

"A man is
great by
deeds, not by
birth"

-Chanakya

Welcome to IIMK



INDIAN INSTITUTE OF MANAGEMENT KOZHIKODE



Working Paper

IIMK/WPS/575/ECO/2023/01

March 2023

**Monetary Policy, Liquidity Shock and Bank lending:
The Case of Currency Demonetization in India**

MD Gyasuddin Ansari¹
Rudra Sensarma²

©

All rights belong to their respective authors.

Please contact the corresponding authors for any queries.

¹Assistant Professor, Economics Area, Indian Institute of Management Kashipur, Email:gyasuddin.ansari@iimkashipur.ac.in

²Professor, Economics Area, Indian Institute of Management Kozhikode, IIMK Campus PO, Kunnamangalam, Kozhikode, Kerala 673 570, India; Email - rsensarma@iimk.ac.in, Phone Number - 0495-2809421

Monetary Policy, Liquidity Shock and Bank lending: The Case of Currency Demonetization in India

MD Gyasuddin Ansari^a and Rudra Sensarma^b

^a Assistant Professor, Economics Area, Indian Institute of Management Kashipur, Email:gyasuddin.ansari@iimkashipur.ac.in

^b Professor, Economics Area, Indian Institute of Management Kozhikode, IIMK Campus, Kozhikode - 673 570, Kerala, India (Email: rsensarma@iimk.ac.in).

Abstract

In this paper, we examine the effect of a change in bank deposits on banks' lending and investment behaviour. To identify the change in deposits, we study a positive liquidity shock i.e., currency demonetization in India in November 2016. We exploit the demonetization effect on different types of banks' deposits (savings bank deposits and demand deposits) to find that the increase in deposits had a negative effect on bank lending. However, banks' balances with the central bank went up with an increase in deposits induced by demonetization. When we analyse the one year lagged effect of deposits on bank lending, we find a positive impact suggesting a long run increase in lending due to demonetization. Finally, we investigate the implications for monetary policy transmission and find that the increase in deposits due to a liquidity shock weakened the monetary policy transmission to bank lending in the long-run.

JEL Classification

C23, E52, E58, G21

Key Words

Demonetization, Monetary Policy Transmission, Deposits, Liquidity, Bank Lending.

1. Introduction

There has been an active discussion in monetary economics on the issue of deposit neutrality i.e. whether higher deposits with banks lead to an increase in lending. However, the

endogeneity of deposits makes it hard to identify its effect on bank loans. One way out is to study how liquidity shocks such as sudden change in deposits in the banking system have an effect on lending (Khwaja and Mian 2008; Imai and Takarabe 2011; Chanda and Cook 2020). There is a sizable empirical literature on liquidity shocks and bank lending, examining negative liquidity shocks in most of the cases (Bernanke and Blinder 1992, Kashyap et al 1993, and Bernanke and Gertler 1995) that have found significant effects of liquidity shocks on bank loans.

However, a positive liquidity shock is unique because banks must deal with a sudden influx of a large pool of liquid funds and as opposed to the case of a negative shock, there is an actual cost in the form of interest incurred by the banks. The costs are exacerbated when the funds lie idle with the banks as cash or reserves instead of being lent out to firms and individuals in the economy. An exogenous policy led liquidity shock has implications far beyond what banks are prepared to handle, at least in the short run, because it comes without prior information. Therefore, a case of an exogenous policy announcement i.e., currency demonetization in India, provides a unique setting for an analysis of positive liquidity shocks. In this paper, we examine the impact of demonetization led liquidity shock on bank behavior in India in terms of bank lending to borrowers, to other banks and banks' balances with the central bank. We also examine the role of this shock on monetary policy transmission to bank lending.

India's demonetization decision was unexpected as the Prime Minister suddenly announced it on national television, on November 8, 2016, rendering two high denomination notes— Rs. 1000 and Rs. 500— illegal, with stated mandate, ranging from elimination of corruption to achievement of a cashless economy.¹ This forced people to either deposit their old, demonetized notes with banks or exchange such notes with notes of smaller denomination

¹ Rs. refers to Indian rupees and 1 USD = Rs. 78.05 as on 17th June 2022.

already in circulation and the newly introduced Rs. 2000 notes. With around 85 per cent of the notes in circulation now demonetized, the surprise policy announcement created several negative as well as positive disruptions across the country including adversely affecting economic activity (Lahiri, 2020), improving digital payments (Chodorow-Reich et al. 2020), decreasing household expenditure (Karmakar and Narayanan, 2020), and inducing redistributive benefits for poorer households (Chanda and Cook, 2020). Our focus is on how demonetization impacted deposits with banks and consequently the percolation of its impact on bank lending. This allows us to test the neutrality of deposits by treating demonetization as a natural experiment in order to evaluate the bank deposit-bank lending relationship.

Demonetization led people to deposit demonetized notes with banks (although many simply exchanged the old notes with equivalent notes of other denominations within permissible limits) which resulted in the influx of fresh deposits. As a result, there was a sudden increase in the amount of deposits with banks creating a situation of surplus liquidity in the banking system. In normal times, liquidity deficit is considered desirable for the smooth functioning of banking system and monetary policy². This is because banks would be encouraged to raise liquidity through deposit creation and monetary policy signals would be effectively transmitted. Demonetization reversed this normal scenario of deficit liquidity by generating excess deposit growth. A study done by the Reserve Bank of India (RBI) reports the following (Singh and Roy 2017):

*“The study estimates that ‘excess’ bank deposit growth (y-o-y) following demonetization has been in the range of 3.0-4.7 percentage points. In nominal terms, these estimates imply excess deposits that accrued to the banking system due to demonetization to be in the range of ₹ 2.8-4.3 trillion.”*³

² <https://core.ac.uk/download/pdf/6961926.pdf>

³ https://rbi.org.in/Scripts/MSM_Demonetisation.aspx#CH2

According to an RBI Report⁴, from October 28, 2016, to January 6, 2017, the notes in circulation declined in India but the value of current account deposits (held by businesses) and savings bank deposits (held by the public) shot up by 4 percentage points. Apart from these, other deposits in various types of accounts like Pradhan Mantri Jan Dhan Yojana (PMJDY) saw a significant increase (almost 38 percent according to the same RBI Report). It is in this context that we examine the impact of deposit taking on lending by banks.

Earlier literature has analyzed the nexus between banks' deposits and loans (Wood 1974; Dermine 1986; Prisman et al. 1986; Corradi et al. 1990). For instance, Prisman et al. (1986) argue that the absence of buffer assets and liquidity cost may induce a correlation between deposits and loans. Corradi et al. (1990) examine the relationship between bank reserves, deposits, and loans in Italy. They find that, among others, there is a causal relationship running from bank deposits to loans. More recently, Jayaratne and Morgan (2000) examine the relationship between insured deposits and bank loans in the US. They find that loan growth of banks is positively correlated with deposit growth. VanHoose and Balasubramanyan (2012) show ambiguous effects of a liquidity coverage ratio shock on both deposits and loans.

This paper may be directly compared with a few recent studies by Khwaja and Mian (2008), Imai and Takarabe (2011) and Imai (2012). Khwaja and Mian (2008) examine the impact of outflow of foreign currency deposit on bank lending, following the announcement of nuclear test in Pakistan. They find there was a decline in bank lending to firms as a result of the liquidity shock where the decline in lending by banks was more for small banks. Imai and Takarabe (2011) study the case of Japanese banks after a sudden reduction in bank deposits. They examine the transmission of liquidity shock to bank credit arising out of the introduction of a policy change that removed blanket insurance on deposits. They find that as a result of outflow

⁴ https://m.rbi.org.in/scripts/BS_ViewBulletin.aspx?Id=17201

of deposits, weak banks cut their loan supply more than the strong banks. Imai(2012) examines the maturity and withdrawal of postal savings in Japan and its consequent impact on the local economy. He observes that the prefectures (regions) shifting away from postal savings did better in terms of output and small business creation. However, all these papers study the effects of negative liquidity shocks on bank lending, but analysis of positive liquidity shocks are missing from the literature.⁵ Secondly, these studies ignore the implications of the liquidity shock for monetary transmission. There are some studies which examine monetary transmission through weak balance sheet, dependency on core deposits and lack of full deposit guarantee (see for instance Jayaratne and Morgan 2000, and Opiela 2003). They argue that banks having these characteristics are more responsive to monetary policy. For instance, Apergis et al (2015) find the role of bank level characteristics in monetary policy transmission to bank lending in Euro Zone. Skander (2012) find that the effect of monetary policy on bank lending and output is contingent upon capital-asset ratio. However, these papers do not study the impact of an exogenous shock on monetary transmission.

Given the above gaps in the literature, our paper makes two contributions. In the first part of the paper, we follow Imai and Takarabe (2011)'s empirical approach to examine the impact of a positive liquidity shock (demonetization) on bank deposits and the effect of the resultant deposit change on bank lending (overall and of various maturities and types) in the short run (Lahiri, 2020) and in the long run (Chanda and Cook, 2020). We find a negative response of bank lending to an increase in deposits (both savings bank deposits and demand deposits) as a result of demonetization. However, the increase in deposits induced by demonetization led to higher banks' balances with the central bank. Further, we find a positive response of bank lending in the long run, with a lag of one year. In the second part of our analysis, we examine

⁵ Milcheva (2013) studied a positive shock but in credit supply and found that house prices are responsive to a policy induced exogenous shock rather than to the bank lending channel.

the implications for monetary transmission due to the sudden changes in bank deposits which occurred as a result of demonetization. We find that monetary transmission to bank lending weakened because of the increase in deposits led by demonetization in the long run.

The remainder of the paper is organized as follows. In section 2 we discuss the data. The methodology is explained in section 3. In section 4 we have discussed the empirical results for the effect of the liquidity shock (due to demonetization) on bank lending and investments in the short run. In section 5, we analyze the effect of the liquidity shock on bank lending in the long run as well as its implications for monetary policy transmission. In section 6, we report the demonetization effect on different maturities and types of loans. Finally, in section 7, we conclude.

