

Effects of Key Financial Markets' Infrastructure on Cash and Liquidity Management of Banks in India

* *Sasanka Sekhar Maiti*

** *N. Hemachandra*

Abstract

The article examined the effect of introduction of the Real Time Gross Settlement System (RTGS) on banks' cash requirements (viz. cash with banks) and liquidity requirements of banks (banker deposits) with the RBI. The empirical results indicated that the introduction of the RTGS system reduced cash requirements of banks significantly due to adoption of centralized processing systems, which facilitated better cash management for banks. However, at the same time, liquidity requirements of banks with the RBI increased on introduction of the RTGS, which did not grow with time, though more amount was settled in the RTGS. Demonetization resulted in huge cash requirements for banks, but it did not impact liquidity requirements of banks with the RBI.

Keywords : payment systems, real time gross settlement, cash with banks, bankers deposit, intra-day liquidity

JEL Classification : E42, E58, J33

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Reserve Bank of India (RBI) took a multi-dimensional role (developmental, operator, overseer, and regulator) in the payment and settlement systems to promote the use of electronic payment systems in the country for achieving a cash less society. The major electronic payment systems introduced by the RBI include the RTGS, the National Electronic Fund Transfer (NEFT), and the National Electronic Clearing Service (NECS). The most important milestone was the introduction of the RTGS system, which is a systemically important payment system of the country for the settlement of time critical large value inter-bank transactions, eliminating credit risk, and reducing systemic risk from payment and settlement systems. The RTGS system being a centralized payment system necessitated the implementation of core banking solutions (CBS) in the banking industry for participation of bank branches. The process of networking of bank branches in major metro branches was initiated during 2001- 02 and the adoption of CBS was essential for participation in the RTGS system (Reserve Bank of India, 2002). The operations of the RTGS system commenced from March 26, 2004. It is a key financial market infrastructure for the country. With the implementation of the RTGS system, cheque based interbank clearing systems (viz., High Value Cheque Clearing (HVCC) across major cities) were closed in a phased manner. The present paper empirically examines the impact of RTGS implementation on liquidity management of banks.

* *Director*, Reserve Bank of India, Department of Statistics and Information Management, C-8 7th Floor, Bandra Kurla Complex, Bandra East, Mumbai - 400 051. E-mail : ssmaiti@rbi.org.in

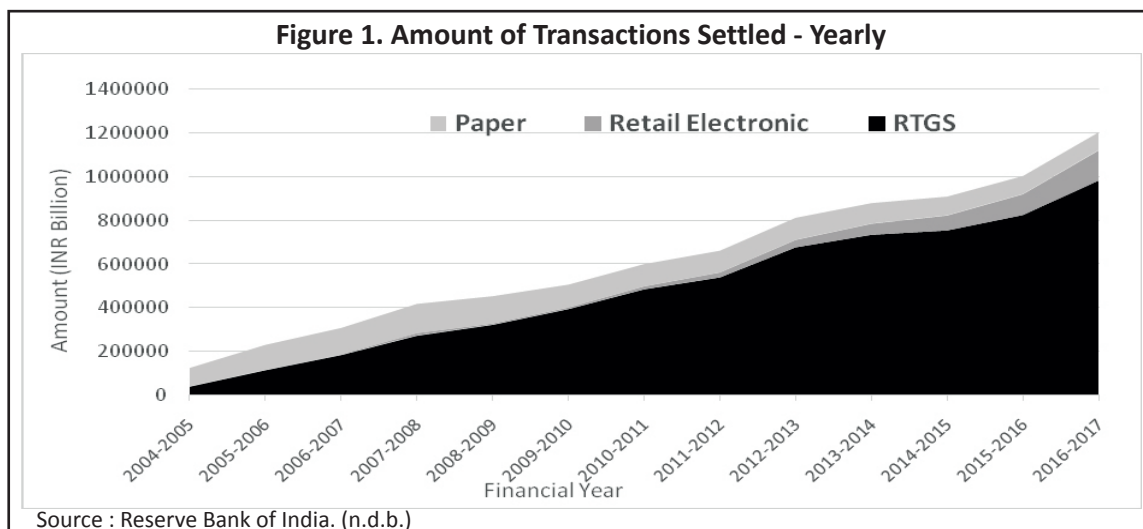
***Professor - Industrial Engineering and Operations Research*, Indian Institute of Technology Bombay, Powai, Mumbai - 400 076. E-mail : nh@iitb.ac.in

