular shortfall despite the continuous accumulation of foreign exchange reserves. Therefore, during the study period foreign exchange reserves were inadequate to meet India's all external obligations. This gap had gradually increased during the study period except few years and the gap stood at US\$ 424 billion as of February 2023. (Table No.6)

h) Economic based indicator

It has been observed that the proportion of foreign exchange reserves to GDP rose from less than 2% in 1991-92 and continued to be less than 10% 2000-01. Since then it has been above threshold level 10% of GDP and it stood at 21.3% in 2021-22.(Table No.3) As per this measure, India holds excess reserves of about US\$ 295 billion. (Table No. 5).

i) Expanded Greenspan-Guidotti rule

The rationale is that countries should have enough reserves to resist a massive withdrawal of short term foreign capital. It has been observed from table no. 4 that the country has adequate foreign exchange reserves and is able to maintain more than the bench mark of 100% from the year 1991-92 and throughout the study period from the year 1992. It should be at 233 as of February 2023. This indicator shows that India holds reserves of US\$ 320 billion in excess over and above the threshold level US\$ 241 billion as of February 2023(Table No.6).

j) Jeanne and Rancière model

It has been observed from table no. 4 that the country has adequate foreign exchange reserves and is able to maintain more than the bench mark of 75-100% from the year 1991-92 throughout the study period. It stood at 269 as of February 2023. India holds reserves of US\$ 346 billion in excess over and above the threshold level US\$ 215 billion as of February 2023(Table No.6).

k) IMF ARA metric

India's reserve coverage against the proposed adequacy 150 percent(Maximum of the range 100-150%) is shown in table no.4.Reserves in terms of ratio of IMF's ARA metric reveals that it increased from 1.1% in 2000 to a peak of 2.6% in 2007 before declining during the taper tantrum period to 1.4 and climbing again to 2.0 in 2020. However, India's reserve as a ratio to ARA metric stood at 1.59 in 2022 indicating that the reserve level (159%) is still higher than the assessed value (@150%).(Table No.4). The country holds reserves of US\$ 299 billion in excess over and above the threshold level US\$ 262 billion as of February 2023(Table No.6).

The different measures of estimating adequacy level of reserves showed that the country holds reserves more than the adequate level except under Reserve Drainer Approach (that takes considers the total M2 which is not practically justifiable) . If any particular shock affects the economy, then it has a greater capacity to absorb the shock. In more extreme situations, even if the entire economy goes into depression and there is a sudden stop of foreign capital inflow, then also the country has sufficient reserves to endure the shock for certain periods.

Table No. 6 : Adequacy of Reserves (absolute) and Gap in US\$ billion (cont.)

