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Digital Payment after Demonetisation: A Leapfrog Jump

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Abstract

Cash shortage during demonetisation resulted in a surge in the usage of non-cash payment channels. With progressive remonetisation and gradual removal of restrictions on cash withdrawals, transaction volumes in most of the non-cash payment channels came down but settled at higher than normal levels. The present study estimates the duration in the expansion of digital payment modes leapfrogged due to demonetisation.

Key words: Demonetization, cashless transactions, ARIMA

1. Introduction

The demonetisation of specified bank notes (SBNs) of Rs.500 and Rs.1000 denomination on November 08, 2016, resulted in 86.9 per cent of the value of notes in circulation to lose their legal character [Singh and Roy, 2017]. Sustained remonetisation efforts by the Reserve Bank restored normalcy with currency in circulation (CIC) reaching 92.6 per cent of the end-October 2016 level by October 20, 2017 and it stabilised around that level. This signifies that there is a definite shift to non-cash transactions.

The shift from cash-based to non-cash transactions in the post-demonetisation period, is also evident in the ratio of non-cash transactions to Gross Domestic Product (GDP) at current market prices rising from 6.3-6.5 per cent in 2012-16 to 7.1 per cent in March 2017 (Table 1), and the currency-GDP ratio declining from around 12 per cent earlier to 8.8 per cent in March 2017.

The period immediately following the demonetisation announcement witnessed several restrictions on cash withdrawals from bank accounts and Automated Teller Machines (ATMs). Many ATMs were non-functional, either awaiting calibration for newly-introduced Rupees 500 and 2000 notes or due to cash shortage. This forced consumers to resort to non-cash transactions for their payments giving rise to strong growth in almost all modes of non-cash payment channels, particularly paper (cheque) clearing, National Electronic Funds Transfer (NEFT), Immediate Payment Service (IMPS), mobile banking, credit and debit cards at POS terminals and pre-paid payment instruments (PPI) (Table 2). Several incentives introduced by Government of India and the Reserve Bank to popularise digital transactions, also helped the process.

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Table 1: Selected ratios

Year	GDP at current market prices (Rs. billion)	Ratio to GDP (%)				
		Currency in circulation*	Real Time Gross Settlement (RTGS) - Customer	Paper clearing	Electronic clearing#	Total Non-cash transactions
1	2	3	4	5	6	7=(4+5+6)
2012-13	99,440	12.0	5.2	1.0	0.3	6.5
2013-14	112,335	11.6	5.1	0.8	0.5	6.4
2014-15	124,451	11.6	5.1	0.7	0.6	6.3
2015-16	136,820	12.2	5.1	0.6	0.7	6.5
2016-17	151,837	8.8	5.6	0.5	1.0	7.1

Source: Database on Indian Economy (https://dbie.rbi.org.in) and authors' calculation.
**:End-March of each year*
#: Includes retail electronic clearing (ECS, NEFT, IMPS and NACH), credit card at point-of-sale (POS), debit card at POS, PPI (m-wallet, PPI cards and paper vouchers) and mobile banking.

After achieving reasonable level of remonetisation, the Reserve Bank removed limits on withdrawal of cash from saving bank accounts on February 8, 2017 in phases and all limits were withdrawn by March 13, 2017 [RBI, August 2017]. This moderated the surge in non-cash payment channels. Nevertheless, as more people got habituated to and found convenience in electronic modes of payment, transactions for some non-cash channels settled at a level higher than these would have reached in the absence of demonetisation. This study attempts to estimate the demonetisation-induced leapfrog-duration for the non-cash payment modes after completion of one-year from demonetisation announcement.

This paper is organised as follows. Recent works examining impact of demonetisation on digital payments are mentioned in Section II, data and methodology deployed for the present study are explained in Section III. Section IV analyses the results and Section V concludes.