2. Data

Our data source is the RBI website from where we collect bank level annual data for all variables. Since demonetization happened in 2017 and we have three years of data after that (till 2020), we start the analysis from 2014 giving us a seven-year window around demonetization (2014-2020). For lending by banks, we use percentage change in log of loans by banks. We also use percentage change in log of banks' balances with the RBI and banks' balances with other banks as alternative use of loanable funds for purposes other than lending. Balances with the RBI refer to banks' reserves (required and excess) parked with the central bank. Balances with other banks represents lending to other banks in the inter-bank market. To measure monetary policy, we use the Weighted Average Call Money Rate (WACR) as a proxy for monetary policy (Aleem 2010). To measure deposit changes, we calculate percentage change in log of bank deposits for two types of deposit data reported by the RBI, i.e., demand deposits (defined as current account deposits held by businesses and a part of savings bank deposits of the public that are withdrawable on demand) and savings bank deposits (held by

the public that combines the features of a current account and term deposit account).⁶ We also include bank specific control variables (capital, size, and profit) and macroeconomic control variables (inflation and GDP growth rate). In this analysis, we have taken data for 48 banks available from the RBI which includes 26 public sector banks and 22 private sector banks. Since foreign banks do not have much share in Indian banking system and short-term deposits hardly matters for these banks, we do not include them in our analysis. Table 1 reports the descriptive statistics for all the variables we have used in the analysis for the full sample of all banks.

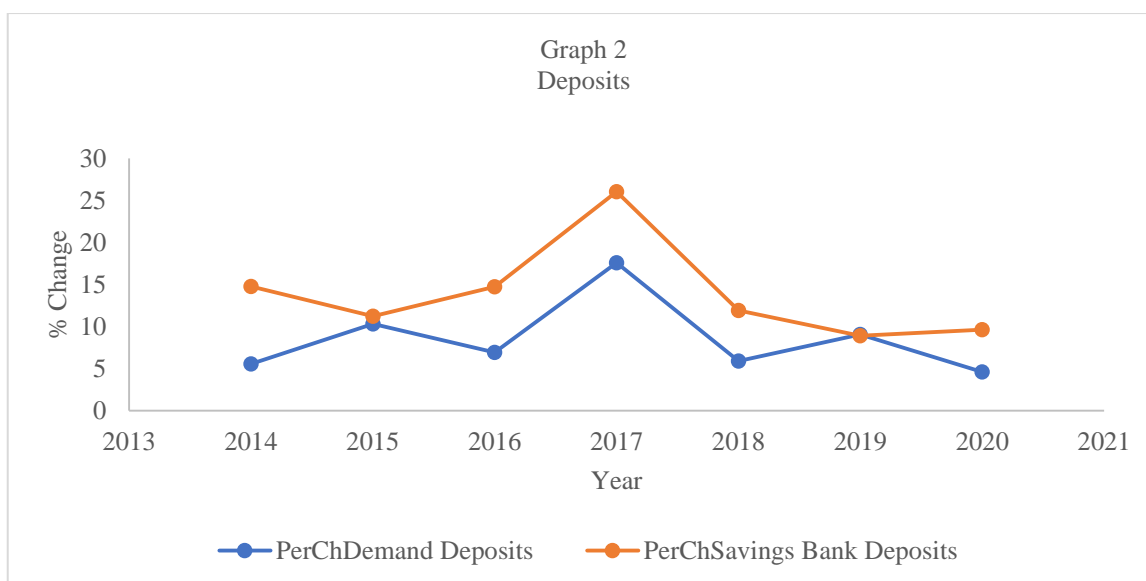
Table 1
Descriptive Statistics: All Banks[†] (2014-2020)

	Mean	Std. Dev.	Minimum	Maximum	Median
$\Delta \ln$ Total Loans	0.082	0.157	-0.448	1.380	0.074
$\Delta \ln$ Balances with RBI	0.096	0.374	-1.691	2.968	0.090
$\Delta \ln$ Balances with Other Banks	-0.188	1.056	-5.478	4.563	-0.048
$\Delta \ln$ Savings Bank Deposits	0.176	0.238	-0.923	2.262	0.125
$\Delta \ln$ Demand Deposits	0.092	0.236	-1.100	1.823	0.087
\ln Capital	6.131	1.460	-1.257	9.707	6.252
\ln Total Assets	11.86	1.340	7.019	15.190	11.989
Return on Assets	0.171	1.342	-5.490	4.460	0.350
$\Delta \ln$ WPI	0.019	0.028	-0.025	0.058	0.020
GDP Growth Rate	6.904	1.233	4.180	8.170	7.168
\ln NNPA	7.774	1.813	-0.342	11.616	8.075
WACR	6.773	0.979	5.428	8.278	6.274

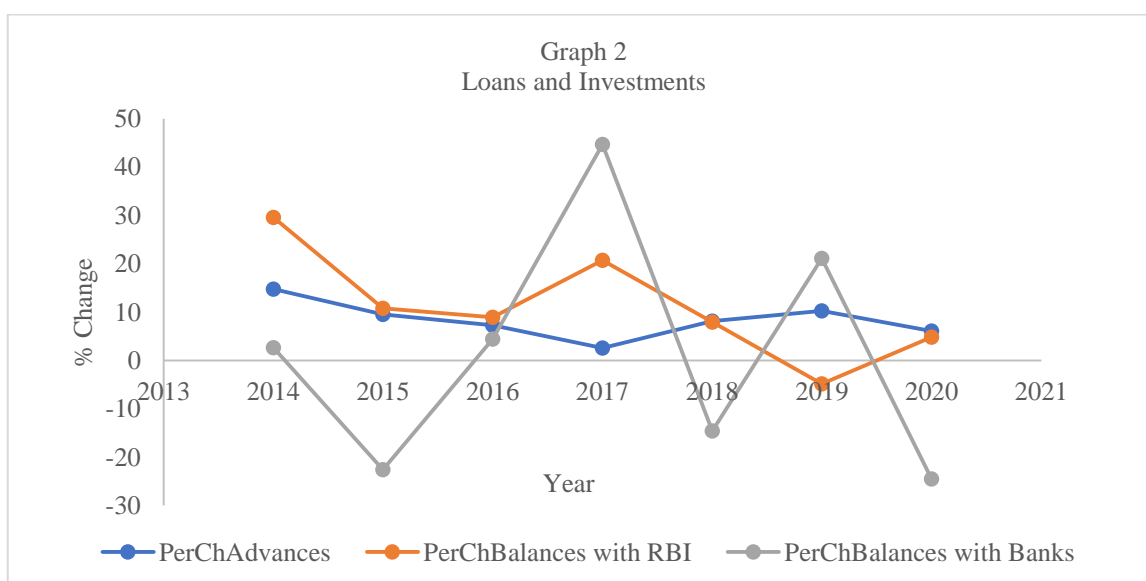
[†]Public Sector Banks and Private Sector Banks combined.

Graph 1 shows the trends in savings bank deposits and demand deposits for all banks during 2014-2020. It is evident from the figure that there was a significant increase in savings bank deposits and demand deposits in banks from 2016 to 2017 (which is the demonetization year). We can also observe that growth in deposits as a result of demonetization led shock is substantial as both before and after 2017 deposits' growth is normal.

⁶ https://m.rbi.org.in/scripts/BS_ViewBulletin.aspx?Id=18233#F2



Source: Composed by the authors. PerChDemand Deposits and PerChSavings Bank Deposits stand for percentage change in demand deposits and percentage change in savings banks deposits, respectively.



Source: Composed by the authors. PerChAdvances and PerChBalances with RBI and PerChBalances with Banks stand for percentage change in banks' lending, percentage change in banks' balances with RBI and percentage change in banks' balances with other banks, , respectively.

Graph 2 reports the trends in loans and investments by banks over the years, i.e. 2014-2020.

It shows that there was an increase in banks' balances with the RBI and banks' balances with other banks from 2016 to 2017. However, lending by banks declined in 2017. It suggests that lending to the economy went down.

3. Methodology

3.1 Panel Unit Root Test

To check for the stationarity of variables, we have applied panel unit root tests covering four types of tests, viz. Levin, Lin, and Chu (LLC), Im, Pesaran and Shin (IPS), Fisher Augmented Dickey–Fuller (Fisher ADF) and Fisher Phillips–Perron (Fisher PP). For the LLC and IPS tests, we follow Levin et al. (2002) and Im et al. (2003) and estimate the equation given below.

$$\Delta y_{it} = \alpha_i + \delta_{it} + \rho_i Y_{i,t-1} + \sum_{l=1}^{\rho_i} \Phi_{il} \Delta y_{i,t-1} + \epsilon_{it} \quad (1)$$

$i = 1, \dots, N; t = 1, \dots, T$

where y_{it} is the variable value for panel member i in period t , ϵ_{it} is assumed to be independent and identically distributed $IID(0, \sigma^2_\epsilon)$ across and Δ denotes the first-difference operator.

In above specification, for LLC and IPS tests, the null hypothesis (non-stationarity) is based on zero value of the ρ parameter (Levin et al. 2002; Im et al. 2003) while the Fisher ADF and Fisher PP tests are based on combining the p-values of the underlying ADF and PP statistics (Madalla and Wu, 1999; Choi, 2001).

