

ELECTRONIC PAYMENT METHODS IN INDIA: A STATISTICAL TREND ANALYSIS

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India's economy has undergone a remarkable transformation in recent decades especially on the digital payment¹ systems. This study provides an overview of the Indian economy, with a focus on digital payment systems and trend analysis of UPI so called electronic payment methods. India's economy has experienced significant transformation in recent years, However, challenges such as income inequality and the informal sector persist, and the COVID-19 pandemic has had a significant impact on the economy. Despite these challenges, India's economy remains one of the fastest-growing in the world, with potential for further growth. Traditional payment methods that have been used for centuries, including cash, checks, demand draft, and bank transfers. These methods have been overtaken by electronic payment methods, which provide faster, more convenient and secure transactions.

Introduction

In recent years, electronic payment methods have revolutionized the way financial transactions are conducted across the globe. One country that has witnessed a significant transformation in its payment landscape is India. With its vast population and rapid technological advancements, India has emerged as a fertile ground for the adoption and growth of electronic payment systems. India, traditionally a cash-dominated economy, has experienced a significant transformation with the widespread adoption of digital payment systems. Initiatives like demonetization and increased Smartphone penetration have facilitated this shift. Businesses benefit from increased efficiency, reduced costs, and improved transparency, while consumers enjoy convenience, security, and financial inclusion. The digitization of payments has also contributed to the formalization of the economy and encouraged financial literacy.

The payment system of banks has undergone significant modernization in both developed and

developing economies. This has led to a decrease in the use of physical cash and the emergence of various electronic and digital modes of payment such as electronic payments, mobile payments, debit and credit cards, mobile wallets, and internet payments. These changes are contributing to the development of a cashless economy, where cash-based transactions are being replaced by electronic transfers and non-electronic payments. Countries like the US have implemented restrictions on cash usage, with most transactions being noncash². India is also experiencing significant growth in cashless transactions. Cashless payments represent a behavioural shift in which people rely less on physical cash and instead use electronic means to exchange goods and services. This trend is driven by continuous technological advancements in the economic environment. The monetary rattle between consumption and affordability slammed the household severely for every now and then in all spheres of life from one pole to another. This research is an encomium on the charisma of Cashless Transaction System, its usability and affordability while they are impacting on its preference to use. The findings reveal that the cashless transaction system has a charismatic appeal as it has an influential effect which is often endorsed by the family and friend.

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While, it is also investigated and concluded that Cashless Transaction System also has its usability and affordability for the consumers.

The study by Pavneet Kaur³ shows that Cashless economy is an economy where maximum transactions are done without using the physical cash but through digital means like credit cards, debit cards, e-wallets and electronic fund transfer (ECS, NEFT, RTGS, USSD, UPI, Aadhar based payment system etc.). Indian digital payments industry is expected to reach \$700 billion by 2022 in terms of value of transactions. Cashless economy is an economic system in which transactions are not done predominantly in exchange for actual cash.

Thirupathi et al.⁴ and Kamal et al.⁵ examine various methods of cashless payments in the Indian economic development, to know the importance of the cashless transaction system, and to analyse the pros and cons of cashless transaction system. In this research the researchers found that the usage of digital payment apps day by day getting more familiarity in our country with 440 percentages increased after demonetization in 2016. As per Reserve Bank of India (RBI)⁶ and National Payments Corporation of India (NPCI), the cashless transactions had been more intensive in familiar channels such as NEFT, Mobile Wallets, Mobile Banking, BHIM, Banking Cards, and Internet Banking. Internet, Mobile, Android and Ios is most re-quired for each digital payment apps to do any transactions. Hence the posture of Indian citizens is shift which is preference a excellent begin-up for cashless or less coin based economy. This will induce India towards more digital and developed economy in India. Devendra Singh⁷ examines the effect of cashless payment on Government of India's flagship initiative, the Digital India program, aims to make India into a cognizant, technologically enabled society. One of the purported parties of Digital India is "Faceless, Paperless, Cashless". The transition from a cash-based to a cashless economy is accelerating the growth of the digital payment system. In order to boost the economy in India, the present government led by Sree Narendra Modi is encouraging citizens to move toward cashless transactions. The purpose of this case study is to investigate the effects of digital payment apps and their effects following demonetization.