2. Literature Survey

There are a number of studies which have analysed the effect of India's recent demonetisation on digital payments. For example, RBI report on macroeconomic impact of demonetisation [RBI, March 2017] among other things analysed growth rates in various payment channels and observed that an important consequence of demonetisation had been the sharp increase in the use of digital transactions. Maiti (2017) found that (i) there has been a reduction in the usage of cheques prior to demonetisation; and (ii) since demonetisation, cash transactions have moved in a sustained manner to non-cash mode of payment systems via retail electronic payment systems, point of sale terminals and cheques. However, in any of these studies there is no quantification of the extent of gain in non-cash payment channels which we attempt in this paper.

3. Data and Methodology

We estimate the number of months of advancement in expansion of non-cash payments by deriving the deviation from the pre-demonetisation trend by using two methods. In the first method (Growth rate model), we apply applicable (linear or quadratic) growth rate on various series depending on their past pattern and, in the

second method (Time series model), we fit suitable Autoregressive Integrated Moving Average (ARIMA) [Box-Jenkins, 1970] model on monthly data for the period April 2012 to October 2016 (month preceding demonetisation announcement):

$$\left(1-\sum_{i=1}^{p}\emptyset_i L^i\right)(1-L)^d X_t = \left(1+\sum_{i=1}^{q}\theta_i L^i\right)\varepsilon_t$$

where X_t is logarithm of volume or value of transactions in different payment channels, L is the lag operator, $\emptyset_i$'s are the parameters of the autoregressive part of the model, θ_i's are the parameters of the moving average part and ε_t are error terms.

Data on volume and value of non-cash transactions have been taken from RBI's Database on Indian Economy (DBIE) till November 2017. In case of debit card at ATM (volume and value both), paper clearing (volume and value both) and mobile banking (value), we have "backcasted" the time series. The models are found to be statistically robust; details of unit root test and ARIMA models are given in Tables 3 and 4 of **Annexure**, respectively. The behaviour of new products like IMPS and NACH could not be modelled using ARIMA model.

4. Results

It is found that the usage of many digital modes of payments leapfrogged during the demonetisation period. Estimates of number of months of advancement are presented in Table 2 and graphs of the **Annexure**. Estimates obtained under both the models are quite close to each other, reflecting consistency of the results. It is assessed that demonetisation has shifted people's preference towards using debit card at POS rather than at ATM as the transaction volume for debit card at POS advanced by around eleven months, whereas usage of debit card at ATM declined by around eighteen months. Volume of transactions for credit card at POS and RTGS customers advanced by more than three months and thirteen months, respectively. In value terms, usage of credit card, debit card at POS and RTGS customer transactions leapfrogged by more than five, ten and twenty months, respectively. The infrastructure supporting payment system also witnessed rapid expansion in consonance and the rate of expansion of POS terminals leapfrogged by nearly three years.

Not all payment channels gained from demonetisation process. Traditional non-cash mode of payment like paper-clearing surged immediately after the demonetisation announcement but it moderated after remonetisation. The transactions volume and value for NEFT and IMPS reverted to their long-term trend in November 2017 after higher growth post-demonetisation. Growth in payments through National Automated Clearing House (NACH) and value of mobile banking payments moderated as compared with the pre-demonetisation trend.

5. Conclusion

There has been noteworthy expansion in transactions in most of the non-cash payment channels immediately following the demonetisation. With subsequent remonetisation, some of these modes have reverted to the pre-demonetisation trend (NEFT, IMPS and PPI volume) but some others (*e.g.*, debit card at POS, credit card at POS, PPI value, RTGS customer and POS terminals) have witnessed a clear step-up and duration gain. In the overall scheme of things, there is a definite shift towards peoples' preference for non-cash transaction post-demonetisation.

