

A Canvas of Data & Indian Card Industry

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Abstract

Indian card industry has gone through several interesting changes in the recent past. We wanted to explore this fascinating world both from card issuing and merchant acquiring perspective within our chosen study period of around 6 years - from Q2, 2011 to Q4, 2016. However rather than hunting the data to prove any pre-defined notion we wanted to listen to the data to capture the story it wants to tell us. We took a canvas of raw primary data from a no. of sources ranging from Reserve Bank of India to World Bank, from Ministry of Finance to Ministry of Statistics & Implementation (of Govt. of India) and a no. of other sources like Yahoo Finance, Index Mundi data portal. As a choice of tool we have used R (an open source software) and Excel for our study. In order to uncover the underlying story behind the data we have used an array of techniques ranging from descriptive trend chart, heat map, multidimensional bubble plot, outlier chart to advanced data analytics techniques like clustering using machine learning algorithm. We also uncovered the correlations of card industry parameters with other economic and social indicators and went ahead in building optimum casual predictive model as well as time series forecasting model.

Keywords: analytics, card industry, demonetization, digital payment, economy, financial inclusion, India, merchant acquiring

1. Journey through the Lanes of History

1.1 Used Methodology

We traced out the entire path of our chosen study period of around 6 years (from Q2, 2011 to Q4, 2016) and tried to explore the trends as well as underlying events. Our findings in this section are mostly presented in form of descriptive charts and heat maps. Primary data source for this entire section is Reserve Bank of India unless otherwise specified.

1.2 Tracing the Heat of the Industry

We have taken a quick peek at the card industry by tracing the following heat maps. The maps were constructed based on quarter to quarter change percentage data (2012-2016) of two important card industry indicators Total Transaction Count and Average no. of Cards in circulation. As it has come out from the graphs that there are certain specific periods where the industry has shown higher growth rate. As we move onto subsequent sections we will try to explore those periods in detail.

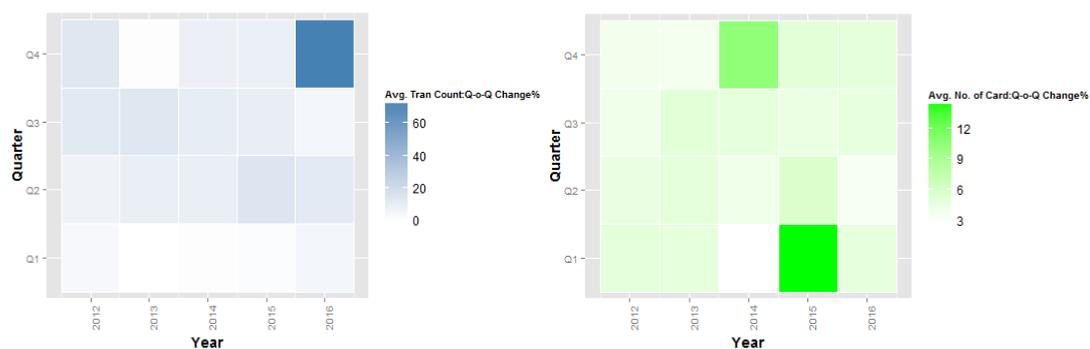


Figure 1. Heat map of Indian card industry

1.3 Deep Dive into Purchase Transaction – Tracing the Underlying Economic Event

Let us now take a closer look at how credit and debit cards performed within our study period in terms of purchase transactions done at Point of Sale (POS) terminals. As it evident, in terms of Quarterly Transaction count, Credit and Debit cards were running neck to neck until middle of 2012, from Q3 2012 the gap started widening and people started spending more using their Debit cards. We have also taken the difference of debit card transaction count and credit card transaction w.r.t. debit card transaction count at each quarter, further found out the change in those difference values Q-o-Q and plotted those in the secondary axis by. It helps us discover 3 distinct points in time in the past where we have seen the difference between the two widening further at a rapid pace.

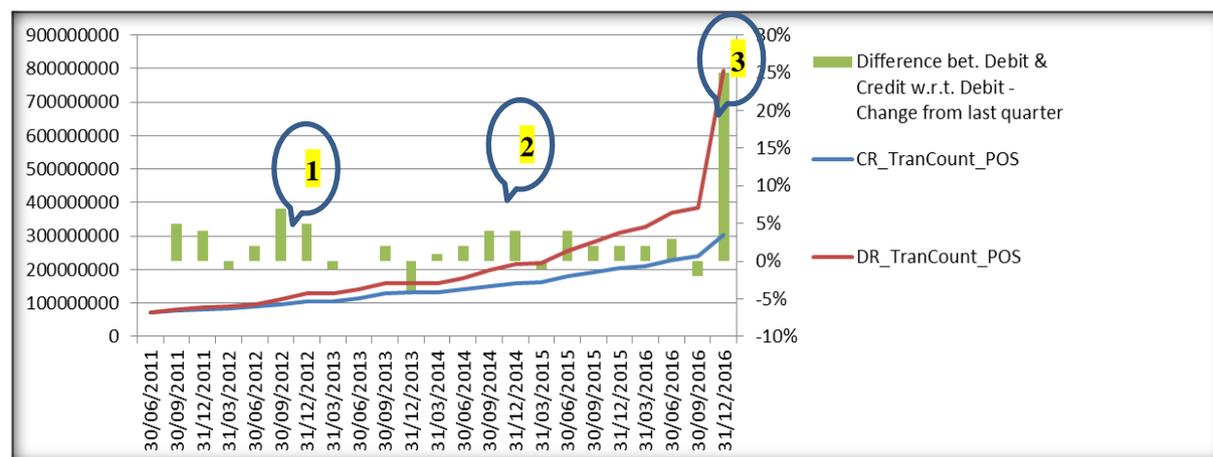


Figure 2. Quarterly card transaction count at POS

Recognizing underlying Economic Event: Now as we clearly identify the three distinct points let us also try to correlate any major economic event that could be held responsible for the same:

- ❖ **Launch of Rupay Debit Card (Q3-Q4, 2012):** The difference (debit VS credit) suddenly doubled from 7% to 14% within a single quarter in Q3, 2012 and witnessed a further 5% hike in the next quarter. This could be attributed to the launch of Rupay Debit Card by NPCI (National Payment Corporation of India) on 26th March, 2012. RuPay card scheme was set up by NPCI (National Payments Corporation of India) which was conceived by Indian Banks Association and has the approval of Reserve Bank of India. With strong backing of Govt. of India and Indian Issuers (both public and private banks), Rupay Debit card was able to increase its base quickly. In fact launch of this domestic card scheme has many fold impact in the overall industry. Rupay not only facilitated lower transaction cost but at the same time it enabled a lot of rural, co-operative banks to have their own card (due to leaner regulation and lower fees in comparison to the global card schemes like Visa, MasterCard). Thus it came up as an important tool in spreading card usage among the mass population.
- ❖ **Inauguration of PMJDY Scheme (Q3-Q4, 2014):** The difference (debit VS credit) continued to vary within 19 - 20% for almost next 2 years which is a mere change of only 5% in 2 years. The next major change is seen Q3-Q4, 2014 when within 2 quarters it grew further from 19% to 27% (a difference of 7% in 2 quarters) followed by another 4% hike in Q2, 2015. This is correlated to the launch of PMJDY scheme (Pradhan Mantri Jan-Dhan Yojana/Prime Minister's People Money Scheme) on 28th August 2014 which was aimed to open bank accounts of poor people and spread financial inclusion. The scheme set a Guinness World Record by opening 18 Million accounts in its first week of launch. The scheme has so far been a major success opening around 281.7 million accounts along with a circulation of around 219.9 million Rupay Debit Cards as on March 29, 2017 (Source: Ministry of Finance, Govt. of India).
- ❖ **Impact of Demonetization (Q4, 2016):** The last major change (debit VS credit) is seen on Q4 2016 where the difference grew by 25% in a single quarter taking it to a staggering 62% lead of Debit card over credit card transactions. This is none other than much talked of Demonetization (banning of Rs.500 & Rs.1000 currency notes by Govt. of India) which has set Indian Card Industry on fire. Both Credit and Debit card transactions displayed sharpest spikes of 25.5% and 105.96% Q-o-Q respectively in Q4, 2016 within our

study period. In fact card transactions as a whole, as well depicted the sharpest Q-o-Q spike (74.95%) in the same quarter. During demonetization major root causes which drove the rise are explained below:

- **Less Cash:** People living with less cash and started using their cards to meet purchase requirements and merchants too were forced to get POS terminals to sustain business. Thus creating an environment for more card usage.
- **Government measures:** Various Government moves encouraged people to use their plastic currency rather than hard cash. Starting from constant awareness building advertising to various measures like cashback at petrol pump for online purchase, waiver of surcharge by IRCTC for online purchase (The Indian Railway Catering & Tourism Corporation, a subsidiary of the Indian Railways that handles online bookings) etc. acted as a catalyst.
- **Waiver of MDR for Debit Card:** One major factor that worked specifically in favour of Debit card was waiver of MDR (Merchant Discount Rate) for an interim period till 31st Dec, 2016. Cardholders may have even encouraged by merchants as well to pay by their debit cards for purchase making a win-win situation for both the parties. In fact Govt. of India continued their encouragement for Debit card usage even post that interim period by announcing a reduction in MDR cap for Debit cards – it will be capped at 0.25% for transactions up to Rs. 1,000 and 0.5% between Rs. 1,000-2,000 VS previous MDR cap of 0.75% for transactions up to Rs. 2,000 (beyond Rs. 2,000 MDR cap remains unchanged at 1%).
- **Role of Banks:** Undoubtedly the banks worked hand in hand with the govt. in sustaining such a dramatic rise. One should not undermine the impact within banks infrastructure both hardware and software in handling such sudden increase in transaction volume. In fact at times people have witnessed banks' network unable to respond to authorization request during peak periods. Despite initial hiccups the situation was handled pretty well. In fact Banks did a wonderful job in giving new POS terminals to a lot of merchants within very short span of time. At the same time they also made constant campaigns to encourage card usage and increase their POS base.

1.4 Cards in Circulation – The Stage Was Already Set

One extremely important incident already happened at the backend which we haven't discussed so far – Debit cards in circulation were already way ahead of credit card in circulation (refer graph below) - almost around 2590% higher w.r.t. to Credit card count). Understandably a steeper spike in Debit Card Transaction count was anyway expected in contrast to Credit Card during demonetization as when forced to use cards people used the card most which they already had in their hands.