3.2 Panel Regression Estimation

As a result of demonetization banks were deluged with funds in the form of deposits. Considering this exogenous shock to bank deposits, we propose to test two hypotheses. First, we hypothesize that demonetization increased the deposits with banks. Second, the increased deposits as result of demonetization were deployed by banks for various purposes (loans, balances with RBI, balances with other banks) in different degrees. There is a substantial literature which applies the two-stage least squares (2SLS) panel regression method to study two sequential hypotheses. For instance, Kuziemko (2006) examine the effect of school size on student achievement applying shocks to school enrollment. Employing property damage as

an instrument for lending growth, Cortes and Strahan (2017) examine the capital reallocation among between and within bank internal capital market. Drechsler et al (2019) examine the association among Fed Fund, deposits and mortgage lending using 2SLS regression. To test these hypotheses, we adopt Imai and Takarabe (2011) and Imai (2012) and estimate the following the impact of demonetization in two stages. First, equation (2) captures the effect of demonetization (measured as a dummy variable for the year of the announcement) on deposits. Along with demonetization we include an interaction of the demonetization dummy with Net Non-performing Assets (Net NPA) to capture the heterogeneous effect of demonetization on banks with different levels of risk taking. This is adopted from Imai and Takarabe (2011) who used a measure of financial health (proxied by Moody's ratings) to capture the varying effect of the policy shock on bank deposits in their case. Next, we use the predicted change in deposits to estimate its effect on lending (equation 3), balances with RBI (equation 4) and balances with other banks (equation 5). The system of equations (with equation 1 and one of the other equations at any time) is estimated using the two-stage least squares approach. Reliability of the instruments (demonetization dummy and its interaction with Net NPA) is evaluated based on Sargan-Hansen statistics (for exclusion restriction) and the F-statistic of the first stage (for instrument relevance).

$$\Delta \ln Deposit_{it} = \alpha_0 + \alpha_1 Demonetization_t + \alpha_2 Demonetization_t * \ln NetNPA_{it} + \mathcal{E}_{it} \quad (2)$$

$$\Delta \ln Loans_{it} = \beta_0 + \beta_1 \% \Delta \widehat{\ln Deposit}_{it} + \beta_2 \ln Capital_{it} + \beta_3 \ln Profit_{it} + \beta_4 \ln Size_{it} + \beta_5 \Delta \ln WPI_t + \beta_6 GDP_t + Y_{it} \quad (3)$$

$$\Delta \ln Balances \text{ with RBI}_{it} = \beta_0 + \beta_1 \% \Delta \widehat{\ln Deposit}_{it} + \beta_2 \ln Capital_{it} + \beta_3 \ln Profit_{it} + \beta_4 \ln Size_{it} + \beta_5 \Delta \ln WPI_t + \beta_6 GDP_t + Y_{it} \quad (4)$$

$$\Delta \ln Balances \text{ with Other Banks}_{it} = \beta_0 + \beta_1 \% \Delta \widehat{\ln Deposit}_{it} + \beta_2 \ln Capital_{it} + \beta_3 \ln Profit_{it} + \beta_4 \ln Size_{it} + \beta_5 \Delta \ln WPI_t + \beta_6 GDP_t + Y_{it} \quad (5)$$

Where, subscript i and t stand for the bank and year, respectively. Demonetization is a dummy variable which indicates the government decision of banning notes of certain denominations in November 2016. We have taken 2017 to define the demonetization dummy because our data is recorded for financial years that end on March 31st (e.g. 2017 represents the period 1st April 2016 to 31st March 2017, as per accounting practice in India). Since demonetization was announced in November 2016, the change in banks' balance sheet variables reflect in their financial statements as on 31st March 2017 or for the year 2017. We use bank specific as well as macroeconomic control variables in the second stage regressions. The former includes capital, total assets (size) and return on assets (profit), while the latter includes inflation (change in WPI) and GDP growth rate. To eliminate a potential risk to identification due to loans being directly affected by demonetization and a resulting decline in credit demand, we have included GDP growth to control for the deterioration in general economic conditions as a result of the demonetization shock. In equation (3), we estimate the percentage change in lending by banks triggered by demonetization led increase in deposits. $\Delta \ln \widehat{Deposit}_{it}$ in second stage equation (3) is the predicted value of deposit growth from the first stage regression. Similarly, in equations (4 and 5), we estimate the percentage change in banks' balances with RBI and banks' balances with the other banks.

4. Results and Discussion

4.1 Panel Unit Root Test

We test for the presence of unit roots so as to ensure the stationarity of the variables. We report the results of panel unit root tests in Table 2 for all banks. We observe that all the variables are stationary at the levels. Therefore, we proceed to use all variables at levels in our regressions.

Table 2
Panel Unit Root Test: All Banks[†] (2014- 2020)

	Intercept Only in the regression				Intercept and trend in the regression			
	LLC	IPS	ADF	PP	LLC	IPS	ADF	PP
$\Delta \ln$ Total Loans	-12.513***	-2.895***	131.186***	171.404***	-17.400***	0.128	79.544	138.110
$\Delta \ln$ Balances with RBI	-19.003***	-5.930***	181.340***	222.241***	-16.486***	-0.503	106.634**	179.677***
$\Delta \ln$ Balances with Banks	-21.078***	-10.460***	256.581***	338.144***	-25.124***	-2.652***	169.659***	306.196***
$\Delta \ln$ Savings Bank Deposits	-6.364***	-1.185	105.319	116.743**	9.728	1.034	57.932	86.354
$\Delta \ln$ Demand Deposits	-31.565***	-9.084***	210.741***	297.706***	4.602	-0.332	100.027*	189.249***
\ln Capital	3.432	6.470	21.212	30.004	2.809	0.831	63.627	116.415**
\ln Total Assets	-89.504***	-24.404***	102.373	169.866***	-8.020***	1.306	63.529	112.129**
Return on Assets	-25.388***	-0.524	86.669	90.964	48.710	0.201	85.024	130.373***
$\Delta \ln$ WPI	-25.153***	-10.825***	283.798***	289.526***	-10.223***	-1.544*	134.913***	203.810***
GDP Growth Rate	18.080	11.163	10.228	10.390*	5.075	3.182	11.345	4.205*
\ln NNPA	-9.077***	-0.310	99.389	124.141**	-6.824***	2.199***	40.956	65.415***
WACR	-5.148***	2.614	33.187	43.379	-8.598***	1.824	26.566	22.571

This table reports panel unit root test for all banks together. LLC, IPS, ADF and PP stand for Levin Lin and Chu, Im Pearson and Sim, Augmented Dickey Fuller and Phillips- Perron Tests. ***, **, * Indicate significance at 1%, 5% and 10% levels, respectively. [†]Public Sector Banks and Private Sector Banks only.

4.2 Panel Regression Estimation

In this section, we report the results for the estimation of equations (2)-(5) for all Indian banks (i.e., public sector banks and private sector banks)⁷. For the first stage regression, we report the results for the impact of demonetization on savings bank deposits and demand deposits. Subsequently, we report the results for the second stages, which show the effects of change in deposits (predicted values) on bank lending (total loans), banks' balances with the central bank (balances with RBI) and banks' balances with other banks (balances with banks). Non rejection of the Sargan-Hansen test shows that our exclusion criteria for the instruments are valid and the F-statistic of the first stage exceeding 10 (a thumb-rule given by Staiger and Stock, 1997) confirms instrument relevance.

Table 3 reports the results of impact of demonetization on savings bank deposits for all banks using two stage least squares regression. The result shows a positive and significant coefficient for demonetization and its interaction with NPA in the first stage suggesting that as a result of demonetization, savings deposit with banks increased. In the second stage, we report the impact of the fitted value of change in savings bank deposits on lending by banks, banks' balances with RBI and banks' balances with other banks. We observe a negative and significant coefficient for the case of bank lending suggesting a decrease in lending by banks as a result of increase in liquid deposits induced by demonetization. The finding of reduced lending is in line with Lahiri (2020) who found a decline in bank lending in the immediate aftermath of demonetization. It is evident from these findings that loans were declining amid the unfavorable macroeconomic sentiments prevailing at the time subsequent to demonetization which caused a fall in demand for credit. However, the coefficients for the fitted value of change in savings bank deposits are positive and significant in the cases of balances with RBI

⁷ We have excluded the foreign banks in our analysis because foreign banks are not that much affected by demonetization as foreign banks are not that important from the point of view of retail deposits.

in the second stage. This shows that banks parked their surplus deposits— generated as a result of demonetization— with the RBI as a safe option with assured returns (the reverse repo rate paid by the central bank on excess reserves). These findings are in consonance with the RBI's Annual report 2016-17 that lending by commercial banks declined in financial year 2016-17 ending on March 31st 2017) which is in the aftermath of demonetization. Lending to other banks also increased as evidenced by the positive coefficient in the case of balances with banks, however the effect is not statistically significant. We also examined the effect (in the second stage) on banks' investments and cash in hand, but the effects were not significant (the results are not reported to save space, but available on request).

Table 3
Two Stage Least Squares Panel Regression for All Banks: Savings Bank Deposits

	Savings Bank Deposits					
	Fixed Effects [†]	Random Effects				
<i>First Stage</i>						
Demonetization _t	0.218** (0.084)	0.345*** (0.125)				
Demonetization _t *NNPA _{it}	-0.007 (0.010)	-0.021 (0.015)				
InCapital _{it}	0.008 (0.013)	0.049*** (0.009)				
InTotal Assets _{it}	-1.060 (0.040)	-0.034*** (0.010)				
Return on Assets _{it}	0.051*** (0.009)	0.061*** (0.009)				
ΔlnWPI _t	-0.580** (0.278)	-0.558 (0.387)				
GDP Growth Rate _t	0.010 (0.009)	0.016* (0.009)				
Intercept	0.750 (0.538)	0.141 (0.129)				
Bank Specific Effects	Yes	Yes				
No. of Observations	305	305				
R Squared	0.188	0.240				
F- stat/ Wald	19.63***	123.00***				
No. of Banks	48	48				
	Total Loans		Balances with RBI		Balances with Banks	
	Fixed Effects [†]	Random Effects	Fixed Effects	Random Effects [†]	Fixed Effects [†]	Random Effects
<i>Second Stage</i>						
ΔlnSavings Bank Deposits _{it}	-0.528*** (0.132)	-0.352*** (0.120)	0.523 (0.343)	0.503* (0.286)	1.117 (1.138)	0.523 (1.002)
InCapital _{it}	0.024* (0.014)	0.038*** (0.009)	-0.031 (0.036)	-0.012 (0.021)	-0.166 (0.118)	-0.012 (0.076)
InTotal Assets _{it}	0.035 (0.042)	-0.025*** (0.008)	-0.028 (0.108)	0.019 (0.021)	0.197 (0.350)	0.098 (0.070)
Return on Assets _{it}	0.081*** (0.011)	0.098*** (0.010)	0.017 (0.029)	0.041* (0.023)	-0.204** (0.096)	-0.058 (0.082)
ΔlnWPI _t	0.093 (0.277)	-0.188 (0.270)	1.929*** (0.717)	1.963*** (0.643)	-3.832* (2.332)	-4.248** (2.196)
GDP Growth Rate _t	0.023** (0.010)	0.005 (0.007)	0.037 (0.026)	0.041** (0.017)	-0.051 (0.083)	-0.088 (0.059)
Intercept	-0.574 (6.555)	0.152* (1.091)	0.229 (1.436)	5.482** (0.217)	-1.255 (4.646)	-0.704 (0.737)
R Squared	0.042	0.240	0.126	0.167	0.003	0.017
F- stat/ Wald	186.29***	168.92***	59.53***	57.71***	20.60***	10.56*