International Experiences

In the context of real time processing of payment transactions, Thore and Eriksen (1973) argued that on implementation of real time processing of payment transactions, there will be a reduction in the float in the banking system depending on the lag in processing or settlement time. Berger, Hancock, and Marquardt (1996) stated that real time gross settlement eliminates credit risk in the settlement systems at the expense of higher liquidity requirement, which has implications on monetary policy and portfolio allocation. Diamond and Rajan (2006) examined the role of banks in the monetary policy transmission, establishing a relationship between money, banks, and aggregate credit. They stated that if banks face liquidity shortages, that would affect the aggregate credit in the banking system. Merrouche and Nier (2012) contended that there is a link between payment system efficiency and credit creation in the sampled Eastern European countries over the 1995 - 2005 period. They indicated that there is a relationship between payment systems, inside money in banking systems, and aggregate credit in the economy. In the Indian context, there is no such empirical study. The article concentrates on two aspects : (a) efficiency of cash management in banks on account of adopting centralized processing systems, and (b) liquidity requirements of banks at RBI after implementation of the RTGS system.

Infrastructure of Financial Markets in India

At present, the RTGS system settles more than 80% (Figure 1) of the total amount of inter-bank transactions in the country. The value and share of RTGS and retail electronic transactions have been increasing over time ; whereas, the value and share of paper based transactions has been decreasing. As the large value inter-bank transactions are settled in a centralized payment system like RTGS, it forced banks to move towards a centralized processing environment. The RTGS system is a liquidity intensive system due to its gross settlement mechanism.



Objectives of the Study

As more and more transactions are being settled in the RTGS system, which is a centralized payment system and is liquidity intensive, the objectives of the present study are :

- (1) To empirically examine the impact of introduction of the RTGS system on the banking industry, and

(2) To empirically examine the impact of demonetization on the banks' cash and liquidity management.

Hypotheses

We need to test the following hypotheses :

- ⇒ **H1** : Introduction of the RTGS system has resulted in better cash management of the banks on account of adoption of CBS.
- ⇒ **H2** : Introduction of the RTGS system has resulted in higher liquidity requirements with the RBI.
- ⇒ **H3** : Demonetization has impacted the cash in hand of banks.
- ⇒ **H4** : Demonetization has impacted the liquidity requirements of the banking system.

