LIQUID ITY AGGREGATES IN INDIA: AN EMPIRICAL ANALYSIS OF RECENT TRENDS

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ABSTRACT

The present paper empirically analyses the recent trends in real growth rates of various components of liquidity aggregates in India over the period December 2019 to April 2021. The results of breakpoint unit root test involving the application of innovational outlier model and minimisation of Dicky-Fuller t-statistic clearly establish a "structural break" in the real growth rates of both M_3 and L_2 thereby bearing testimony to the adverse liquidity conditions prevailing in the Indian economy. The future course of Indian economy crucially hinges on how well the monetary authority handles this formidable challenge.

Keywords: Certificates of Deposit, Postal Deposits, Broad Money Supply, Call-Borrowings, Refinancing Institutions.

I. Introduction

It has been over two decades that Liquidity Aggregates, as distinguished from Monetary Aggregates, have come to the centre-stage ever since the Third Working Group of Reserve Bank of India (1998) on Money Supply introduced the general concept of "Financial Aggregates" following the principle of progressivity in terms of liquidity. More specifically, the Third Working Group (TWG) acknowledged that due to the ongoing process of financial innovations under an era of financial reforms, several new financial assets were being offered both by Banks as well as Non-Bank Financial Corporations in India.

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Though these newly emerging financial assets such as Certificates of Deposit added liquidity to the economy in monetary terms, yet they did not fit into the traditional notion of money supply. Accordingly, the Group (TWG) introduced the concept of "Liquidity Aggregates" that included these newly-emerging liquid assets thereby serving as an effective supplement to the traditional notion of "Monetary Aggregates" and both these types of aggregates were in general referred to as "Financial Aggregates".

In line with the recommendations of its Third Working Group, the Reserve Bank of India (RBI) has been consistently publishing data on three alternative forms of Liquidity Aggregates since September 1998 *viz.*, L_1, L_2 and L_3 of which L_1 and L_2 are compiled on a monthly basis whereas the data on L_3 is released on a quarterly basis. Further, following the norm of progressivity, each financial aggregate defined by the Group is broad enough to include the previous one as its subset. Accordingly, L_1 is a subset of L_2 which in turn is a subset of L_3.

Though the importance of liquidity aggregates has been recognised time and again by the monetary authority and policy-makers in India through the periodic publications of RBI, yet these aggregates did not gain much attention of researchers in as much as no serious attempt has so far been made to empirically analyse the emerging trends in various components of "Liquidity Aggregates" in India using advanced techniques of statistics and econometrics.

The present study is therefore undertaken to bridge this lacuna and towards this end, we empirically analyse the recent trends in real growth rates of Certificates of Deposit issued by Commercial Banks as well as Non-Bank Financial Companies, Term-Deposits with Term-Lending and Refinancing Institutions and Term-Borrowing by Financial Institutions as also Broad Money supply (M_3), Call-Borrowings and Postal Deposits using the monthly data released by the Reserve Bank of India over the period December 2019 to April 2021.

Apart from a routine graphical and statistical analysis of all the relevant data series, we go deeper into an advanced econometric analysis of data and try to endogenously identify as to when a "structural break" would have occurred in the concerned data

series by applying the *innovational outlier* model and minimising the Dicky-Fuller *t*-statistic. The purpose is to empirically explore whether the liquidity conditions in the Indian economy as reflected by liquidity aggregates and their components have been adversely affected in recent months.

The next section discusses the conceptual issues revolving around the notion and significance of liquidity aggregates and briefly reviews the literature available on it. In contrast, the subsequent section *viz.*, III describes the issues relating to data collection and takes a closer look at the statistical and graphical analysis of the relevant data on various prominent financial assets that have contributed to liquidity in the Indian economy over the sample period. This is followed in next section *i.e.*, IV by a detailed discussion of the econometric analysis of data concerning liquidity aggregates, focussing on empirical results and their interpretation. And finally, the conclusions drawn from the present study are recorded in section V.

II. SIGNIFICANCE OF LIQUIDITY AGGREGATES: CONCEPTUAL ISSUES AND THE REVIEW OF LITERATURE

Money is considered to be a unique financial asset as it alone is perfectly liquid. What this essentially implies is that due to its universal acceptability as a medium of exchange, money alone can serve as a universal generalised purchasing power in an economy. In other words, money has an exalted status in the entire financial system by virtue of its "liquidity" in monetary terms in the sense that it has the ability to be accepted by all in the settlement of all transactions, including deferred payments and future transactions in the economy.

Evidently, it is by virtue of its liquidity that the use of money improves transactional efficiency and saves on the wastage of precious resources involved under a barter system. In this context, Jadhav (2006) is of the opinion that money not only broadens the scope of exchanges, but also leads to a greater efficiency in the allocation of resources along with expanding the production possibilities in the economy.

This apparently goes on to prove the importance of "Liquidity" of a financial asset in the economy. It is not essential that a financial asset should have 100 per cent or perfect

liquidity, but the very fact that an asset could add a reasonable degree of liquidity in the economy, proves its importance in terms of its potential towards raising financial efficiency.

Of late, under an era of integration of global financial markets, a new regime of financial reforms came into being in the case of Indian economy especially since the early 1990s, on the recommendations of the Report of the Committee on the Financial System, a high-powered committee appointed by the Government of India (1991). In due course, the process of reform of the financial sector initiated by this committee was carried forward under the second-generation of financial reforms whose road map was laid down by the Report of the Committee on Banking Sector Reforms appointed by the Government of India (1998).

The distinguishing characteristic of the new policy regime emerging under economic and financial reforms was an orientation towards the market-based system of competition coupled with a thrust on economic and financial efficiency. It was under the ensuing liberalised economic environment that the Indian financial system witnessed a number of unprecedented and path-breaking "financial innovations" of which the offer of new-types of financial assets by the financial institutions with a view to catering to the diversified needs of their customers was particularly noteworthy.

Evidently, all these newly emerging financial assets such as Certificates of Deposit contributed to financial efficiency by infusing "liquidity" in the economy. It was the recognition of this crucial aspect that led the Third Working Group (TWG) of Reserve Bank of India to devise "Liquidity Aggregates" by adding all such newly-emerging liquid financial assets to the prevailing "Monetary Aggregates". In fact, the Group (TWG) even proposed new monetary aggregates by modifying the then-existing money supply measures by incorporating liquid assets like Certificates of Deposit issued by Commercial Banks as also Call-Borrowings of the Banking System from Non-Depository Financial Corporations in them.