Dependent Variable: ΔlnSavings Bank Deposits in first stage and ΔlnTotal Loans, ΔlnBalances with RBI and ΔlnBalances with Other Banks in second stage. ΔlnSavings Bank Deposits in the second stage is predicted value of growth in saving banks deposits as a result of demonetization. ***, **, * Indicate significance at 1%, 5% and 10% levels, respectively. Standard error in parentheses. [†]Indicates the appropriate model as suggested by Hausman Test. F-stat is reported for Fixed Effects models and Wald Chi Square for Random Effects.

Next, in Table 4, we report the results of the effect of demonetization on demand deposits in the first stage and the subsequent impact of predicted value of demand deposits on banks' lending, banks' balances with RBI and other banks in the second stages. We find a positive and significant impact of demonetization on demand deposits in the first stage and a negative and significant impact of predicted demand deposits on lending by banks in the second stage. As before we find that the deposit shock due to demonetization led to a decline in lending to customers possibly due to the adverse macroeconomic conditions. However, we find a positive and significant coefficient of the instrumented demand deposits in the case of banks' balances with the RBI and banks' balances with other banks (although the latter is not statistically significant) suggesting that banks substituted lending with parking the surplus funds with the RBI as a safe investment option with assured returns.

Table 4
Two Stage Least Squares Panel Regression for All Banks: Demand Deposits

Demand Deposits						
	Fixed Effects	Random Effects [†]				
<i>First Stage</i>						
Demonetization _t	0.389*** (0.145)	0.456*** (0.141)				
Demonetization _t *NNP	-0.033* (0.017)	-0.041** (0.017)				
A _{it}						
lnCapital _{it}	0.020 (0.023)	0.022** (0.010)				
lnTotal Assets _{it}	-0.075 (0.069)	-0.010 (0.011)				
Return on Assets _{it}	0.045*** (0.015)	0.065*** (0.010)				
ΔlnWPI _t	0.064 (0.478)	0.066 (0.438)				
GDP Growth Rate _t	0.013 (0.015)	0.009 (0.010)				
Intercept	0.742 (0.923)	-0.026 (0.146)				
Bank Specific Effects	Yes	Yes				
No. of Observations	305	305				
R Squared	0.130	0.131				
F- stat/ Wald	5.83***	86.00***				
No. of Banks	48	48				
	Total Loans		Balances with RBI		Balances with Banks	
	Fixed Effects	Random Effects [†]	Fixed Effects	Random Effects [†]	Fixed Effects [†]	Random Effects
<i>Second Stage</i>						
ΔlnDemand Deposits _{it}	-0.514*** (0.196)	-0.310** (0.144)	0.768* (0.412)	0.691** (0.342)	1.326 (1.355)	0.530 (1.189)
lnCapital _{it}	0.032* (0.019)	0.027*** (0.007)	-0.047 (0.039)	-0.004 (0.018)	-0.190 (0.128)	0.005 (0.063)
lnTotal Assets _{it}	0.019 (0.054)	-0.017** (0.007)	-0.004 (0.113)	0.013 (0.018)	0.238 (0.364)	0.086 (0.061)
Return on Assets _{it}	0.079*** (0.014)	0.097*** (0.012)	0.007 (0.030)	0.024 (0.028)	-0.211** (0.103)	-0.058 (0.099)
ΔlnWPI _t	0.344 (0.375)	-0.051 (0.283)	1.513** (0.789)	1.639** (0.674)	-4.484* (2.529)	-4.479** (2.262)
GDP Growth Rate _t	0.024* (0.013)	0.001 (0.007)	0.030 (0.027)	0.043** (0.017)	-0.057 (0.087)	-0.081 (0.056)
Intercept	-0.483 (0.708)	0.111 (0.090)	0.119 (1.489)	-0.439** (0.215)	-1.476 (4.783)	-0.638 (0.721)
R Squared	0.019	0.225	0.142	0.168	0.003	0.020
F- stat/ Wald	111.41***	161.13***	56.65***	57.30***	19.50***	10.46*

Dependent Variable: ΔlnDemand Deposits in first stage and ΔlnTotal Loans, ΔlnBalances with RBI and ΔlnBalances with Other Banks in second stage. ΔlnDemand Deposits in the second stage is predicted value of growth in demand deposits as a result of demonetization. ***, **, * Indicate significance at 1%, 5% and 10% levels, respectively. Standard error in parentheses. † Indicates the appropriate model as suggested by Hausman Test. F-stat is reported for Fixed Effects models and Wald Chi Square for Random Effects.

Next, we explore whether the short run decline in bank lending observed above was reversed in subsequent years by banks. To do this, we study the impact of demonetization led deposit shock on the next year's bank lending by using the following specification for the second stage regression:⁸

$$\Delta \ln Loan_{it} = \beta_0 + \beta_1 \Delta \ln \widehat{Deposit}_{it-1} + \beta_2 \ln Capital_{it-1} + \beta_3 \ln Profit_{it-1} + \beta_4 \ln Size_{it-1} + \beta_5 \ln WPI_{t-1} + \beta_6 GDP_{t-1} + \gamma_{it} \quad (6)$$

Table 5 shows the results for bank lending with a one-year lag. The first stage regression results are similar to what we found earlier. In the second stage, we find that the coefficients of predicted deposits (both in the case of savings bank deposits and demand deposits) are positive and statistically significant. This shows that while demonetization had a detrimental effect on bank lending in the short run (with banks parking the surplus deposits with the RBI in the demonetization year), subsequently bank lending increased with a one-year lag. This result suggests that banks were able to deploy their surplus deposits with a one-year lag in the credit market once the macroeconomic situation allowed them to resume lending operations. This result is in line with Chanda and Cook (2020) who found a similar positive long run effect of demonetization on bank credit using household data. Using bank balance-sheet data we provide evidence for a short run reduction in lending reversed by a long run increase. In other words, deposits may be neutral in the short run, but eventually non-neutral in affecting bank lending in the long run.

⁸ All control variables appear with a lag because we had to take one-year lead for the dependent variable instead of a lag for the endogenous variable in order to ensure proper instrumentation (i.e. demonetization year should not change from 2017).

Table 5
Estimated Coefficients for Effects on Long Run Bank Lending for All Banks: 2SLS Regression
Savings Bank Deposits and Demand Deposits

	Savings Bank Deposits		Demand Deposits	
	Fixed Effects [†]	Random Effects	Fixed Effects [†]	Random Effects
<i>First Stage</i>				
Demonetization _t	0.301*** (0.070)	0.335*** (0.128)	0.537*** (0.137)	0.554*** (0.138)
Demonetization _t *NNPA _{it}	-0.018** (0.008)	-0.022 (0.016)	-1.051*** (0.016)	-0.053*** (0.017)
lnCapital _{it}	-0.005 (0.012)	1.055*** (0.010)	0.011 (0.023)	0.035*** (0.010)
lnTotal Assets _{it}	-0.055 (0.040)	-1.044*** (0.011)	-0.106 (0.079)	-0.025** (0.012)
Return on Assets _{it}	0.028*** (0.010)	0.067*** (0.010)	0.024 (0.021)	0.078*** (0.011)
ΔlnWPI _t	-0.523* (0.275)	-0.743* (0.401)	-0.048 (0.538)	-0.278 (0.430)
GDP Growth Rate _t	0.002 (0.016)	-0.002 (0.018)	-0.020 (0.031)	-0.031* (0.019)
Intercept	0.820 (0.578)	0.360** (0.184)	1.418 (1.133)	0.392** (0.195)
Bank Specific Effects	Yes	Yes	Yes	Yes
No. of Observations	257	257	257	257
R Squared	0.139	0.140	0.113	0.114
F- stat/ Wald	17.49***	109.00***	4.65***	104.00***
No. of Banks	48	48	48	48
	Total Loans		Total Loans	
	Fixed Effects [†]	Random Effects	Fixed Effects	Random Effects [†]
<i>Second Stage</i>				
ΔlnSavings Bank Deposits _{it-1}	0.229** (0.111)	0.147 (0.116)		
ΔlnDemand Deposits _{it-1}			0.252** (0.118)	0.200* (0.121)
lnCapital _{it-1}	-0.002 (0.013)	0.008 (0.009)	-0.006 (0.014)	0.009 (0.008)
lnTotal Assets _{it-1}	-0.256*** (0.043)	-0.006 (0.009)	-0.242*** (0.046)	-0.005 (0.008)
Return on Assets _{it-1}	0.035*** (0.012)	0.066*** (0.011)	0.036*** (0.012)	0.060*** (0.012)
ΔlnWPI _{t-1}	-0.418 (0.289)	0.056 (0.252)	-0.525* (0.314)	0.001 (0.253)
GDP Growth Rate _{t-1}	-0.058*** (0.017)	-0.029** (0.011)	-0.054*** (0.018)	-0.023* (0.012)
Intercept	3.500*** (0.620)	0.253** (0.124)	3.348*** (0.656)	0.207 (0.132)
R Squared	0.040	0.384	0.048	0.375
F- stat/ Wald	170.03***	148.51***	152.30***	151.94***

Dependent Variable: ΔlnSavings Bank Deposits and ΔlnDemand Deposits in first stage and ΔlnTotal Loans in second stage. ΔlnSavings Bank Deposits and ΔlnDemand Deposits in second stage are lagged predicted value of growth in savings bank deposits and demand deposits as a result of demonetization. ***, **, * Indicate significance at 1%, 5% and 10% levels, respectively. Standard error in parentheses. †Indicates the appropriate model as suggested by Hausman Test. F-stat is reported for Fixed Effects models and Wald Chi Square for Random Effects.