Objective

- To explore the trend of electronic payment in India from 2014 to 2022.
- To check the significance of number of ATM⁸ deployed by bank with respect to GDP of India.

- To make statistical Comparison between On-site and Off-site ATM Deployed by the Bank.
- To determine the trend and pattern of Mobile Banking Transactions.

Data Collection

The data collection process for this analysis involves gathering secondary data from three sources: Reserve Bank of India (RBI), National Payments Corporation of India (NPCI)⁹, and India stat. The data included in this study focused on several key indicators related to electronic transactions in India. To gather information on ATM deployment, data was collected from the NPCI, which provided details on the number of on-site and off-site ATMs deployed across the country. Information on the amount of electronic transactions carried out using credit and debit cards was obtained from NPCI. This data provided insight into the volume of cashless payments being made using these types of cards, and how this has changed over time. In addition to mobile banking transactions, data was collected from RBI. This information was obtained from the RBI and NPCI, used to identify trends in the usage of these payment methods. Data on electronic transactions provided a comprehensive overview of the various forms of digital payments being used in India.

Statistical Tool and Techniques

Statistical tools and techniques are used in this study to analyse the collected data efficiently and effectively and to draw certain conclusions.

In order to reach the aim of first and fourth objective we use trend analysis and forecasting with the help of MS-Excel (2019), for checking where the model is best fit or not, we consider the R^2 value It ranges from 0 to 1, where a value closer to 1 indicates a better fit of the regression model to the data.

To determine the aim of second objective, we use ANOVA (Analysis of Variance) and to perform this analysis we use SPSS (Statistical Package for Social Science).

To achieve aim of the third objective of our study, we employed Paired T test for this analysis also we use SPSS. If p-value is less than the chosen significance level, we reject the null hypothesis, which states that the mean difference is equal to zero, and conclude that there is a statistically significant difference between the two sets of measurements. If the p-value is greater than the chosen

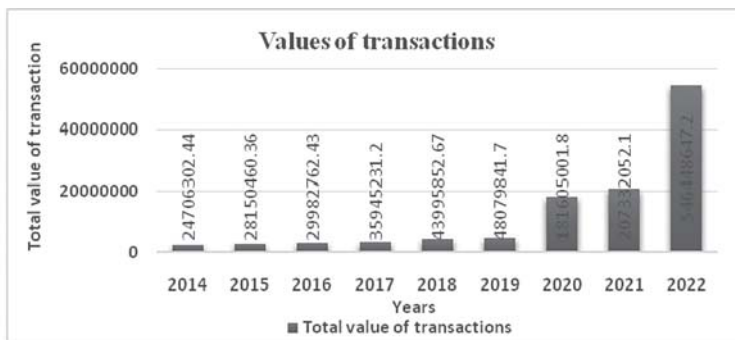


Fig. 1: Bar Pot for the Total Amount of Transaction

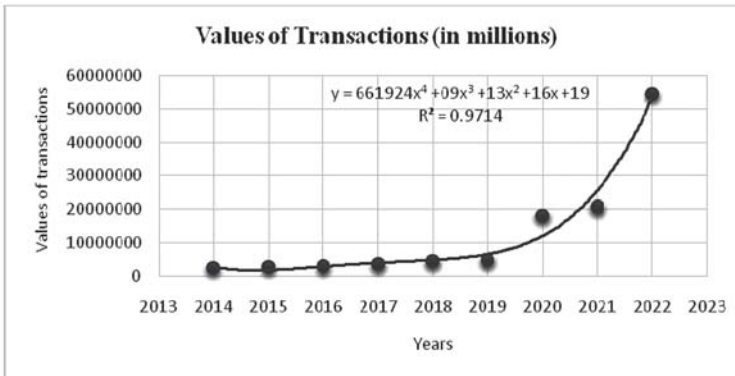


Fig. 2: Curve Fitting for Values of Transactions (in millions)

