

Evaluating the Financial Impact of Electronic Toll Collection Systems on Banking Institutions: A Case Study of FASTag in Select Retail Banks in India

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ABSTRACT

Purpose: The introduction of FASTag as an electronic toll collection system in India has significantly transformed the conventional approach to toll payments. By streamlining the toll collection process, FASTag has reduced transaction times, minimized delays, and contributed to a decline in vehicular emissions. This technological advancement has not only enhanced user convenience but also introduced notable implications for the financial sector, particularly banking institutions. The current study explores the extent to which FASTag adoption has influenced the profitability of banks. Specifically, the investigation centres on critical financial indicators, namely Return on Equity and Return on Assets, to assess the performance outcomes associated with the growing volume of FASTag transactions.

Keywords: FASTag, electronic toll collection (ETC) system, ROA, ROE

INTRODUCTION:

India possesses the second largest road network globally, reflecting the country's expansive and complex transportation infrastructure. To modernize toll collection mechanisms and improve traffic efficiency, the FASTag initiative was introduced in 2014 as a pilot project along the Delhi-Mumbai segment of the Golden Quadrilateral, specifically on the stretch between Ahmedabad and another key urban centre (Joshi, 2017). This program was conceptualized to establish an uninterrupted toll payment system, allowing vehicles equipped with a passive RFID tag to pass through toll plazas without the need to halt for manual transactions.

The core objective of this initiative is to facilitate seamless mobility across national highways while promoting electronic payments. The envisioned system is intricate, incorporating the operational integration of toll plaza concessionaires across the country through a centralized clearing framework. This centralized model is designed to ensure accurate and efficient reconciliation of toll collections among various participating entities, laying the foundation for a uniform and technologically advanced tolling infrastructure in India.

Understanding FASTag: A Component of the National Electronic Toll Collection Framework

The National Electronic Toll Collection (NETC) initiative, developed by the National Payments Corporation of India (NPCI), represents a significant innovation in the domain of digital infrastructure and transportation services in India. Designed to facilitate a uniform and interoperable toll payment system across the country, the program seeks to enhance user convenience, reduce delays at toll plazas, and promote cashless transactions.

A key feature of the NETC program is its emphasis on interoperability. Unlike earlier toll collection systems that were restricted to specific service providers, the NETC framework ensures that users can access toll services at any participating toll plaza regardless of the acquiring bank or operator. This level of standardization greatly enhances operational flexibility and user experience, making toll transactions seamless across the national highway network.

FASTag serves as the technological foundation of the NETC system. It employs Radio Frequency Identification (RFID) technology to enable automated toll payments. A passive RFID tag is affixed to the vehicle's windscreen, allowing toll charges to be automatically deducted from a linked prepaid or bank account as the vehicle passes through the toll gate. This mechanism eliminates the need for vehicles to halt at toll plazas, thereby contributing to reduced congestion, faster transit times, and lower fuel consumption. By integrating FASTag into the broader NETC ecosystem, India has taken a critical step toward modernizing its road transport and digital payment infrastructure.

The implementation of FASTag within the National Electronic Toll Collection (NETC) framework offers a range of tangible benefits that enhance its distinctiveness in the Indian transportation landscape. One of the most significant advantages for users is the potential to save both fuel and time. By enabling uninterrupted movement through toll plazas, FASTag reduces vehicle idling and congestion, thereby contributing to improved fuel efficiency and shorter travel durations.

In addition to operational efficiency, the system promotes cashless transactions, removing the need for drivers to carry physical currency or engage in manual toll payment procedures. This feature not only streamlines the toll collection process but also aligns with the broader national agenda of promoting digital financial inclusion.

The integration of nationwide interoperability, combined with the application of RFID technology and user-centric benefits, positions FASTag as a transformative tool within India's toll management system. Its ability to unify toll transactions across diverse operators while enhancing user convenience underscores its strategic value in advancing digital infrastructure and transportation efficiency across the country.