Table 2: Estimated Number of Months of Advancement due to Demonetisation

		Annualised growth rate (%)			Estimated number of months advanced	
		3-year up to Oct'16	Feb'17 to Nov'17	Oct'16 to Nov'17	Growth rate model	ARIMA model
Payment Channel						
1. Credit Card at POS	Volume	25.3	30.2	27.6	5.6	3.3
	Value	30.4	51.8	28.4	7.9	5.6
2. Debit card at POS	Volume	37.1	10.3	83.3	14.6	10.9
	Value	36.0	2.5	60.0	14.8	10.2
3. PPI	Volume	130.5	-20.3	77.4	-2.3	-2.7
	Value	106.0	54.2	108.1	19.1	10.9
4. Debit card at ATM	Volume	14.2	7.5	-8.2	-18.4	-20.0
	Value	13.5	40.8	-2.0	-4.2	-5.7
5. Paper clearing	Volume	-7.9	-11.1	11.2	-20.0	-20.0
	Value	-7.1	8.1	4.1	-19.5	-18.5
6. EFT/NEFT	Volume	32.8	12.6	19.8	4.6	-1.8
	Value	35.0	38.4	41.9	5.2	0.3
7. RTGS (Customer)	Volume	9.8	26.7	19.4	13.3	15.2
	Value	11.7	44.6	30.7	20.2	20.1
8. IMPS	Volume	116.7^	71.4	100.6	-0.7	#
	Value	150.7^	90.7	113.8	-0.2	#
9. NACH	Volume	53.0^	43.4	20.9	-7.2	#
	Value	89.8^	63.0	20.8	-6.1	#
10. Mobile Banking	Volume	115.6	92.7	89.4	1.1	-3.2
	Value	287.8	-34.0	-16.5	-14.4	-14.7
11. POS terminals	Volume	16.2	48.9	88.1	19.4	34.9

Source: Database on Indian Economy (https://dbie.rbi.org.in) and authors' calculation.
^: 1-year growth up to Oct'16
#:Appropriate ARIMA model could not be fitted.

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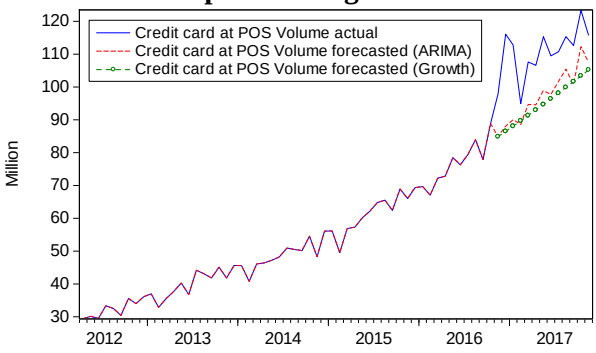
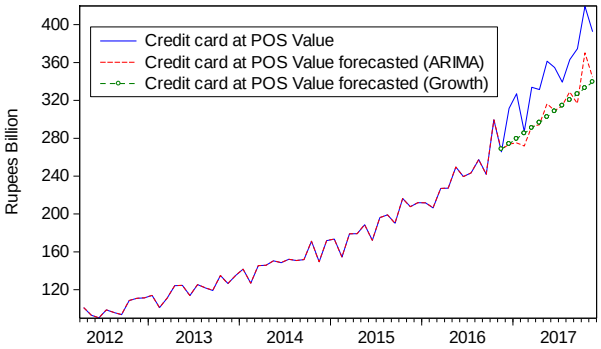
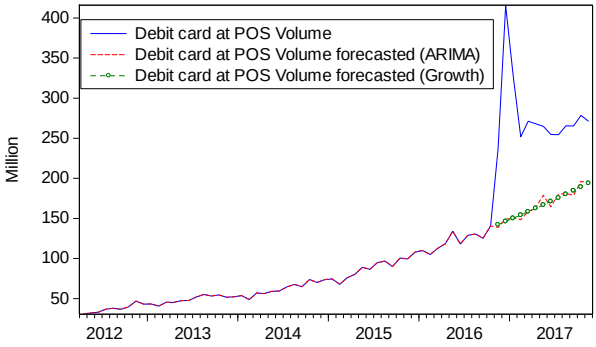
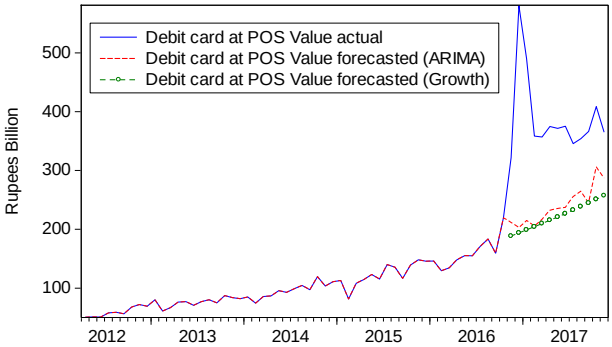
Annexure