In addition, the Liquidity Aggregates L_1, L_2 and L_3 proposed by the RBI's Group (TWG) also took into account other liquid assets such as Postal Deposits *i.e.*, all

deposits with the Post Office Savings Banks as also the Certificates of Deposit issued by Non-Bank Financial Institutions, Term Deposits with Term-Lending and Refinancing Institutions, Term-Borrowing by Financial Institutions and Public Deposits of Non-Bank Financial Companies.

In view of the crucial significance of liquidity for financial efficiency and smooth conduct of the functioning of the financial system in India, it was imperative to carry out a detailed statistical and econometric analysis of the recent trends in all the components of liquidity aggregates in India. Towards this end, it was first of all essential to choose a sample period for our study and compile the requisite data base for such an empirical analysis. The issues related to collection of relevant data and its statistical analysis are discussed in the next section.

III. DATA COLLECTION AND ITS STATISTICAL ANALYSIS

As the data on monetary as well as liquidity aggregates in India are compiled by the Reserve Bank of India, therefore the monthly Bulletin of Reserve Bank of India (2021a) as well as the "Database on Indian Economy" on the official website of the Reserve Bank of India (2021b) comprised the main source of data for our study. In order to capture the latest trends in liquidity aggregates and their components in India, we wanted to confine our empirical analysis only to the recent period. At the same time, however, with a view to making the observation set larger so as to derive meaningful results on the basis of the statistical and econometric analysis of the relevant data, we decided to use "Monthly" instead of "Annual Data".

But a major constraint posed by the decision to utilise monthly data while analysing liquidity aggregates in the Indian economy is that the Reserve Bank of India (RBI) compiles data on the broadest notion of Liquidity Aggregates *viz.*, L_3 on a quarterly rather than monthly basis. Thus, we had to restrict our empirical analysis to the Liquidity Aggregate "L_2" on which monthly data was easily forthcoming from the RBI. Consequently, the trends in public-deposits of Non-Banking Financial Companies could not be covered in our study as the highest frequency of data available on it was a quarter rather than a month.

Another issue relating to the compilation of data base for our study was that according to the Handbook of Statistics on Indian Economy, 2019-20 released by the Reserve Bank of India (2020), the data on liabilities of Financial Institutions from November 2019 and onwards is not strictly comparable to the past data due to the incorporation of updated data since November 2019.

More specifically, when we consider some prominent components of liquidity aggregates such as the Certificates of Deposit issued by Financial Institutions other than banks, Term-Deposits with Term-Lending and Refinancing Institutions and Term Money Borrowing *i.e.*, Term-Borrowing by Financial Institutions, some of the relevant financial institutions are the Export-Import (EXIM) Bank, National Bank for Agriculture and Rural Development (NABARD), National Housing Bank (NHB) and Small Industrial Development Bank of India (SIDBI).

These are prominent institutions in the field of financing for economic development and institutions like NABARD typically specialise in "Refinancing" in the sense that if some local-level institution such as a State Financial Corporation (SFC) has provided financial assistance to small and marginal farmers or rural artisans, then that agency can seek a loan *i.e.*, refinance from the NABARD against such loans provided by it since NABARD is an apex institution among the Development Financial Institutions for agricultural and rural development in India.

But as due to data compilation procedures on the part of RBI, the relevant data on the liabilities of these financial institutions for periods prior to November 2019 was not strictly comparable for the period beyond it, therefore we had to restrict the starting point of empirical analysis in our study to November 2019 only.

It is against this backdrop that taking into account the issues of data availability along with statistical considerations of a reliable sample size, we chose November 2019 to April 2021 as the sample period for our empirical study. Thus, to begin with, we had 18 sample observations for the statistical and econometric analysis of all the relevant data series in our study.

One sample observation was however reduced subsequently as it was realised that a comparison of rates of growth of all the relevant variables in real terms would be more meaningful rather than looking at all the data series in terms of absolute numbers in nominal terms. For, the assumption of rationality in monetary theory requires the absence of "money illusion" meaning thereby that economic agents should base their decisions on real rather than nominal magnitudes.

This is supported by statistical theory too since nominal magnitudes of variables could quite conceivably be reflective of changes in prices and thus all nominal variables must be deflated by a suitable price deflator. Towards this end, we utilised the Wholesale Price Index, on which relevant data for the entire sample-period of our study, was easily available in the database of RBI on its official website.

In addition, as per statistical theory, even after deflating nominal magnitudes by the suitably chosen price index to arrive at their real magnitudes, it is advisable to compare such real variables in terms of their growth rates rather than absolute magnitudes. For, real growth rates of a variable give a better idea about its movement over time in relation to its counterparts as for instance, in absolute magnitudes, there could be major differentials between various components of liquidity aggregates themselves even in real terms but finding the rate of growth in real terms evens-out this differential. Finding the real growth rate, however, reduces one observation from the sample.

Consequently, we in effect had December 2019 to April 2021 with 17 sample observations as the sample period in our study on the empirical analysis of recent trends in liquidity aggregates and their components in India. It is worth noting that the real rate of growth of any variable for a particular month say December in our study actually measures the growth rate registered by that variable in real terms between the months of November and December in the concerned year.

The real growth rates of all the variables relevant to our study, as computed on the basis of Reserve Bank of India Data compiled in the manner described in the foregoing discussion, are presented in *Table 1* and *Table 2*. for the entire sample period of our study *viz.*, December 2019 to April 2021.

The notations used in these data tables are described below:

RGRCDCB = Real Growth Rate of Certificates of Deposit issued by Commercial Banks in India.

RGRCDFI = Real Growth Rate of Certificates of Deposit issued by Financial Institutions in India.

RGRCB = Real Growth Rate of Call-Borrowings by the Banking System from Non-Depository Financial Corporations in India.

RGRTBFI = Real Growth Rate of Term-Borrowing by Financial Institutions in India.

RGRPD = Real Growth Rate of Postal Deposits in India.

RGRTDTLRI = Real Growth Rate of Term-Deposits with Term-Lending and Refinancing Institutions in India.

GRM_3 = Real Growth Rate of Broad Money supply in India.

and, $RGRL_2$ = Real Growth Rate of Liquidity Aggregate L_2 in India.