However at the back end as it appears that the stage was already set by the Government – a lot of people were given plastic cards almost 2 years back through PMJDY scheme. Analysis reveals that the sharpest Q-o-Q rise in no. of debit cards within our study period were seen in two immediate quarters, post launch of PMJDY scheme on 28th August, 2014. While during entire period the Q-o-Q rise was arrested within 3% – 6%, Q4, 2015 and Q1, 2015 have seen Q-o-Q rise of 10.78% and 14.81% respectively. As on March 1st, 2017 a whopping 586 banks of India issues Rupay Debit cards in the country enabling millions of Indians to use plastic. This simple statistics explains a lot of no.s that comes up in the table including the fact that in our study period while the growth in Credit card number is 57.17% while the growth in Debit card number is 218.55%.

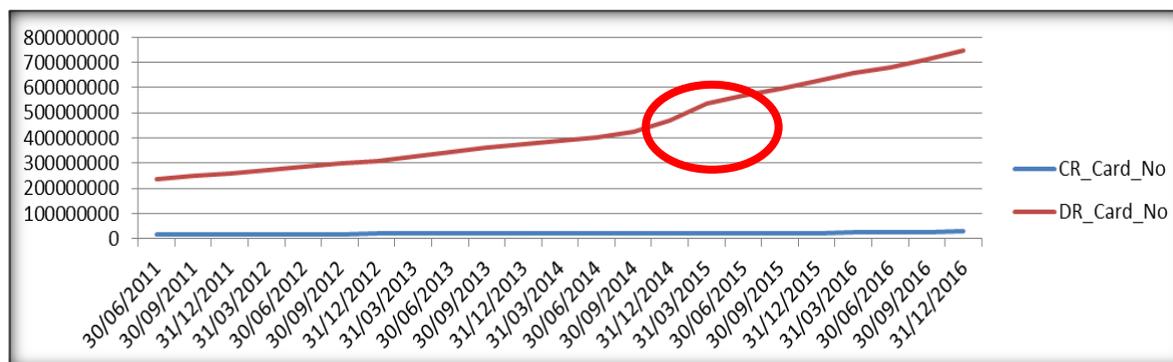


Figure 3. Quarterly average No. of cards in circulation

1.5 Debit vs Credit Card with Respect to Transaction Volume – Turning the Table

Despite having such dominance in terms of Transaction Count or No. of cards in circulation, Debit card transaction volume had always been lagging behind Credit card transaction volume (refer graph below) until Demonetization hit the economy. In Q4, 2016 both Credit (17.99%) and Debit (118.21%) cards have displayed their sharpest Q-o-Q transaction volume spikes and riding on huge transaction count difference (around 62% - in comparison to 37% of previous quarter) w.r.t. credit card, debit card transaction volume surpassed credit card transaction volume in Q4, 2016 for the first time within our study period.

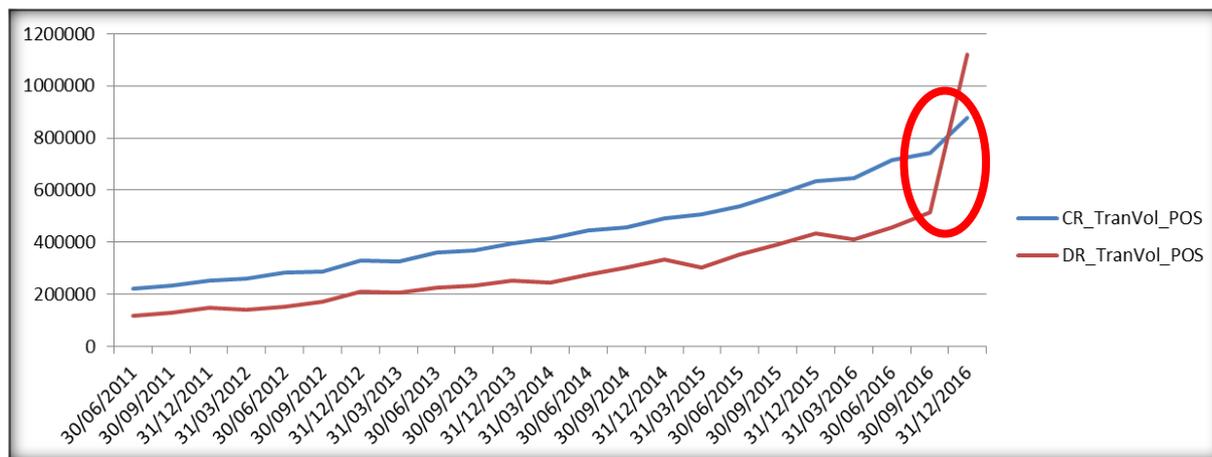


Figure 4. Quarterly transaction volume of card at POS (in Rs. Million)

1.6 Insights from Avg. Ticket Size – Is Credit Card Only for the Affluent?

This in fact in turn also indicates that average ticket size (Transaction Volume/ Transaction Count) for Debit card should be considerably lower than Credit Card. Analysis of data reveals that the mean value of average ticket size for credit card is more than double to that of debit card. In fact another very interesting insight that comes up is despite changes in economic conditions for both cases the distributions display low standard deviation around mean.

Table 1. Mean & standard deviation of average ticket size

	Credit Avg. Ticket Size (Rs.)	Debit Avg. Ticket Size (Rs.)
Mean	3060.04	1500.7
Standard Deviation	87.23	127.23

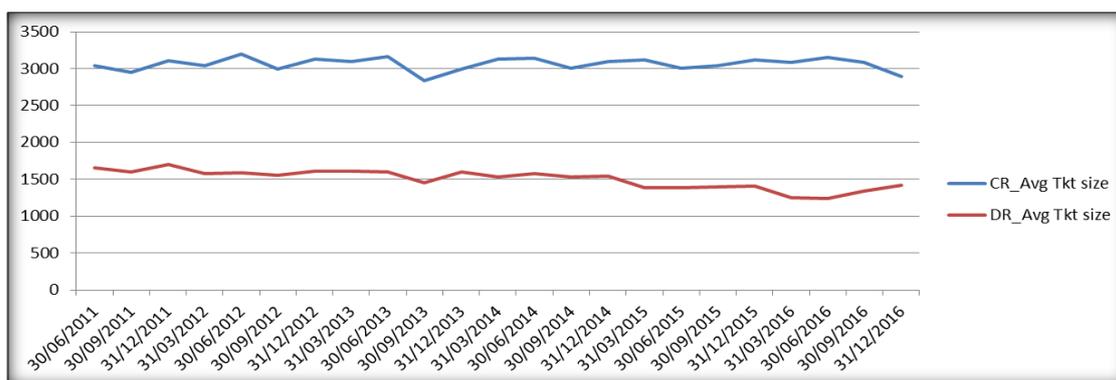


Figure 5. Quarterly average ticket size at POS (in Rs.)

This also gives us a good indication that credit card possibly has always been more penetrated into the affluent section of the society who can afford to have high ticket size. Credit card issuers are always looking forward to

increase their card base but possibly don't want to extend it to other bigger part of society and attract potential bad debt by providing unsecured loans to them in terms of credit card.

The industry possibly would need to re-consider the stance and extend credit card (with lower available balance) to those as well who are having decent past track of maintaining steady balance in their savings account / decent track record of spending using their debit card and at the same time relaxing some of its credit & risk evaluation criteria and adding different evaluation criteria. From an ongoing risk monitoring perspective as well banks may need to devise its strategies very carefully for those customers.

Rupay credit card – The next game changer?: Possibly the time is just ripe for launch of Rupay credit card (was expected to be launched in 2016) which can become very useful to target this section of the society (just like its Debit counterpart). This can very well act as next game changer in the industry.

1.7 Average Card Utilization – Still Debit Would Need More Encouragement

Another very interesting insight comes up when we look at Average No. of Card transaction per card or Average Card Spend per card (depicted in below graphs) for Credit & Debit cards at POS terminals. Trend indicates that possibly more encouragement / awareness/ campaign is still needed on debit card and it has potential of growth.

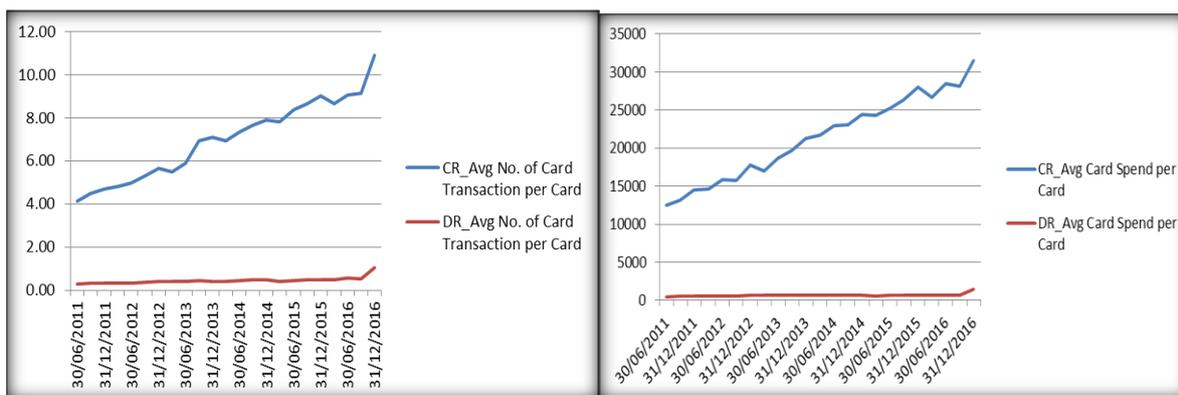


Figure 6. Quarterly avg. card transaction & card spend (in Rs.) at POS per card

1.8 Usage of Cards at the ATM

The Debit card transaction count or amount in ATM has shown a gradual growth trend within our study period which is mostly attributed to increase in no. of debit card keeping in mind the fact that there are restrictions imposed by RBI in India on free usage of debit card in ATM. A surprising observation is that there was a huge decline in both debit card transaction count and volume at ATM in Q4, 2016 during Demonetization period though large queues were seen outside the ATMs in the same period which can be attributed to lower cash withdrawal limit (than branch) and non-availability of cash at ATM. On the other hand Credit card transactions performed at ATM are categorized as Cash Advance transactions which always attract fees and hence are not practiced much and contributes to less than 1% of total no. of ATM transactions.

