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Trends of Mobile Financial Services and the Impact of Using Electronic Modes of Transaction on Cash-Based Transactions in Bangladesh

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Abstract

Despite a pervasive lack of financial literacy, Bangladesh has made remarkable progress in financial inclusion through the rapid increase of Mobile Financial Service (MFS) accounts. MFS accounts per hundred people are found to have increased more than six times within eight years, accelerating the country's financial inclusion. Although a rapid penetration of MFS is observed, the pace of adopting electronic modes of MFS transactions as a substitute for cash-based modes of MFS transactions lags compared to the overall usage of MFS in the country. Time series data analysis, applying the Autoregressive Distributed Lag (ARDL) model, demonstrates that electronic modes of MFS usage are causing a significant reduction in the share of traditional cash-based MFS usages as a long-term impact. The findings of the study serve as a basis for strategic decision-making for policymakers and allow industry players to explore innovative approaches in response to the changing dynamics of the market.

Keywords: Electronic Transaction, MFS Penetration, Financial Literacy, Financial Inclusion.
JEL Classification: G210, C320, O310.

1. Introduction

Mobile Financial Service (MFS) offers financial services with mobile wireless networks and enables users to perform banking transactions (Bangladesh Bank, 2012). Through MFS, users can get financial services, even in remote locations. MFS users need not visit a physical bank branch to make any transactions. They do not even require a bank account in a commercial bank. MFS allows users to utilize an alternative channel beyond the periphery of commercial banking, operated primarily by branch and ATM networks. Compared to commercial banks, it enables customers easier access to the formal banking system. As a large portion of Bangladesh's people are unbanked and have poor financial literacy, MFS is an easy tool to access financial services for those

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unbanked people at affordable rates. MFS effectively enhances financial inclusion and promotes a country towards development (Mowla & Tani, 2020).

In Bangladesh, the number of MFS customers and transactions is increasing continuously, which manifests in gradual financial inclusion. At the end of July 2023, MFS's registered customers increased to 209.57 million compared to 181.14 million one year ago. During FY2022-23, MFS transactions were around 5.54 billion valuing BDT 12,174 billion. It showed an increase of 16.13% and 22.97% in number and value, respectively, compared to FY2021-22. The gradual increase of MFS transactions in the country manifests the people's inclination towards electronic payments (Bangladesh Bank, 2022). Easy accessibility and wide acceptability of MFS have catalyzed the increasing usage of the service all over the country.

Different payment platforms facilitate customers' different types of payment needs. Usually, MFS caters to the need for small ticket-size retail payments. It is a great advantage that only identity proof is required to open an MFS account. So, for people who do not have an account in a commercial bank, an MFS account is an easy tool for them to access formal financial services without any trouble. MFS transactions can be done with a feature phone and a mobile network, even without a smartphone and an internet connection.

Bangladesh Bank, the country's central bank, allows scheduled commercial banks, financial institutions, and government entity-led MFS providers to operate. As of September 2023, nine banks, three subsidiaries of three banks, and one govt. entity (Bangladesh Post Office) have been delivering mobile financial services in the country (Bangladesh Bank, 2023). The limited financial services of MFS include cash-in to and cash-out; Person-to-Business (P2B) payments, such as educational institutional fees, and merchant payments; Business-to-Person (B2P) payments, such as salary disbursements; Person-to-Person (P2P) payments, such as a person's MFS account to another person's MFS or bank account; Business-to-Business (B2B) payments, such as vendor payments; Government-to-person (G2P) payments, such as pension; person to government (P2G) payments, such as tax (Bangladesh MFS Regulations, 2022).

Among different types of usages of MFS, the cash-in and cash-out are related to cash transactions, whereas others are platform-based electronic transfers that do not require any cash involvement. In this paper, cash-in and cash-out have been considered cash-based modes of MFS usage, whereas other methods, such as P2P, P2B, B2P, B2B, G2P, and P2G transactions, have been considered electronic modes of MFS usage.