The Real Growth Rates of Certificates of Deposit issued by Commercial Banks in India (RGRCDCB) and those issued by Financial Institutions (RGRCDFI), as also the Real Growth Rates of Call-Borrowings (RGRCB) and Term-Borrowing by Financial Institutions (RGRTBFI) reported in *Table 1* are graphically depicted in GRAPHS 1 to 4 respectively.

Likewise GRAPHS 5 to 8 respectively depict the Real Growth Rates of Postal Deposits (RGRPD) and Term-Deposits with Term-Lending and Refinancing Institutions (RGRTDTLRI) on the one hand, and the Real Growth Rates of broad money supply M_3 ($RGRM_3$) and Liquidity Aggregate L_2 ($RGRL_2$) on the other, as reported in *Table 2*.

Along with each of these graphs, some of the descriptive statistics relating to the depicted data series are also presented in the form of corresponding CHARTS 1 to 8. These statistics were obtained from the detailed statistical analysis of the concerned variables over the sample period December 2019 to April 2021.

TABLE 1

Real Growth Rates of some Prominent Components of Liquidity Aggregates in India

S.N.	Month	RGRCDCB	RGRCDFI	RGRCB	RGRTBFI
(1)	Dec. 2019	−1.506047	−5.170328	−1.547150	−6.177715
(2)	Jan. 2020	12.61062	5.509249	−2.729485	−3.627247
(3)	Feb. 2020	3.303979	4.898709	0.030576	−3.259519
(4)	March 2020	−5.013676	−8.952537	1.846861	182.2352
(5)	April 2020	−2.316478	−5.654416	−1.598111	26.48772
(6)	May 2020	−3.274312	−8.651140	−2.143854	10.36734
(7)	June 2020	−22.19183	−0.113684	−2.836518	−2.739827
(8)	July 2020	−14.89673	−20.64911	−5.835857	−22.12046
(9)	Aug. 2020	−17.98997	−8.472957	−1.293533	−6.529163
(10)	Sep. 2020	−17.33364	−0.732303	−6.721465	−28.73730
(11)	Oct. 2020	144.6930	−2.602527	−0.907081	−45.67782
(12)	Nov. 2020	−63.79035	−1.543295	2.160375	−16.07947
(13)	Dec. 2020	1.425556	0.685122	−4.953311	−0.239234
(14)	Jan. 2021	−6.913780	−0.869565	−4.212205	−0.869565
(15)	Feb. 2021	−13.13029	−1.249024	−0.568916	−1.249024
(16)	March 2021	39.68942	−7.586443	−1.672575	−1.385681
(17)	April 2021	8.325891	−16.95481	−4.420423	32.86590

(Source of Data: All these growth rates have been calculated on the basis of the data released by the Reserve Bank of India in the *Database on Indian Economy* on its official website.)

All these graphs and charts make it very clear that different components of liquidity aggregates in India have exhibited an erratic growth pattern in real terms over the sample period of our study. Not only is the extent of "dispersion" in various data series quite high in terms of the reported value of standard deviation, but over time, the distribution of real rates of growth of all the variables suffers from different degrees of either positive or negative "skewness".

TABLE 2

Real Growth Rates of L_2 and some other Prominent Components of Liquidity Aggregates in India

S.N.	Month	RGRPD	RGRTDTLRI	RGRM$_3$	RGRL$_2$
(1)	Dec. 2019	1.433813	−2.663573	0.161884	0.183726
(2)	Jan. 2020	1.138427	−12.52418	1.882753	1.785907
(3)	Feb. 2020	2.415561	−5.301091	1.230487	1.246371
(4)	March 2020	4.458077	−5.781123	3.597407	3.554813
(5)	April 2020	1.006711	0.853764	2.414616	2.343541
(6)	May 2020	1.446809	2.062197	2.618702	2.504223
(7)	June 2020	−1.508801	−0.291394	−1.002464	−1.018583
(8)	July 2020	−1.404959	2.441364	0.338790	0.169726
(9)	Aug. 2020	−0.819672	1.227041	−0.694787	−0.694853
(10)	Sep. 2020	−0.732303	−2.962411	−0.216120	−0.342351
(11)	Oct. 2020	−0.566343	0.776197	−0.207761	−0.215093
(12)	Nov. 2020	−1.199041	−1.059017	−0.454305	−0.438765
(13)	Dec. 2020	−0.239234	−7.241971	0.413862	0.334032
(14)	Jan. 2021	−0.869565	−0.869565	1.031712	0.923648
(15)	Feb. 2021	−1.249024	−1.249024	−0.379139	−0.393331
(16)	March 2021	−1.385681	49.43747	−0.299316	−0.245566
(17)	April 2021	−1.366743	0.812779	−0.988191	−1.086098

(Source of Data: All these growth rates have been calculated on the basis of the data released by the Reserve Bank of India in the *Database on Indian Economy* on its official website.)

More specifically, it is only the distributions of Real Growth Rates of Certificates of Deposit issued by Financial Institutions (RGRCDFI) and that of Call-Borrowings (RGRCB) which are "negatively" skewed, whereas the distributions of all other variables are positively skewed over the sample period of our study. What this essentially implies is that in the case of 6 out of 8 variables representing liquidity that were considered in our study, high real growth rates are confined to very few months whereas for most part of the sample period, growth remains sluggish or even retarded in them.