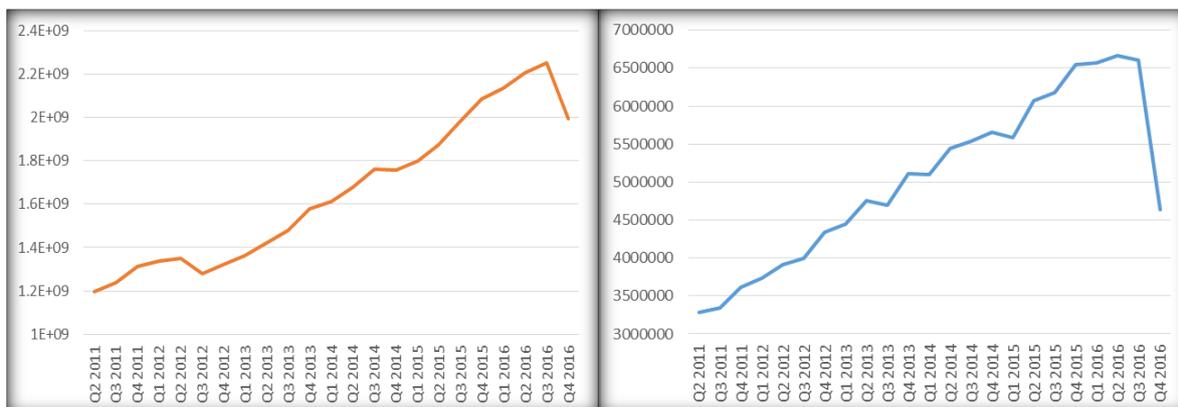


Figure 7. Quarterly transaction count (left) and volume (right, in million rs.) of debit cards at ATM

We have also taken a quick look at the no. of active bank ATMs (excluding ATMs owned by co-operative banks and sub-members banks as designated by NPCI) which is an essential pre-requisite for performing transactions at the ATM. The trend line for no. of active bank owned ATM tells us about a gradual growth for most part of our study period along with a peak in Q1, 2014 when it grew by 10.68% over its previous quarter which can be attributed largely due to nationalised banks. We can also observe a sluggishness since 2015 with a quarterly growth rate of 1-2%. This sluggishness could be lack of interest on the side of the banks which can be attributed to growing cost of ATM deployment and maintenance incurred by the banks. However keeping in mind low ATM penetration (which is again less dense in semi-urban and rural region) RBI allowed setting up third party white label ATMs. As on Feb, 2017 there are 8 licensed white label ATM providers in India with 13,900 ATMs (source: NPCI) - 58.6% of it are owned by Tata Communications Payment Solutions Ltd.

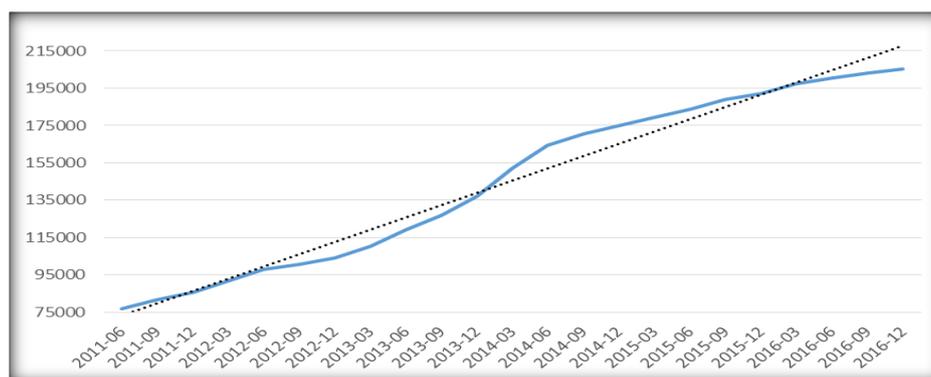


Figure 8. Quarterly average count of active bank ATM

1.9 The Acquiring Sector in Terms of POS Count – It's a Gradual Rise

The count of POS devices in India (which is a representative of spread of acquiring market) has shown an overall growth of around 146.58% within our study period. The growth pattern is also mostly linear across the tenure barring a couple of minor drops and spikes. Effect of Demonetization in Q4, 2016 is also pronounced in form of a visible spike in the graph.

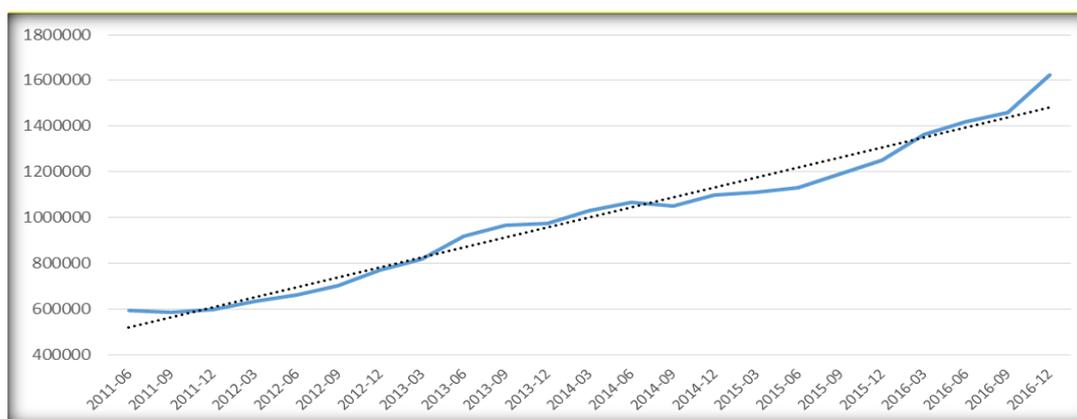


Figure 9. Quarterly average count of active POS

2. Public vis-a-vis Private Banks

2.1 Used Methodology

Banks in India are classified into Public (where more than 50% stake held by Indian Govt.) and Private based on their ownership structure. Post-independence in 1947, there were a series of moves by the Govt. to nationalize the banks following which by 1990s the public sector banks had 90 per cent share in the country's banking business (source RBI). In present day, as far as the number of banks engaged in Issuing/ Acquiring business is concerned the Public banks have an upper hand covering around 56% of the total no of banks. However, we have performed a detailed study in this field utilizing descriptive techniques (mostly trend line and multi-dimensional

bubble chart) to understand in terms of transaction count and other parameters which group is having an upper hand in the Indian card industry and if there is any change in the trend within our study period. Primary data source for this entire section is Reserve Bank of India unless otherwise specified.

2.2 The Credit World – Private Banks Have an Upper Hand

In terms of no. of credit card in circulation – it is pretty much one sided game as far as the private players are concerned. The public banks’ card base is roughly one fourth of the private players. Even though the public payers have shown a steady growth throughout and in many occasions outperformed the growth of the private banks, however the sheer lack of card base has made sure they did not pose any major challenge to the other party. In line with our previous observation the below graph also make a clear indication that in terms of card transaction count (trend line on transaction volume also presents similar picture) private banks are not only leading but at the same time increasing their lead. Some of the reasons that are behind having larger card base / transaction share by the private banks are:

- ✓ Better advertisement and aggressive campaigning to create product awareness
- ✓ Lucrative offers on card usage in terms of loyalty, cash back and other benefits
- ✓ Use of innovative payment technologies to attract more attention
- ✓ Hassle free application processing

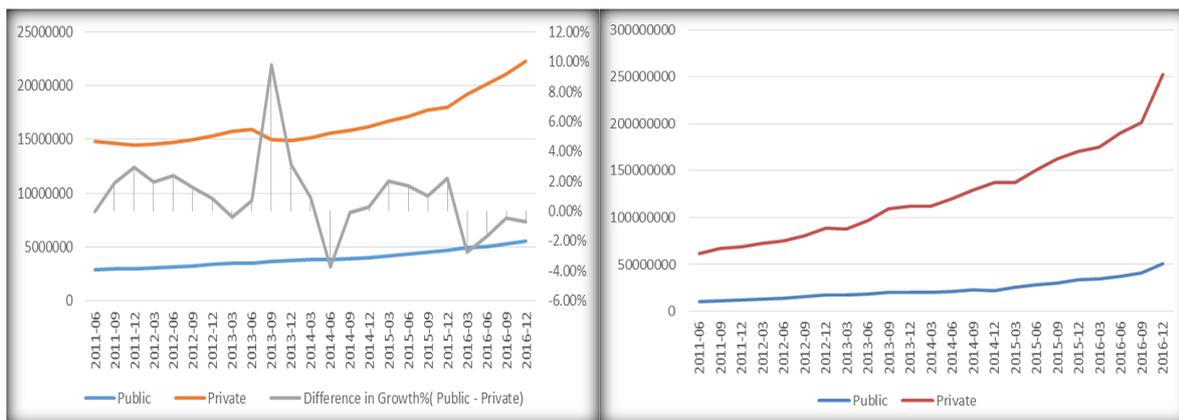


Figure 10. Quarterly avg. credit card in circulation count (left) & quarterly credit card transaction count (right) @ POS

However, the average ticket size for public and private banks does NOT follow the pattern of overall transaction count (/volume). Even though the average ticket size for private banks is higher than the public banks, the gradual decrease in their difference shows that public banks are catching up the private players in terms of the average consumer spending – probably an indication that they are able to increase their card base in high income group population successfully during this period.

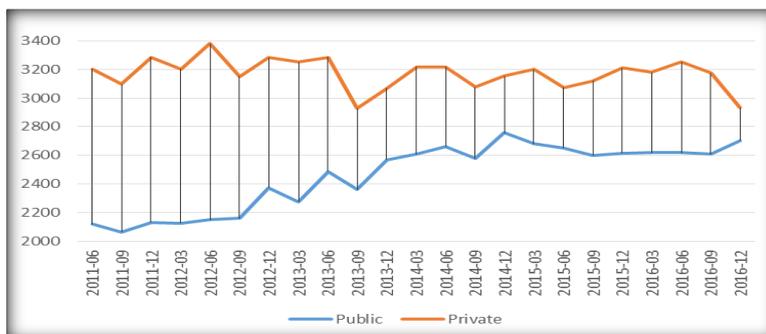


Figure 11. Quarterly average credit card ticket size at POS

2.3 Debit Cards – An Interesting Contrasting Picture

The debit card count distribution presents an exact opposite scenario with respect to the credit cards. The public banks by its sheer virtue of extensive semi-urban and rural reach has huge number of debit cards in circulation, which in most of the cases comes in as a complement to the bank accounts and is largely used in ATM for cash withdrawal. The growth in public banks have been on a higher note from the beginning and the gap is widening throughout the entire tenure. Barring a few cases, the public banks have shown higher growth percentage than the private banks including the period of PMJDY scheme launch. As on Q4, 2016, the private banks are still lagging with only 18.78% of total debit cards in circulation.