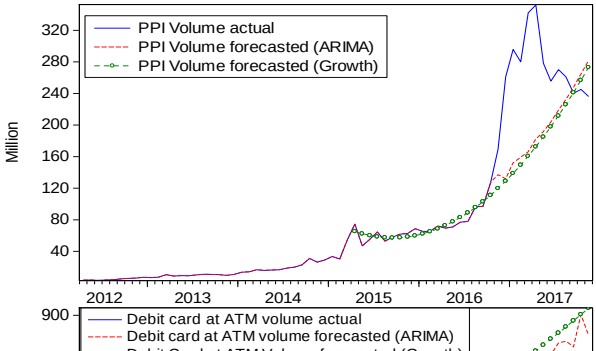
Graphs showing advancement in volume and value of transactions

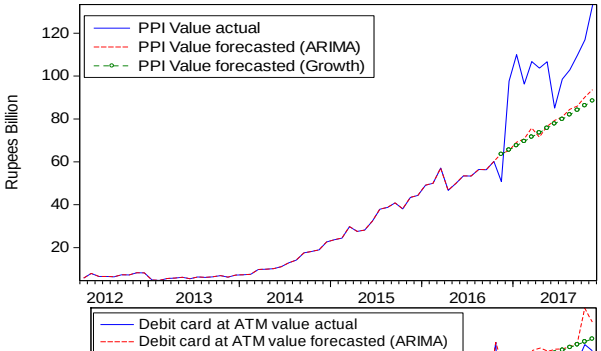


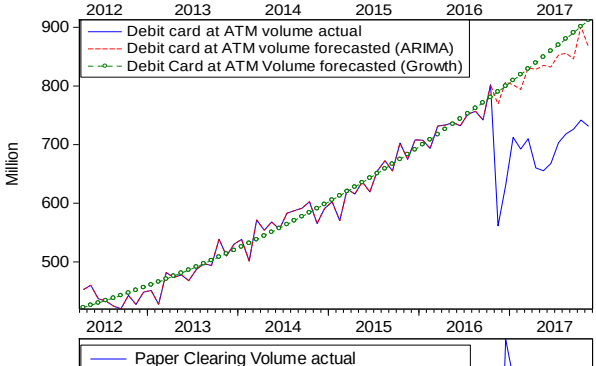


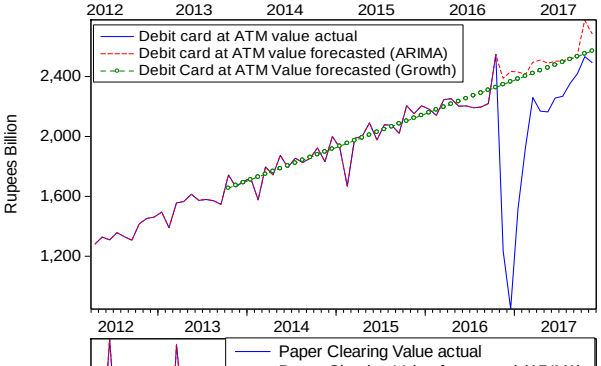


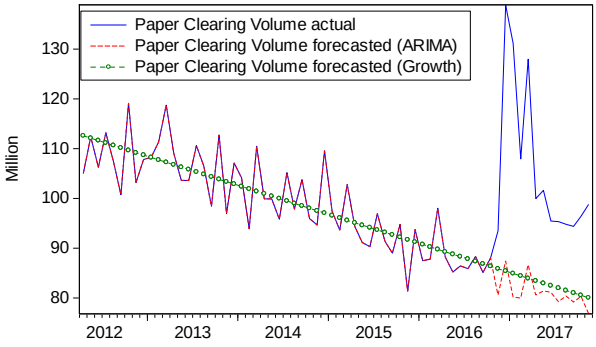


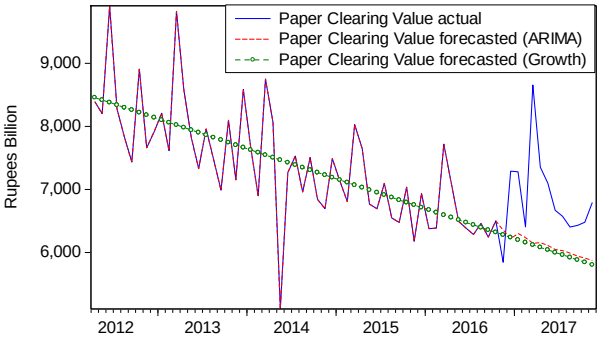


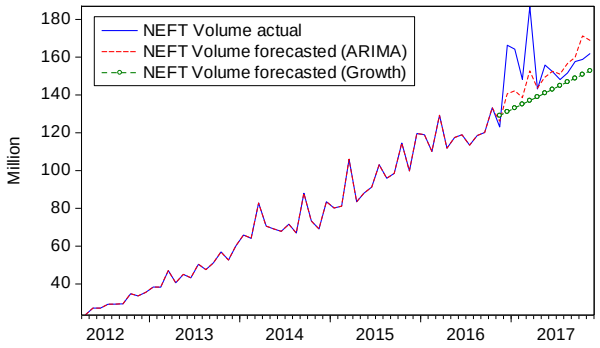


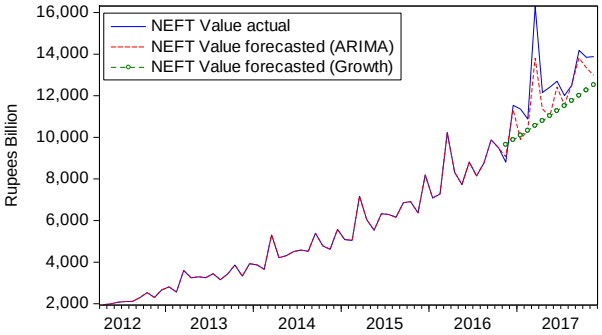


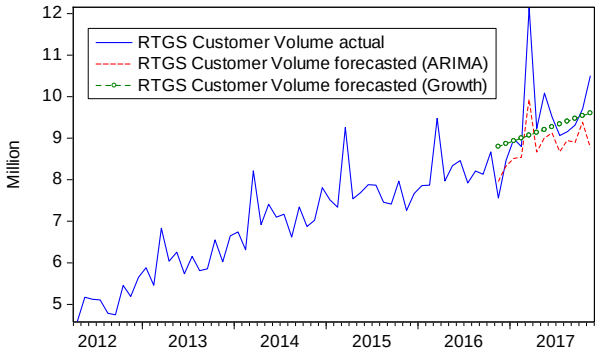


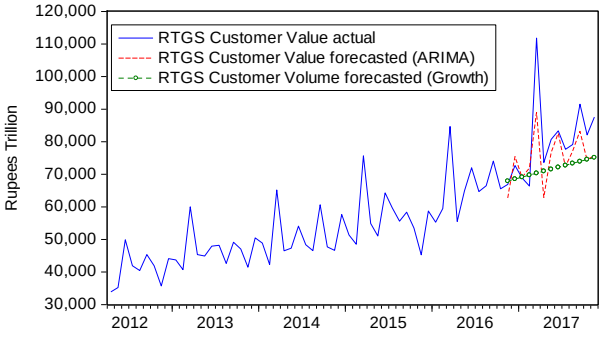