GRAPH-1

Real Growth Rates of Certificates of Deposit issued by Commercial Banks in India
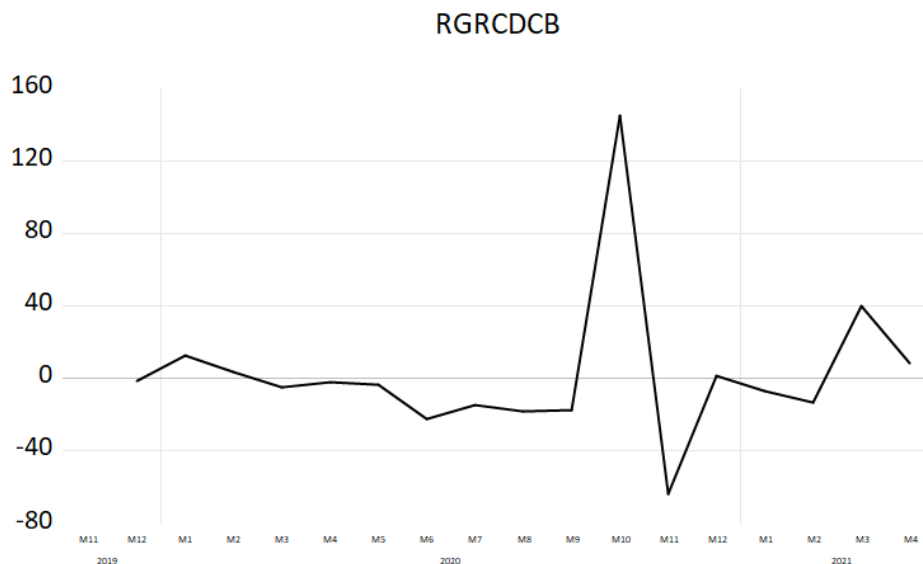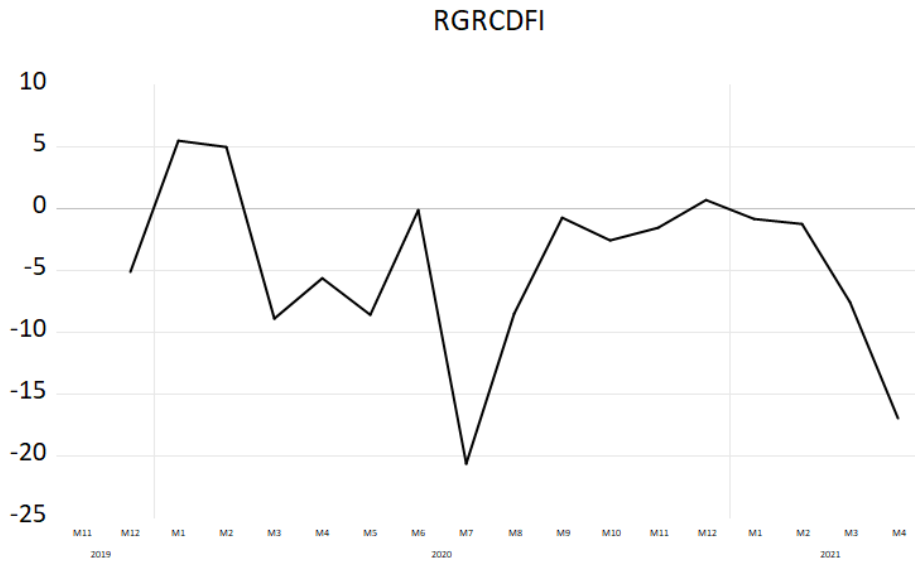**(December 2019 to April 2021)**

RGRCDCB

CHART-1

Descriptive Statistics on the Real Growth Rates of Certificates of Deposit
issued by Commercial Banks in India
(December 2019 to April 2021)

Mean: 2.452435
Median: −3.274312
Standard Deviation: 42.07268
Skewness: 2.247597
Jarque-Bera Statistic: 41.04277
(Probability)   (0.000000)

GRAPH-2
Real Growth Rates of Certificates of Deposit issued by Financial Institutions in India
(December 2019 to April 2021)

RGRCDFI

CHART-2
Descriptive Statistics on the Real Growth Rates of Certificates of Deposit
issued by Financial Institutions in India
(December 2019 to April 2021)

Mean: −4.594651
Median: −2.602527
Standard Deviation: 6.913964
Skewness: −0.770917
Jarque-Bera Statistic: 1.720708
(Probability)   (0.423012)

GRAPH-3
Real Growth Rates of Call-Borrowings in India
(December 2019 to April 2021)

RGRCB

CHART-3
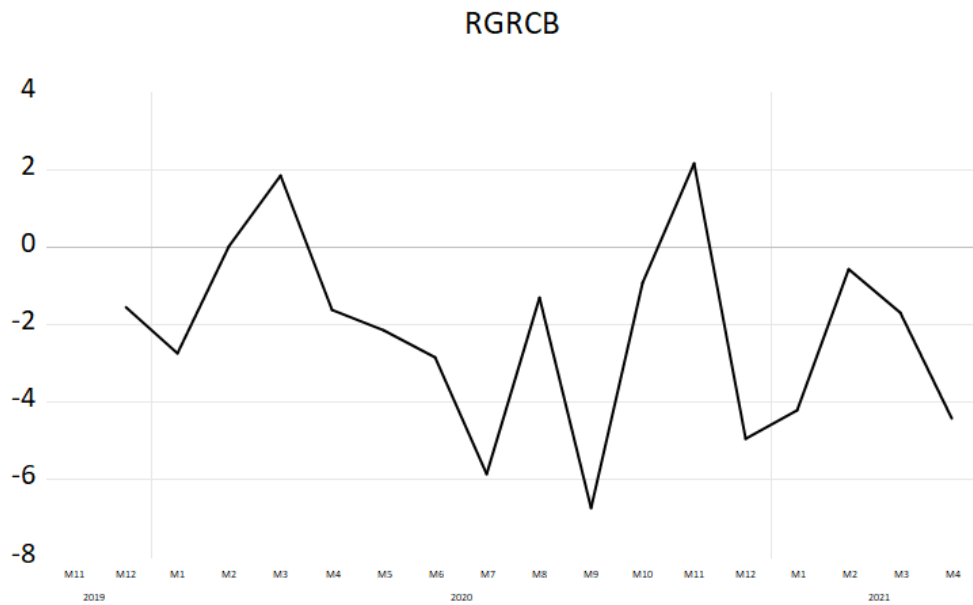**Descriptive Statistics on the Real Growth Rates of Call-Borrowings in India**
(December 2019 to April 2021)

Mean: −2.200157
Median: −1.672575
Standard Deviation: 2.468521
Skewness: −0.054223
Jarque-Bera Statistic: 0.241765
(Probability)   (0.886138)