5. Demonetization and Effectiveness of Monetary Policy

In the previous section, we found that bank lending declined in the aftermath of demonetization. However, that argument is based on the contemporaneous decline in lending in the same year as the demonetization shock to deposits. We also found that as a result of accumulation of deposits caused by demonetization, the lending by commercial banks increased after a lag. In this section, we augment our analysis with the inclusion of a monetary policy indicator to examine the effectiveness of monetary policy in the wake of liquidity shock due to demonetization. In other words, we study the role of increase in deposits, caused by demonetization, on monetary policy transmission to bank lending. This allows us to examine the evidence of bank lending channel at the time of demonetization.

We incorporate the effects of monetary policy and estimate the following two equations, again adopting Imai and Takarabe (2011) and Imai (2012), but with a monetary policy indicator (the inter-bank rate i.e. WACR) in the second stage regression:

$$\Delta \ln Deposit_{it} = \alpha_0 + \alpha_1 Demonetization_t + \alpha_2 Demonetization_t * \ln NetNPA_{it} + \mathcal{E}_{it} \quad (7)$$

$$\begin{aligned} \Delta \ln Loan_{it} = & \beta_0 + \beta_1 WACR_{t-1} + \beta_2 WACR_{t-1} * \widehat{\Delta \ln Deposit}_{it-1} + \beta_3 \ln Capital_{it} + \beta_4 \ln Profit_{it} \\ & + \beta_5 \ln Size_{it} + \beta_6 \Delta \ln WPI_t + \beta_7 GDP_t + Y_{it}^9 \end{aligned} \quad (8)$$

Equation (7) estimates the percentage change in deposits as a result of announcement of demonetization. In Equation (8), we estimate the effectiveness of monetary policy on bank lending given the change in deposits (with lag) as a result of demonetization estimated in equation (7). $WACR_{t-1} * \widehat{\Delta \ln Deposit}_{it-1}$ in equation (8) indicates the role of change in deposits (with lag) — induced by demonetization estimated in equation (7) — in monetary

⁹ We tried incorporating a separate term for fitted deposits in equation (7) but facing collinearity issue we had to exclude it.

policy transmission aftermath the announcement of demonetization.¹⁰ Here too, we use bank specific control variables and macroeconomic control variables as described earlier.

In Table 6, we report the results of the second stage of the regression.¹¹ The first two columns of Table 6 show the results with the inclusion of monetary policy in our specification with respect to savings bank deposits. We find a negative but not statistically significant impact of monetary policy rate ($WACR_{t-1}$) on bank lending (for Random Effects suggested by Hausman test), while the coefficient of interaction term of monetary policy with predicted value of savings bank deposits ($WACR_{t-1} * \Delta \ln Savings Bank Deposits_{t-1}$) is positive and significant. The positive coefficient of the interaction term indicates the weakening of monetary policy transmission to bank lending due to the influx of savings bank deposits after the demonetization. It shows an unintended role played by the increase in savings bank deposits—caused by demonetization—to monetary policy transmission to bank lending, however with a lag.

¹⁰ Since this exercise requires us to interact the monetary policy indicator (WACR) with the endogenous variable (change in deposits), we could not do a combined estimation of both stages and had to separately estimate the first stage and use the predicted values of the endogenous variable in a separate second stage estimation.

¹¹ We do not report the results of the first stage for the sake of space but available on request. We do find a positive effect of demonetization on both savings bank deposits and demand deposits.

Table 6
 Estimated Coefficients for Effects on Long Run Bank Lending and Monetary Policy Effectiveness for All Banks: Panel Regression for Savings Bank Deposits and Demand Deposits

	Total Loans		Total Loans	
	Fixed Effects	Random Effects [†]	Fixed Effects	Random Effects [†]
<i>Second Stage: With Monetary Policy</i>				
WACR _{t-1}	0.005 (0.012)	-0.014 (0.010)	0.004 (0.012)	-0.013 (0.010)
WACR _{t-1} *ΔlnSavings Banks Deposits _{it-1}	0.064*** (0.023)	0.053** (0.021)		
WACR _{t-1} *ΔlnDemand Deposits _{it-1}			0.049** (0.021)	0.040** (0.018)
lnCapital _{it}	0.016 (0.011)	0.014*** (0.005)	0.013 (0.011)	0.014*** (0.005)
lnTotal Assets _{it}	0.051 (0.036)	-0.003 (0.005)	0.040 (0.036)	-0.001 (0.005)
Return on Assets _{it}	0.055*** (0.007)	0.075*** (0.004)	0.054*** (0.007)	0.074*** (0.005)
ΔlnWPI _t	0.438* (0.244)	0.219 (0.233)	0.313 (0.232)	0.131 (0.222)
GDP Growth Rate _t	0.005 (0.008)	0.001 (0.008)	0.007 (0.008)	0.003 (0.007)
Intercept	-0.795 (0.517)	0.035 (0.083)	-0.602 (0.506)	0.043 (0.083)
R Squared	0.262	0.506	0.330	0.504
F- stat/ Wald	14.59***	302.39***	14.10***	299.66***
No. of Observations	303	303	303	303
No. of Banks	48	48	48	48

Dependent Variable: ΔlnTotal Loans. ΔlnSavings Bank Deposits and ΔlnDemand Deposits in second stage are lagged predicted value of growth in savings bank deposits and demand deposits as a result of demonetization. ***, **, * Indicate significance at 1%, 5% and 10% levels, respectively. Standard errors in parentheses. [†]Indicates the appropriate model as suggested by Hausman Test. F-stat is reported for Fixed Effects models and Wald Chi Square for Random Effects.

In the last two columns of Table 6, we report the results for the role of demonetization induced increase in demand deposits (with lag) on the bank lending channel of monetary policy transmission. In the second stage regression, we observe that (for Random Effects suggested by Hausman test), bank lending reacts negatively but not statistically significant to monetary policy ($WACR_{t-1}$). However, the positive and significant coefficient of the interaction term ($WACR_{t-1} * \Delta \ln Demand Deposits_{t-1}$) seems to have moderated the negative impact of monetary policy transmission to bank lending. It is evident from these findings that, while in the long-

run demonetization led to an increase in bank lending, but the demonetization led increase in deposits may have weakened the bank lending channel of monetary policy transmission.

6. Demonetization Effect on Different Types of Loans

In this section, we explore the effect of change in deposits— savings bank deposits and demand deposits— on different types of loans, i.e., short-term loans, medium term loans, long-term loans, priority sector loans, non-priority sector loans and loans to public sector. In Table 7 we report the effect of demonetization induced savings bank deposits on short-term loans, medium-term loans, long-term loans, priority sector loans, non-priority sector loans and loans to public sector. We observe that change in savings bank deposits have a negative and significant effect on medium-term loans, priority sector loans and non-priority sector loans. These results are consistent with our main results reported in Table 3. However, short-term loans, long-term loans and loans to public sector do not respond to change in savings bank deposits, significantly.

Results for demand deposits reported in Table 8 represents a different story as compared to Table 7. Here we observe that change in demand deposits as a result of demonetization has negative and significant effect on priority sector loans. The loans of different maturities, non-priority sector loans and loans to public sector do not respond to the change in demand deposits.

Table 7
Two Stage Least Squares Panel Regression for All Banks: Savings Bank Deposits

