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Digital Transactions Through Debit Cards – Costs and Prices for the Payment Services

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Abstract

To promote small ticket debit card transactions up to Rs. 2000, the government during the calendar years 2018 and 2019 made merchant discount rate (MDR) zero for the merchants, while providing monetary support to banks @ 0.4%, towards MDR. In contrast, effective January 2020, the government made MDR zero for any transaction amount for use of RuPay debit cards alone and neither merchants nor the government paid the banks for such merchant transactions. However, banks were allowed to impose MDR for any transaction amount onto the merchants for use of mastercard/VISA debit cards.

For the period January-June 2020, with about Rs. 3,69,609.00 crore worth of debit card merchant transactions, the government has done away with the merchant's zero MDR regime (on ticket sizes up to Rs. 2,000.00) for about Rs. 1,88,867.00 crore worth of transactions that were done through mastercard/VISA debit cards. A simple projection implies that merchants would be overburdened in the calendar year 2020 in the range of Rs. 1,500.00 crore and Rs. 3,400.00 crore depending upon the MDR ranging between 0.4% and 0.9% for mastercard/VISA's sub Rs. 2,000.00 ticket transactions, as against nil burden in calendar years 2018 and 2019.

We show that during the one year period August 2018 through July 2019, there had been issuance of at least 455 lakh RuPay debit cards corresponding to at least 422 lakh new accounts added under PMJDY. In contrast, for the same tenure during August 2019 through July 2020, we see a subdued issuance of around 77 lakh RuPay debit cards despite at least 366 lakh new PMJDY accounts added. This showcases that with a revenue differential between RuPay and mastercard/VISA, banks and system providers, in their commercial interest have taken steps to move away from RuPay and promote a card scheme which generates more revenue for them.

The government and RBI have effectively implemented a net increase of debit card MDR expenses at least for the small and medium merchants. Now, there are two contrary aspects to such an increase. (A) Such an increase in the "cost to merchant" is good for the development and increased acceptance of debit cards, and (B) The increased net MDR, onto small and medium merchants, is bad for the development and increased usage of debit cards.

If (A) holds (and merchants pay a controlled MDR), there was no need for the induced discrimination between RuPay and mastercard/VISA. The same could have been achieved by arriving at a lower controlled MDR, uniform across all card schemes. However, if (B) holds, by putting restrictions only for RuPay and discriminatorily allowing mastercard/VISA to impose MDR onto merchants, we have not quite achieved desired results, unlike the government's strategy of zero MDR for merchants for the two calendar years 2018-19.

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Using debit card and ATM data, this paper prepare grounds for policy guidance.

Keywords: ATM cash withdrawal; Merchant Discount Rate; RuPay Debit Card.

1. Introduction

Debit cards are issued by banks for facilitating bank account holders towards interoperable ATM cash withdrawal and carrying out merchant transactions. For merchant payments, such debit cards are issued under a card schemes, which are primarily *mastercard*, *VISA* and *RuPay*. Historically, card payments for merchant transactions had a well-defined revenue generating structure, where the revenue came from Merchant Discount Rate[1] (MDR).

In order to set catalysts for the digital payment systems, Government of India on February 29, 2016 came out with cabinet approved guidelines for the 'Promotion of Payments through Cards and Digital means'. The Finance Ministry's office memorandum provides broad guidelines on the way forward for promotion of digital payments. Among several measures for wider adoption of card/digital transactions, two specific measures therein was to take steps to "rationalize MDR on card transactions" and to ensure that the card holders are not imposed a charge for using such a digital means of payment.

1.1. The history of MDR regulations

In September 2012, Reserve Bank of India (RBI) mandated to cap debit card MDR at 0.75% for transactions up to Rs. 2,000.00 and 1% for transactions above Rs. 2,000.00. This continued till 08 November 2016.

Immediately after the demonetization of the specified bank notes on 08 November 2016, the government instructed banks to temporarily waive MDR imposed on merchants.

As an interim measure, RBI effective 01 January 2017 rationalized the MDR on debit cards by capping it at (i) 0.25% for transactions valued up to Rs. 1,000.00; (ii) 0.5% for transactions valued in excess of Rs. 1,000.00 but not exceeding Rs. 2,000.00; and (iii) 1% for transactions valued in excess of Rs. 2,000.00. RBI's new caps on debit card MDR were a substantial reduction to the RBI's pre-demonetization cap of 0.75% for transactions valued up to Rs. 2,000.00.

Subsequently, effective 01 January 2018, RBI tweaked MDR rules claiming that such tweaks would encourage some small businesses to accept debit card payments. For businesses with annual turnover below Rs. 20.00 lakhs, RBI capped the debit card MDR at 0.4% of transaction value or Rs. 200.00, whichever is lower. For others, the debit card MDR was capped at 0.9% of the transaction value or Rs. 1,000.00, whichever is lower. For QR-code based debit card acceptance, the MDR caps were set 10 basis points lower than the physical POS and online debit card acceptance infrastructure.