GRAPH-4
Real Growth Rates of Term-Borrowing by Financial Institutions in India
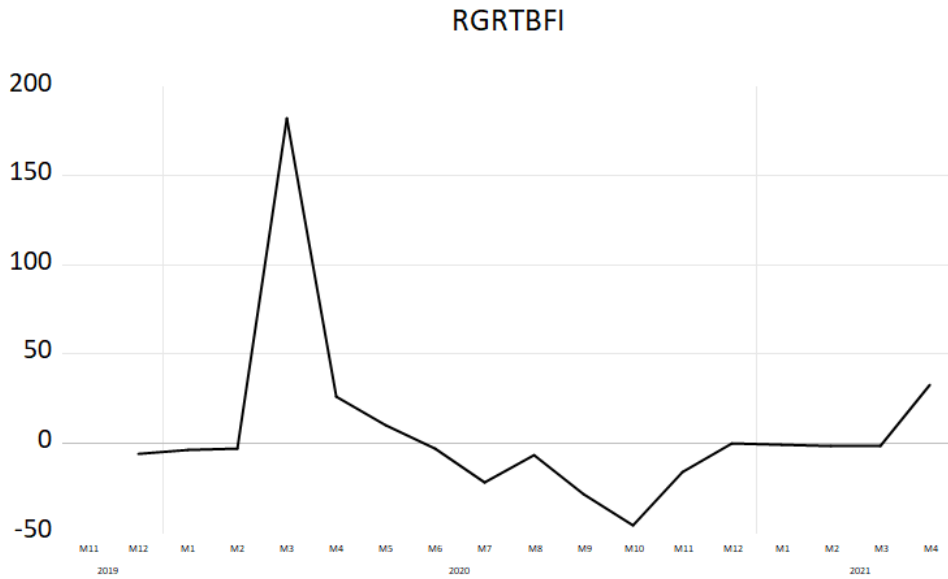**(December 2019 to April 2021)**

RGRTBFI

CHART-4
Descriptive Statistics on the Real Growth Rates of
Term-Borrowing by Financial Institutions in India
(December 2019 to April 2021)

Mean: 6.662595
Median: −2.739827
Standard Deviation: 48.81138
Skewness: 2.883684
Jarque-Bera Statistic: 71.67718
(Probability)   (0.000000)

GRAPH-5
Real Growth Rates of Postal Deposits in India
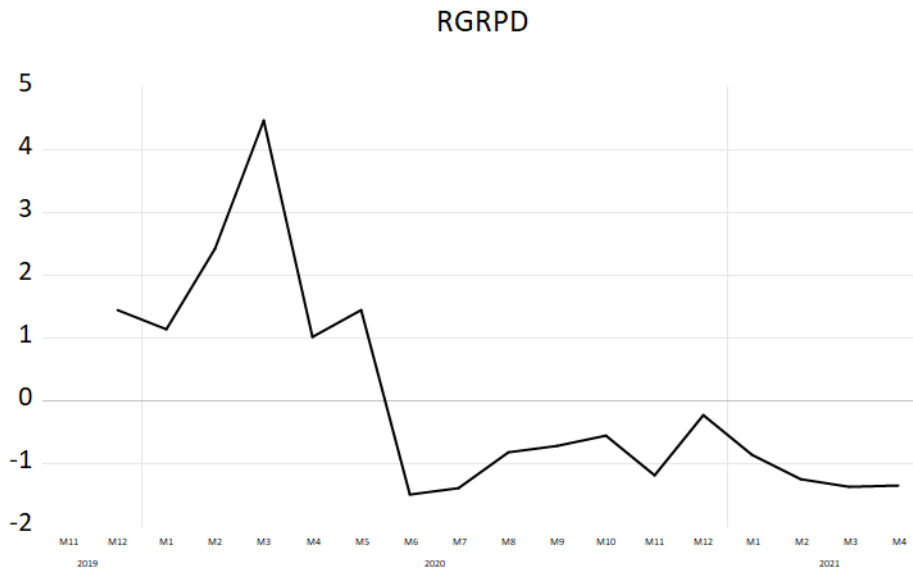**(December 2019 to April 2021)**

RGRPD

CHART-5
Descriptive Statistics on the Real Growth Rates of Postal Deposits in India
(December 2019 to April 2021)

Mean: 0.032825
Median: −0.732303
Standard Deviation: 1.686863
Skewness: 1.205179
Jarque-Bera Statistic: 4.456727
(Probability)   (0.107705)

GRAPH-6
Real Growth Rates of Term-Deposits with Term-Lending and
Refinancing Institutions in India
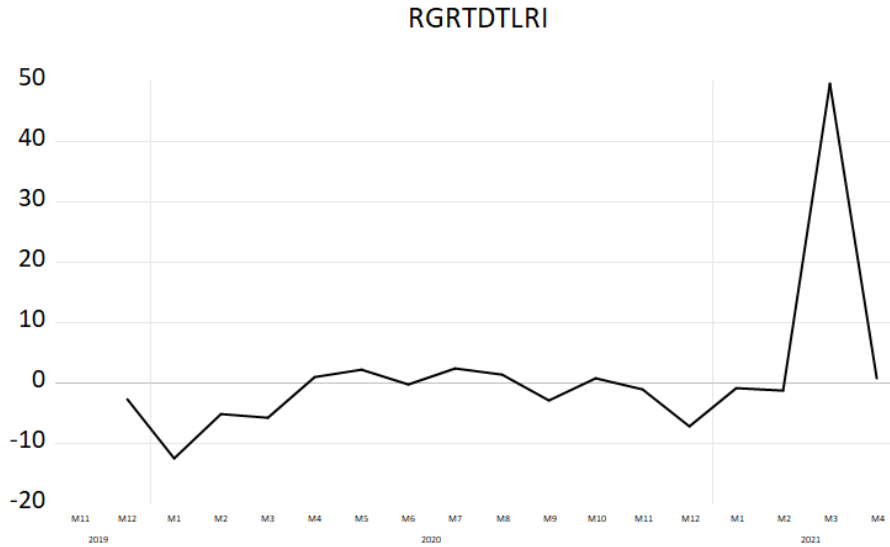**(December 2019 to April 2021)**

RGRTDTLRI

CHART-6
Descriptive Statistics on the Real Growth Rates of Term-Deposits with
Term-Lending and Refinancing Institutions in India
(December 2019 to April 2021)

Mean: 1.039262
Median: −0.869565
Standard Deviation: 13.06146
Skewness: 3.168410
Jarque-Bera Statistic: 93.94682
(Probability)   (0.000000)