	Savings Bank Deposits ^{††}	Savings Bank Deposits [†]	Savings Bank Deposits [†]	Savings Bank Deposits ^{††}	Savings Bank Deposits [†]	Savings Bank Deposits ^{††}
<i>First Stage</i>						
Demonetization _{it}	0.201*** (0.047)	0.184*** (0.032)	0.184*** (0.032)	0.201*** (0.047)	0.184*** (0.032)	0.181*** (0.046)
Demonetization _{it} *NNPA _{it}	-0.006 (0.006)	-0.004 (0.004)	-0.004 (0.004)	-0.006 (0.006)	-0.004 (0.004)	-0.003 (0.006)
lnCapital _{it}	0.050*** (0.009)	0.008 (0.013)	0.008 (0.013)	0.050*** (0.009)	0.008 (0.013)	0.040*** (0.010)
lnTotal Assets _{it}	-0.039*** (0.009)	-0.061 (0.040)	-0.061 (0.040)	-0.039*** (0.009)	-0.061 (0.040)	-0.023** (0.011)
Return on Assets _{it}	0.061*** (0.009)	0.050*** (0.009)	0.050*** (0.009)	0.061*** (0.009)	0.050*** (0.009)	0.058*** (0.010)
ΔlnWPI _t	-0.558 (0.388)	-0.575** (0.278)	-0.575** (0.278)	-0.558 (0.388)	-0.575** (0.278)	-0.355 (0.361)
GDP Growth Rate _t	0.016* (0.009)	0.010 (0.009)	0.010 (0.009)	0.016* (0.009)	0.010 (0.009)	0.011 (0.009)
Intercept	0.188 (0.123)	0.756 (0.537)	0.756 (0.537)	0.188 (0.123)	0.756 (0.537)	0.095 (0.137)
Bank Specific Effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	305	305	305	305	305	287
R Squared	0.088	0.187	0.187	0.088	0.187	0.099
F- stat/Wald	121.000***	19.730***	19.730***	121.000***	19.730***	84.000***
No. of Banks	48	48	48	48	48	46
	ΔlnLoans (<1 year)	ΔlnLoans (1-3 years)	ΔlnLoans (3-5 years)	ΔlnPriority Sector Loans	ΔlnNon-Priority Sector Loans	ΔlnLoans to Public Sector
<i>Second Stage</i>						
ΔlnSavings Bank Deposits _{it}	-0.025 (0.265)	-0.618* (0.335)	-0.492 (0.423)	-0.435** (0.172)	-0.363** (0.161)	-1.263 (1.009)
lnCapital _{it}	0.046** (0.020)	-0.019 (0.035)	-0.019 (0.005)	0.048*** (0.013)	0.025 (0.017)	0.045 (0.071)
lnTotal Assets _{it}	-0.028 (0.018)	0.054 (0.106)	0.088 (0.134)	-0.036*** (0.012)	0.046 (0.051)	-0.035 (0.070)
Return on Assets _{it}	0.085*** (0.021)	0.031 (0.028)	0.069** (0.035)	0.088*** (0.013)	0.084*** (0.013)	0.185** (0.080)
ΔlnWPI _t	0.424 (0.586)	1.160* (0.703)	-0.984 (0.887)	0.121 (0.381)	-0.017 (0.337)	-1.857 (2.065)
GDP Growth Rate _t	-0.006 (0.016)	0.033 (0.025)	0.018 (0.032)	0.022** (0.010)	0.015 (0.012)	-0.113** (0.055)
Intercept	0.135 (0.198)	-0.608 (1.407)	-0.856 (1.776)	0.161 (0.129)	-0.695 (0.675)	1.183 (0.808)
R Squared	0.124	0.001	0.009	0.016	0.106	0.024
F- stat/Wald	45.580***	23.850***	32.580***	64.020***	100.820***	11.010*

Dependent Variable: ΔlnSavings Bank Deposits in first stage and Short-term loans (Δlnloans < 1 year), medium-term loans (Δlnloans of 1-3 years), long-term loans (Δlnloans of 3-5 years), Δlnpriority sector loans, Δlnnon-priority sector loans and Δlnloans to public sector in second stage. ΔlnSavings Bank Deposits in the second stage is predicted value of growth in saving banks deposits as a result of demonetization. ***, **, * Indicate significance at 1%, 5% and 10% levels, respectively. Standard errors in parentheses. †Indicates Fixed Effects model and †† shows Random Effects model suggested by Hausman Test. F-stat is reported for Fixed Effects models and Wald Chi Square for Random Effects.

Table 8
Two Stage Least Squares Panel Regression for All Banks: Demand Deposits

	Demand Deposits ^{††}	Demand Deposits [†]	Demand Deposits [†]	Demand Deposits ^{††}	Demand Deposits ^{††}	Demand Deposits ^{††}
<i>First Stage</i>						
Demonetization _t	0.212*** (0.053)	0.202*** (0.056)	0.202*** (0.056)	0.212*** (0.053)	0.212*** (0.053)	0.163*** (0.051)
Demonetization _t *NNPA _{it}	-0.014** (0.007)	-0.014* (0.007)	-0.014* (0.007)	-0.014** (0.007)	-0.014** (0.007)	-0.007 (0.007)
lnCapital _{it}	0.023** (0.010)	0.020 (0.023)	0.020 (0.023)	0.023** (0.010)	0.023** (0.010)	0.011 (0.011)
lnTotal Assets _{it}	-0.018* (0.011)	-0.076 (0.069)	-0.076 (0.069)	-0.018* (0.011)	-0.018* (0.011)	-0.005 (0.012)
Return on Assets _{it}	0.064*** (0.010)	0.042*** (0.015)	0.042*** (0.015)	0.064*** (0.010)	0.064*** (0.010)	0.052*** (0.011)
ΔlnWPI _t	0.072 (0.439)	0.088 (0.478)	0.088 (0.478)	0.072 (0.439)	0.072 (0.439)	0.219 (0.400)
GDP Growth Rate _t	0.010* (0.010)	0.013 (0.015)	0.013 (0.015)	0.010* (0.010)	0.010* (0.010)	0.006 (0.010)
Intercept	0.060 (0.139)	0.754 (0.924)	0.754 (0.924)	0.060 (0.139)	0.060 (0.139)	0.001 (0.152)
Bank Specific Effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	305	305	305	305	305	287
R Squared	0.128	0.133	0.133	0.128	0.128	0.008
F- stat/Wald	84.000***	5.800***	5.800***	84.000***	84.000***	52.000***
No. of Banks	48	48	48	48	48	46
	ΔlnLoans (<1 year)	ΔlnLoans (1-3 years)	ΔlnLoans (3-5 years)	ΔlnPriority Sector Loans	ΔlnNon-Priority Sector Loans	ΔlnLoans to Public Sector
<i>Second Stage</i>						
ΔlnDemand Deposits _{it}	-0.003 (0.321)	-0.496 (0.406)	-0.457 (0.497)	-0.381** (0.196)	-0.024 (0.167)	-1.370 (1.388)
lnCapital _{it}	0.004*** (0.016)	-0.013 (0.038)	-0.012 (0.047)	0.035*** (0.010)	0.032*** (0.008)	0.012 (0.062)
lnTotal Assets _{it}	-0.027* (0.016)	0.040 (0.111)	0.074 (0.138)	-0.026*** (0.010)	-0.017** (0.008)	-0.015 (0.069)
Return on Assets _{it}	0.083*** (0.026)	0.023 (0.030)	0.066* (0.037)	0.087*** (0.016)	0.106*** (0.013)	0.187** (0.094)
ΔlnWPI _t	0.423 (0.607)	1.385* (0.773)	-0.765 (0.947)	0.290 (0.371)	-0.393 (0.316)	-1.281 (2.277)
GDP Growth Rate _t	-0.007 (0.015)	0.030 (0.027)	0.017 (0.033)	0.017* (0.009)	-0.013* (0.008)	-0.121** (0.055)
Intercept	0.131 (0.193)	-0.510 (1.459)	-0.773 (1.787)	0.111 (0.118)	0.150 (0.100)	1.089 (0.827)
R Squared	0.128	0.006	0.009	0.055	0.432	0.008
F- stat/Wald	43.740***	20.500***	31.660***	69.630***	231.910***	9.940

Dependent Variable: ΔlnDemand Deposits in first stage and Short-term loans (Δlnloans < 1 year), medium-term loans (Δlnloans of 1-3 years), long-term loans (Δlnloans of 3-5 years), Δlnpriority sector loans, Δlnnon-priority sector loans and Δlnloans to public sector in second stage. ΔlnDemand Deposits in the second stage is predicted value of growth in saving banks deposits as a result of demonetization. ***, **, * Indicate significance at 1%, 5% and 10% levels, respectively. Standard errors in parentheses. † Indicates Fixed Effects model and †† shows Random Effects model suggested by Hausman Test. F-stat is reported for Fixed Effects models and Wald Chi Square for Random Effects.

Table 9
Estimated Coefficients for Effects on Long Run Bank Lending for All Banks: 2SLS Regression Savings Bank Deposits

	Savings Bank Deposits ^{††}	Savings Bank Deposits ^{††}	Savings Bank Deposits ^{††}	Savings Bank Deposits [†]	Savings Bank Deposits [†]	Savings Bank Deposits ^{††}
<i>First Stage</i>						
Demonetization _t	0.233*** (0.049)	0.233*** (0.049)	0.233*** (0.049)	0.188*** (0.027)	0.188*** (0.027)	0.189*** (0.041)
Demonetization _t *NNPA _{it}	-0.014* (0.007)	-0.014* (0.007)	-0.014* (0.007)	-0.006 (0.004)	-0.006 (0.004)	-0.007 (0.006)
lnCapital _{it}	0.056*** (0.010)	0.056*** (0.010)	0.056*** (0.010)	-0.004 (0.012)	-0.004 (0.012)	0.038*** (0.011)
lnTotal Assets _{it}	-0.047*** (0.010)	-0.047*** (0.010)	-0.047*** (0.010)	-0.055** (0.041)	-0.055** (0.041)	-0.026** (0.013)
Return on Assets _{it}	0.066*** (0.010)	0.066*** (0.010)	0.066*** (0.010)	0.028*** (0.010)	0.028*** (0.010)	0.056*** (0.012)
ΔlnWPI _t	-0.728* (0.404)	-0.728* (0.404)	-0.728* (0.404)	-0.517* (0.277)	-0.517* (0.277)	-0.499 (0.331)
GDP Growth Rate _t	-0.001 (0.018)	-0.001 (0.018)	-0.001 (0.018)	0.003 (0.016)	0.003 (0.016)	0.003 (0.016)
Intercept	0.378** (0.178)	0.378** (0.178)	0.378** (0.178)	0.817 (0.584)	0.817 (0.584)	0.201 (0.194)
Bank Specific Effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	257	257	257	257	257	242
R Squared	0.069	0.069	0.069	0.144	0.144	0.019
F- stat/Wald	111.000***	111.000***	111.000***	16.940***	16.940***	71.000***
No. of Banks	48	48	48	48	48	46
	ΔlnLoans (<1 year)	ΔlnLoans (1-3 years)	ΔlnLoans (3-5 years)	ΔlnPriority Sector Loans	ΔlnNon-Priority Sector Loans	ΔlnLoans to Public Sector
<i>Second Stage</i>						
ΔlnSavings Bank Deposits _{it-1}	0.410 (0.313)	0.060 (0.306)	0.863** (0.428)	0.030 (0.135)	0.367** (0.166)	1.833* (1.162)
lnCapital _{it-1}	0.020 (0.025)	-0.009 (0.025)	-0.010 (0.035)	-0.009 (0.015)	0.002 (0.019)	-0.078 (0.093)
lnTotal Assets _{it-1}	-0.016 (0.024)	0.014 (0.023)	0.019 (0.033)	-0.149*** (0.052)	-0.325*** (0.064)	-0.036 (0.102)
Return on Assets _{it-1}	0.042 (0.029)	0.068** (0.029)	0.099* (0.040)	0.025* (0.014)	0.042** (0.017)	-0.015 (0.113)
ΔlnWPI _{t-1}	-0.496 (0.696)	-0.310 (0.681)	0.468 (0.949)	0.242 (0.347)	-0.703* (0.426)	2.728 (2.343)
GDP Growth Rate _{t-1}	-0.031 (0.032)	-0.060** (0.031)	-0.064 (0.043)	-0.018 (0.021)	-0.081*** (0.026)	-0.271** (0.114)
Intercept	0.266 (0.338)	0.362 (0.331)	0.205 (0.466)	2.040*** (0.744)	4.432*** (0.914)	2.592* (1.418)
R Squared	0.069	0.084	0.131	0.018	0.042	0.019
F- stat/Wald	22.360***	20.360***	50.310***	202.440***	70.760***	14.740***