In comparison to cash-based (cash in and out) usage of MFS, electronic payment gateways, such as P2P, P2B, B2B, B2P, P2G, and G2P, have some advantageous features, like hassle-free transfer of money directly to the beneficiary from any time at any place that are influencing the consumers in the adoption of electronic payment gateways in MFS. Moreover, the demand for electronic transactions is growing globally (Kapoor et al., 2024).

For this study on MFS, Bangladesh was chosen because it has a lot of underprivileged people who lack proper financial literacy and have no bank account (Parvez & Woodard, 2015). These financially excluded people have been brought under the umbrella of MFS successfully, which can be an imitable example for the countries where many people are excluded from the formal financial arena.

The objectives of this paper are as follows:

i) To explore the trend of MFS in Bangladesh with respect to its adoption over the period.

ii) To find out the pattern of usage of MFS, especially focusing on whether the usages of MFS as a means of electronic payment gateways, such as P2P, P2B, B2P, B2B, G2P, and P2G transactions, are replacing traditional means of cash-based MFS transactions, such as cash-in or cash-out.

Analyzing the secondary data on MFS adoption, the rapid penetration of MFS is observed over time, accelerating the country's financial inclusion. The MFS accounts per hundred people are found to have increased more than six times within eight years (2015-2023). The analysis of the time series data applying the Autoregressive Distributed Lag (ARDL) model (Pesaran & Shin,

1995) explored that electronic modes of MFS usage negatively and significantly impact cash-based MFS usage in Bangladesh.

The paper seeks to contribute to the literature on MFS by offering empirical evidence on the evolution of MFS usage in Bangladesh over time, using objective measures instead of relying solely on users' opinions. The study will be valuable for policymakers, regulatory authorities, industry players, MFS providers, and consumers. Policymakers and regulatory authorities can leverage the paper's findings to assess the evolving landscape of technology usage among users in Bangladesh. By understanding the changes in user behavior and preferences, MFS providers can identify new business opportunities and tailor their services to better concentrate on customers' need. The empirical evidence presented in the paper can serve as a basis for strategic decision-making, allowing MFS providers to adapt their offerings and explore innovative approaches in response to the changing dynamics of the market.

Section-2 of this paper contains an overview of MFS in Bangladesh. Section 3 reviews related literature and develops research issues. Section 4 describes the data and methodology of this study. Section 5 presents the results, analysis and discussion. Section 6 provides conclusions, limitations, and areas of further research.

2. Overview of MFS in Bangladesh

In 2011, Bangladesh Bank introduced MFS, opening a new horizon of digital payment systems. At the initial stage, the usage of MFS was mostly confined to cash-in and cash-out transactions. However, it is now used as a medium for various payment gateways, like P2P, P2B, B2P, B2B, G2P, and P2G transactions.

The government of Bangladesh has taken steps to ensure the advancement in power connectivity nationwide, the availability of mobile phones at lower cost, the digitization of payment systems, and the availability of country-wide mobile network coverage and internet at an affordable price. Moreover, the recent implementation of interoperability among all financial service providers, including MFS has amplified the scope of MFS usage in the country. All these have widened the prospects of mobile financial services throughout the country.

As of July 2023, the country's mobile phone and mobile internet connections reached 187.48 million and 118.79 million, respectively (BTRC, 2023). With an easy account opening process and user-friendly, cost-effective features, MFS has extended the avenues for accessing financial services to the unbanked population. This infrastructure facilitation has expanded the scope of MFS penetration massively in the country. These favorable facilities encourage the MFS providers to reach customers easily (Pazarbasioglu et al., 2020). The exponential growth in mobile phone subscribers and the introduction of e-KYC accelerated MFS penetration in the country (ADB, 2022).