NETC FASTag TRANSACTION PROCESS FLOW



Leg1 - As a vehicle gracefully glides through the ETC lane of the Toll Plaza, the vigilant Toll Plaza system swiftly captures and transmits the intricate details of the FASTag. This includes the distinctive Tag ID, Transaction ID (TID), Vehicle class, and other relevant information. The system ensures accuracy and efficiency in transmitting this data to the Acquiring bank for further processing.

Leg2 - The Acquiring bank, driven by a commitment to seamless transactions, promptly sends a meticulous request to the highly advanced and revered NETC Mapper. This request aims to validate the captured tag details, ensuring their authenticity and correctness.

Leg3 - The NETC Mapper, a sentinel of precision and integrity, diligently examines the Tag ID. With its comprehensive repository of information, it swiftly responds, furnishing invaluable details such as the Vehicle class, Vehicle Registration Number (VRN), Tag Status, and more. In the rare event that the Tag

ID is not found within its database, it dutifully informs that the Tag ID is yet to be registered, emphasizing the importance of proper enrolment.

Leg4 - Empowered by the validated Tag ID from the NETC Mapper, the astute acquirer host deftly calculates the exact toll fare using a sophisticated algorithm. This meticulous calculation takes into account various factors such as distance traveled, vehicle type, and applicable tariffs. With precision, the host initiates a debit request to the highly secure and efficient NETC system.

Leg5 - The NETC System, a robust and interconnected network, seamlessly transfers the debit request to the respective issuer bank responsible for the linked FASTag account. This ensures a streamlined and prompt flow of the payment process, harmonizing the efforts of all entities involved.

Leg6 - The venerable issuer host, armed with formidable financial capabilities, dutifully debits the customer's linked account. With unwavering efficiency, it initiates the transfer of funds and promptly sends an SMS alert to the tag holder, confirming the successful payment. Simultaneously, the issuer host provides a response message to the NETC system, signifying the completion of the transaction. In adherence to defined Time-At-Threshold (TAT), any failure to respond within the specified timeframe results in the transaction being deemed accepted, ensuring continuous workflow and customer satisfaction.

Leg7 - The diligent NETC system, acting as the orchestrator of the toll payment ecosystem, meticulously updates the acquirer host with the response received from the issuer host. This seamless flow of information ensures transparency and real-time tracking of transactions.

Leg8 - The vigilant acquirer host, acting as a messenger of efficiency, promptly disseminates the updated status to the respective toll plaza system. This communication ensures that the toll plaza is instantly informed of the transaction's progress, facilitating a smooth passage for the vehicle and enhancing the overall commuter experience.

Return on Assets (ROA) measures a bank's profitability relative to its total assets. It reflects the efficiency of asset utilization in generating profits. Return on Equity (ROE) measures a bank's profitability in relation to its shareholders' equity, indicating how effectively it employs equity capital to generate returns. By analysing the relationship between FASTag volumes and banks' ROE, we can gain insights into the effectiveness of the electronic toll collection system on the financial performance of banks.

Literature Review:

Shivani Sawarkar, Vidhita Kamble, and colleagues (2017), the researchers explored an online toll collection system that utilizes Optical Character Recognition (OCR) technology. The primary aim of their project was to enhance the overall efficiency and performance of toll operations by automating the identification and transaction process. The system was designed to detect vehicle license plates using OCR, thereby retrieving key information related to the vehicle owner. This includes the owner's name, contact details, and associated bank account number, enabling automatic toll deductions without the need for manual intervention. The approach proposed in this study differs from Radio Frequency Identification (RFID)-based systems like FASTag by focusing on visual recognition rather than tag-based communication. Despite the technological differences, both systems share the common goal of facilitating faster and more efficient toll processing through automation and digital integration.