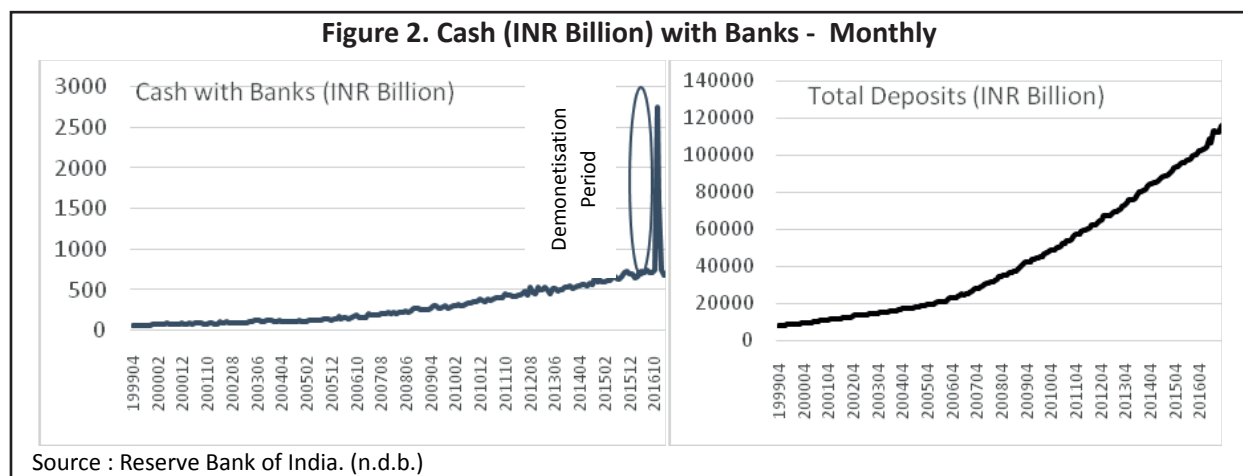
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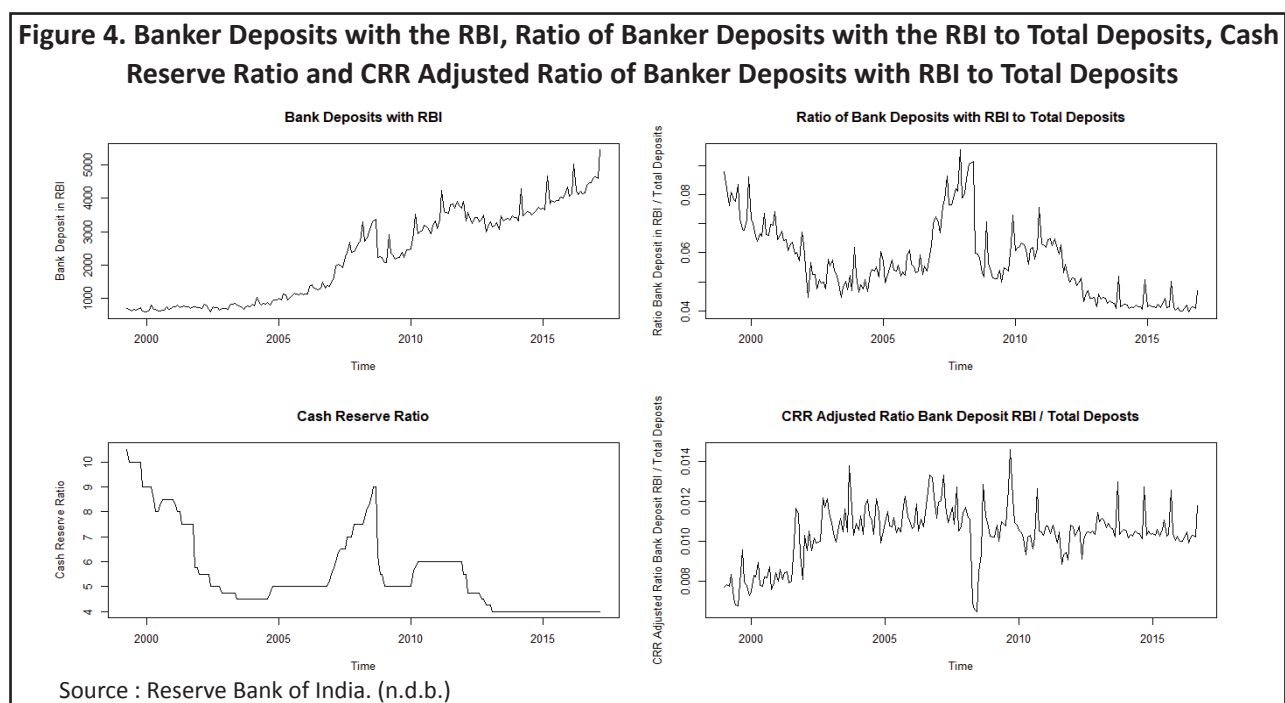
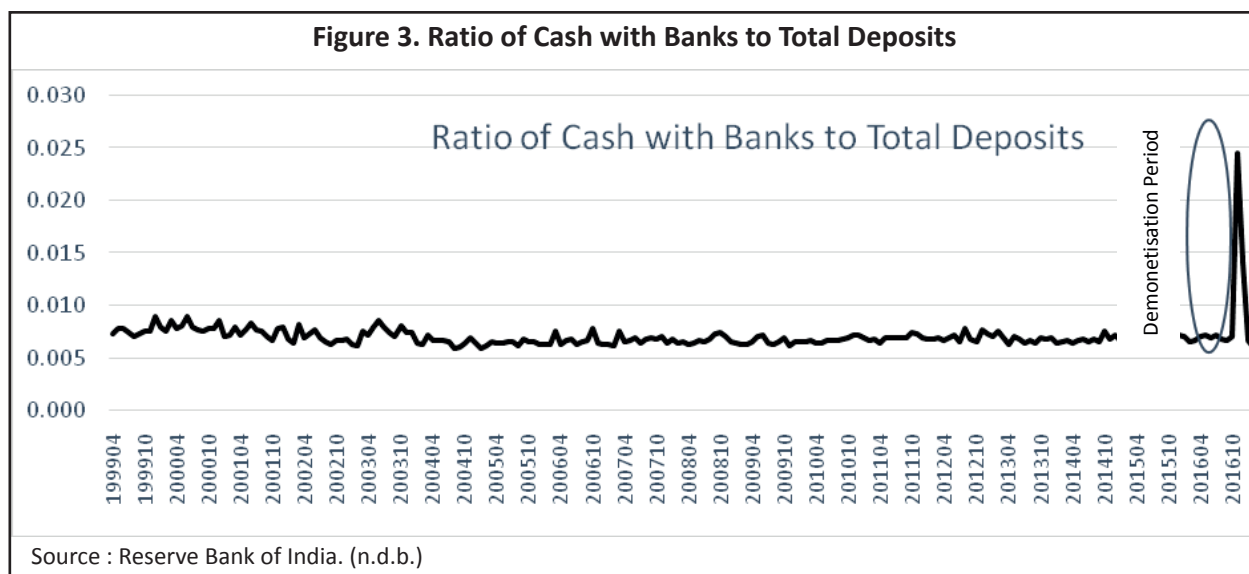
The study has been carried out on the basis of money components :