Despite the huge MFS penetration in the country, there are challenges. There is limited accessibility to digital financial services for a large segment of the people living mainly in the rural parts of Bangladesh. A critical challenge MFS faces in Bangladesh is the lack of digital financial literacy among a large portion of its population. A survey (BIGD, 2020) found that more than 60% of the MFS users in Bangladesh operates their accounts by others as they have not adequate digital financial literacy. It disrupts data confidentiality and violates security.

MFS fraud is widespread in the country. It reduces the credibility of the MFS platforms, and people are compelled to adopt traditional payment methods. According to a survey (2022) conducted by the *Policy Research Institute of Bangladesh (PRI)*, ten percent of MFS users in the country faced financial fraud. The main reasons for fraud, as they pointed out, are the lack of digital financial literacy, sharing Personal Identification Numbers (PINs) with relatives and agents, and sharing PINs with someone fraudulently personifying as officials of the MFS provider. The highest (56%) form of fraud happened in the form of PINs and scams involving impersonation, as they found (Azad & Rahman, 2022).

3. Literature Review

Existing literature on MFS primarily deals with the impact of MFS on financial inclusion (e.g., Sultana & Khan, 2016; Kanobe et al., 2017) and economic development (e.g., Ouma et al., 2017; Akhter & Khalily, 2020) of a country. Some papers have dealt with the driving force behind using MFS (e.g.,

Abdinoor & Mbamba, 2017; Ehsan et al., 2019; Mowla & Tani, 2020; Adjei et al., 2020) from users' perspectives.

Akhtaruzzaman et al. (2017) reported that in the household context, family members mostly transfer money among themselves, mainly to purchase family groceries and meet educational expenses in Bangladesh. They also surveyed small and medium business firms and found they use MFS to enhance their business activities, primarily revenue collection and suppliers' payment.

Kabir et al. (2020) studied the scenario of MFS, its regulatory framework, prospects, and challenges in Bangladesh. They examined MFS in Bangladesh and presented its growth of accounts from 2014 to 2019. From their collected data set, they also compared Bangladesh's MFS scenario.

Fernandes et al. (2021) analyzed the impact of the electronic modes of financial services on the financial inclusion based on the ARDL model. They found the crucial role of electronic modes of financial services on financial inclusion as the former extends access to the underserved people in Mozambique.

The review of prior literature clearly shows a gap in the existing research on the analysis of the trends of MFS in a country context and the examination of whether there are any changes in MFS usage over the period based on historical data, not on users' opinions, especially in the context of Bangladesh. The analysis of the overall trend of MFS with respect to the number of MFS accounts, MFS customer-to-MFS agent ratio, and MFS transactions provides insight into the penetration speed of MFS in a country. Moreover, observing the trend of MFS regarding the adoption rate with respect to the total population provides a clear picture of the financially included portion of a country due to the adoption of MFS over the period.

Though Bangladesh has been experiencing MFS for over a decade, the changing pattern of MFS usage with respect to the focus on whether the electronic payment gateways of MFS, such as P2P, P2B, B2P, B2B, G2P, P2G transactions are replacing the cash-based MFS usage, such as cash-in and cash-out, have not been analyzed in contemporary papers. Even the changing pattern of MFS usage

in the mentioned area has not been observed in available literature in the context of other countries.

4. Data and Methodology

4.1 Variables

For analyzing the trends of MFS in Bangladesh, the considered variables and their definitions are mentioned in Table-1.

Table 1: Variable (MFS trends) description

Variable	Definition
MFSCustomer	Number of MFS customers (in million).
MFSAgent	Number of MFS agents (in million).
MFSTranNo	Number of MFS transactions (in million).
MFSTranAmt	Amount (in billion BDT) of MFS transactions.

Source: Author's Compilation

For analyzing different categories of usages of MFS over time in Bangladesh, the considered variables and their definitions are mentioned in Table-2.