In parallel, effective 01 January 2018, the government decided to bear MDR for two years on all debit card transactions valued up to Rs. 2,000.00. However, the government fixed

[1] Merchant Discount Rate or Merchant Discount Fee is a service charge that banks take from merchants accepting card/ digital payments, which is usually a certain percentage of the transaction amount. The MDR paid by merchants is shared between acquirer banks, issuer banks and the card payment networks.

the MDR at 0.4% for debit card transactions up to Rs. 2,000.00. In effect, due to the government's intervention, RBI's decision to allow banks to charge up to 0.9% as MDR for businesses with annual turnover of Rs. 20.00 lakh or more (even for transaction amounts less than Rs. 2,000.00), got overruled and the banks got only 0.4% as MDR for such transactions.

Corresponding to this MDR of 0.4%, the interchange[2] fixed by card payment networks is 0.15%. Thus, RBI's MDR mandates could never get implemented since the government felt otherwise on small ticket sized transactions up to Rs. 2,000.00 and reduced the MDR to zero for all merchant categories and restricted the banks to receive no more than 0.4% as MDR.

In fact, National Payments Corporation of India (NPCI) was the only network to adopt lower-than-cap MDR. The MDR pricing structure arrived at (effective October 2019) for RuPay debit card had been 0.4% (0.3% when the transaction is QR-code based) for transactions up to Rs. 2,000.00 and 0.6% (0.5% when the transaction is QR-code based) for transactions exceeding Rs. 2,000.00, with a ceiling on MDR of Rs. 150.00 for any transaction.

1.2. The present *avatar* of MDR

Effective 01 January 2020, the government decided not to bear MDR any further on all debit card transactions valued up to Rs. 2,000.00.[3] In effect, due to this decision, RBI's mandate got re-invoked and banks got the leverage to charge MDR @ 0.9% or less from businesses with annual turnover of Rs. 20.00 lakh or more for transactions of any value. Furthermore, for businesses with annual turnover of less than Rs. 20.00 lakh, banks got the freedom to impose an MDR of 0.4% or less.

However, the government simultaneously brought in a new law where RuPay debit card had been identified as a prescribed payment mode such that banks and system providers could no longer charge any fee to the merchants for whom they setup the payment acceptance infrastructure. Consequently, any charge, including the MDR, was no longer applicable on payments made through RuPay debit card.

While taking such a step, the government envisage that among low-cost digital modes of payment, RuPay debit cards (and not mastercard/VISA debit cards) will promote less cash economy through their extensive use for P2M (person-to-merchant payment) transactions. The underlying philosophy is that neither merchants nor consumers should get any feel of extra cost while adopting such digital modes of payment. An impression given is that RBI and banks will be able to absorb the associated costs from the savings that will accrue to them on account of handling less cash as people move to these digital modes of payment.

1.3. The law

The government under Section 10A of the Payment and Settlement Systems (PSS) Act, 2007, indicate that no bank or system provider shall impose any charge upon a person making or receiving a payment by using the electronic modes of payment prescribed under section 269SU of the Income-tax Act, 1961. In the Income-tax Rules, 1962, a new Rule 119AA has been inserted that prescribed RuPay debit card and BHIM-UPI as the electronic modes of payment for the purpose of Section 269SU.

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[2] Interchange or issuer interchange is the share of the MDR that the issuer bank keeps as their commission. Thus, MDR comprises of the interchange and the acquirer's commission.

[3] Earlier banks were getting reimbursement of 0.4% MDR for transactions up to Rs. 2,000.00 from MeitY.

Technically, this implies that banks shall not levy any charges to a person for payments made or received through RuPay debit card and BHIM-UPI.

2. Banks and System Providers

To harmonise a way forward for the banks, early January 2020, the Indian Banks' Association (IBA) made a move when 15 major banks came together to decide what should be the MDR for mastercard/VISA debit cards. Considering the government's agenda of promoting digital transactions and encouragement to merchants for promoting low value transactions, the IBA indicate that the banks reached a consensus that for transactions up to Rs. 2,000.00, the applicable MDR should be 0.4% irrespective of the merchant category.

Like the government, IBA too did not feel it appropriate to charge a high MDR of up to 0.9% for merchants having annual turnover of Rs. 20.00 lakh or more. This, possibly raises doubt on RBI's December 2017 regulation, where it had removed the concept of MDR based on ticket size and set a very low benchmark of Rs. 20.00 lakh to categorise small and medium merchants. Actually, that may have triggered the government to intervene, and now IBA too.

The norms recommended by the banks that mostly prevail are:

a) MDR cap should be 0.4% for businesses with annual turnover of less than Rs. 20.00 lakh.
b) For businesses with annual turnover of Rs. 20.00 lakh or more,
   i. MDR to be capped @ 0.4% for transactions up to Rs. 2,000.00.
   ii. MDR to be capped @ 0.9% for transactions above Rs. 2,000.00.

2.1. Moving towards a lower controlled MDR

IBA's new norm is not quite in sync with RBI's attempt in January 2018 to eliminate the concept of MDR based on ticket size (which had been in place since 2012 for transactions up to Rs. 2,000.00). It is felt that had RBI's merchant categorisation been more rationale, we would not have seen intervention by the government with such vigour.