- (1) Cash in hand of banks ;
- (2) Deposits of banks with the RBI ; and
- (3) Total deposits.

The data on payment systems and money components are published on a monthly basis through RBI's Data Warehouse (DW). The monthly money component variable from April 1999 to March 2017 were considered for the analysis.

(1) Cash in Hand of Banks : The cash in hand of banks increased over time and was found to be abnormally high during the demonetization period. The monthly total deposits with banks saw an increasing trend (Figure 2). The ratio of cash with banks to total deposits (RCTD) remained range bound except in the demonetization period (Figure 3). The RCTD is considered as an underlying variable for cash management of banks.





(2) Banker Cash with RBI : Banks maintain deposits with the RBI for reserve requirements and cash requirements to participate in financial markets for trading and for meeting payment obligations to other counter parties. A graphical representation of monthly data on deposits of banks with the RBI, ratio of deposits with the RBI to total deposits, cash reserve ratio (CRR) stipulated by the RBI, and CRR adjusted ratio of bank deposits with the RBI to the total deposits is given in the Figure 4.

It can be observed that bank deposits with the RBI have grown over time with peaks and troughs in line with the cash reserve requirements. Now, the CRR adjusted ratio of bank deposits with the RBI to total deposits is the underlying variable to examine whether the RTGS system has an effect.

Methodology

(1) Cash in Hand of Banks : RCTD is the underlying variable to see the effect of the introduction of the RTGS system on cash with banks on the basis of the following linear model :

$$C_t = \alpha + \gamma t + \sum_i \xi_i M_{it} + \beta E_t + \eta D_t + \epsilon_t \quad \dots\dots\dots (1)$$

where, C_t denotes the RCTD at time t ; M_{it} denotes the i^{th} month of time t ; E_t represents an indicator (dummy) variable having presence of the RTGS system at time t ; D_t is an indicator variable representing presence of demonetization at the time t , and ϵ_t is an error term. The intercept term is α coefficient for time is γ , ξ_i represents monthly seasonality, β provides the impact of RTGS introduction, and η gives the impact of demonetization. The positive values of the coefficients γ , ξ_i , β , and η indicate increased cash in hand requirement, and negative values of these coefficients imply less cash in hand requirement.