Dependent Variable: ΔlnSavings Bank Deposits in first stage and Short-term loans (Δlnloans < 1 year), medium-term loans (Δlnloans of 1-3 years), long-term loans (Δlnloans of 3-5 years), Δlnpriority sector loans, Δlnnon-priority sector loans and Δlnloans to public sector in second stage. ΔlnSavings Deposits in the second stage is predicted value of growth in saving banks deposits as a result of demonetization. ***, **, * Indicate significance at 1%, 5% and 10% levels, respectively. Standard errors in parentheses. † Indicates Fixed Effects model and †† shows Random Effects model suggested by Hausman Test. F-stat is reported for Fixed Effects models and Wald Chi Square for Random Effects.

In Table 9 we report long-run (after a lag of one year) effect of increase in savings bank deposits on different maturities and types of loans. Here we find that long-term loans, non-priority sector loans and loans to public sector reacts positively to an increase in savings bank deposits as a result of demonetization. Again these results are similar to our main results reported in Table 5. Short-term loans, medium-term loans and priority sector loans do not respond to change in savings bank deposits.

Table 10 reports the long-run effect of demand deposits on loans of different maturities and types. We observe that short-term loans, long-term loans, non-priority sector loans and loans to public sector respond positively to change in demand deposits conforming to our main results reported in Table 5. However, medium-term loans and priority sector loans do not react significantly to change in demand deposits.

In Table 11, we report the role of increase in demonetization induced savings bank deposits (lagged) and demand deposits (lagged) in monetary policy transmission to bank lending of different maturities and types. Here we find that there is a moderating effect of savings bank deposits and demand deposits in monetary policy transmission to bank loans of long-term, priority sector, non-priority sector and public sector as it is evident from the positive and significant coefficients of the interaction term ($WACR * Savings\ Bank\ Deposits$). We find similar results when it comes to an increase in demand deposits and its role in monetary policy transmission. Additionally, monetary transmission to short-term loans is also weakened. Again, these results are consistent with our main results reported in Table 6. Monetary policy transmission to short-term loans and medium-term loans does not get weakened by an increase in savings bank deposits. However, in the case of an increase in demand deposits, monetary transmission to only medium-term loans does not weakened.

Table 10
Estimated Coefficients for Effects on Long Run Bank Lending for All Banks: 2SLS Regression Demand Deposits

	Demand Deposits ^{††}	Demand Deposits ^{††}	Demand Deposits ^{††}	Demand Deposits [†]	Demand Deposits [†]	Demand Deposits ^{††}
<i>First Stage</i>						
Demonetization _{it}	0.225*** (0.052)	0.225*** (0.052)	0.219*** (0.051)	0.210*** (0.054)	0.210*** (0.054)	0.178*** (0.049)
Demonetization _{it} *NNPA _{it}	-0.020** (0.008)	-0.020** (0.008)	-0.018** (0.008)	-0.016** (0.008)	-0.016** (0.008)	-0.013* (0.007)
lnCapital _{it}	0.037*** (0.010)	0.037*** (0.010)	0.040*** (0.012)	0.015 (0.023)	0.015 (0.023)	0.017 (0.014)
lnTotal Assets _{it}	-0.035*** (0.011)	-0.035*** (0.011)	-0.043*** (0.014)	-0.108 (0.080)	-0.108 (0.080)	-0.012 (0.018)
Return on Assets _{it}	0.078*** (0.011)	0.078*** (0.011)	0.071*** (0.013)	0.025 (0.021)	0.025 (0.021)	0.046*** (0.016)
ΔlnWPI _t	-0.275 (0.434)	-0.275 (0.434)	-0.205 (0.423)	-0.026 (0.546)	-0.026 (0.546)	-0.051 (0.396)
GDP Growth Rate _t	-0.031* (0.019)	-0.031* (0.019)	-0.025 (0.020)	-0.018 (0.032)	-0.018 (0.032)	-0.025 (0.019)
Intercept	0.489*** (0.192)	0.489*** (0.192)	0.528** (0.219)	1.399 (1.152)	1.399 (1.152)	0.291 (0.250)
Bank Specific Effects	Yes	Yes	Yes	Yes	Yes	Yes
No. of Observations	257	257	257	257	257	242
R Squared	0.044	0.044	0.198	0.112	0.112	0.016
F- stat/Wald	98.000***	98.000***	74.000***	3.750***	3.750***	32.000***
No. of Banks	48	48	48	48	48	46
	ΔlnLoans (<1 year)	ΔlnLoans (1-3 years)	ΔlnLoans (3-5 years)	ΔlnPriority Sector Loans	ΔlnNon-Priority Sector Loans	ΔlnLoans to Public Sector
<i>Second Stage</i>						
ΔlnDemand Deposits _{it-1}	0.607* (0.376)	0.142 (0.354)	1.032** (0.475)	0.085 (0.151)	0.503** (0.206)	2.396* (1.552)
lnCapital _{it-1}	0.020 (0.023)	-0.011 (0.022)	-0.007 (0.034)	-0.012 (0.016)	-0.009 (0.022)	-0.048 (0.093)
lnTotal Assets _{it-1}	-0.013 (0.024)	0.017 (0.022)	0.023 (0.037)	-0.145*** (0.052)	-0.298*** (0.071)	-0.069 (0.114)
Return on Assets _{it-1}	0.019 (0.038)	0.060* (0.036)	0.070 (0.047)	0.024* (0.014)	0.040** (0.019)	-0.038 (0.126)
ΔlnWPI _{t-1}	-0.636 (0.718)	-0.332 (0.677)	0.183 (0.899)	0.193 (0.360)	-0.942** (0.490)	2.145 (2.483)
GDP Growth Rate _{t-1}	-0.011 (0.036)	-0.056* (0.034)	-0.027 (0.045)	-0.017 (0.020)	-0.075*** (0.028)	-0.196 (0.127)
Intercept	0.102 (0.386)	0.308 (0.364)	-0.076 (0.547)	2.006*** (0.744)	4.162*** (1.013)	2.383 (1.650)
R Squared	0.044	0.078	0.198	0.023	0.065	0.016
F- stat/Wald	21.650***	20.370***	38.190***	202.530***	59.460***	13.460***

Dependent Variable: ΔlnDemand Deposits in first stage and Short-term loans (Δlnloans < 1 year), medium-term loans (Δlnloans of 1-3 years), long-term loans (Δlnloans of 3-5 years), Δlnpriority sector loans, Δlnnon-priority sector loans and Δlnloans to public sector in second stage. ΔlnDemand Deposits in the second stage is predicted value of growth in saving banks deposits as a result of demonetization. ***, **, * Indicate significance at 1%, 5% and 10% levels, respectively. Standard errors in parentheses. † Indicates Fixed Effects model and †† shows Random Effects model suggested by Hausman Test. F-stat is reported for Fixed Effects models and Wald Chi Square for Random Effects.

Table 11
 Estimated Coefficients for Effects on Long Run Bank Lending and Monetary Policy Effectiveness for All Banks: Panel Regression for Savings Bank Deposits and Demand Deposits