Dr. Shakti Singh and Rakhi Yadav (2018) conducted a comparative study focused on the toll collection systems at the Kherki Daula Toll Plaza in Gurugram, Haryana. The primary objectives of their research were to assess the awareness levels of commuters regarding the various toll payment methods available, to evaluate user preferences among those methods, and to identify the most effective toll payment option

based on commuter feedback. The study employed both exploratory and descriptive research approaches. Data was collected using a structured questionnaire distributed through random sampling, allowing for a broad representation of commuter opinions. The results indicated that while all respondents (100%) were familiar with the conventional, cash-based toll payment system, only 20% were aware of the RFID-based method, and 70% had knowledge of the FASTag service. Despite this relatively high awareness of FASTag, only 45% of respondents expressed a preference for using it, while 50% continued to favour the traditional payment method, and just 5% showed interest in paying through RFID. Based on these findings, the study recommended that the government and relevant authorities should intensify efforts to encourage the adoption of digital toll payment systems, particularly FASTag. Awareness campaigns and user incentives may play a key role in transitioning a greater proportion of commuters toward cashless and automated toll transactions.

Abhishek Sontakke (2019) conducted a study focused on the integration of intelligent systems for automatic traffic challan issuance and toll payment using FASTag on Indian highways. The primary objective of the research was to explore the potential of Radio Frequency Identification (RFID) technology in creating a more streamlined and user-friendly system for both toll collection and traffic management. By leveraging RFID-enabled FASTag cards, the study proposed a model that facilitates not only contactless toll payment but also the possibility of automating traffic violation penalties. The findings emphasized the practicality and efficiency of using FASTag technology, particularly its ability to alleviate congestion at national toll plazas. With the FASTag affixed to the vehicle's front windshield, toll charges are deducted automatically from the associated prepaid or bank account as the vehicle moves through the toll lane. This automation reduces the need for physical interaction and significantly decreases processing time. The study concluded that the implementation of FASTag contributes to a smoother vehicular flow, minimizes human intervention, and sets the foundation for more intelligent traffic regulation systems.

Akshay Hinge (2020) carried out a study aimed at evaluating the performance of the existing Electronic Toll Collection (ETC) system implemented across toll plazas in India. The primary objective of the research was to analyse the current system's operational efficiency and to recommend remedial measures that could enhance its functionality, particularly during periods of peak traffic. The study employed a combination of methodologies, including a preliminary field survey, traffic flow analysis, and traffic composition studies. Through this empirical approach, the researcher was able to capture real-time operational challenges faced at toll plazas. The findings indicated that, while the ETC system has significantly modernized toll operations, it still faces marginal inefficiencies, especially during high-traffic hours. These operational issues result in avoidable delays, affecting both commercial and non-commercial vehicles. The study concluded that further optimization of the ETC infrastructure—such as improved system calibration, better traffic lane management, and enhanced coordination between toll operators—could help mitigate these delays and improve the overall user experience.

B. Gayathiri and Dr. K. Ravindran (2020), conducted a study on customer Discernment towards FASTag Implementation in Madurai District. The objective of this study was to analyse the customer discernment towards electronic toll collection systems and system payment methods. The methodology used in the study was primary and secondary data collection. The finding of this study was most responders have aware of the FASTag and its importance, and the majority of the vehicle are cars, vans and other kinds of four-wheelers that have the welfare.

N. Akshaya and Dr. R. Guna Sundari (2021), in their article entitled, a study on passenger's satisfaction using FASTag with special reference to Coimbatore city. The main objectives of the study were to understand the demographic characteristic of the people using FASTag and to examine the problems faced by the people due to the implementation of FASTag. They used the methodology of primary and secondary

data collection. Hence, the finding has concluded that people using FASTag are more satisfied with the ease of payment in FASTag

Objectives of the Study:

The main objective of the study is to perceive the association between Volume of FASTag transactions and banks profitability.

The specific objectives are as follows:

- i. Identify the association between Volume of FASTag transactions and banks profitability.
- ii. Provide suggestions for improvement in FASTag framework.

Hypothesis of the study:

H₀: There is no association between Volume of FASTag transactions and bank profitability

H_a: There is an association between Volume of FASTag transactions and bank profitability

Methodology:

The present study is empirical in nature and has adopted the descriptive research design as it intends to study the past performance of banks and the impact of FASTag implementation on their performance.