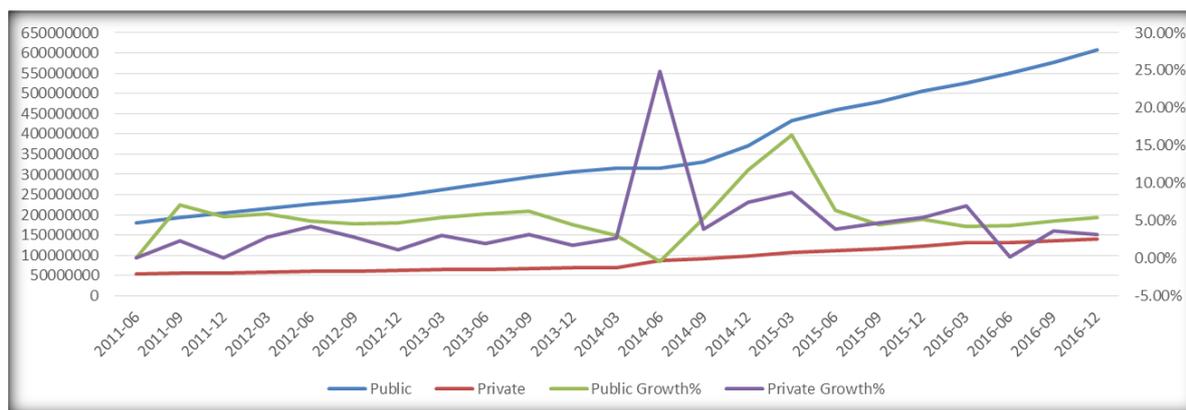


Figure 12. Quarterly average debit card in circulation count

Unlike cards in circulation (where public banks were ahead by a distant margin), in terms of debit card usage at POS (both count and volume) the competition is neck to neck – evidently hinting cards of public banks are not widely used at POS. Private players were doing a bit better with respect to the volume till Q3, 2016, however, the major trend breaker for this is Demonetisation. In Q4, 2016, even though the private banks grew by 81.82% on transaction count and 85% in volume, the public banks outperformed them with a staggering growth of 129.52% on count and 155.23% on volume, thereby surpassing the private banks in both count and volume. However the thin dominance of public banks in this space is mostly basis there superior card base which helped them out in the last quarter and we would really need to see in future if they can maintain the lead.

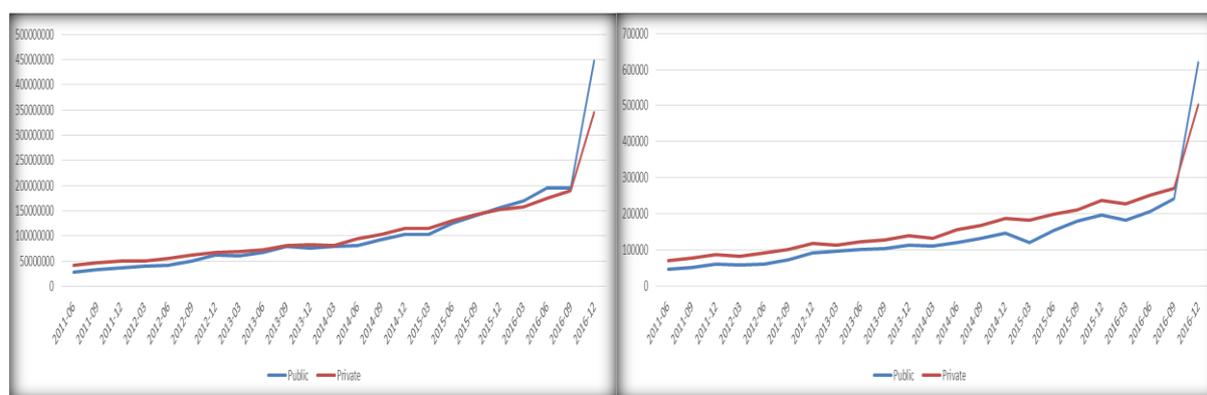


Figure 13. Quarterly debit card transaction count (left) and transaction volume (right, in million Rs.) at POS

The quarterly avg. ticket size at POS hints towards higher penetration of public banks into non-affluent section of the society who needs more encouragement/ awareness for using debit card at POS terminals. Though the public banks displayed upward trend during demonetization but still a long way to go.

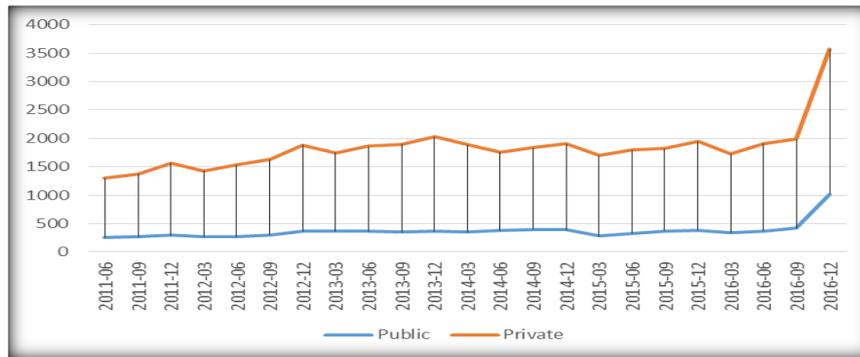


Figure 14. Quarterly average ticket size at POS

In terms of Debit card transactions performed in ATM, public banks lead by huge margin over its peer which is mainly attributed to possession of higher card base by the public banks.

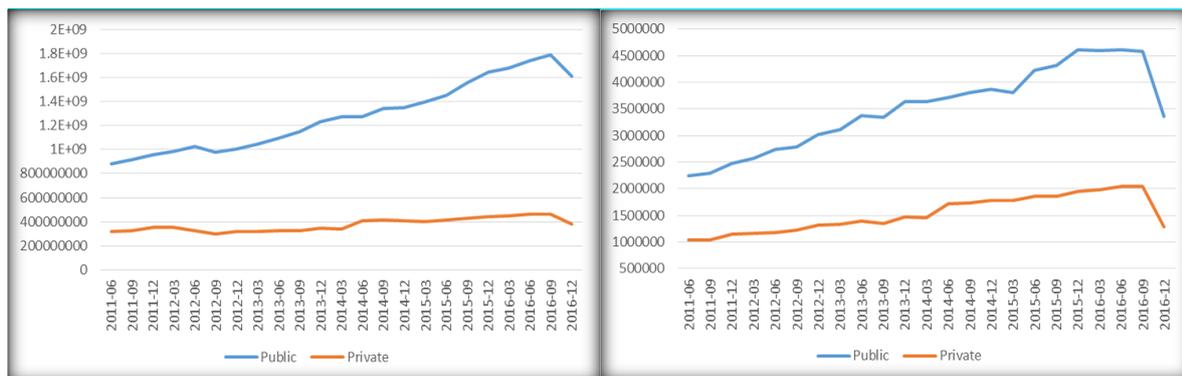


Figure 15. Quarterly debit card transaction count (left) & transaction volume (right, in million Rs.) at ATM

2.4 Merchant Acquiring Space – The Gap Is Bridging

In the acquiring sector (in terms of no. of POS terminals), the Private Banks had a lion’s share in 2011 and still continuing its dominance by holding around 60% of the market. However, the growth percentage of the public banks during our study period stands at a staggering 1097.38% with respect to the private bank’s growth of 78.72% and we see the gap is bridging between the two. But at the same time while taking a further deeper dive we realized SBI – the big guy is actually behind bridging the gap.

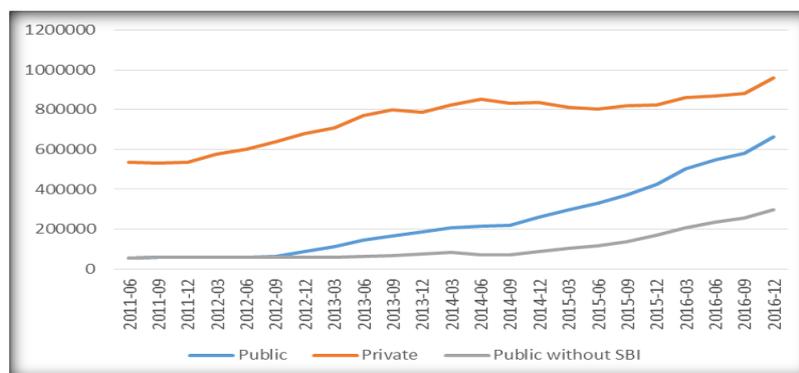


Figure 16. Quarterly average POS count in circulation

2.5 A Comparative Glance at the Top Public & Private Banks

We would also like to present following bubble chart (capturing 5 different dimensions) to give an impression on

how top 5 public & private banks (w.r.t. no. of card of 2016) were positioned in market during last 5 years. As it appears within our large grouping taken as Public and Private bank and within Top10 range, there are few banks who appear to have done considerably better than the peers. This hints us possible presence of outperformers/outliers in the data.