GRAPH-7
Real Growth Rates of Broad Money (M₃) in India
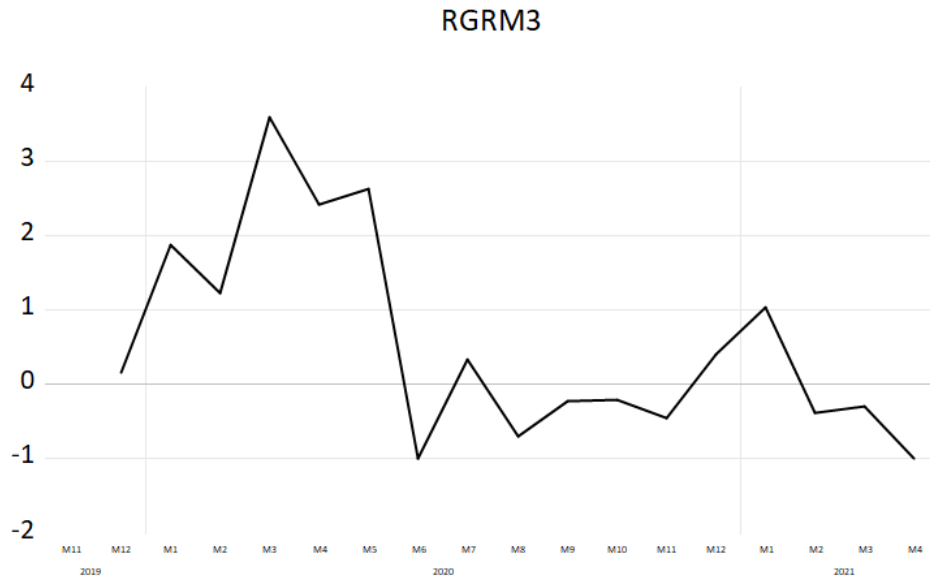**(December 2019 to April 2021)**

RGRM3

CHART-7
Descriptive Statistics on the Real Growth Rates of Broad Money (M₃) in India
(December 2019 to April 2021)

Mean: 0.555772
Median: 0.161884
Standard Deviation: 1.364909
Skewness: 0.841689
Jarque-Bera Statistic: 2.118449
(Probability)   (0.346725)

GRAPH-8
Real Growth Rates of Liquidity Aggregate L₂ in India
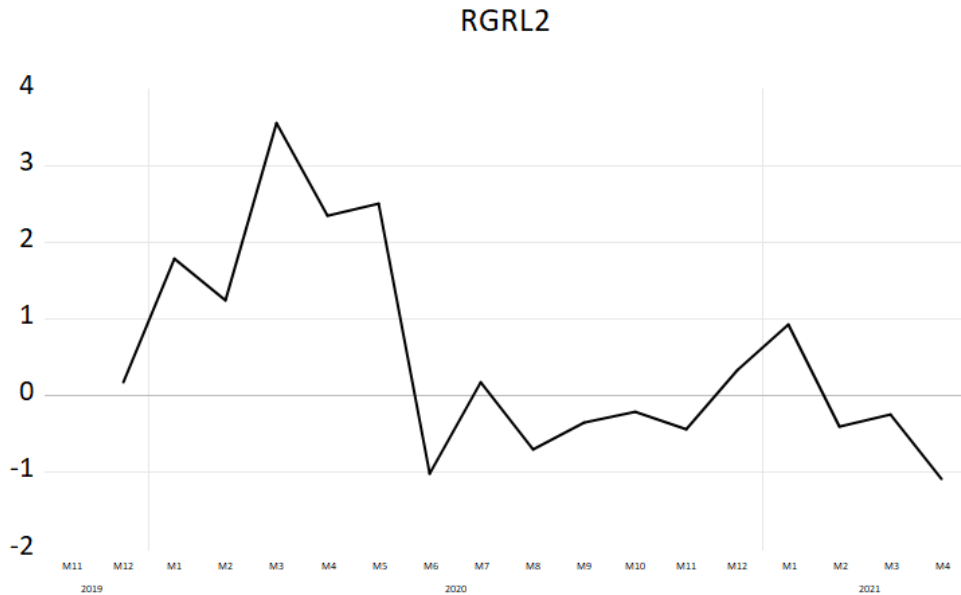**(December 2019 to April 2021)**

RGRL2

CHART-8
Descriptive Statistics on the Real Growth Rates of Liquidity Aggregate L₂ in India
(December 2019 to April 2021)

Mean: 0.506550
Median: 0.169726
Standard Deviation: 1.348125
Skewness: 0.859334
Jarque-Bera Statistic: 2.165979
(Probability)   (0.0338582)

In fact, a closer examination of the reported values of Jarque-Bera Statistic in these charts testifies that three of the data series analysed in our study on the components of liquidity aggregates in the Indian economy do not conform to a normal distribution. To be specific, applying the usual standards of statistical significance, the null hypothesis of a "normal distribution" can be outrightly rejected in the case of Real Growth Rates of Certificates of Deposit issued by Commercial Banks (RGRCDCB),

Term-Borrowing by Financial Institutions (RGRTBFI) and Term-Deposits with Term-Lending and Refinancing Institutions (RGRTDTLRI) according to the values of probabilities associated with the Jarque-Bera Statistic reported in the Charts 1, 4 and 6 respectively.

IV. RESULTS OF ECONOMETRIC ANALYSIS AND THEIR INTERPRETATION

In addition to analysing the dispersion, skewness and normality of the underlying distribution, however, it is quite pertinent to investigate whether a data series is "stationary" in the sense that its mean and autocovariances are not conditional on time. For, non-stationary series are said to have a unit root and standard procedures of statistical inference are not applicable to regressions containing series having a unit root. In view of this, stationarity becomes a desirable attribute that must be possessed by any data series.

Apart from ascertaining the stationarity of all data series over the sample period of our study, however, it was equally important to explore the possibilities of a "structural break" that might have taken place in any of the data series under consideration. For, in terms of the real growth rates of relevant liquidity aggregates and their components, the sample period of our study *viz.*, December 2019 to April 2021 was also the period wherein the world economy witnessed the worst economic crisis of modern times on account of the unprecedented Covid-19 pandemic.

In this context, the Economic Survey 2020-21 released by the Ministry of Finance, Government of India (2021) very aptly observes that the Covid-19 pandemic engendered a unique recession in 2020 that can be termed as a "once-in-a-century global crisis" whereby 90 per cent of countries are likely to experience a contraction in their per-capita national products. Likewise, in its Annual Report 2020-21, the Reserve Bank of India (2021c) finds the global and domestic outlook to be grim as it is overshadowed by extreme uncertainties and downside risks posed by the Covid-19 pandemic.

Thus, it is quite conceivable that due to the pandemic, the real growth rates of many of the components of liquidity aggregates might have experienced a downturn sooner or later, thereby adversely affecting the liquidity conditions in the Indian economy. This possibility is further corroborated by the fact that according to the descriptive statistics given in Charts 1 to 8, many components of liquidity aggregates in India have either experienced negative average real growth rates or otherwise have a negative median value of their growth rate in real terms over the sample period of our study.