Year	FXR	Reserve Drainer Approach Ratio		Expanded Greenspan-Guidotti Ratio		Jeanne and Rancière Ratio		IMF ARA metric	
		TRR	GAP	TRR	GAP	TRR	GAP	TRR	GAP
1991	5.8	62.0	-56.2	18.2	-12.4	16.5	-10.7		
1992	9.2	56.2	-46.9	8.3	1.0	6.9	2.4		
1993	9.8	51.5	-41.7	9.8	0.0	8.6	1.3		
1994	19.3	57.5	-38.2	4.8	14.4	4.1	15.2		
1995	25.2	72.1	-46.9	7.7	17.5	6.8	18.4		
1996	21.7	76.8	-55.2	10.9	10.8	9.9	11.8		
1997	26.4	83.5	-57.1	11.3	15.1	10.0	16.4		
1998	29.4	83.3	-53.9	10.5	18.8	9.5	19.8		
1999	32.5	87.6	-55.1	8.3	24.2	7.4	25.1		
2000	38.0	94.7	-56.7	8.1	29.9	7.3	30.7	19.6	18.4
2001	42.3	97.6	-55.3	6.2	36.1	5.5	36.8	23.2	19.1
2002	54.1	104.3	-50.2	6.1	48.0	5.6	48.5	21.3	32.8
2003	76.1	122.2	-46.1	11.0	65.1	10.0	66.1	28.3	47.8
2004	113.0	160.4	-47.5	18.5	94.4	17.6	95.3	37.1	75.8
2005	141.5	197.6	-56.1	20.2	121.3	16.7	124.8	49.5	92.0
2006	151.6	245.8	-94.2	29.4	122.2	25.5	126.1	61.4	90.2
2007	199.2	300.9	-101.7	37.7	161.4	32.1	167.1	84.1	115.1
2008	309.7	402.7	-93.0	61.4	248.3	52.3	257.4	97.9	211.8
2009	252.0	370.9	-118.9	71.2	180.8	62.6	189.4	95.0	157.0
2010	279.1	460.2	-181.1	90.6	188.4	80.2	198.9	117.3	161.7
2011	304.8	531.1	-226.3	113.9	190.9	100.9	203.9	143.3	161.6
2012	294.4	546.6	-252.2	156.4	138.0	140.7	153.7	146.7	147.7
2013	292.0	575.2	-283.2	184.9	107.2	165.6	126.5	160.6	131.5
2014	304.2	553.2	-248.9	124.0	180.2	105.6	198.6	160.6	143.6
2015	341.6	552.1	-210.5	112.4	229.2	95.3	246.3	174.7	167.0
2016	360.2	572.8	-212.6	105.6	254.6	88.9	271.3	166.1	194.1
2017	370.0	597.9	-228.0	103.3	266.6	85.7	284.3	182.6	187.3
2018	424.5	721.0	-296.5	150.9	273.7	130.4	294.1	199.4	225.1
2019	412.9	773.4	-360.5	165.6	247.3	143.9	268.9	214.0	198.9
2020	477.8	772.8	-295.0	131.5	346.3	110.1	367.7	214.5	263.3
2021	577.0	855.4	-278.4	125.1	451.9	104.9	472.1	228.1	348.9
2022	607.3	975.8	-368.5	160.4	446.9	136.0	471.3	247.0	360.3
23-Feb	560.9	985.2	-424.3	241.0	319.9	214.8	346.1	261.9	299.0

Source: RBI and Own Computation

VI. Conclusion

The trend in India's forex reserves reveals that despite liberalization of the economy and adoption of current account convertibility since the early 1990s, reserve level remained low during the 1990s. The pace of reserve buildup accelerated since 2000 due to various factors like Initiation of current account convertibility, flexibility in capital account, lower oil prices, software services exports and remittances from Indians employed overseas, a moderate CAD and increased foreign capital inflows. However, reserves depletion during the GFC period was followed by

rising oil prices, ballooning of CAD and sudden stops during the taper tantrum. During the Pandemic period, India was one of the recipient economies, which helped shore up its foreign exchange reserves by a whopping 33 percent from the pre-pandemic levels (US\$450 billion) to the October 2021 levels (US\$ 642 billion). Most of the accumulation happened between April 2020 and November 2020. This rise is because of a rise in the dollar value of assets held as reserves by the RBI, positive current account surplus. However, the foreign exchange reserves again started decreasing from November, 2021 and stood at US\$561 billion due to appreciation in Dollar and current account Deficit. Further, it is revealed from the analysis that the share of gold in total forex reserves has fallen from 78% prior to liberalization of the Indian economy to around 7.4% at present. Consequently the share of FCA in total reserves has increased to about 89 per cent. It is very difficult to define an adequate level of foreign exchange reserves for any country. Different researchers have applied various methods to ascertain the adequate level of foreign exchange reserves. However, no one measure can fully capture the range of factors that bear on a country's resilience against shocks. The different measures of estimating adequacy level of reserves applied in this study showed that the country holds reserves more than the adequate level except under Reserve Drainer Approach (that considers the total M2). If any particular shock affects the economy, then it has a greater capacity to absorb the shock. In more extreme situations, even if the entire economy goes into depression and there is a sudden stop of foreign capital inflow, then also the country has sufficient reserves to endure the shock for certain periods. Moreover, reserves are only one part of a country's defense against shocks.

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