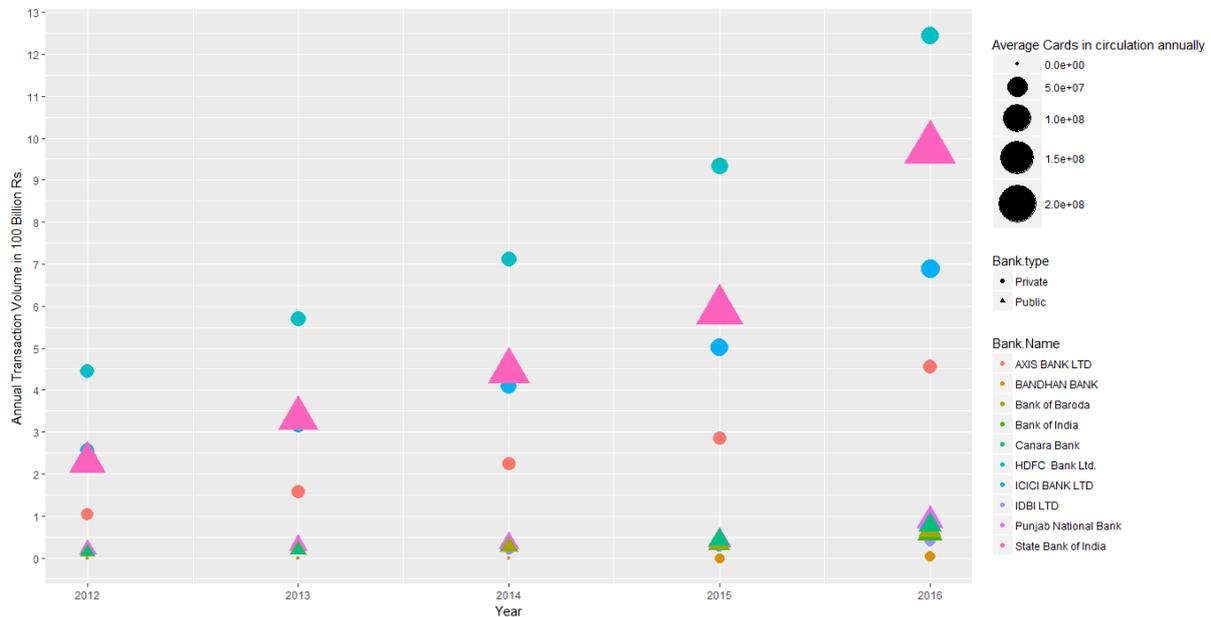


Figure 17. Comparative bubble plot of top 5 public & top 5 private banks

3. Finding the Outperformers

3.1 Used Methodology

Outlier analysis was performed to find the outperforming banks in 4 different dimensions (Quarterly card transaction Count, Quarterly Card Transaction Volume, Quarterly avg. Card Count, Quarterly avg. POS Count) at 4 definite points within our study period (primary data source for all being Reserve Bank of India). While we looked at the quarterly values at the start (Q2, 2011) and at the end (Q4, 2016), we also looked at two additional points in the past (Q4, 2012 and Q4, 2014) which were adjacent to two game changing events (launch of Rupay Debit card and PMJDY scheme). Outperforming banks are shown as the points which stood outside the boundary drawn at $Q3 + 1.5 * IQR$ (where $Q3$ is 3rd quartile, and IQR is the difference of 3rd Quartile and 1st Quartile).

3.2 Spend at POS

Analysis of Quarterly Card Transaction Count at POS and Quarterly Card Transaction Volume at POS (taken in unit of 10,000 Rs.) reveal similar pictures and below are some interesting insights that came up:

- Five banks - HDFC, ICICI, SBI (State Bank of India), Citi and Axis - continue to remain as Outliers throughout the period.
- Stan Chart (Standard Chartered Bank) and HSBC lost their status as outlier over the period.
- HDFC appears as market leader in both the segment in first 3 quarter (that we have taken for consideration) but lost its crown to SBI in the last quarter.
- Composition of the outliers suggest that in both these segments most of the dominant players are non-government banks and barring SBI none of the government banks appear in the list.
- The gap between the Outliers and the rest of the performers widened to a great extent during this period.

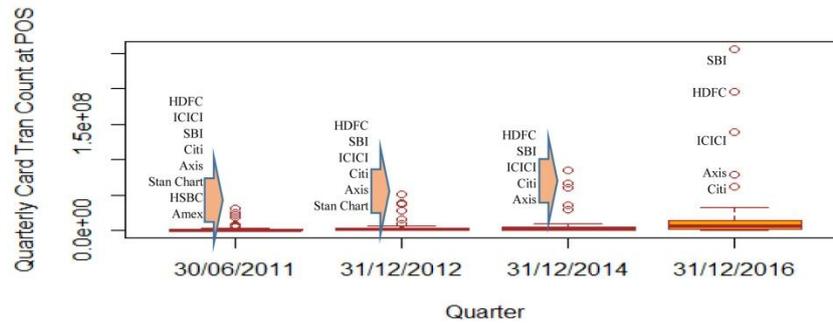


Figure 18. Outlier plot based on quarterly card transaction count at POS

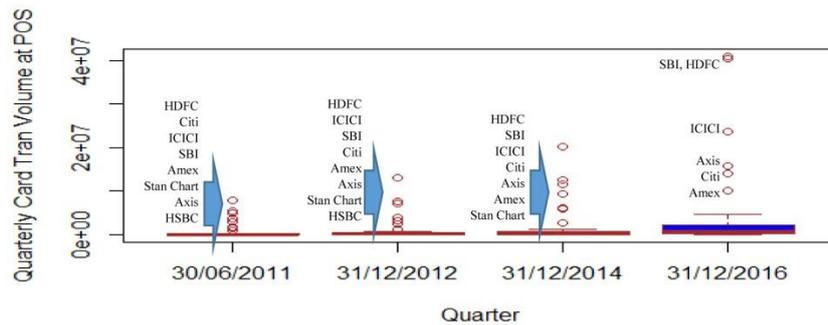


Figure 19. Outlier plot based on quarterly card transaction volume at POS

3.3 Cards in Circulation

Similar Outlier Analysis performed on Quarterly Avg. Card Count gives us below findings:

- ❖ There are 3 banks SBI, Punjab National Bank and ICICI who maintained their outlier status in all 4 quarters.
- ❖ SBI appears to be not only the undoubted leader in this segment but at the same time it always stayed much ahead from rest of the population, while other outliers remain comparatively closer to the other performers throughout the period.
- ❖ Government banks did pretty well here, while in 2011 only 2 (SBI and PNB – Punjab National Bank) out of 5 outliers were Govt. banks, while in 2016 Bank of India and Bank of Baroda joined the elite Outlier club taking the total count to 4 (out of 5) in the list of outliers. This possibly hints us towards more participation of Govt. Banks towards card issuance and in turn enabling financial inclusion.

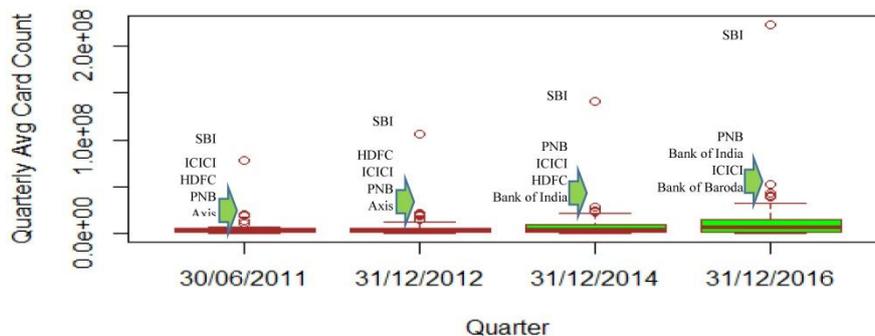


Figure 20. Outlier plot based on quarterly average no. of card in circulation

3.4 POS Terminal Count:

In Merchant Acquiring space (in terms of POS count) we came across below findings:

- ✓ Three banks – HDFC, ICICI and Axis maintained their outlier status in all 4 quarters and this segment appear to be highly dominated by non-govt. banks.

- ✓ An amazing success story of SBI should be noted here. SBI, who didn't appear in the outlier list of first 2 quarters, occupied the top spot in this segment in Jan 2016 and more over continued to increase its lead steadily over its closest competitor. Corporation bank too stormed into the club in Q4,2016.

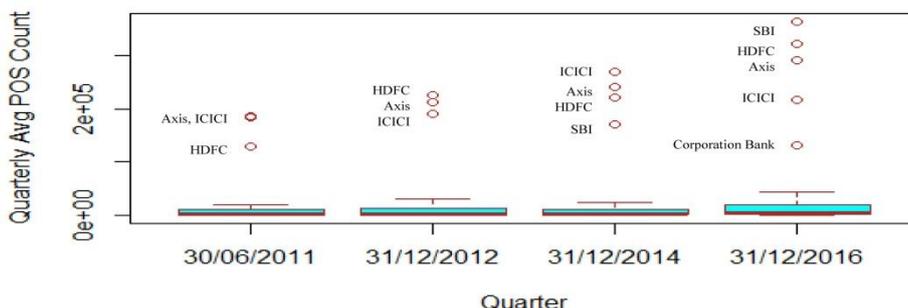


Figure 21. Outlier plot based on quarterly average no. of active POS

4. Clustering the Issuers and Acquirers

4.1 Used Methodology

Most of the Issuers and Acquirers have seen large variations in their business during our study period. Data analysis was performed at the beginning (Q2, 2011) and at the end (Q4, 2016) to understand how they are clustered (primary data source for all being Reserve Bank of India). We have used K-means Clustering algorithm which falls in the family of Unsupervised Learning within Machine Learning domain to find out the clusters. To overcome the two major challenges of K-means clustering we have used the below techniques:

- **Challenge #1:** Being a greedy algorithm it has very high probability of getting stuck in local minima and thus can return different results as initialization happens at random.
- **Solution:** Best model was taken into consideration after building the model several times by having start position set at different random points.
- **Challenge # 2:** Finding the no. of Clusters.
- **Solution:** The optimum no. of cluster was chosen by seeing the recommendations coming out from a no. of indices like Hubert, Dindex etc. (all using “Euclidean” distance between the points)

4.2 Issuers in a 3 Dimensional Space

Issuers were clustered in a 3 dimensional space (No. of Card, POS Transaction Count and POS Transaction Volume) as shown below to get a holistic view of an Issuer’s performance. The 3 chosen attributes which represents 3 axis are extremely important parameters in judging a card issuers performance.