In all this zero or low MDR mess, what had been at stake is the banks' and system providers' revenue losses from large merchants like Amazon, Big Bazaar, IRCTC and the like, where they have been kept at par with small and medium merchants, with respect to small ticket transactions up to Rs. 2,000.00. Moreover, it does not make sense to see only RuPay debit cards offering zero MDR to small and medium merchants while mastercard/VISA debit cards imposing MDR @ 0.4% for transactions up to Rs. 2,000.00.

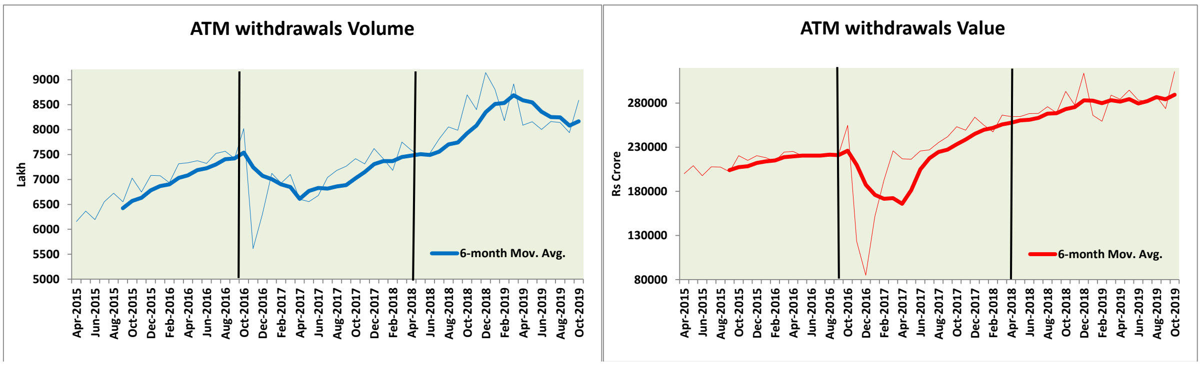
What is possibly missing is the payment industry's will to see a modification of the merchant categorization, where a lower controlled MDR is set for large merchants after a more rational merchant categorised than RBI's present categorization. There is an urgent need for a reasonable definition of large merchants for the purpose of MDR.

3. From Cash to Cards

Debit cards are extensively used by bank account holders towards cash withdrawal at ATM. Currently RBI and banks are absorbing significant costs while they provide cash as a prominent mode of payment. The promotion of excessive cash needs to be mitigated in such a way that it not only reduces cash handling costs for the banks but also saves enough to support digital payments.

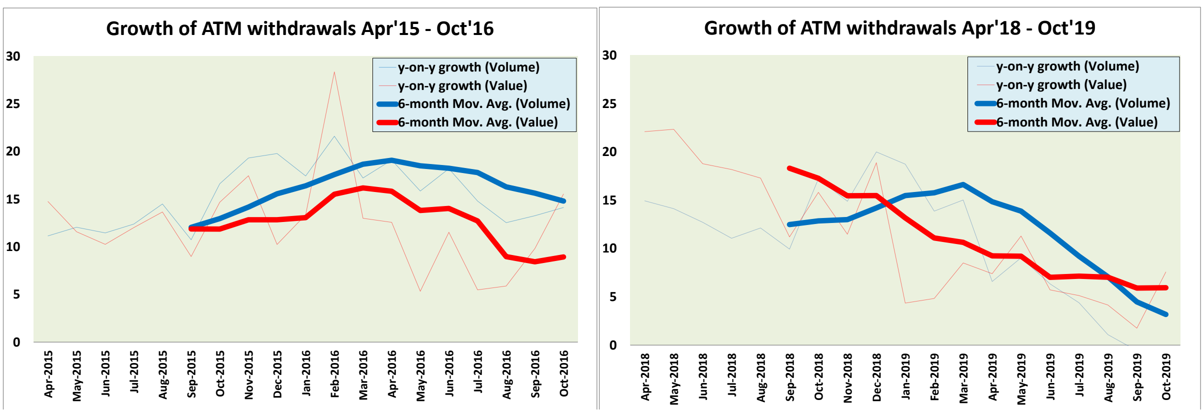
3.1. Cash from ATM

Cash is predominantly promoted in India with 8 to 10 free ATM withdrawals. This potentially amounts to bank's disbursement of up to Rs. One lakh of free cash per month to an individual holding a bank account. While keeping 17 months of wash-out period in between the pre- and post-demonetisation periods, Figures 1 and 2 show how the debit card usage at ATM behaved during the pre-demonetisation period April 2015 – October 2016 and the post-demonetisation period April 2018 – October 2019. The figures indicate that though in absolute terms there has not been any significant respite from predominant ATM usage in the country, there are some signs of reduced y-on-y growth in later months. The period November 2019 – July 2020 has been dealt separately since effective November 2019, RBI in its monthly ATM data dissemination has changed the definition of the ATM usage.