More specifically, RGRCDFI and RGRCB had negative mean values whereas despite having a positive average value, RGRCDCB, RGRTBFI, RGRPD and RGRTDTLRI had negative median values as per the statistical results of our study. In the latter case, the positive mean value was merely reflective of the influence of extreme values whereby despite having a poor growth performance in general, the average real growth rate of the concerned variables became positive due to the exceptionally good performance recorded in a particular month.

What this essentially implies is that the growth performance of most of the indicators of liquidity in the Indian economy was poor in real terms over the sample period of our study and this could quite conceivably be due to the adverse impact of the Covid-19 pandemic. In view of this, it became imperative to not only test for the stationarity of various data series in our study by investigating the occurrence of a unit root in them, but also to explore the likelihood of a "structural break" in them over the entire sample period of our study particularly in the light of the Covid-19 pandemic that started spreading practically since March 2020 in the Indian economy.

Assuming that such a break would typically occur gradually in the case of data relating to the real growth rates of various components of liquidity aggregates in the Indian economy, we carried out "unit root test with a breakpoint" by applying the *innovational outlier* model and minimising the Dicky-Fuller *t*-statistic in order to endogenously determine from the data itself, as to when a "structural break" is most likely to have occurred in various data series.

The empirical results following from the application of such a Breakpoint Unit Root Test in our study are presented in *Table 3*. As is clear from the reported probabilities

i.e., Prob. or Vogelsang's asymptotic one-sided p-values in *Table 3*, at the 1% level of statistical significance, the null hypothesis of a unit root can be outrightly rejected in the case of data series on RGRCDCB, RGRCB, RGRTBFI, RGRM$_3$ and RGRL$_2$.

Further, at the 5% level of statistical significance, the null hypothesis of a unit root can be rejected in the case of the data series on RGRPD and RGRTDTLRI also. That is to say, following the usual norms of statistical significance, 7 out of 8 data series in our study were empirically found to be "stationary" over the sample period December 2019 to April 2021.

When it comes to the case of Real Growth Rate of Certificates of Deposit issued by Financial Institutions *viz.*, RGRCDFI, it is quite clear from the reported probabilities or p values in *Table 3* that it is only at the 10% level of statistical significance that the null hypothesis of a unit root in the concerned series can be rejected. In view of this, we carried out the breakpoint unit root test on RGRCDFI in first difference and found the value of Augmented Dickey-Fuller test statistic or *t*-statistic to be −6.100255 with an associated probability or Vogelsang asymptotic one-sided p-value of < 0.01 thereby implying that even at the 1% level of statistical significance, the series on RGRCDFI was "stationary" in first difference.

TABLE 3
**Results of Breakpoint Unit Root Test on Real Growth Rates of L$_2$ and some
Prominent Components of Liquidity Aggregates in India**

Data Series ↓	*t*-Statistic	Prob. [Vogelsang's asymptotic one-sided p-values]	Break Date
RGRCDCB	−7.739066	< 0.01	2020M09 or September 2020
RGRCDFI	−4.618961	0.0966	2020M09 or September 2020
RGRCB	−6.342718	< 0.01	2020M09 or September 2020
RGRTBFI	−7.297720	< 0.01	2020M03 or March 2020
RGRPD	−5.097494	0.0247	2020M11 or November 2020
RGRTDTLRI	−5.186417	0.0184	2021M01 or January 2021
RGRM$_3$	−6.017117	< 0.01	2020M05 or May 2020
RGRL$_2$	−5.914800	< 0.01	2020M05 or May 2020

It must however be pointed out that even in first difference, the results of the concerned breakpoint unit root test established that the Real Growth Rate of Certificates of Deposit issued by Financial Institutions exhibited a "structural break" in the month of September 2020 *i.e.*, 2020M09 which is very much in line with the results on the concerned structural break for RGRCDFI shown in the last column of *Table 3*.

Further, as is also clear from the most likely "Break Date" reported in the last column of *Table 3*, the various data series on real growth rates of components of liquidity aggregates and the assets contributing to liquidity in the Indian economy have been characterised by "structural breaks" at different points of time over the sample period of our study *viz.*, December 2019 to April 2021.

To be specific, on the one hand we have variables like Real Growth Rate of Term-Borrowing by Financial Institutions (RGRTBFI) wherein the break occurred as early as March 2020 itself whereas on the other hand, there are variables such as Real Growth Rate of Term-Deposits with Term-Lending and Refinancing Institutions (RGRTDTLRI) where the structural break took place as late as in January 2021.

As far as the rest of the data series analysed in our study are concerned, the empirical results reported in *Table 3* clearly establish that in the case of the Real Growth Rate of broad money supply M_3 (RGRM$_3$) and that of the liquidity aggregate L_2 (RGRL$_2$), the episodes of a structural break occurred in May 2020 whereas for the Real Growth Rates of Certificates of Deposit issued by Commercial Banks (RGRCDCB), Certificates of Deposit issued by Financial Institutions (RGRCDFI) and Call Borrowings (RGRCB), the structural breaks are seen in September 2020. Likewise, for the Real Growth Rate of Postal Deposits (RGRPD), the break in data series is empirically observed in November 2020.

On closer examination, we find that these empirical results reflect on a clear-cut adverse impact of the Covid-19 pandemic on various assets contributing to liquidity in the Indian economy. For, in the case of Real Growth Rate of Term-Borrowing by Financial Institutions (RGRTBFI), the "structural break" is empirically observed to have taken place in March 2020 itself when the pandemic had just begun showing its

impact and the country-wide lockdown was imposed for the first time in India so as to contain the spread of the deadly virus.

This interpretation is supported by the pattern of RGRTBFI depicted in GRAPH-4 over the entire sample period of our study *viz.*, December 2019 to April 2021. As is clear from the graph, the concerned growth rate of Term-Borrowing by Financial Institutions in real terms dipped sharply beyond March 2020 and continued to decline to such an extent that it even became "negative" and continued to remain so for several months and it is only in April 2021 that RGRTBFI has shown perceptible signs of recovery.

Given that Term Money Borrowing or TBFI are an important component of liabilities of Development Financial Institutions like NABARD and SIDBI, such a declining trend in their real rate of growth on account of Covid-19 pandemic has serious repercussions for the overall growth and development of the Indian economy. For, a structural break in RGRTBFI towards a decisive decline ever since the outbreak of pandemic in March 2020 implies a curtailment in their transactions which is likely to hamper the process of economic development in India.