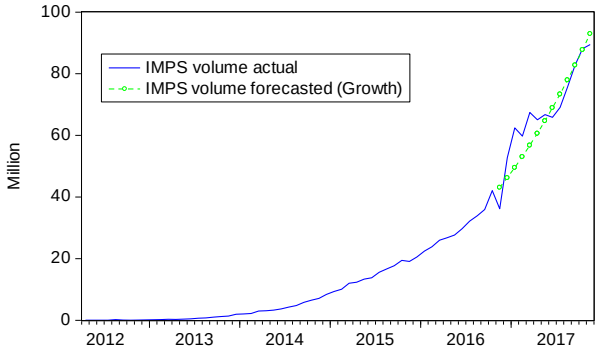


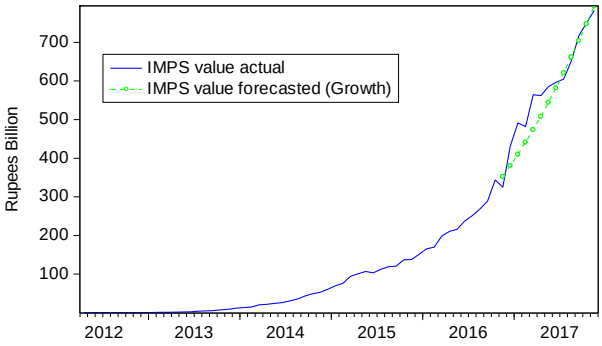

NEFT Volume actual
NEFT Volume forecasted (ARIMA)
NEFT Volume forecasted (Growth)
Million
180
160
140
120
100
80
60
40
2012
2013
2014
2015
2016
2017

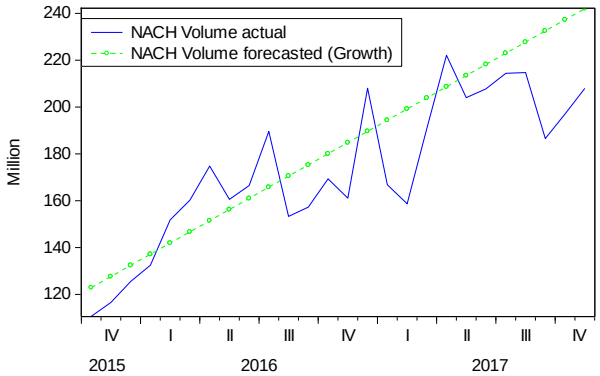

NEFT Value actual
NEFT Value forecasted (ARIMA)
NEFT Value forecasted (Growth)
Rupees Billion
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
2012
2013
2014
2015
2016
2017