Source: RBI data

Figure 1: ATM withdrawals during the pre- and post-demonetisation (after wash-out period)

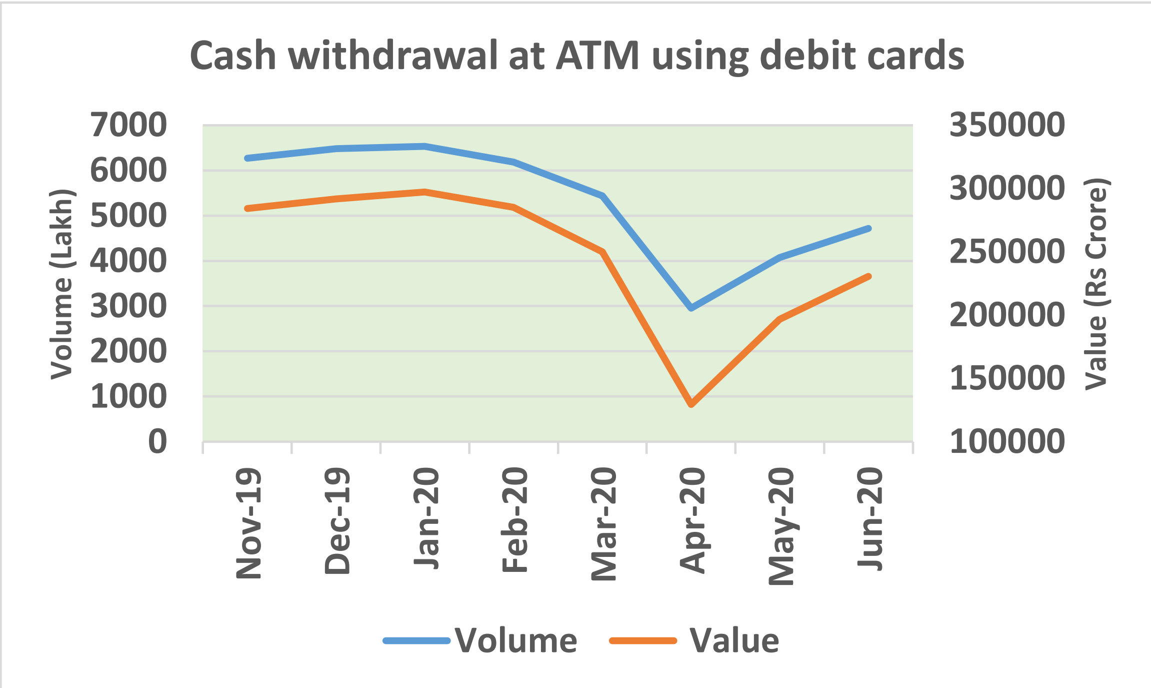


Source: RBI data and author's computation

Figure 2: y-on-y growth of ATM withdrawal during the pre- and post-demonetisation (after wash-out period)

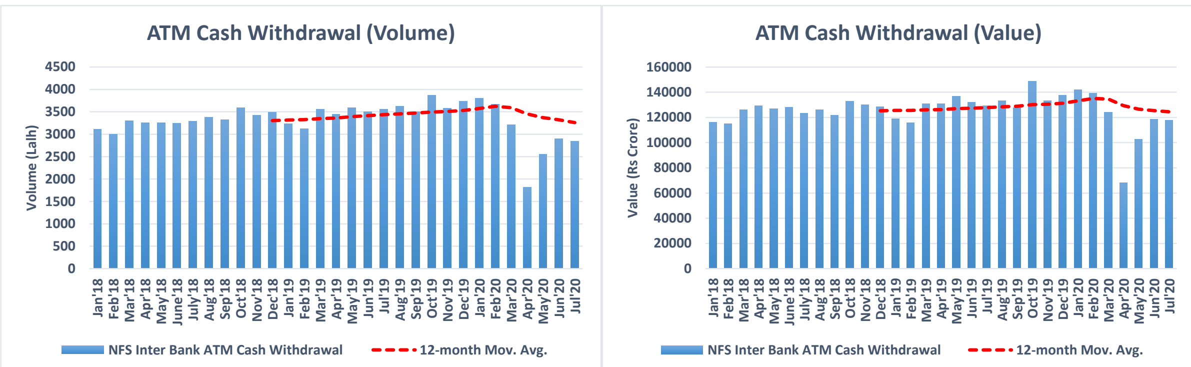
Figure 3 shows how the ATM cash withdrawal using debit cards behaved during the period November 2019 – June 2020. The period since March 2020 shows the effects of

COVID-19 lockdown and partial unlocks. As such, even if we supplement with more recent National Financial Switch (NFS) off-us ATM data till July 2020, as shown in Figure 4, we see no respite from predominant ATM cash withdrawals in the country.