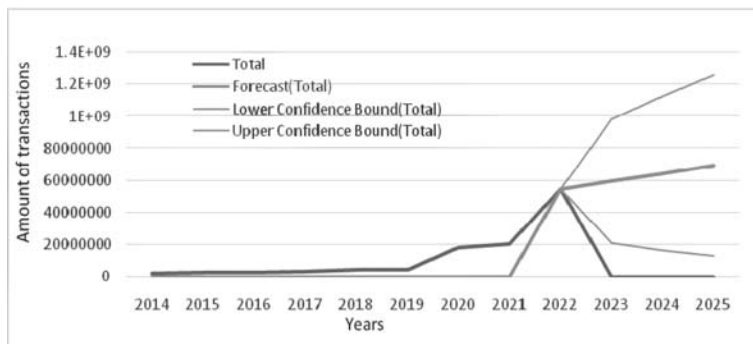


Fig. 3: Curve Fitting for Forecasting Amount of Transactions

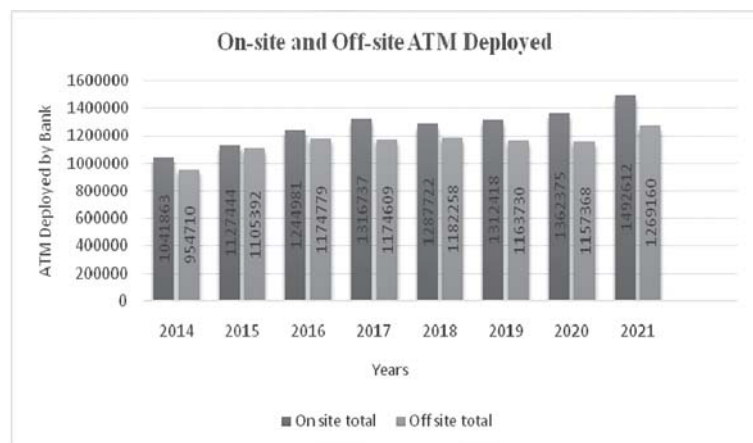


Fig. 4: On-site and Off-site ATM Deployed by the Bank

significance level, we fail to reject the null hypothesis and conclude that there is not enough evidence to suggest a significant difference.

Statistical Analysis

The total value of transactions has shown an overall increasing trend from 2014 to 2022. There was steady growth from 2014 to 2019, with moderate increases each year. However, there was a significant jump in the total value of transactions from 2020 to 2021, and there was a substantial increase again in 2022. These fluctuations indicate a rapid growth rate during these years.

The total value of transactions reveals a consistent upward trend over the years. The percent of changes between consecutive years demonstrate the growth rate. There were significant increases in 2020 and 2022. These figures indicate exceptional growth during those specific years compared to the previous ones. The data suggests a positive trend with a notable acceleration in recent years, the 4th order regression model with a high R^2 value of 0.9745, indicating a strong fit to the data and a high level of explained variance in the total value of transactions over time.

The data reveals a continuous rise in the number of on-site and off-site ATMs deployed by a bank from 2014 to 2021. Although on-site ATMs consistently outnumber off-site ATMs, both categories have experienced an overall growth. In 2021, the combined total of on-site and off-site ATMs exceeds 1.4 million, with a clear distinction in bar graphs for each year, showcasing higher bars for on-site ATMs and a general increase in height over time.

Here, we use ANOVA to understand the analytical relationship between GDP and Total AT Deployed in India by the banks. The ANOVA table is shown below, and the hypothesis will be

Null Hypothesis (H_0): There is no significance difference between the mean of the GDP and ATM Deployed in India by banks.