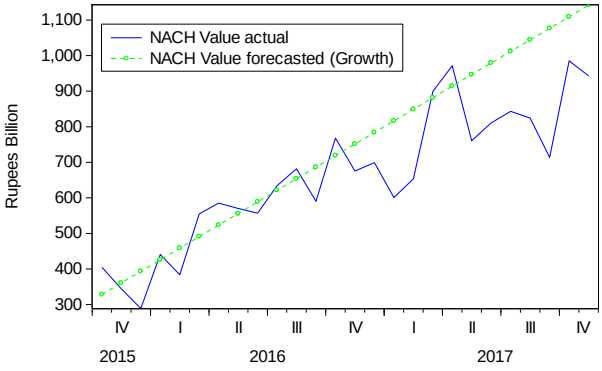

RTGS Customer Volume actual
RTGS Customer Volume forecasted (ARIMA)
RTGS Customer Volume forecasted (Growth)
Million
12
11
10
9
8
7
6
5
2012
2013
2014
2015
2016
2017

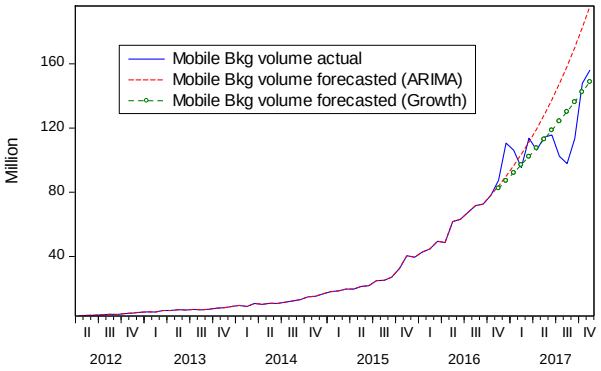

RTGS Customer Value actual
RTGS Customer Value forecasted (ARIMA)
RTGS Customer Volume forecasted (Growth)
Rupees Trillion
120,000
110,000
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
2012
2013
2014
2015
2016
2017