Source: RBI data

Figure 3: Cash withdrawal at ATM



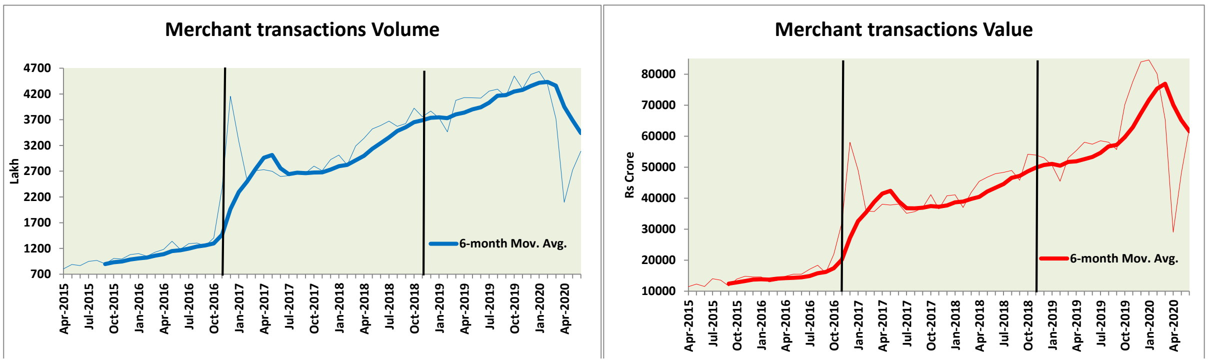
Source: NPCI and RBI data

Figure 4: NFS inter bank ATM cash withdrawal

But for RBI's mandate allowing significant amount of cash withdrawal free for many bank customers, technically speaking, banks would not have incurred such avoidable and non-remunerating expense. There is nothing that RBI appears to have done as a deterrent, which strongly prompts a reduction of large amounts of cash withdrawal in a month. Digital payment modes are now amply available where large and frequent cash is still in use. May be RBI advocating banks of charging a fee in a tiered fashion for total cash withdrawals in excess of a reasonable amount, say Rs. 20,000.00 a month, could create enough deterrent. Such a move would allow generating desirable revenue for the banks to meet cash handling costs and additionally support costs for digital payments infrastructure.

3.2. Merchant transactions using debit cards

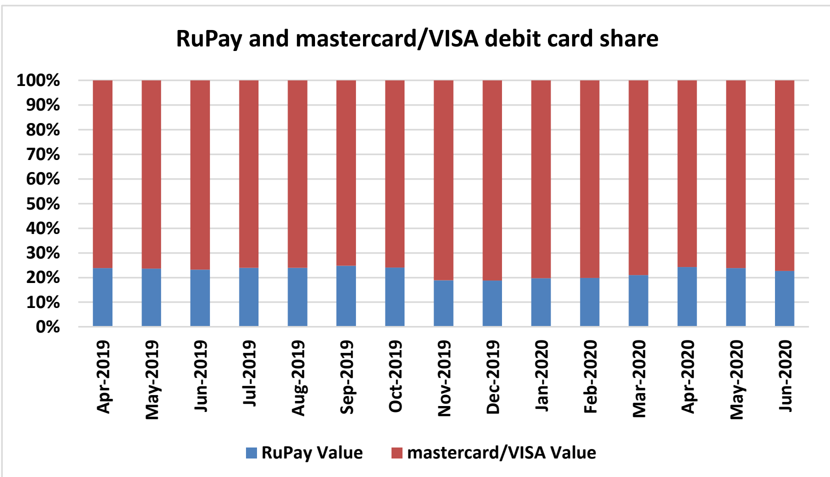
Figure 5 shows the trend for debit card merchant payments during the period April 2015 – June 2020 where we have indicated a wash-out period of 12 months to account for the disturbances due to impact of demonetisation. Clearly, under a controlled MDR-revenue model, debit card usage and acceptance for merchant payments has shown a consistent growth for some time now (exception being the COVID-19 lockdowns and partial unlocks). This has an associated cost for which revenue is collected either directly or indirectly from the users of the banking system.



Source: RBI data

Figure 5: Debit card merchant transactions during the pre- and post-demonetisation (after wash-out period)

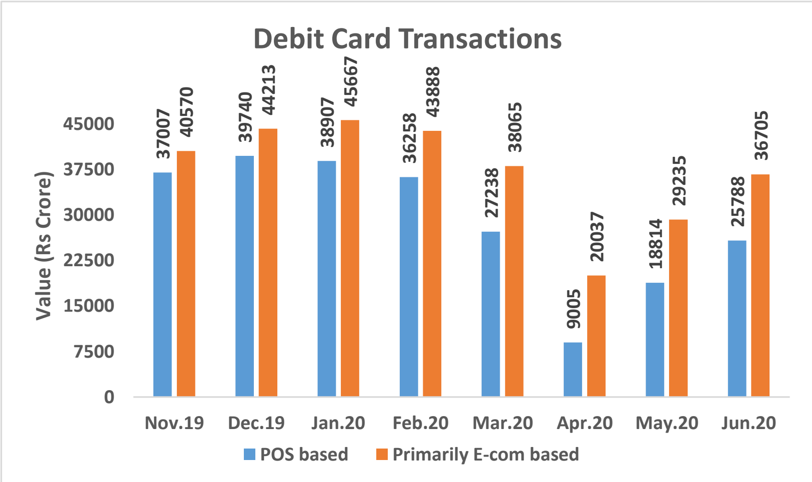
Figure 6 shows the percentage share of debit card transactions for RuPay and mastercard/VISA. During April 2019 – June 2020, in value terms, RuPay had an average share of only 22% whereas mastercard/VISA had 78%. In fact, even during January-June 2020, in value terms, RuPay had an average share of 22% whereas mastercard/VISA had 78%.