Table 2: Variable (MFS usage) Description

Variable	Definition
CashInAmt	MFS usage (in amount) of cash-in (as % of total MFS usage) in the country.
CashOutAmt	MFS usage (in amount) of cash-out (as % of total MFS usage) in the country.
P2PAmt	MFS usage (in amount) of P2P (as % of total MFS usage) in the country.
MerPayAmt	MFS usage (in amount) of merchant payment (as % of total MFS usage) in the country. It can be B2B and P2B.
G2PAmt	MFS usage (in amount) of G2P (as % of total MFS usage) in the country.
SalDisbAmt	MFS usage (in amount) of salary disbursement (as % of total MFS usage) in the country. It can be B2P and G2P.
UtiBillPayAmt	MFS usage (in amount) of utility bill payment (as % of total MFS usage) in the country. It can be P2G, P2B, B2G, and B2B.
CashInNo	MFS usage (in number) of cash-in (as % of total MFS usage) in the country.
CashOutNo	MFS usage (in number) of cash-out (as % of total MFS usage) in the country.
P2PNo	MFS usage (in number) of P2P (as % of total MFS usage) in the country.
MerPayNo	MFS usage (in number) of merchant payments (as % of total MFS usage) in the country. It can be B2B and P2B.
G2PNo	MFS usage (in number) of G2P (as % of total MFS usage) in the country.

Variable	Definition
SalDisbNo	MFS usage (in number) of salary disbursement (as % of total MFS usage) in the country. It can be B2P and G2P.
UtiBillPayNo	MFS usage (in number) of utility bill payments (as % of total MFS usage) in the country. It can be P2G, P2B, B2G, and B2B.

Source: Author's Calculation

4.2 Data

The secondary data for 97 months (July 2015-July 2023) on MFS registered customers, agents, transaction numbers, and transaction amounts have been collected from the annual reports (2015-2023) and the website of Bangladesh Bank to study the MFS trends.

For studying different categories of usages of MFS over time, secondary data for 56 months (Dec 2018-July 2023) has been collected from the Bangladesh Bank website. The study sample represents the entire MFS industry in the country.

4.3 Hypothesis

Traditional cash-based MFS usage (cash-in and cash-out) is negatively associated with the electronic modes of MFS usage (P2P, P2B, B2P, B2B, G2P, and P2G transactions).

4.4 Research Method

The ARDL model (Pesaran & Shin, 1995) has been applied to examine the hypothesis. The reason for applying the ARDL model is to explore the long-run cointegrating relationship between the variables of interest and estimate both the long-run and short-run relationships. Besides, enough lags in the model can handle serial correlation and endogeneity, and it permits using different optimal lags for different variables in the same model (Duasa, 2007).

In ARDL, the dependent variable is a function of its past lagged values and other explanatory variables' current and past values. It focuses on the exogenous variables and selecting the correct lag structure from the dependent and independent variables. An ARDL model assumes that the independent variables

are independent in the sense that it is not necessary to include the dependent variable as a predictor of the independent variables.

An ARDL model contains independent variables and their lagged values. Simultaneously it contains the lagged values of the dependent variable.

In general form, with p lags of y and q lags of x, an $ARDL\ (p, q)$ model can be expressed as –

$$Y_t = \beta_0 + \beta_1 Y_{t-1} + \cdots\cdots + \beta_p Y_{t-p} + \propto_0 X_t + \propto_1 X_{t-1} + \propto_2 X_{t-2} + \cdots\cdots + \propto_q X_{t-q} + \varepsilon_t \cdots\cdots (1)$$

where ε_t is a random disturbance term. The model is autoregressive in the sense that Y_t is explained partly by its lagged values. It also has a distributed lag component in the form of successive lags of the 'X' explanatory variable.

To avoid the nonlinearity in variables, natural logs for all the variables on both sides of the econometric specification (log-log model) have been used to generate the desired linearity.