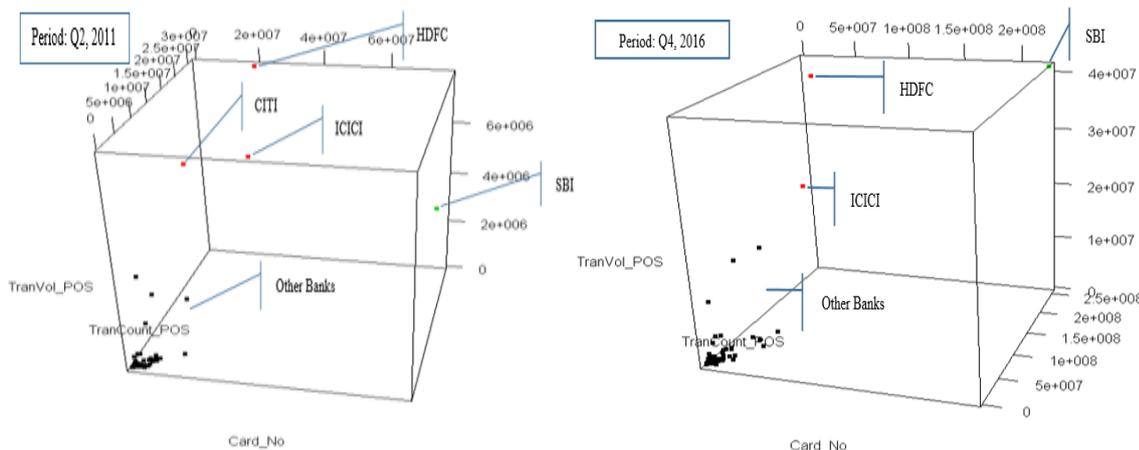


Figure 22. Clustering of issuers in a 3 dimensional space

Following are some inferences that can be drawn:

- In both periods it came out to be 3 cluster solution. However within 51 banks in Q2, 2011 and 55 banks in Q4, 2016 only 3 – 4 banks formed two separate high performing clusters indicating that the Indian Issuing space is largely led by those banks.
- SBI always forming a separate single cluster from rest of the banks, clearly depicting its phenomenal performance as an Issuer. In fact in terms of POS Transaction Count and POS Transaction Volume it was lagging behind few Issuers in Q2, 2011 but in Q4, 2016 it raced ahead further and in fact is sitting in the extreme edge of the space citing its ultimate dominance.
- HDFC and ICICI always clearly distinctive from the group of ‘Other Banks’ and forming a separate cluster indicating the private bank duo’s performance is somewhat similar.
- CITI Bank appeared in the same cluster as that of HDFC and ICICI in Q2, 2011 but in Q4, 2016 it slipped into the cluster of ‘Other Banks’.
- Within the cluster of ‘Other Banks’ few issuers that somewhat stayed ahead from their peers of the same cluster in one or more parameters are:

Q2, 2011: Axis, Standard Chartered, Amex, Punjab National Bank

Q4, 2016: Axis, Citi, Amex, Punjab National Bank, Bank of India, Bank of Baroda

4.3 Acquirers in Oligopoly Market

Acquirers were clustered in a single dimension (No. of POS) due to constraint in data availability for other two important parameters (like Acquirer specific count of volume of transaction performed at POS terminal) as shown in below figure.

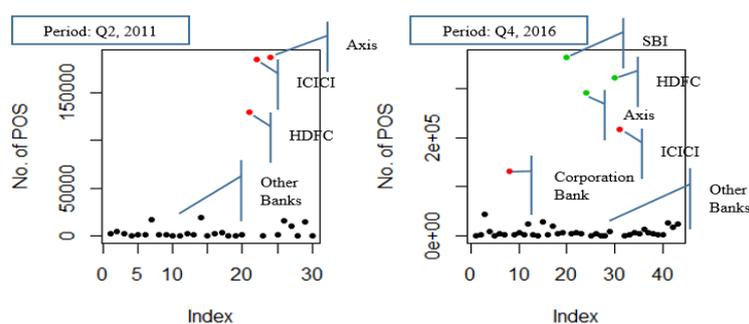


Figure 23. Clustering of acquirers

Below are some interesting insights that came up:

- ✓ **Oligopoly Market Characteristics:** Among 30 acquirers in Q2, 2011 the optimum no. of clusters came out to be 2 while among 43 acquirers in Q4, 2016 it came out as a 3 cluster solution. However the cluster size of top most performing cluster remained same at 3 and there is formation of a 2nd best performing cluster with cluster size of only 2. Moreover few players (total - 3) of the best performing cluster in Q2, 2011 occupied 83.15% market share and in Q4, 2016, the best and the 2nd best performing cluster members (total - 5) together occupied 81.67% market share. This clearly indicates Indian Acquiring market purely exhibits oligopoly characteristics with an inherent dominance of few players who is controlling more than 80% of the market share.
- ✓ HDFC and Axis always appeared in highest performing cluster in both the periods while SBI stormed in it in Q4, 2016.
- ✓ While ICICI slipped into the 2nd best performing cluster, Corporation Bank appeared in it in Q4, 2016.
- ✓ **Relevance of having 3rd party acquirer processors:** Evidently more banks entered into the market space during last 6 years. Also there is a significant increase in the cluster size of the lowest performing cluster – it increased from 27 to 38 who is actually operating in only less than 20% market space. Now with that being said let us try to understand certain attributes of general Acquiring industry and certain characteristics which

are specific to Indian Acquiring industry to understand higher relevance of having 3rd party backend processors in India:

- **Low Margin Business:** Acquiring business unlike Issuing, is always low margin business, as the Acquirer processing fee is always lesser than the Interchange fee charged by the Issuer. This in fact is a standard industry norm set worldwide, prime reason being Issuers undertakes risk of the card holders while acquirers do own the merchant fraud risk which is always on the lower side and also due to the fact that acquirers most of the cases get settled in T+1 (Transaction Day + 1) while issuers will have to wait till cardholder payment due date post statement generation.
- **War of Flat Pricing Model in absence of matured pricing models:** In India merchants are mostly offered flat pricing model by the acquirers and there is absence of other matured pricing models like Interchange Plus or Tiered Pricing Models. Indian acquirers to win over competition concede ground on the flat rate to satisfy heavily price sensitive Indian merchants who most of the times are not ready to move into other matured models due to concern of variability in fees. This in turn makes the business a low margin business.
- **Economies of Scale:** To continue in such a market place the best possible option would be to operate with huge volume and leverage economies of scale to have the business profitable. However getting huge volume is definitely not easy in presence of industry giants. The only feasible solution that comes out is to have 3rd party acquirer processors for doing the backend processing either partially / fully on behalf of the banks rather than banks spending their own money to build their own in house software and hardware infrastructure and servicing team. The backend processors can very well leverage the economies of scale and be profitable in India and both the parties ending up in a win-win situation.
- **Global and Local 3rd party processors:** Entry of First Data (a global payment industry leader) in Indian market through acquisition of 81% stake in ICICI merchant services in 2010 and later forming an alliance with the newly born IDFC bank (received banking license in 2015) enabling the bank to offer electronic payment acceptance solution is a noteworthy event. There are other players like Hitachi Payment Services, iSG (In Solutions Global) who offer full management of various backend needs as per banks' wish. With Indian card industry's dramatic rise in volume post demonetization Indian Acquiring business may attract other 3rd party processors/ acquirers to foray in Indian segment in near future either through the rout of acquisition (complete/ partial) or acting as pure-play backend processor offering an array of backend services.

5. Discovering Relationship between Card Industry with Macro Economic & Social Indicators

5.1 Used Methodology

We wanted to understand how Indian card industry is related with the Macro economy of the country and also with the social status prevailing in the nation. In course of our study we have used:

- a) Card industry data taken in span of around 6 years – Q2, 2011 to Q4, 2016 (the primary data source is RBI).
- b) Macro-economic and social indicator primary data from various other sources - ranging from World Bank to Ministry of Statistics and Programme Implementation of Indian Govt. (detailed in due course).

Keeping in mind the nature of the data that we are dealing with, Pearson's product moment correlation coefficient was determined between various arrays of the data to discover the underlying relationship – if any at all.

5.2 Relations within the Card Industry

We have used quarterly values of the various variables of Card Industry and arrived at below Correlation graph. Overall the chosen variables (taken in pair) have shown strong positive linear relationship while in most of the cases when we excluded the quarters which had impacts of PMJDY scheme/ Demonetization an increase in strength is observed. The graph hints that if any economic/ social indicator variable that we choose in course of the study depicts a strong linear relationship with any card industry variables (mentioned below) it is most likely that other card industry variables will follow the same course.

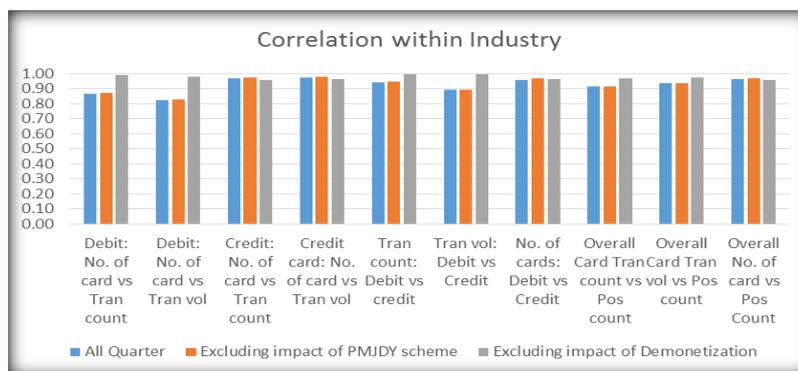


Figure 24. Correlation within card industry

5.3 Economic Indicators & Card Industry

GDP, Sensex (S&P Bombay Stock Exchange Sensitive Index) and Gold (as precious metal) price were taken as representative indicators of the prevalent economic condition of the country. Quarterly average values of various Card Industry variables along with GDP (Source: Statistics Times), Sensex (Source: Yahoo Finance) and Gold price (Source: index mundi) were used to produce the below given Correlation graph. As it is evident that all 4 different card industry parameters shown below are having strong positive linear relationship with GDP and Sensex while with Gold price it is having very weak negative linear relationship.



Figure 25. Correlation coefficients between card industry and GDP, sensex, gold price

5.4 Few Other Social and Economic Indicators

We have also studied the correlation between card industry with few other economic and social indicators in the below graph. However for all those cases basis data availability only annual values were used within our study period - hence the conclusions drawn might not be decisive. But still we wanted to present our findings only as a probable indication rather claiming a definite trend. Primary data for Private Final consumption expenditure (at 2016 current price), Per capita Net national income (at 2016 current price) and Population were sourced from “Press note on first revised estimates of National income, consumption expenditure, saving and capital formation, 2015-16” (published by Ministry of Statistics and Programme Implementation, Govt. of India). All these chosen parameters appear to have strong positive correlation with card industry.