Such a setback in the real growth rate owing to the Covid-19 pandemic is not merely confined to the Term-Borrowing by Financial Institutions in India. For, as the GRAPHS-7 & 8 along with *Table 3* make it very clear, a decisive "structural break" occurred with a sudden downfall in the Real Growth Rates of broad money supply M_3 ($RGRM_3$) as also the liquidity aggregate L_2 ($RGRL_2$) in May 2020, just 2 months after the outbreak of Covid-19 so much so that even in due course, minor recoveries could not put back these measures of liquidity on a higher growth trajectory.

In fact, apart from the Currency held by the public, the commonly known "broad measure" of money supply or "M_3" not only includes Demand Deposits, but also includes the Time-Deposits held by the public with commercial banks. Thus construed, by definition, M_3 is an important contributor to the overall "liquidity" in the Indian economy as measured by the liquidity aggregate L_2. Now that the empirical results of our study as reported in *Table 3* have clearly established a decisive "structural break" towards a reduction in the real growth rates of both M_3 as well as

L_2 because of Covid-19, this *per se* bears testimony to the adverse impact of the pandemic on the liquidity conditions in the Indian economy over the sample period of our study.

V. SUMMARY AND CONCLUSION

Liquidity Aggregates were originally devised by the Third Working Group of the Reserve Bank of India (RBI) way back in 1998 so as to account for the newly-emerging assets that added liquidity to the economy under a regime of financial innovations and financial reforms in India. Thus construed, the "Liquidity Aggregates" were an effective supplement to the traditionally prevailing "Monetary Aggregates" as an indicator of the liquidity conditions in the Indian economy, so crucial for the process of economic growth and development.

Despite the repeated recognition of the importance of liquidity aggregates by the monetary authority and policy-makers in India through the periodic publications of RBI, these aggregates did not gain much attention of researchers in the sense that no serious attempt had so far been made to empirically analyse the emerging trends in various components of "Liquidity Aggregates" in India using advanced techniques of statistics and econometrics.

Such an empirical analysis was, however, long over-due now in as much as these liquidity aggregates have already been in vogue for well over two decades in India. Further, in the contemporary context, it became all the more desirable to carry out this kind of a comprehensive statistical and econometric analysis of liquidity aggregates in India in the light of the sudden outbreak of the Covid-19 pandemic leading to an unprecedented country-wide lockdown in March 2020 that could quite conceivably have an adverse impact on the liquidity conditions in the Indian economy in recent months.

Against this backdrop, the present study was undertaken so as to fill the lacunae existing in the past research work. Towards this end, dictated by the availability and comparability of reliable data, we analysed the recent trends in real growth rates of various components of liquidity aggregates in India using monthly data released by

the Reserve Bank of India (RBI) over the period December 2019 to April 2021. The purpose was to empirically investigate whether the Covid-19 pandemic had any adverse impact on the liquidity conditions in the Indian economy.

For this purpose, a routine graphical and statistical analysis of all the relevant data series in our study was supplemented by an advanced econometric analysis of data with a view to endogenously identifying as to when a "structural break" was most likely to have occurred in the concerned data series by applying the *innovational outlier* model and minimising the Dicky-Fuller *t*-statistic.

The empirical results of our study clearly established that the data series relating to the real rates of growth of different indicators of liquidity in the Indian economy are characterised by a high level of "dispersion" in terms of the reported value of standard deviation, along with differing degrees of either positive or negative "skewness" over the sample period of our study.

Likewise, applying the usual standards of statistical significance, the reported values of probabilities associated with the Jarque-Bera Statistic as obtained from detailed statistical analysis in our study testified that the data series on real growth rates of Certificates of Deposit issued by Commercial Banks, Term-Borrowing by Financial Institutions and Term-Deposits with Term-Lending and Refinancing Institutions did not conform to a "normal distribution" in the case of Indian economy.

Further, the probability or Vogelsang's asymptotic one-sided p-values following from the application of Breakpoint Unit Root Test to various data series analysed in our empirical study revealed that except for the real growth rate of Certificates of Deposit issued by Financial Institutions, all data series turned out to be "stationary" over the sample period December 2019 to April 2021, either at the 1% or at least at the 5% level of statistical significance.

When it comes to the remaining series *viz.*, the one relating to the real growth rate of Certificates of Deposit issued by Financial Institutions, the reported probabilities or p values in our study established that it is only at the 10% level of statistical significance that the null hypothesis of a unit root in the concerned series could be rejected. Upon

further econometric analysis, however, the concerned series too was found to be "stationary" in first difference even at the 1% level of statistical significance as it was in fact integrated of order one *i.e.*, I(1).

Most importantly, the results of the breakpoint unit root test in our study bear testimony to the adverse impact of the Covid-19 pandemic on liquidity aggregates and liquidity conditions in the Indian economy. For, in the case of real growth rates of various assets contributing to liquidity in India, a "structural break" is empirically observed to have taken place as early as March 2020 on the one hand and as late as January 2021 on the other, as happened with "Term-Borrowing by Financial Institutions" and "Term-Deposits with Term-Lending and Refinancing Institutions" respectively.

The net outcome of all these adverse developments, as is amply clear from the empirical results of our study, is that a decisive "structural break" occurred with a sudden downfall in the real growth rates of the liquidity aggregate L_2 as also its prominent component *viz.*, broad money supply M_3 in May 2020, just 2 months after the outbreak of Covid-19 pandemic so much so that even in the future, minor recoveries failed to put back these measures of liquidity on a higher growth trajectory in India.

Such a declining trend in the real rates of growth of liquidity aggregates and their components on account of Covid-19 pandemic has serious repercussions for the overall growth and development of the Indian economy and is likely to prove a major hurdle in putting it back on the sustained growth path for the future.

While reviewing the emerging trends in financial markets and liquidity conditions in its latest Monetary Policy Report, the Reserve Bank of Indian (2021d) has recently reiterated its commitment to ensure ample surplus liquidity in consonance with its accommodative policy stance with a view to mitigating the impact of Covid-19 on the Indian economy and reviving growth on a sustainable basis. Evidently, this appears to be a challenging task before the monetary authority and how effectively the planners and policy makers in India handle this formidable challenge would eventually decide the course of the Indian economy in the times to come.

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