(2) Liquidity Requirements of Banks at RBI : The CRR adjusted ratio of banker deposits with the RBI to total deposits is taken for liquidity management at the RBI through equation (2) depicted below :

$$B_t = \alpha_1 + \beta_1 t + \sum_i \xi_i M_{it} + \eta_1 E_t + \delta D_t + \epsilon_t \quad \dots\dots\dots (2)$$

where, B_t is the CRR adjusted ratio of banker deposits with the RBI to total deposits at time t ; E_t represents an indicator variable having presence of the RTGS system at time t , D_t is an indicator variable representing presence of demonetization at the time t , and ϵ_t is an error term. The positive values of the coefficients β_1 , ξ_i , η_1 , and δ indicate increased liquidity requirement, and negative values of these coefficients imply less liquidity requirement.

The estimation of both equations (1) and (2) was carried using the methodologies by Chambers (1992) and Wilkinson and Rogers (1973). The equations (1) and (2) have been estimated for the following four time buckets :

- (i) April 1999 - March 2004 (prior to introduction of RTGS);
- (ii) April 2004 - September 2016 (introduction of RTGS but prior to demonetization);
- (iii) April 1999 - September 2016 [union of (i) and (ii)]; and
- (iv) April 1999 - March 2017.

Analysis and Results

(1) Cash in Hand of Banks : The estimates of the equation (1) for the period from Apr'99 - Mar'04 indicate that the cash requirements of banks decreased over time during this period as the estimated intercept term (α) is positive and the coefficient for time (γ) is negative and both are statistically significant at the 0.1% level (Table 1). It means cash requirements of banks decreased on account of CBS implementations during this period for centralizations of their information systems, which was a pre - requisite for participation in centralized payment systems (H1). The monthly seasonal coefficients indicate higher cash requirements of banks for the months of March, May, June, and December.

The estimated regression coefficients for the period Apr'04 - Sep'16 reveal that cash requirements increased during this period as the intercept term (α) is negative and the coefficient for time (γ) is positive and both are statistically significant at the 0.1% percent level (Table 1). However, the decreasing rate of cash requirements during Apr'99 - Mar'04 was higher than the increasing rate of cash requirements during Apr'04 - Sep'16. Monthly seasonal coefficients show higher cash requirements of banks for the months of October and November.

Table 1. Regression Results of Linear Model (1)

Coefficients	Estimates			
	Apr 1999 - Mar 2004 (i)	Apr 2004 - Sep 2016 (ii)	Apr 1999 - Sep 2016 (iii)	Apr 1999 - Mar 2017 (iv)
α	3.424e-01 (***)	-7.256e-02 (***)	-4.622e-02 (*)	-3.885e-02
γ	-1.676e-04 (***)	3.938e-05 (***)	2.668e-05 (**)	2.300e-05
β	Not Applicable	Not Applicable	-9.464e-04 (***)	-9.223e-04 (***)
η	Not Applicable	Not Applicable	Not Applicable	1.228e-02 (***)
ξ_2	-1.682e-04	-9.148e-05	-1.181e-04	-1.456e-04
ξ_3	9.887e-04 (**)	1.935e-04	4.193e-04 (**)	3.702e-04
ξ_4	2.652e-04	-1.071e-04	4.162e-05	3.813e-05
ξ_5	7.548e-04 (*)	1.614e-04	3.678e-04 (*)	3.646e-04
ξ_6	1.228e-03 (***)	2.425e-04	5.540e-04 (***)	5.512e-04 (*)
ξ_7	5.704e-04	-3.465e-05	1.675e-04	1.650e-04
ξ_8	2.843e-04	5.735e-05	1.508e-04	1.485e-04
ξ_9	8.511e-05	8.622e-05	1.126e-04	1.106e-04
ξ_{10}	4.035e-04	4.304e-04 (**)	4.345e-04 (**)	4.328e-04
ξ_{11}	5.368e-04	3.517e-04 (**)	4.142e-04 (**)	6.990e-04 (**)
ξ_{12}	1.015e-03 (**)	1.415e-04	4.024e-04 (**)	1.124e-04
Adj. R^2	0.4561	0.2731	0.4359 (***)	0.7812 (***)

Note : (***), (**), and (*) indicate statistically significant at 0.1%, 1%, and 5% levels of significance, respectively.

The estimated intercept term (α) is negative, coefficient for time (γ) is positive, coefficient for RTGS (β) is negative, and all the coefficients are statistically significant at the 5% level for the period Apr'99 - Sep'16. It implies that though cash requirements of banks increased over time during Apr'99 - Sep'16, but cash requirements reduced during this period on account of the RTGS implementation (H1). Seasonal coefficients indicate higher cash requirements during the months of March, May, June, October, and December (Table 1).