For testing the hypothesis, 4 (four) separate models have been tested. Based on equation (1), the mathematical equations for Models-I to IV stand as follows:

Model-I

$$\begin{aligned} LnCashInNo_t = {} & \beta_0 + \beta_1 LnCashInNo_{t-1} + \beta_2 LnCashInNo_{t-2} + \cdots\cdots \\ & + \beta_p LnCashInNo_{t-p} + \alpha_0 LnP2PNo_t + \alpha_1 LnP2PNo_{t-1} \\ & + \alpha_2 LnP2PNo_{t-2} + \cdots\cdots + \alpha_p LnP2PNo_{t-p} + \gamma_0 LnSalDisbNo_t \\ & + \gamma_1 LnSalDisbNo_{t-1} + \gamma_2 LnSalDisbNo_{t-2} + \cdots\cdots \\ & + \gamma_p LnSalDisbNo_{t-p} + \delta_0 LnG2PNo_t + \delta_1 LnG2PNo_{t-1} \\ & + \delta_2 LnG2PNo_{t-2} + \cdots\cdots + \delta_p LnG2PNo_{t-p} + \varepsilon_t \end{aligned}$$

Model-II

$$LnCashInAmt_t = \beta_0 + \beta_1 LnCashInAmt_{t-1} + \beta_2 LnCashInAmt_{t-2} + \cdots\cdots + \beta_p LnLnCashInAmt_{t-p} + \alpha_0 LnP2PAmt_t + \alpha_1 LnP2PAmt_{t-1} + \alpha_2 LnP2PAmt_{t-2} + \cdots\cdots + \alpha_p LnP2PAmt_{t-p} + \gamma_0 LnSalDisbAmt_t + \gamma_1 LnSalDisbAmt_{t-1} + \gamma_2 LnSalDisbAmt_{t-2} + \cdots\cdots + \gamma_p LnSalDisbAmt_{t-p} + \delta_0 LnG2PAmt_t + \delta_1 LnG2PAmt_{t-1} + \delta_2 LnG2PAmt_{t-2} + \cdots\cdots + \delta_p LnG2PAmt_{t-p} + \varepsilon_t$$

Model-III

$$LnCashOutNo_t = \beta_0 + \beta_1 LnCashOutNo_{t-1} + \beta_2 LnCashOutNo_{t-2} + \cdots\cdots + \beta_p LnCashOutNo_{t-p} + \alpha_0 LnP2PNo_t + \alpha_1 LnP2PNo_{t-1} + \alpha_2 LnP2PNo_{t-2} + \cdots\cdots + \alpha_p LnP2PNo_{t-p} + \gamma_0 LnMerPayNo_t + \gamma_1 LnMerPayNo_{t-1} + \gamma_2 LnMerPayNo_{t-2} + \cdots\cdots + \gamma_p LnMerPayNo_{t-p} + \delta_0 LnUtiBillPayNo_t + \delta_1 LnUtiBillPayNo_{t-1} + \delta_2 LnUtiBillPayNo_{t-2} + \cdots\cdots + \delta_p LnUtiBillPayNo_{t-p} + \varepsilon_t$$

Model-IV

$$LnCashOutAmt_t = \beta_0 + \beta_1 LnCashOutAmt_{t-1} + \beta_2 LnCashOutAmt_{t-2} + \cdots\cdots + \beta_p LnCashOutAmt_{t-p} + \alpha_0 LnP2PAmt_t + \alpha_1 LnP2PAmt_{t-1} + \alpha_2 LnP2PAmt_{t-2} + \cdots\cdots + \alpha_p LnP2PAmt_{t-p} + \gamma_0 LnMerPayAmt_t + \gamma_1 LnMerPayAmt_{t-1} + \gamma_2 LnMerPayAmt_{t-2} + \cdots\cdots + \gamma_p LnMerPayAmt_{t-p} + \delta_0 LnUtiBillPayAmt_t + \delta_1 LnUtiBillPayAmt_{t-1} + \delta_2 LnUtiBillPayAmt_{t-2} + \cdots\cdots + \delta_p LnUtiBillPayAmt_{t-p} + \varepsilon_t$$