Regression of data has been conducted using ANNOVA analysis. SPSS v24 software has been used for analysis. In the study researcher has used the below Model and Dependent -Independent Variables:

Dependent and Independent Variables:

Variables		Indicator	Proxy	Significance
Dependent	Performance	Return on Assets (ROA)	Net Income/ Total Assets	Higher ROA Indicated higher financial performance
		Return on Equity (ROE)	Net Income/ Total Equity	Higher ROE Indicated higher financial performance
Independent	Digital Technology	FASTag	Volume of Transaction	Higher Volume indicates higher investment in FASTag
Control Variables	Bank Specifications	Capitalization (CAR) (Capital Adequacy ratio)	Total Equity/ Total Assets	Higher CAR indicates higher Bank Capitalization
		Cost Efficiency (EEF) (Ratio of intermediation cost to total assets)	Cost to income ratio= Operating Expenses/Operating Income	Higher EEF indicates Lower Cost Efficiency
		Asset Quality (AQ) (Ratio of net NPA To net advances)	Nonperforming/Total Loans	Higher AQ indicates lower AQ
		Bank Size (SIZE)	Ln (Total Assets)	Higher SIZE indicates higher Bank Size

The establishment of relationship and the study of impact of FASTag on ROA and ROE has been done through multiple regression technique. The model used by the researcher is as below:

1. $ROA_{i,t} = \alpha + \beta_1 FASTag_{i,t} + \beta_2 CARI_{i,t} + \beta_3 EFF_{i,t} + \beta_4 AQ_{i,t} + \beta_5 SIZE_{i,t} + \epsilon$
2. $ROE_{i,t} = \alpha + \beta_1 FASTag_{i,t} + \beta_2 CARI_{i,t} + \beta_3 EFF_{i,t} + \beta_4 AQ_{i,t} + \beta_5 SIZE_{i,t} + \epsilon$

Where:

- "ROA" and "ROE": performance in bank "i" for period "t".
- " α ": Y-intercept.
- " β ": coefficient of variable where "i" ranges from 1 to 8.
- " $FASTag_{i,t}$ ": FASTag volumes in acquirer banks "i" for period "t".
- " $CARI_{i,t}$ ": capitalization in bank "i" for period "t".
- " $EFF_{i,t}$ ": cost efficiency in bank "i" for period "t".
- " $AQ_{i,t}$ ": asset quality in bank "i" for period "t".
- " $SIZE_{i,t}$ ": size of bank "i" in period "t".
- " ϵ ": error term.

Scope of Study:

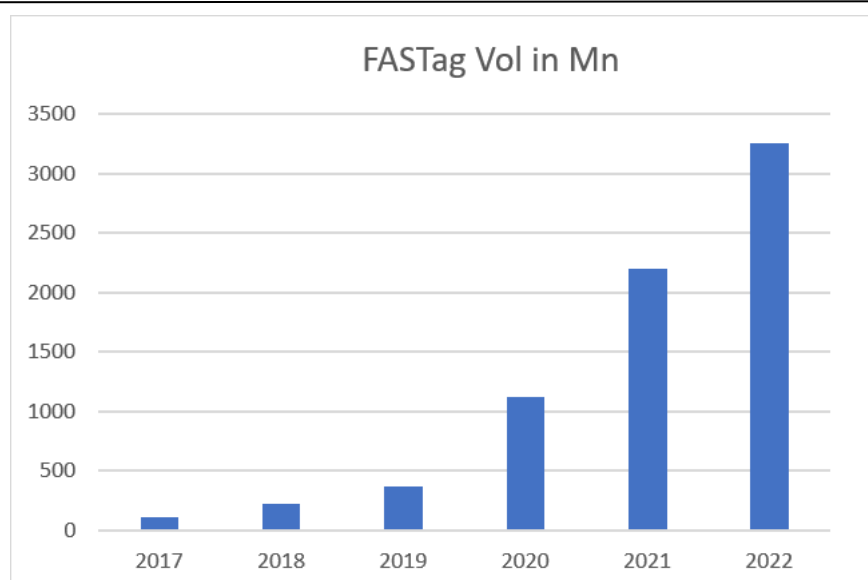
Time Period in Scope – 2021 to 2022

Table 1 - Banks in Scope:

Sr No	Name of Bank	Type of Bank
1	HDFC Bank	Private
2	ICICI Bank	Private
3	IndusInd Bank	Private
4	Kotak Mahindra Bank	Private
5	Axis Bank	Private

Result and Discussion

Figure 1 – Year wise summary of FASTag Volumes in the country



Source NETC

The analysis of above data presents that the number of transactions performed through FASTag have significantly shown a growth during the period of study. From a nominal number of 105.37 million transactions during 2017 it rose to 3251.98 million transactions during 2022-23. This shows the attraction of customers towards FASTag which may be assigned to various reasons such as convenience, technological advancement, literacy, government rules etc

Descriptive Statistics of the Banks:

The descriptive statistics are performed to have a preliminary understanding of bank's characteristics enrolled in the sample. The focus of this research is mainly on the mean, which measures the central tendency, and the standard deviation, which measures the dispersion.

Table 2 - Descriptive statistics

Variable	Obs	Mean	Std Dev.	Min	Max
Banks					
Year	10	2021.5	0.527	2021	2022
ROE	10	12.17	3.334	7.06	16.656
ROA	10	1.533	0.501	0.7	2.13
CAR	10	19.438	1.686	17.38	22.69
EFF	10	2.198	0.299	1.85	2.736
AQ	10	0.768	0.314	0.32	1.24
SIZE	10	13.346	1.52	9.42	14.54
FASTag Vol	10	20.343	22.8	6.75	68.08

Source – Authors own calculation

The results of Table 2 show the descriptive statistics. The average ROE is 12.17, ROA is 1.53, CAR is 19.438 EFF is 2.198, AQ is 10.768, SIZE is 13.345. The FASTag volume has a mean of 20.343 which indicates that is developed in the Retail banking sector. Overall, the descriptive statistics indicates a sound position of the Retail Banking Sector.

Impact of FASTag Vol on Banks ROA

Table 3 – Model Summary of ROA

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Model Summary (ROA)			
R	R Square	Adjusted R Square	Std. Error of the Estimate
.93	.87	.71	.27

ANOVA (ROA)					
	Sum of Squares	df	Mean Square	F	Sig.
Regression	1.97	5	.39	5.34	.065
Residual	.29	4	.07		
Total	2.26	9			

Coefficients (ROA)										
	Unstandardized Coefficients		Standardized Coefficients		t	Sig.	95% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta				Lower Bound	Upper Bound	Tolerance	VIF
(Constant)	-1.54	1.68		.00	-.92	.401	-6.21	3.13		
CAR	.28	.06		.94	4.41	.012	.10	.45	.72	1.38
EFF	-.40	.37		-.24	-1.09	.336	-1.43	.62	.66	1.51
AQ	-1.40	.39		-.88	-3.59	.023	-2.48	-.32	.54	1.84
SIZE	-.04	.08		-.12	-.53	.622	-.25	.17	.60	1.67
FASTaG_Vol	.01	.00		.39	1.76	.153	.00	.02	.68	1.47

Coefficient Correlations (ROA)						
		CAR	EFF	AQ	SIZE	FASTaG_Vol
Covariances	CAR	2.83	-.04	-.21	-.22	-.10
	EFF	-.04	.00	-.01	-.01	.00
	AQ	-.21	-.01	.14	.03	.00
	SIZE	-.22	-.01	.03	.15	.02
	FASTaG_Vol	-.10	.00	.00	.02	.01

Source – Authors own calculation

The probability value of 0.147 indicates that the regression relationship was highly significant in predicting how FASTag affect profitability of commercial banks. The F calculated at 5% level of significance is 6.13 since F calculated is greater than the F critical ($F_{7,2,0.5} = 4.18$), t Since the obtained F-statistic (6.13) is greater than the critical F-value (4.18), we can conclude that the regression is statistically significant at the 0.5 significance level.