Usage of card requires some extent of education and for a developing nation like India education appears to be a showstopper for a large part of society in using card. Hence we looked at “Population of official Age of secondary/ upper secondary education” and “No. of Students enrolled at higher education” to understand how / whether at all educational indicators of the country is correlating with the card usage data. For the first two primary data source was World Bank and for the last one “Youth in India 2017” – report published by Ministry of Statistics and Programme Implementation, Govt. of India. As per our findings we see that all these 3 parameters as well are showing strong positive correlation with card industry. Of course the population included in those 3 parameters are definitely not major contributors as card users but surely those no. are indicative of the educational level of the society at large which in turns impacts card usage.

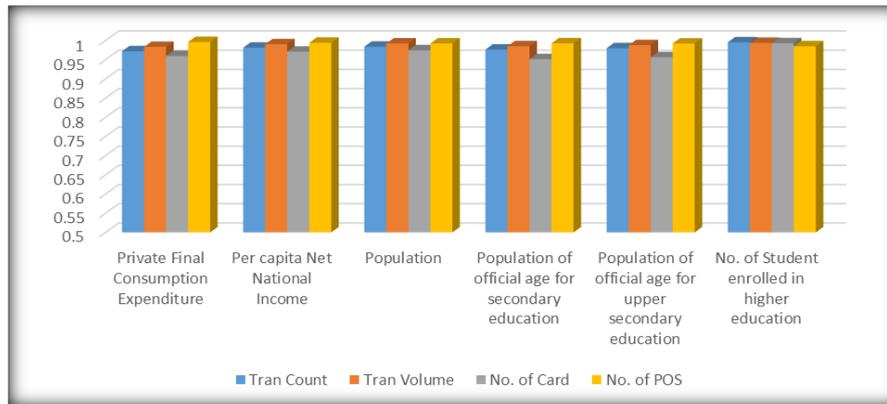


Figure 26. Correlation between card industry and few other social & economic parameters

6. Building a Predictive Model

6.1 Used Methodology

In this section we attempted to build a Predictive model which can be used to predict 4 parameters of the card industry Total Card Transaction Count of the Quarter at POS, Total Card Transaction Volume of the quarter (unit in million INR) at POS, Average No. of Card of the quarter and Average No. of POS terminal of the quarter (primary data source for all being RBI data). Basis availability of data at quarterly level, we have used average quarterly values of 3 independent variables – GDP (unit in 10 million INR at current price of 2015-2016 fiscal year), Sensex (S&P Bombay Stock Exchange Sensitive Index) and Gold (as precious metal) price (in INR per Troy ounce) starting from Q2, 2011 to Q4, 2015. The data sources independent variables are: GDP - Statistics Times, Sensex - Yahoo Finance and Gold price - index mundi. In our pursuit to build the model we have used an array of techniques progressively ranging from building a Correlation Matrix, Bartlett’s Test of Sphericity, Principal Component Analysis/ Factor Extraction and Linear Regression.

6.2 Correlation Matrix of Independent variables & Bartlett’s Test of Sphericity:

To understand whether the 3 chosen independent/ predictor variables share any common factor, we constructed a Correlation matrix (represented below pictorially) which gives an overall impression that there is redundancy between the variables. Note: QGDP represents Quarterly GDP.

To confirm further we performed Bartlett’s Test of Sphericity which gave us a p value = 5.018775e-08. Thus we rejected the Null Hypothesis that the Independent variables are uncorrelated/ do not share any common factor and proceed further for Factor extraction.

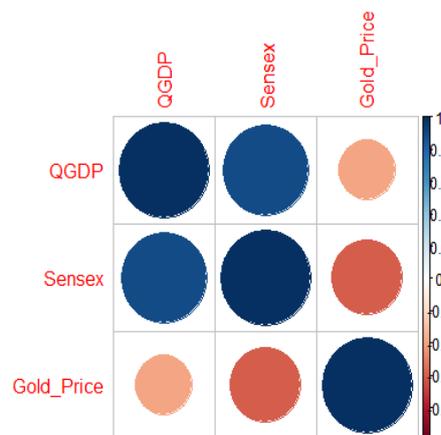


Figure 27. Correlation matrix of independent variables

6.3 Dimension Reduction by Principal Component Analysis

Principal component analysis was performed on the set of chosen independent variables which yielded the below results. Evidently First principal component is sufficient as it can explain more than 99% of the data variance.

Table 2. Principal components – their compositions and cumulative proportion of explained variance

Independent Variable	Principal Component 1	Principal Component 2	Principal Component 3
QGDP	0.999943153	-0.007666884	0.007410128
Sensex	0.008786232	0.198739278	-0.980013011
Gold Price	-0.006040963	-0.980022407	-0.198795343
<i>Cumulative Proportion of explained variance</i>	<i>0.9998</i>	<i>1</i>	<i>1</i>

6.4 Arriving at Optimum Model Using Linear Regression

To arrive at the optimum predictive model of 4 dependent/ response variables we performed 3 sets of linear regression:

- We utilized the derived First principal component (PC1) obtained by Dimension reduction and performed linear regression using only PC1
- Using all 3 original set of variables (QGDP, Sensex and Gold_Price)
- Moreover taking a cue from composition of First Principal (heavily inclined towards QGDP) and looking at the p value of the independent variables Sensex and Gold_Price obtained during step b, we performed linear regression using only QGDP.

The model parameters of all these 12 models are presented in the below chart:

Table 3. Model fit of various models

Dependent Variable	Model built with 1st Principal Component (PC1)		Model built with all 3 original variables	Model built with only QGDP
	Adjusted R-squared	p value of PC1	Adjusted R-squared	Adjusted R-squared
Transaction Count	0.8874	1.07E-09	0.8952	0.8874
Transaction Volume	0.907	2.09E-10	0.9143	0.9069
No. of card	0.8637	5.48E-09	0.8815	0.8637
No. of POS	0.9329	1.29E-11	0.9381	0.9329

Evidently by sacrificing the model fit (adjusted R squared) by around .5%-1.8% we can construct models with only QGDP for our use. Even using the 1st principal component there is not much difference than using only QGDP as the first principal component was mostly composed of QGDP. Given below are coefficients of the 4 models (linear equations) that we can use to predict the 4 response variables where we have used only QGDP as predictor variable and which can explain around 86% - 93% of the variability of response variables as indicated in the previous table.

Table 4. Model parameters of the linear regression models built with GDP

Response Variables	Intercept	Coefficient of Quarterly GDP
		(unit in 10 million INR at current price of 2015-2016 fiscal year)
Total Quarterly Transaction Count at POS	-3.5850E+08	2.3490E+02
Total Quarterly Transaction Volume of Card at POS (in Rs. Million)	-6.4750E+05	4.6470E-01
Quarterly Average No. of card	-3.1560E+08	2.6160E+02
Quarterly Average No. of POS	-4.1640E+05	4.8210E-01

7. Forecasting the Future

7.1 Used Methodology

In this section we attempted to create a forecasting model based on Time series forecasting mechanism, which use historical data as the basis of future outcomes. In the Time series forecasting mechanism we have used the exponential smoothing by using Holt's linear trend model & Holt-Winter seasonal model. Holt's liner trend model is an extension of the exponential to allow forecasting of data with a trend. The method involves a forecast equation & two smoothing equations (one for the level and other for the trend). Winter extended Holt's

method to capture seasonality thereby adding another smoothing equation for the seasonal component. Holt-Winter seasonal model have two variants based on the seasonality factor – additive and multiplicative.

7.2 Time Series Model

In this section we attempted to build the best fitting model using Holt's linear trend method and Holt-winter seasonal model. The variables chosen for forecasting are – Quarterly total transaction count at POS, Quarterly total transaction volume at POS, Quarterly Average No. of cards in circulation & Quarterly average No. of POS in circulation. Same method was followed for individual variables to identify the best fitting model which included the below steps:

- **Data Preparation** – Modify the discrete data elements to a time series data for analysis. Understand the basic nature of the series.

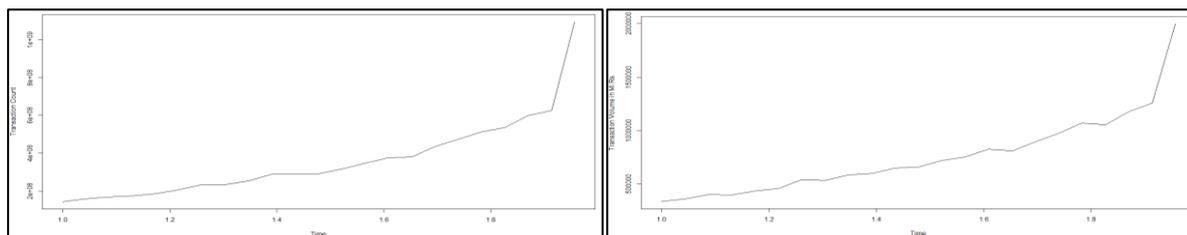


Figure 28. Time series plot of quarterly transaction count (left) and transaction volume (right)

The transaction count and volume graphs (present above) clearly shows an enormous spike in the end which is the direct effect of Demonetisation. The Q4 2016 data point is ignored for time series forecasting model as the exponential trend would be skewed due to that single outlier data point. However No. of cards/ POS graphs (present below) doesn't display such extremely steep price.

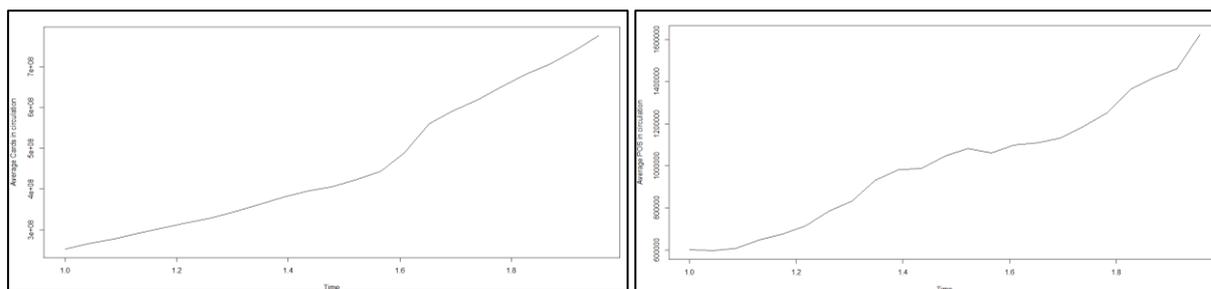


Figure 29. Time series plot of No. of cards in circulation (left) and No. of active POS (right)

- **Application of multiple models** – For all the individual variables the below models were applied - Holt's linear model with exponential (M1), Holt's linear model with both exponential & damped (M2), Holt Winter Multiplicative model with Exponential & damped (M3).
- **Evaluation of residuals** – For all the models, residuals are extracted and evaluated by Ljung-Box test which would give a p-value. The smaller p-value is evidence to dependency of residual on the model, so a higher p-value is better but not conclusive as it is not an evidence of independence. So the accuracy is calculated on Mean Absolute Percentage Error. For the models having the least MAPE value, the correlogram was constructed to check in-sample forecast errors. Based on the in-sample error and the MAPE, p-value the models are selected (marked in green in the table below).