Source: RBI and NPCI data

Figure 6: Percentage share of RuPay and mastercard/VISA (in Value terms)

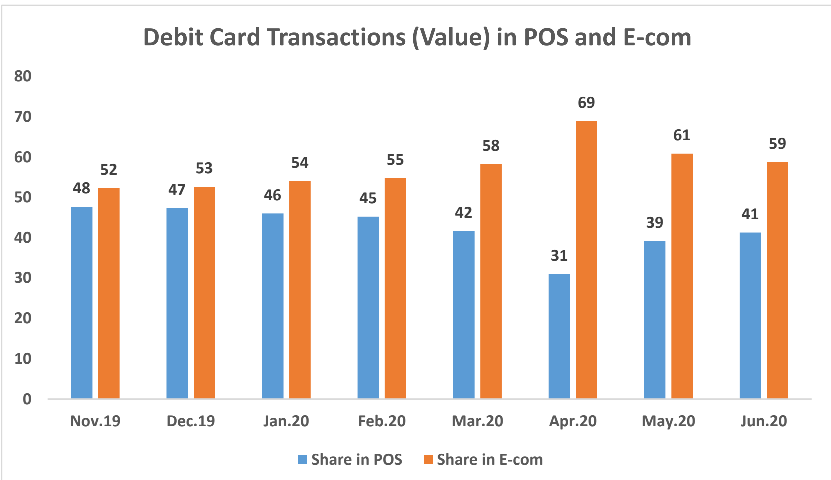
The use of debit cards, in value terms, is more prominent among E-com merchant transactions rather than physical POS transactions. Primarily, E-com constitute data on e-commerce transactions. However, though relatively meagre, RBI includes digital bill payments through ATMs and card to card transfers for debit cards under their E-com data. Primarily Figures 7 and 8 show the extent of E-com and POS transactions. Even before the COVID-19 pandemic, in value terms, the E-com transactions had been more than the POS transactions (though in volume terms it is only since April 2020 that we see the same trend). The effect of lockdown on physical retail shops and other services had its impact in increasing the gap between E-com and POS transactions.



Source: RBI

Figure 7: Share of POS and E-com merchant transactions using debit cards

In value terms, there had been a consistent increase in percentage share of E-com over POS transactions. During the first six months of 2020, percentage share of E-com had been 58%. For bank account based transactions, the trend in debit card acceptance for E-com is unavoidable unless BHIM-UPI becomes a better choice for all. Unlike E-com, cash is always an alternative for POS since POS is an expensive proposition for many small and medium merchants. However, such merchants need to be migrated and enable for the asset-lite BHIM-UPI acceptance.



Source: RBI

Figure 8: Percentage share of E-com and POS transactions (value)

4. Costs and Prices

We now need to address three pertinent questions.

(i) Given that there is zero MDR on RuPay alone, would there be an increase in the card acceptance desire at merchant locations?

(ii) If 'cost to merchant' is an important attribute for merchant's choice for card acceptance and the bank's desire to provide the card acceptance infrastructure, how would it impact continuation of the card acceptance trend?

(iii) What would be the consequence of the discriminatory approach adopted for RuPay?

The Watal Report[4] highlights the breakup of debit card transactions of less than Rs. 2,000.00 and more than Rs. 2,000.00 in value terms (see Table 1). Nearly 65% of the total values of debit card transactions fall in the sub Rs. 2,000.00 tickets category, and all these transactions would now attract MDR within the RBI set cap of 0.9% for about 78% of debit card usage amounts (*i.e.*, for mastercard/VISA but not RuPay).

As a result, we now see merchants paying MDR for sub Rs. 2,000.00 tickets, contributed by 78% of the debit card usage. The banks' re-imposition of debit card MDR @ 0.4-0.9% has affected the *small and medium* merchants when mastercard/VISA cards are used. This being the only source of MDR revenue in the debit card business for banks, it creates a strong potential for RuPay debit cards (constituting about 22% of the total values of debit card transactions) being marginalized in due course. As there is a revenue differential for banks between RuPay and mastercard/VISA, banks would always, in their commercial interest, tend to promote that card scheme which generates more revenue for them.

Table 1: Distribution of debit card transactions in value terms

Table 6.10.: *Breakup of acquirer gross margins**

Type of transaction	% of transactions value by value	MDR charged to merchants	Issuer interchange fees	Scheme fees	Acquirer gross margin
Debit Regular $\lesssim$ INR 2,000	20%	0.75%	0.50%	0.07%	01.8%
Debit Premium $\lesssim$ INR 2,000	15%	0.75%	0.65%	0.07%	0.03%
Debit Regular > INR 2,000	10%	1.00%	0.75%	0.07%	0.18%
Debit Premium > INR 2,000	10%	1.00%	0.90%	0.07%	0.03%
Prepaid	5%	1.00%	1.85%	0.07%	0.92%
Credit Regular	10%	1.30%	1.10%	0.07%	0.13%
Credit Premium	25%	1.90%	1.80%	0.70%	0.03%
Credit Corporate	5%	1.90%	2.00%	0.07%	0.17%

*Source: See, submission dated 28-10-2016 by Payment Council of India

Source: Shri Ratan P. Watal Report "Committee on Digital Payments – Medium Term Recommendations to Strengthen Digital Payments Ecosystem"

[4] Report of the Committee on Digital Payments headed by Shri. Ratan P Watal, December 2016. Ministry of Finance, Government of India.