Impact of FASTag Vol on Banks ROE

Table – Model Summary of ROE

Model Summary (ROE)				
R	R Square	Adjusted R Square	Std. Error of the Estimate	
.91	.82	.61	2.09	

ANOVA (ROE)					
	Sum of Squares	df	Mean Square	F	Sig.
Regression	82.59	5	16.52	3.77	.111
Residual	17.52	4	4.38		
Total	100.12	9			

Coefficients (ROE)										
	Unstandardized Coefficients		Standardized Coefficients		t	Sig.	95% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta				Lower Bound	Upper Bound	Tolerance	VIF
(Constant)	8.94	12.97		.00	.69	.521	-27.06	44.95		
CAR	1.39	.49		.70	2.86	.046	.04	2.74	.72	1.38
EFF	-6.45	2.85		-.58	-2.26	.087	-14.37	1.47	.66	1.51
AQ	-10.11	3.01		-.95	-3.36	.028	-18.46	-1.76	.54	1.84
SIZE	-.22	.59		-.10	-.37	.731	-1.86	1.43	.60	1.67
FASTaG_Vol	.05	.04		.35	1.39	.237	-.05	.15	.68	1.47

Coefficient Correlations (ROE)						
	CAR	EFF	AQ	SIZE	FASTaG_Vol	
Covariances						
CAR	168.16	-2.63	-12.44	-13.01	-5.65	
EFF	-2.63	.24	-.58	-.54	-.02	
AQ	-12.44	-.58	8.14	2.05	.25	
SIZE	-13.01	-.54	2.05	9.05	.93	
FASTaG_Vol	-5.65	-.02	.25	.93	.35	

The probability value of 0.111 indicates that the regression relationship was highly significant in predicting how FASTag affect profitability of commercial banks. The F calculated at 5% level of significance is 6.13

since F calculated is greater than the F critical ($F_{5,4,0.5} = 0.324$), t Since the obtained F-statistic (3.77) is greater than the critical F-value (0.324), we can conclude that the regression is statistically significant at the 0.5 significance level.

CONCLUSION:

The findings of the present study indicate a substantial increase in FASTag transaction volumes during the observed period. However, this sharp growth has not resulted in a corresponding improvement in the profitability of selected banks in India. Key indicators of profitability, namely Return on Assets and Return on Equity, have shown a noticeable decline. The analysis confirms that the volume of FASTag transactions does not have a statistically significant effect on either Return on Assets or Return on Equity. This suggests that, despite the widespread adoption of FASTag, it has yet to produce measurable financial gains for banking institutions.

One possible explanation for the limited impact on profitability is the considerable investment required for the installation and maintenance of the FASTag infrastructure. Additional factors such as regulatory requirements and government policies may also be placing financial pressure on banks. These observations are consistent with the findings of Shirley and Sushanta, who in their two thousand six study argued that while the use of information technology may reduce costs, excessive spending on technology without strong network effects could lead to a decline in profitability. They further suggested that the financial benefits of technology investment are dependent on the strength of the network effect. When the network effect is relatively weak, increased investment in information technology is likely to yield modest outcomes such as reduced staffing costs, marginal increases in market share, and limited improvement in revenue and profit.

It is also important to acknowledge the limitations of the current study. The analysis considers only the volume of FASTag transactions as an influencing factor on bank profitability. Future research may extend this study by including additional variables such as the cost of acquiring FASTag customers, the operational expenses related to the setup and maintenance of the system, and other indirect financial impacts.

In conclusion, while FASTag is gaining significant traction and public support, it remains in an early stage of development. Its full potential to contribute to bank profitability has not yet been realized. With stronger coordination among banks and more support from government initiatives, the financial benefits of FASTag can be enhanced over time.

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