The estimated intercept term (α) is negative but statistically insignificant, coefficient for time (γ) is positive but statistically insignificant, coefficient for RTGS (β) is negative and statistically significant at the 0.1% level, and coefficient for demonetization (η) is positive and statistically significant at the 0.1% level for the period Apr'99 - Mar'17 (Table 1). It implies that cash requirements of banks did not increase significantly over time from Apr'99 - Mar'17 ; cash requirements reduced on implementation of RTGS system (H1); and higher cash requirements of banks were noted during the demonetization period (H3). Seasonal coefficients indicate higher cash requirements during the months of June and November (Table 1).

In summary, the empirical results reveal that cash requirements of banks reduced on account of RTGS implementation in the country as banks were adopting core banking solutions for centralized information processing during Apr'99 - Mar'04, which was a pre - requisite for participation in the RTGS system. The results also support the fact that banks had a huge cash in hand requirement during the demonetization period.

(2) Liquidity Requirements of Banks at RBI : The estimated intercept term (α_1) is negative, coefficient for time (β_1) is positive, and both are found to be statistically significant at the 0.1% level (Table 2) during the period Apr'99 - Mar'04. It implies that there was an increased growth of liquidity requirements of banks at RBI over time during Apr'99-Mar'04 on account of RTGS implementation (H2).

Table 2. Regression Results of Linear Model (2)

Coefficients	Estimates			
	Apr 1999 - Mar 2004 (i)	Apr 2004 - Sep 2016 (ii)	Apr 1999 - Sep 2016 (iii)	Apr 1999 - Mar 2017 (iv)
α_1	-1.750e+00 (***)	7.647e-02 (**)	-3.239e-02	-2.208e-02
β_1	8.788e-04 (***)	-3.274e-05 (**)	2.093e-05	1.578e-05
η_1	Not Applicable	Not Applicable	1.045e-03 (***)	1.079e-03 (***)
δ	Not Applicable	Not Applicable	Not Applicable	-6.537e-04
ξ_2	-3.887e-04	-1.726e-04	-2.183e-04	-2.108e-04
ξ_3	1.494e-03 (**)	1.760e-03 (***)	1.718e-03 (***)	1.704e-03 (***)
ξ_4	4.933e-04	2.561e-04	1.476e-04	1.755e-04
ξ_5	2.689e-04	-2.334e-04	-2.516e-04	-2.233e-04
ξ_6	-8.483e-05	-7.581e-05	-2.194e-04	-1.907e-04
ξ_7	1.382e-04	7.747e-06	-8.051e-05	-5.134e-05
ξ_8	-2.430e-04	-2.042e-05	-1.901e-04	-1.605e-04
ξ_9	-6.528e-04	1.006e-04	-1.999e-04	-1.699e-04
ξ_{10}	-3.951e-04	-2.360e-04	-3.364e-04	-3.092e-04
ξ_{11}	1.260e-04	1.371e-06	2.291e-06	1.501e-05
ξ_{12}	-3.607e-04	-1.178e-04	-2.071e-04	-1.617e-04
Adj. R^2	0.7565 (***)	0.4907 (***)	0.3955 (***)	0.3936 (***)

Note : (***), (**), and (*) indicate statistically significant at 0.1%, 1%, and 5% levels of significance, respectively.

For the period Apr'04-Sep'16, the estimated intercept term (α_1) is positive, coefficient for time (β_1) is negative, and both the estimated coefficients are found to be statistically significant at the 1% level (Table 2). It implies that there was a decreased growth of liquidity requirements of banks at RBI over time during Apr'99 - Sep'16. The reduced liquidity requirements of banks at the RBI could be due to various facilities, such as intra - day liquidity (IDL) facility for RTGS transactions against eligible collaterals and liquidity adjustment facilities (LAF) under repo and reverse repo, which were available to banks to adjust their liquidity positions.