Table 1: Predicted Values of Amount Transactions

Total	Forecast	Lower Confidence Bound	Upper Confidence Bound
2023	595446867.9	210275510.68	980618225.17
2024	644445088.7	162749690.72	1126140486.58
2025	693443309.4	131369542.99	1255517075.76

Alternative Hypothesis (H_1): There is significance difference between the mean of the GDP and ATM Deployed in India by banks.

Descriptive Statistics

	Mean	Std. Deviation	N
GDP	2558.42688	386.167863	8
ATM Deployed	2421019.75000	224184.280626	8

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method
1	ATM Deployed ^b	.	Enter

a. Dependent Variable: GDP

The results from ANOVA have been shown in **ANOVA** that the value of $F_{(1,6)} = 32.167$ and at 5% level of significance the F -value at degrees of freedom (1,6) is, $F_{(1,6)}(0.05) = 5.99$. Thus, the $F_{(1,15)} > 5.99$, proves that the

two samples are statistically highly significant. This reject the null hypothesis with which proves the alternative hypothesis: There is significance difference between the mean of the GDP and ATM Deployed in India by banks.

We want to compare the means of the ATM Deployed On-site and Off-site by the Bank. The paired sample t-test is appropriate when the two groups being compared are related to each other (e.g., two samples are taken from the same group of subjects).

Null Hypothesis (H_0): states that there is no significant difference between the mean of ATM Deployed On-site and Off-site by the Bank.

Alternative Hypothesis (H_1): states that there is a significant difference between the mean of ATM Deployed On-site and Off-site by the Bank.

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pair 1 On site	1290936.3333	9	140432.28161	46810.76054
Off site	1149958.8889	9	84513.85548	28171.28516

Paired Samples Correlations

	N	Correlation	Sig.
Pair 1 On site & Off site	9	.871	.002

Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				Sig. F Change	Durbin-Watson
					R Square Change	F Change	df1	df2		
1	.918 ^a	.843	.817	165.379962	.843	32.167	1	6	.001	1.567

a. Predictors: (Constant), ATM Deployed

b. Dependent Variable: GDP

ANOVA^a

Model		Sum of Squares	d.f.	Mean Square	F	Sig.
1	Regression	879776.140	1	879776.140	32.167	.001 ^b
	Residual	164103.190	6	27350.532		
	Total	1043879.330	7			

a. Dependent Variable: GDP

b. Predictors: (Constant), ATM Deployed

Paired Samples Test

Mean	Paired Differences					t	df	Sig. (2-tailed)
	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference					
			Lower	Upper				
Pair 1 On site – Off site	140977.44444	78715.04106	26238.34702	80471.70771	201483.18118	5.373	8	.001

From the above result, we can see that the p-value, which is 0.001, is less than 0.05. Thus, we reject the null hypothesis that there is no significant difference between the mean of ATM Deployed On-site and Off-site by the Bank. It proves that there is a significant difference in the On-site and Off-site ATM Deployed by the bank. The correlation between both On-site and Off-site ATM Deployed by the bank is strong, showing that they are strongly correlated.

These results suggest that the Bank's decision to deploy ATMs On-site vs. Off-site may have an impact on their usage and accessibility.

The bar plot given below shows the amount of transaction done by mobile banking in India. The value is given in millions of rupees.

The above bar plot highlights a consistent pattern of increasing mobile banking transactions, emphasizing the rising popularity and acceptance of mobile banking as a convenient means of conducting financial transactions.

The polynomial equation of second order governing the mobile banking transactions and the from the curve we can see that the mobile banking transactions in increasing continuously form the past few years. The model is,

$$y = 4012.5x^2 + 7x + 10$$

The R^2 value of 0.9914 shows that the polynomial equation mentioned fits the data accurately.

Conclusion

With the increasing popularity of transactions through cards, cash is slowly but surely expected to die a natural death but with longer time period in future to come. The trend analysis of credit and debit card transactions from 2014 to 2022 shows an increasing trend with a steep increase in 2020 and 2021.