4.1. The increased MDR burden for *small and medium* merchants

In Table 2, we present the debit card data for January-June 2020 and compute the merchant payoffs towards MDR for sub Rs. 2,000.00 ticket transactions. Prior to this, the government had made such merchant MDR zero for two calendar years 2018-19. Unlike pre-January 2020, for the first six month of 2020, when 78% of the sub Rs. 2,000.00 debit card transactions (in value terms) attracted MDR @ 0.4% from merchants (including small and medium merchants), it amounted to a total payoff of Rs. 755.00 crore. When projected (linear projection) for the full year 2020, the MDR payoff amounts to Rs. 1,511.00 crore. These figures would more than double when MDR is applied @ 0.9%.[5]

Table 2: Debit card transactions and computation of MDR payoffs

Value (Rs Crore)	Debit cards (1)	RuPay cards (2)	mastercard/ VISA cards (3)	Sub Rs 2000 transactions @65% of (3) (4)	MDR Revenue @0.4% of (4) (5)	MDR Revenue @0.9% of (4) (6)
Jan-2020	84575	16728	67846	44100	176	397
Feb-2020	80146	15902	64244	41758	167	376
Mar-2020	65303	13745	51558	33513	134	302
Apr-2020	29043	7051	21991	14294	57	129
May-2020	48049	11438	36611	23797	95	214
Jun-2020	62494	14180	48314	31404	126	283
Jan-Jun 2020	369609	79044	290565	188867	755	1700
Jan-Dec 2020					1511	3400

Source: RBI/NPCI data and author's computation

But for the COVID-19 lockdowns in the country, the level of debit card transactions would have been much higher and would have led to much larger MDR payoffs by the debit card accepting merchants. The government and RBI have effectively implemented a net increase of debit card MDR expenses at least for the small and medium merchants. Now, there are two contrary aspects to such an increase.

(A) Such an increase in the "cost to merchant" is good for the development and increased acceptance of debit cards, and

(B) The increased net MDR, onto small and medium merchants, is bad for the development and increased usage of debit cards.

If (A) holds (and merchants pay a controlled MDR), there was no need for the induced discrimination between RuPay and mastercard/VISA. The same could have been achieved by arriving at a lower controlled MDR, uniform across all card schemes.

However, if (B) holds, by putting restrictions only for RuPay and discriminatorily allowing mastercard/VISA to impose MDR onto merchants, we have not quite achieved desired results, unlike the government's strategy of zero MDR for merchants for the two calendar years 2018-19.

[5] The average ticket size on RuPay debit card transactions being less than Rs. 1,200.00, the benefit of zero MDR on RuPay debit cards on ticket sizes more than Rs. 2,000.00 is minimal.

We have to choose between (A) and (B).

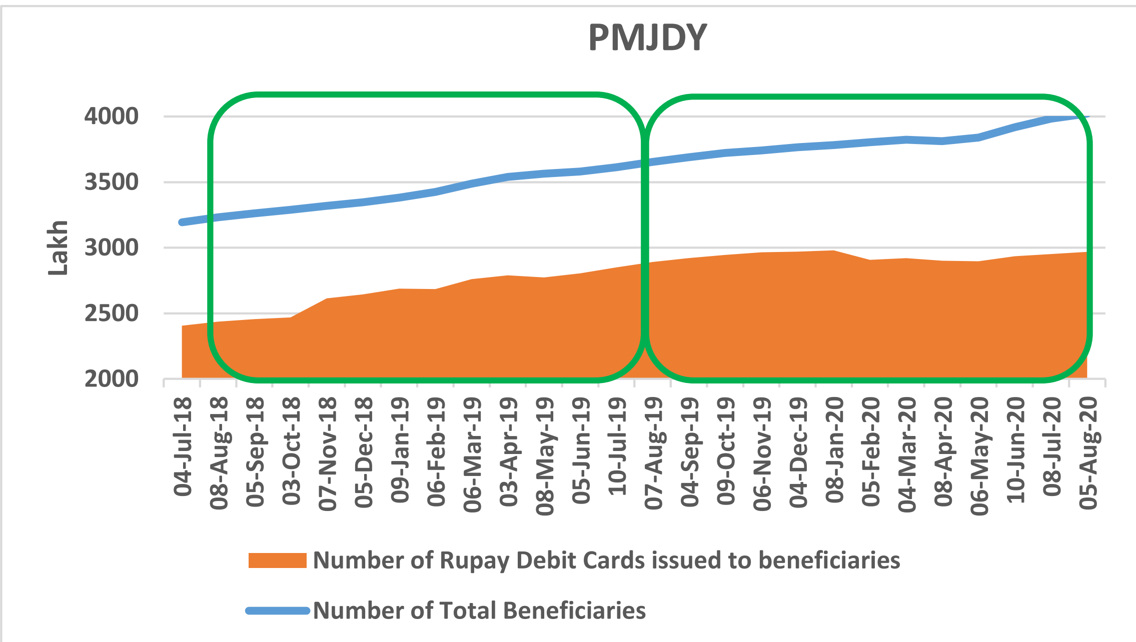
Even if we keep aside the issue of MDR, Section 10A of the Payment and Settlement Systems Act 2007 emphasises that no bank or system provider shall impose any charge upon anyone, either directly or indirectly, for using RuPay debit cards. If we can have a bundled pricing for RuPay card acceptance, the monthly/ yearly rentals for POS terminals and PGs would increase with rentals being attributed to mastercard/VISA (and not RuPay) debit cards. This would actually lead to an indirect charge being imposed on RuPay debit cards.