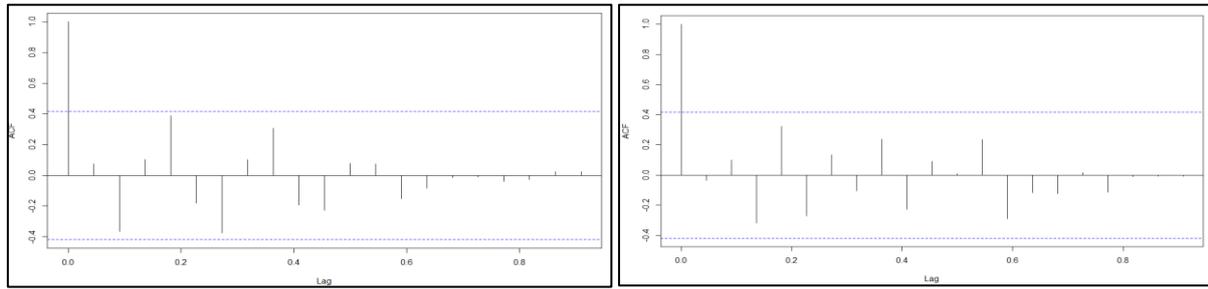


Figure 30. ACF plot for the best fitting model of transaction count and volume

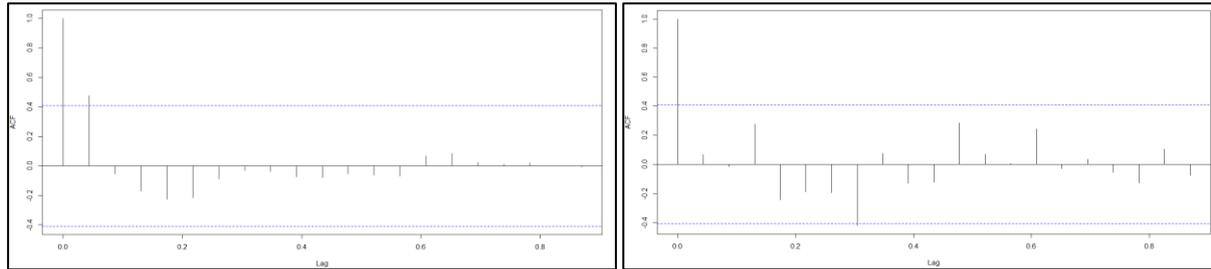


Figure 31. ACF plot for the best fitting model of average card and POS count

Table 5. P-value and MAPE score of different models

Dependent Variable	Model M1		Model M2		Model M3	
	p-value	MAPE	p-value	MAPE	p-value	MAPE
Transaction Count	0.15	2.99	0.21	3.53	0.21	3.53
Transaction Volume	0.06	2.54	0.18	3.01	0.18	3.01
Avg. No. of card	0.91	1.25	0.85	1.53	0.86	1.53
Avg. No. of POS	0.36	3.11	0.11	2.71	0.12	2.71

Forecasting with the best fit model – With the best fitting model, forecasting was done for future quarters and plotted as below. While the data of Q4 2016 was not taken into the forecast as it was an outlier, the forecast prediction has been corrected for count and amount with the additive factor which is equal to the additional growth due to effect of demonetisation.

As per the forecast, the transaction volume would see around 80% growth by end of 2020 with quarterly transaction counts reaching around 1.97 Billion for a quarter considering the point estimate. The darker range showing 95% probable range and the lighter area 80% probable range.

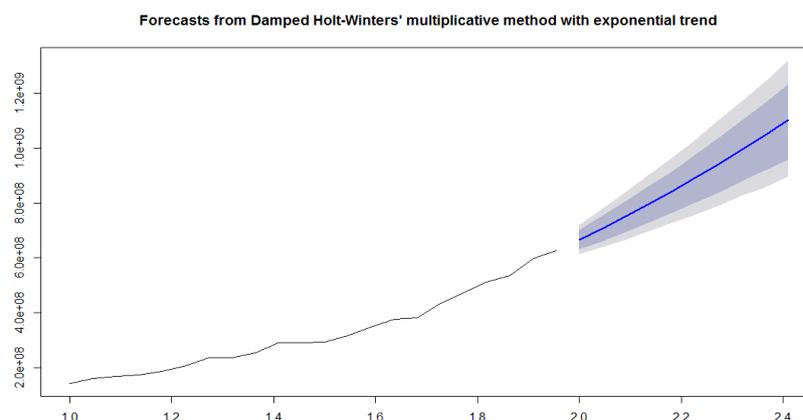


Figure 32. Forecast of the quarterly transaction count at POS

As per the forecast, the transaction volume would see around 108% growth by end of 2020 with quarterly transaction volume reaching around Rs. 4150 Billion in a quarter considering the point estimate. The darker range showing 95% probable range and the lighter area 80% probable range.

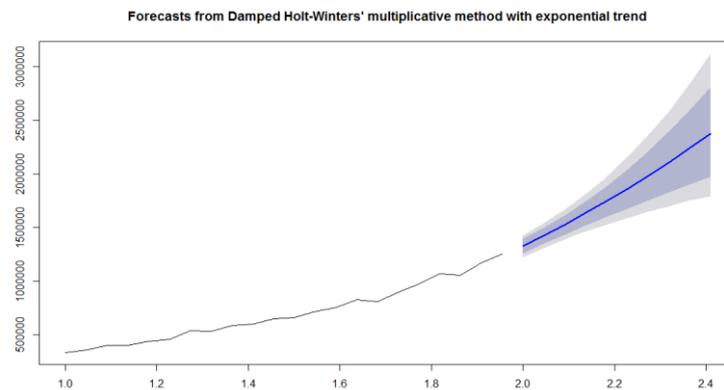


Figure 33. Forecast of the quarterly transaction volume (in million Rs.) at POS

As per the forecast, the average card in circulation would see around 128% growth by end of 2020 with quarterly average no of cards in circulation reaching around 1.7 Billion as per the point estimate. The darker range showing 95% probable range and the lighter area 80% probable range.

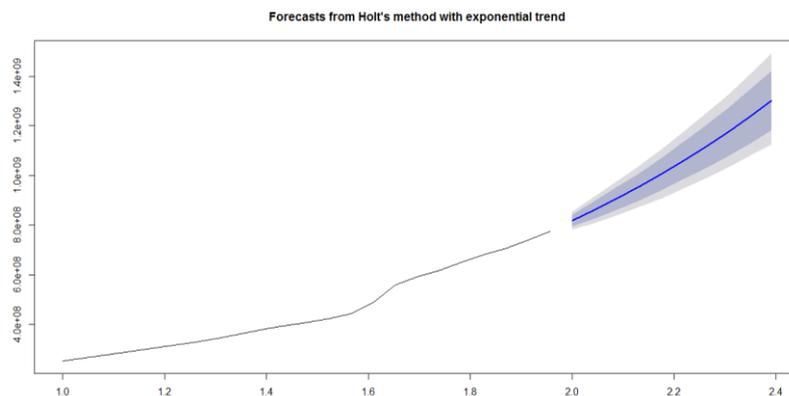


Figure 34. Forecast of the quarterly average No. of cards in circulation

As per the forecast, the average POS in circulation would see around 74% growth by end of 2020 with quarterly average no of POS in circulation reaching around 2.8 Million with the point estimate. The darker range showing 95% probable range and the lighter area 80% probable range.

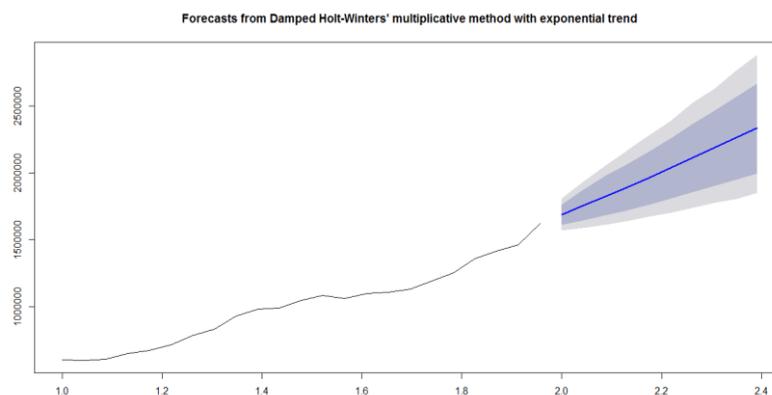


Figure 35. Forecast of the quarterly average No. of POS in circulation

8. Conclusion

Indian Card Industry appears to have gone through a no. of significant changes within our chosen study period of around 6 years - from Q2, 2011 to Q4, 2016. Visible shifts can be seen both in Issuing and Acquiring segment as we see significant changes when it comes to comparing public vs private bank or credit card vs debit card share or even in terms of market leaders in several industry parameters. An extremely noteworthy effort by Indian government through a series of moves like launch of Rupay (as its own domestic card scheme), launch of PMJDY scheme (to facilitate financial inclusion of weaker section) and finally Demonetization along with subsequent push for Digital transactions have almost resulted in a paradigm shift within this 6 year period. The Indian Govt. model can very well be emulated in other nations who want to simulate such changes in their own economy to curb the cost of cash transactions. Keeping in mind the dedicated effort by Indian Govt., the card industry in India expected to continue its fabulous growth path – which could very well lead to further decrease in transaction cost, entry of new domestic and global players and launch of innovative products in the industry. Even other alternate form of digital payments like digital wallets, UPI (united payment interface), Aadhaar (multi-purpose national identity card) enabled payments are getting significant tractions. Needless to mention in the way forward Indian Card Industry is expected to continue as a fascinating world with its inherent growth and innovation.

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