The ANOVA conducted to compare the mean of GDP and Total ATM Deployed by banks in India shows that there is a significant difference between the means of the two variables. The null hypothesis has been rejected, and it has been concluded that there is a significant difference between the mean of GDP and Total ATM Deployed in India by banks.

The mean number of On-site ATMs was consistently higher than the mean number of Off-site ATMs. The correlation between the two categories was strong, indicating a strong relationship between them. These findings

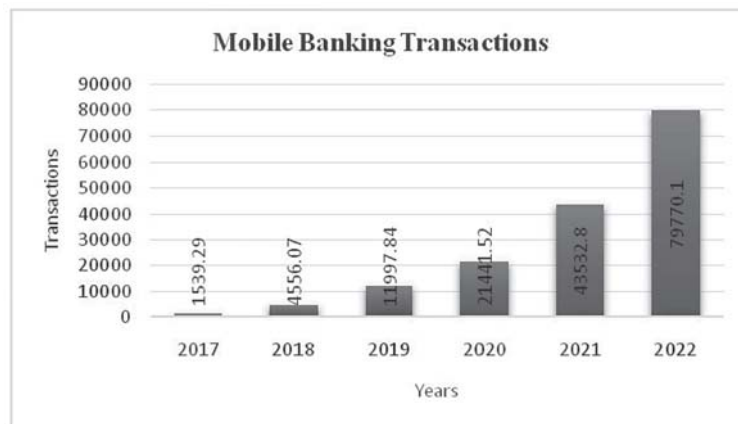


Fig. 5: Bar plot for Mobile Banking Transactions

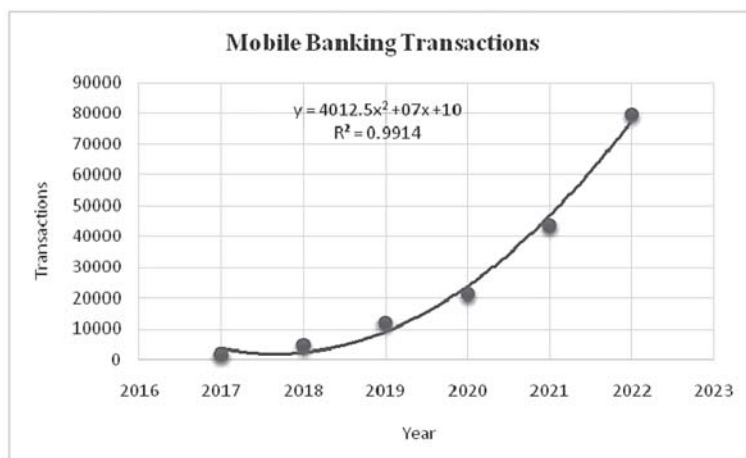


Fig. 6: Curve Fitting for Mobile Banking Transactions

suggest that the bank's deployment strategy for ATMs may have an impact on their accessibility and usage.

A clear trend of increasing mobile banking transactions over the past few years, indicating a growing acceptance of mobile banking as a convenient way to conduct financial transactions in India can be seen in general.

This shift towards electronic payments in India has the potential to significantly reduce cash-related issues such as loss, theft, and robbery. While there are challenges in implementing a cashless economy in a country with a large population living in poverty, the change in mindset towards digital means of monetary transactions is evident. Electronic payment systems, including credit/debit cards, mobile wallets, and digital payment apps, have gained popularity due to their convenience, accessibility, and speed. The government led by NDA with the Vision of Sree Narendra Modi Ji, Honourable PM of India has taken steps to promote digital payments, including the launch of the Unified Payment Interface (UPI) and the demonetization drive in 2016. The future of payment systems in India is expected to see further growth in digital payments, driven by the government's push towards a cashless economy, the growth of e-commerce, and the

increasing adoption of UPI and mobile wallets. The legalization of crypto-currencies in India also presents potential opportunities for their integration into the payment system, although regulations are still evolving, and concerns exist regarding their use in illegal activities. □

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