For the period Apr'99 - Sep'16, the estimated intercept term (α_1) is negative but statistically insignificant, coefficient for time (β_1) is positive but statistically insignificant, coefficient for RTGS (η_1) is positive and statistically significant at the 0.1% level (Table 2). It means that the liquidity requirements of banks at the RBI did not increase significantly during the period from April 1999 to September 2016, however, there was significant increased liquidity requirement of banks at the RBI on account of RTGS implementation (H2).

For the period Apr'99 - Mar'17, the estimated intercept term (α_1) is negative but statistically insignificant, coefficient for time (β_1) is positive but statistically insignificant, coefficient for RTGS (η_1) is positive and statistically significant at the 0.1% level, and coefficient for demonetization (δ) is negative but statistically insignificant (Table 2). It implies that the liquidity requirements of banks at RBI did not increase significantly over time during Apr'99 - Mar'17, but the liquidity requirements of banks at RBI increased on account of the RTGS system (H2). However, demonetization had no significant impact on liquidity requirements of banks at the RBI (H4).

The estimates of monthly seasonal coefficients for all time buckets indicate that there was a spike in liquidity requirements of banks at the RBI for the month of March. It implies that liquidity requirement of banks during

March was much higher compared to other months. In summary, it may be seen that liquidity requirements of banks at the RBI increased on account of RTGS implementation, and demonetization did not impact the liquidity requirements of banks at the RBI.

Research Implications

The RTGS system is the primary settlement system in the country. Implementation of the RTGS has immensely benefited the financial system as it has reduced settlement risk in the payment system. The empirical results reveal the empirical evidence - benefits of RTGS to the banking system by lowering the cash requirements on one side and increasing liquidity requirements otherwise. The RTGS system has played a balancing role for the banking system.

Conclusion

It can be summarized that the introduction of the RTGS system in the country has reduced requirements of cash within the banking industry as adoption of CBS has facilitated better cash management. On the other hand, liquidity requirements of banks went up as the RTGS is a liquidity intensive system, but the liquidity requirement of banks with the RBI has not grown over time, though more values of inter-bank transactions are settled in the RTGS, which could be due to availability of intra-day liquidity facility against eligible collateral and other liquidity facilities from the RBI. Demonetization resulted in huge cash requirements for banks, but it did not impact the liquidity requirements of banks with the RBI. It is observed that the requirement of cash for banks was higher during October, November, December, March, May, and June. The liquidity requirement of banks was much higher during the month of March.

The empirical results support the hypotheses H1, H2, and H3. That is, introduction of the RTGS system resulted in better cash management in the banking system (acceptance of H1) ; RTGS resulted in higher amount of liquidity requirements of banks (acceptance of H2) ; high amount of cash in hands of banks was witnessed on account of demonetization (acceptance of H3) ; and there was no impact on banks' liquidity requirements at the RBI (rejection of H4).

Limitations of the Study Scope for Further Research

The study has focused only on the issue of cash management and liquidity requirements of banks on account of RTGS implementation and demonetization. The cash management of banks may vary due to multiple factors such as public sentiments on some breaking news, elections, etc. The liquidity requirements of banks may change due to several other factors such as volatility in the underlying markets, counter party obligations, interventions of regulators, etc. The study has not considered these factors, which may affect cash management and liquidity requirements of banks as well.

As stated earlier, the study has not considered various other factors that may impact banks' requirements of cash in hand and banks' deposits with the RBI. Volatility of various markets and RBI's liquidity operations may alter the need of cash in hand and liquidity requirements at the RBI. Therefore, the study can be extended by including more variables that have a possible impact on the need for cash in hand and liquidity requirements of banks at the RBI.

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About the Authors

Sasanka Sekhar Maiti is Director in the Department of Statistics and Information Management of Reserve Bank of India (RBI). He has been serving the RBI for 19 years in various areas, that is, information management, statistical data analysis, payment systems, and reserve management. His research interests are in the areas of central banking, exploratory data analysis, optimization techniques, and simulation of complex systems.

N. Hemachandra is a Professor of Industrial Engineering and Operations Research (IEOR) at Indian Institute of Technology Bombay (IITB), Powai, Mumbai, India. His research interests are operations research (OR) methodologies like Markov decision models, queueing models, game theory, machine learning and their applications to communication networks, supply chains, financial engineering, logistics, and power systems.