An important question remains as to whether zero MDR for RuPay debit cards would serve the purpose of promoting card payments in a situation where merchants are still overburdened from the fee for accepting other cards (cards other than RuPay debit cards). Could the answer lie in allowing merchants, at their discretion, not to accept cards other than RuPay debit cards? Surely not, since that may be a hindrance in their sales.

4.2. Discriminatory approach for RuPay debit cards

So how would the system work now without any revenue stream for RuPay debit card (a prescribed modes of payment)? Also, how would the system work in presence of the induced discrimination between RuPay on the one hand and mastercard/VISA on the other hand?

Though the zero MDR for RuPay debit card has led to savings for some merchants (of about Rs. 1,000.00 crore for calendar year 2020), an important question remains as to whether it would serve the purpose of promoting card payments in the presence of merchants being still overburdened on the fee for accepting other cards (cards other than RuPay debit cards). Note that for mastercard/VISA, effective January 2020, the merchants no longer enjoy zero MDR on transactions up to Rs. 2,000.00. Could the answer lie in allowing merchants, at their discretion, not to accept cards other than RuPay debit cards?



Source: Data submitted to DFS by Public Sector Banks, Regional Rural Banks and Major Private Sector Banks

Figure 8: RuPay debit card issued against PMJDY accounts

How should the government and the RBI solve this complex problem? If there is a revenue differential for banks between RuPay and mastercard/VISA, banks would always in their commercial interest have a tendency to promote that card scheme which generates more revenue for them. This is clearly reflected in Figure 8 where, during the one year period August 2018 through July 2019, there had been issuance of at least 455 lakh RuPay debit cards corresponding to at least 422 lakh new accounts added under PMJDY. In contrast, for the same tenure during August 2019 through July 2020, we see a subdued issuance of around 77 lakh RuPay debit cards despite at least 366 lakh new PMJDY accounts added. This showcases that banks have taken steps to move away from RuPay and promote a card scheme which generates more revenue for them.

5. Concluding Remark

Using debit card and ATM data, this paper prepares grounds for policy guidance. Pricing policy can be ideally based on economic and accounting principles. For a way forward for debit cards, based on cost to the banking industry and prices implicitly paid by bank depositors, we refer to Das A. (2020), "*Merchant transactions through debit cards – costs and prices*", IIT Bombay Technical Report (forthcoming).

References

Basic Statistical Returns of Scheduled Commercial Banks (SCBs) in India. Volume **47**, March 2018. RBI. 03 January 2019.

Basic Statistical Return BSR 2 - Deposits with Scheduled Commercial Banks (SCBs). March 2019. RBI, 15 November 2019.

Concept Paper on Card Acceptance Infrastructure. RBI, 08 March 2016.

Das, Ashish (2016a). *Incentivising ATM-Cash and Cheques Over Electronic Transactions - A Policy Gap*. IIT Bombay Technical Report. 26 January 2016.

Das, Ashish (2016b). *Promotion of Payments Through Cards and Digital Means*. IIT Bombay Technical Report. 24 April 2016.

Das, Ashish (2017). *Discovering the Right MDR for India*. IIT Bombay Technical Report. 28 February 2017.

Das, Ashish (2020). *Discriminatory Approach for RuPay Debit Cards: Some Suggestions for Corrective Measures*. IIT Bombay Technical Report. 07 January 2020.

Das, Ashish (2020). *Deviating from the BHIM-UPI Law*. IIT Bombay Technical Report. 24 August 2020.

Das, Ashish and Das, Praggya (2016). *Sanitising Distortions in Digital Payments*. IIT Bombay Technical Report. November 28, 2016.

Das, Ashish and Agarwal, Rakhi (2010). *Cashless Payment System in India - A Roadmap*. IIT Bombay Technical Report. May 31, 2010.

Promotion of payments through cards and digital means. Government of India (Ministry of Finance), 29 February 2016.

Report of the committee to review the ATM interchange fee structure. Report of the RBI constituted committee. October 2019.

Report of the committee on the analysis of QR (Quick Response) code. RBI. 22 July 2020.