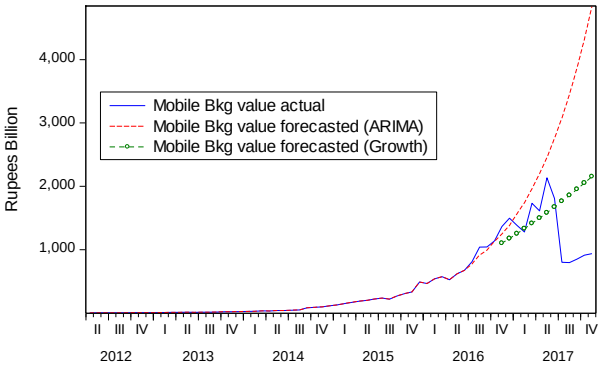

IMPS volume actual
IMPS volume forecasted (Growth)
Million
100
80
60
40
20
0
2012
2013
2014
2015
2016
2017


IMPS value actual
IMPS value forecasted (Growth)
Rupees Billion
700
600
500
400
300
200
100
2012
2013
2014
2015
2016
2017


NACH Volume actual
NACH Volume forecasted (Growth)
Million
240
220
200
180
160
140
120
IV
I
II
III
IV
I
II
III
IV
2015
2016
2017


NACH Value actual
NACH Value forecasted (Growth)
Rupees Billion
1,100
1,000
900
800
700
600
500
400
300
IV
I
II
III
IV
I
II
III
IV
2015
2016
2017


Mobile Bkg volume actual
Mobile Bkg volume forecasted (ARIMA)
Mobile Bkg volume forecasted (Growth)
Million
160
120
80
40
2012
2013
2014
2015
2016
2017


Mobile Bkg value actual
Mobile Bkg value forecasted (ARIMA)
Mobile Bkg value forecasted (Growth)
Rupees Billion
4,000
3,000
2,000
1,000
2012
2013
2014
2015
2016
2017

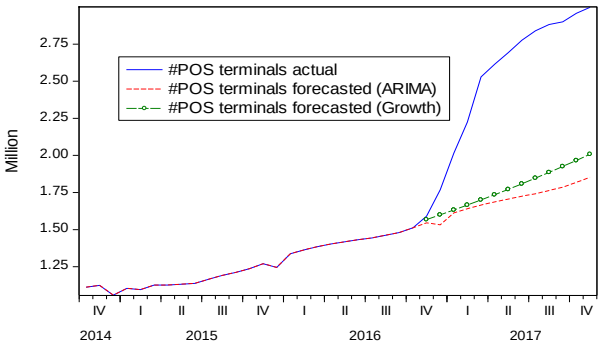

#POS terminals actual
#POS terminals forecasted (ARIMA)
#POS terminals forecasted (Growth)
Million
2.75
2.50
2.25
2.00
1.75
1.50
1.25
2014
2015
2016
2017

Table 3: Results of Unit Root Tests

	Credit card at POS		Debit card at POS		PPI		Debit card at ATM		Paper clearing		EFT/NEFT		RTGS (Customer)		IMPS		Mobile Banking		POS
	Dlog(Vol)	Dlog(Val)	Dlog(Vol)	Dlog(Val)	Dlog(Vol)	Dlog(Val)	Dlog(Vol)	Dlog(Val)	Vol	Val	Dlog(Vol)	Dlog(Val)	Dlog(Vol)	D(Val)	Dlog(Vol)	Dlog(Val)	Dlog(Vol)	Dlog(Val)	Dlog(count)
ADF test	-6.04	-8.14	-11.88	-9.14	-7.85	-11.55	-8.85	-9.14	-11.45	-7.14	-10.24	-6.16	-10.64	-7.26	-4.54	-6.69	-11.42	-10.20	-8.21
PP test	-19.08	-22.90	-16.10	-14.29	-9.28	-11.23	-16.20	-14.29	-4.70	-8.62	-17.99	-23.80	-18.83	-18.32	-18.47	-6.98	-11.32	-10.37	-8.18

Notes: (1) Sample: 2012M04- 2016M10,(2) Above test statistics are significant at 1% level.