	Savings Bank Deposits						Demand Deposits					
	Loans (<1 year) ^{††}	Loans (1-3 years) ^{††}	Loans (3-5 years) [†]	Priority Sector Loans ^{††}	Non-Priority Sector Loans [†]	Loans to Public Sector [†]	Loans (<1 year) ^{††}	Loans (1-3 years) ^{††}	Loans (3-5 years) [†]	Priority Sector Loans ^{††}	Non-Priority Sector Loans [†]	Loans to Public Sector [†]
<i>Second Stage: With Monetary Policy</i>												
WACR _{t-1}	-0.041 (0.030)	-0.025 (0.031)	0.067 (0.048)	0.017 (0.014)	-0.005 (0.018)	0.118 (0.127)	-0.033 (0.031)	-0.021 (0.032)	0.069 (0.049)	0.019 (0.014)	-0.004 (0.018)	0.104 (0.128)
WACR _{t-1} *ΔlnSaving Banks Deposits _{it-1}	0.079 (0.059)	0.059 (0.064)	0.232*** (0.084)	0.051* (0.028)	0.076** (0.031)	0.580*** (0.226)						
WACR _{t-1} *ΔlnDemand Deposits _{it-1}							0.085* (0.049)	0.062 (0.061)	0.208*** (0.079)	0.040* (0.023)	0.060** (0.024)	0.403** (0.182)
lnCapital _{it}	0.043*** (0.014)	-0.012 (0.014)	-0.015 (0.043)	0.021*** (0.008)	0.017 (0.016)	0.028 (0.110)	0.044*** (0.014)	-0.012 (0.014)	-0.020 (0.042)	0.021*** (0.008)	0.015* (0.016)	0.012 (0.110)
lnTotal Assets _{it}	-0.028* (0.015)	0.023 (0.016)	0.200 (0.142)	-0.010 (0.009)	0.045 (0.053)	-0.070 (0.415)	-0.027* (0.015)	0.023 (0.016)	0.167 (0.141)	-0.010 (0.009)	0.032 (0.052)	-0.209 (0.409)
Return on Assets _{it}	0.084*** (0.013)	0.058*** (0.014)	0.027 (0.029)	0.054*** (0.007)	0.067*** (0.011)	0.054 (0.078)	0.081*** (0.014)	0.056*** (0.014)	0.027 (0.030)	0.053*** (0.007)	0.077*** (0.011)	0.055 (0.079)
ΔlnWPI _t	1.054 (0.681)	1.243* (0.698)	0.584 (0.961)	0.380 (0.311)	0.442 (0.356)	0.258 (2.524)	1.078* (0.654)	1.228* (0.679)	0.300 (0.924)	0.325 (0.299)	0.340 (0.336)	-0.889 (2.387)
GDP Growth Rate _t	0.011 (0.022)	0.003 (0.023)	-0.026 (0.031)	0.001 (0.010)	0.003 (0.011)	-0.196** (0.084)	0.012 (0.022)	0.003 (0.023)	-0.022 (0.031)	0.002 (0.010)	0.004 (0.011)	-0.182** (0.083)
Intercept	0.194 (0.238)	-0.067 (0.244)	-2.780 (2.034)	-0.089 (0.127)	-0.674 (0.754)	0.523 (5.863)	0.169 (0.235)	-0.071 (0.242)	-2.242 (1.998)	-0.080 (0.126)	-0.458 (0.735)	2.752 (5.731)
R Squared	0.144	0.090	0.008	0.268	0.306	0.042	0.147	0.091	0.013	0.269	0.373	0.019
F- stat/Wald	49.660***	29.250***	2.170**	89.280***	8.980***	1.710*	51.000***	29.420***	2.050**	89.200***	8.990***	1.460
No. of Observations	303	303	303	303	303	286	303	303	303	303	303	286
No. of Banks	48	48	48	48	48	46	48	48	48	48	48	46

Dependent Variable: Short-term loans (Δlnloans < 1 year), medium-term loans (Δlnloans of 1-3 years), long-term loans (Δlnloans of 3-5 years), Δlnpriority sector loans, Δlnnon-priority sector loans and Δlnloans to public sector. ΔlnDemand Deposits in first stage and in second stage. ΔlnSavings Bank Deposits and ΔlnDemand Deposits in the second stage are predicted value of growth in saving banks deposits and demand deposits as a result of demonetization. ***, **, * Indicate significance at 1%, 5% and 10% levels, respectively. Standard errors in parentheses. †Indicates Fixed Effects model and †† shows Random Effects model suggested by Hausman Test. F-stat is reported for Fixed Effects models and Wald Chi Square for Random Effects.

7. Conclusions

In this paper we analyzed the relationship between deposits collected by banks and their lending and investment behavior using the currency demonetization of 2016 as our identification strategy. In a two-stage least squares framework, we estimate the impact of demonetization on two types of bank deposits and examine its subsequent effects on bank lending, banks' balances with RBI and banks' balances with other banks. We find the evidence of positive effect of demonetization on both savings bank deposits and demand deposits. Subsequently, we find that the demonetization led increase in deposits have negative impact on bank lending but positive effects on banks' balances with RBI.

We also estimated the effect of predicted lagged value of change in deposits on lending by banks. We find a positive effect on bank lending indicating non-neutrality of deposits in the long run even while there was a decline in lending in the short run. Finally, we examined the effectiveness of monetary policy transmission in the wake of demonetization. We find that increase in deposits caused by demonetization, weakened the monetary policy transmission to bank lending in the subsequent year.

The policy implications of our study are as follows. First, since bank lending in the short run may decline due to a sudden increase in deposits (as in the case of demonetization), the policy makers should take adequate measures to deal with a sudden influx of deposits. As a temporary policy measure in order to tackle sudden surge in liquidity (in the aftermath of demonetization), the RBI had announced an incremental Cash Reserve Ratio (CRR) of 100 percent to be maintained by banks (the RBI does not pay any interest on the mandated cash reserves). This temporal measure was withdrawn in a month which meant that the banks still ended up parking their surplus liquidity with the RBI. Instead the central bank needs to ensure that banks' parking their surplus funds in such deposit facilities can be used for productive alternatives when

situations like surplus liquidity occur. Second, the long run increase in bank lending and its subsequent unintended role in monetary transmission to bank lending should be taken into consideration while devising monetary policy. Mechanisms need to be developed to absorb surplus liquidity so that optimum liquidity is available with banks that makes monetary policy effective.

References

Aleem, Abdul. "Transmission mechanism of monetary policy in India." *Journal of Asian Economics* 21, no. 2 (2010): 186-197.

Apergis, Nicholas, Stephen M. Miller, and Effrosyni Alevizopoulou. "The bank lending channel and monetary policy rules for Eurozone banks: further extensions." *The BE Journal of Macroeconomics* 15, no. 1 (2015): 93-112.

Balasubramanyan, Lakshmi, and David D. VanHoose. "Bank balance sheet dynamics under a regulatory liquidity-coverage-ratio constraint." *Journal of Macroeconomics* 37 (2013): 53-67.

Bernanke, Ben S., and Mark Gertler. "Inside the black box: the credit channel of monetary policy transmission." *Journal of Economic perspectives* 9, no. 4 (1995): 27-48.

Bernanke, Ben, and Alan S. Blinder. "The federal funds rate and the transmission of monetary policy." *American Economic Review* 82, no. 4 (1992): 901-921.

Chanda, Areendam, and C. Justin Cook. "Was India's Demonetization Redistributive? Insights from Satellites and Surveys." *Insights from Satellites and Surveys*. (May 22, 2020) (2020). Louisiana State University Working paper available at https://www.dropbox.com/s/sneqtkup3blhp5/Chanda_Cook_Demonetization_draft%205-24-21.pdf?dl=0 (accessed on 10th November 2021).

Choi, In. "Unit root tests for panel data." *Journal of international money and Finance* 20, no. 2 (2001): 249-272.

Corradi, Valentina, Marzio Galeotti, and Riccardo Rovelli. "A cointegration analysis of the relationship between bank reserves, deposits and loans: The case of Italy, 1965–1987." *Journal of Banking & Finance* 14, no. 1 (1990): 199-214.

Cortés, Kristle Romero, and Philip E. Strahan. "Tracing out capital flows: How financially integrated banks respond to natural disasters." *Journal of Financial Economics* 125, no. 1 (2017): 182-199.

Im, Kyung So, M. Hashem Pesaran, and Yongcheol Shin. "Testing for unit roots in heterogeneous panels." *Journal of econometrics* 115, no. 1 (2003): 53-74.

Imai, Masami, and Seitaro Takarabe. "Transmission of liquidity shock to bank credit: Evidence from the deposit insurance reform in Japan." *Journal of the Japanese and International Economies* 25, no. 2 (2011): 143-156.

Imai, Masami. "Local economic effects of a government-owned depository institution: Evidence from a natural experiment in Japan." *Journal of Financial Intermediation* 21, no. 1 (2012): 1-22.

Jayaratne, Jith, and Donald P. Morgan. "Capital market frictions and deposit constraints at banks." *Journal of Money, Credit and Banking* (2000): 74-92.

Karmakar, Sudipto, and Abhinav Narayanan. "Do households care about cash? Exploring the heterogeneous effects of India's demonetization." *Journal of Asian Economics* 69 (2020): 101203.

Kashyap, Anil; Stein, Jeremy and Wilcox, David W. "Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance." *American Economic Review*, March 1993, 83(1), pp. 78-98.

Khwaja, Asim Ijaz, and Atif Mian. "Tracing the impact of bank liquidity shocks: Evidence from an emerging market." *American Economic Review* 98, no. 4 (2008): 1413-42.

Kuziemko, Ilyana. "Using shocks to school enrollment to estimate the effect of school size on student achievement." *Economics of Education Review* 25, no. 1 (2006): 63-75.

Lahiri, Amartya. "The great Indian demonetization." *Journal of Economic Perspectives* 34, no. 1 (2020): 55-74.

Levin, Andrew, Chien-Fu Lin, and Chia-Shang James Chu. "Unit root tests in panel data: asymptotic and finite-sample properties." *Journal of econometrics* 108, no. 1 (2002): 1-24.

Maddala, Gangadharrao S., and Shaowen Wu. "A comparative study of unit root tests with panel data and a new simple test." *Oxford Bulletin of Economics and statistics* 61, no. S1 (1999): 631-652.

Milcheva, Stanimira. "A bank lending channel or a credit supply shock?" *Journal of Macroeconomics* 37 (2013): 314-332.

Opiela, Timothy. "Deposit guarantees and distributional effects of monetary policy on bank lending." In *CEPR/JFI Conference on the Monetary Transmission Mechanism, Barcelona, Spain*. 2003.

Prisman, Eliezer Z., Myron B. Slovin, and Marie E. Sushka. "A general model of the banking firm under conditions of monopoly, uncertainty, and recourse." *Journal of Monetary Economics* 17, no. 2 (1986): 293-304.

Schnabl, Philipp, Alexi Savov, and Itamar Drechsler. "How Monetary Policy Shaped the Housing Boom." (2019).

Van den Heuvel, Skander J. "Banking conditions and the effects of monetary policy: Evidence from US states." *The BE Journal of Macroeconomics* 12, no. 2 (2012).



भारतीय प्रबंध संस्थान कोषिककोड
Indian Institute Management Kozhikode
Globalizing Indian Thought

Research Office
Indian Institute of Management Kozhikode
IIMK Campus P. O.,
Kozhikode, Kerala, India,
PIN - 673 570
Phone: +91-495-2809237/ 238
Email: research@iimk.ac.in
Web: <https://iimk.ac.in/publications>