Table 4: Details of ARIMA Models

	Credit card at POS		Debit card at POS		PPI		Debit card at ATM		Paper clearing		EFT/NEFT		RTGS (Customer)		Mobile Banking		POS
	Dlog(Vol)	Dlog(Val)	Dlog(Vol)	Dlog(Val)	Dlog(Vol)	Dlog(Val)	Dlog(Vol)	Dlog(Val)	Dlog(Vol)	Dlog(Val)	Dlog(Vol)	Dlog(Val)	Dlog(Vol)	D(Val)	Dlog(Vol)	Dlog(Val)	Dlog(count)
Constant	0.02 (4.95)***	0.02 (10.75)***	0.03 (3.00)***	0.03 (2.74)***	0.06 (3.93)***	0.03 (1.33)	0.01 (1.65)	0.01 (5.78)***	-0.01 (-2.49**	-0.01 (-0.84)	0.03 (3.95)***	0.03 (5.20)***	0.01 (2.33)**	637.22 (1.02)	0.06 (9.22)***	0.11 (11.13)***	0.01 (1.80)
AR(1)	-0.56 (-4.65)***		-0.21 (-2.12)**	-0.42 (-2.47)**	-0.82 (-3.98)***	-0.25 (-2.17)**	-0.20 (-2.32)**		-0.87 (-6.89)***	-0.68 (-3.38)***		-0.10 (-1.70)*		-0.44 (-4.61)***	-0.41 (-3.67)***	-0.30 (-1.77)*	
AR(2)	-0.31 (-3.24)***			-0.25 (-1.73)*	-0.46 (-4.31)**				-0.38 (-3.68)***	-0.57 (-6.49)***				-0.26 (-2.83)***			
AR(4)																-0.31 (-3.19)***	
AR(10)									-0.27 (-2.87)***								
AR(11)									-0.52 (-4.95)***								
AR(12)	0.51 (6.21)***	0.71 (7.82)***	0.64 (8.08)***	0.52 (4.36)***		0.34 (2.97)***	0.74 (9.86)***	0.59 (7.31)***			0.52 (4.63)***	0.84 (11.65)***	0.80 (13.02)***	0.64 (7.89)***			0.67 (3.45)***
MA(1)		-0.88 (-8.86)***			0.62 (2.44)**			-0.80 (-9.17)***			-0.60 (-5.03)***	-0.68 (-5.36)***	-0.76 (-7.18)***				
R^2	0.73	0.76	0.54	0.57	0.15	0.15	0.74	0.64	0.72	0.45	0.58	0.86	0.79	0.83	0.17	0.20	0.44
F-stat	33.90***	52.42***	20.00***	16.39***	3.42**	2.97**	49.29***	30.69***	25.00***	14.19***	23.28***	75.13***	65.68***	61.54***	5.38***	4.21***	8.56***
DW	2.28	2.05	2.06	2.17	1.91	1.66	2.04	1.80	2.11	2.10	2.20	1.81	1.93	2.20	1.92	2.03	1.99
Correlogram of residuals	Insignificant except lag 4	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant except lag 3	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant
Correlogram of Squared residuals	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant except lag 4	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant	Insignificant

Notes: (1) Sample: 2012M04 - 2016M10 [For last column i.e. POS: 2014M10 2016M10], (2) Figures in brackets represent t-statistic
*(3) Significance level [***/**/* significant at 1%/5%/ 10% level], (4) AR or MA roots of all the equations lie within unit circle.(5) Models are fitted using Eviews®.*