Considering different types of MFS usage and respective utility in Bangladesh, it is assumed that cash-in, a traditional cash-based MFS transaction, is supposed to be reduced by alternative electronic modes of injecting money into the MFS wallet or account. Among different types of MFS transactions allowed by the regulatory authorities of Bangladesh, as elaborated in the earlier part of this paper, Person-to-Person (P2P) transactions, salary disbursement to the employees by the employers (B2P transactions), and Government-to-Person

(G2P) payments are electronic modes that inject money into the MFS wallet or account. These types of injection of money in electronic modes are supposed to reduce or appear as a substitute for cash-based MFS usage like cash-in from an MFS agent point. Based on the assumption that MFS transactions in electronic modes grab traditional cash-based modes, for models I and II, the expected relationships between the dependent variables and the selected independent variables considered for the models are shown in Table-3.

Table 3: Independent Variables and Expected Relation (Models-I and II)

Model	Independent Variables	Expected Relation
I	P2PNo	-
I	SalDisbNo	-
I	G2PNo	-
II	P2PAmt	-
II	SalDisbAmt	-
II	G2PAmt	-

Source: Author'

Again, considering different types of MFS usages in Bangladesh, it is assumed that cash-out, another traditional cash-based MFS transaction, is supposed to be reduced by the alternative electronic modes of spending money from the MFS wallet or account. Among different types of MFS transactions allowed by the regulatory authorities of Bangladesh, as elaborated in the introduction part of this paper, P2P transactions, Merchant payment (P2B and B2B transactions), and utility bill payments (P2B, P2G, B2G, and B2B) are electronic modes that are used to spend money from the MFS wallet or account. These types of spending money in electronic modes are supposed to reduce or appear as substitutes for cash-based MFS usage, such as cash-out from an MFS agent point. Based on the assumption that MFS transactions in electronic modes grab traditional cash-based modes, for models III and IV, the expected relationships between the dependent variables and the selected independent variables considered for the models are shown in Table-4.

Table 4: Independent Variables and Expected Relation (Models-III and IV)

Model	Independent Variables	Expected Relation
III	P2PNo	-
III	MerPayNo	-
III	UtiBillPayNo	-
IV	P2PAmt	-
IV	MerPayAmt	-
IV	UtiBillPayAmt	-

Source: Author's Calculation

Time series data was processed and analyzed with the help of Stata 14.2. In Stata, the data set was declared as a time series. The skewness and kurtosis tests were run to check normality for each variable included in the models, and it was found to be normally distributed. The variables used in a regression model must be stationary. A unit root test was conducted to find out whether the data set was stationary at the level or stationary at the first difference. To determine whether the data set is stationary at which level, the Augmented Dickey-Fuller test (Dickey & Fuller, 1979) was run, and the results were cross-checked with the Phillips Perron test (Phillips & Perron, 1988).

Before conducting the cointegration test (Engle & Granger, 1987), it is required to find out the optimum lag of the variables for the model because it is assumed that in the time series, present month data are to some extent influenced by their previous data. According to all selection order criteria, considering the maximum and smaller lag criteria, the optimum lags were selected.

Then, the cointegration test was conducted to find out whether the variables had a long-run relationship. The Bound test from ARDL (Pesaran et al., 2001) was conducted to estimate the cointegration for each of the models.

Several diagnostic tests were conducted to find out the validity of each of the models. With the Variance Inflation Factor (VIF), all the models were checked to determine whether there was any multicollinearity in them. With the Durbin-Watson test (Durbin & Watson, 1971) and the Breusch-Godfrey test (Breusch, 1978; Godfrey, 1978), the models were checked whether there was autocorrelation. With White's test (White, 1980), models were tested to determine whether there were any heteroscedastic errors in the models. Lastly,

with the CUSUM test (Brown et al., 1975), the stability of the estimated coefficients in the models was checked.

5. Results, Analysis, and Discussion

5.1 Trends of MFS Adoption in Bangladesh

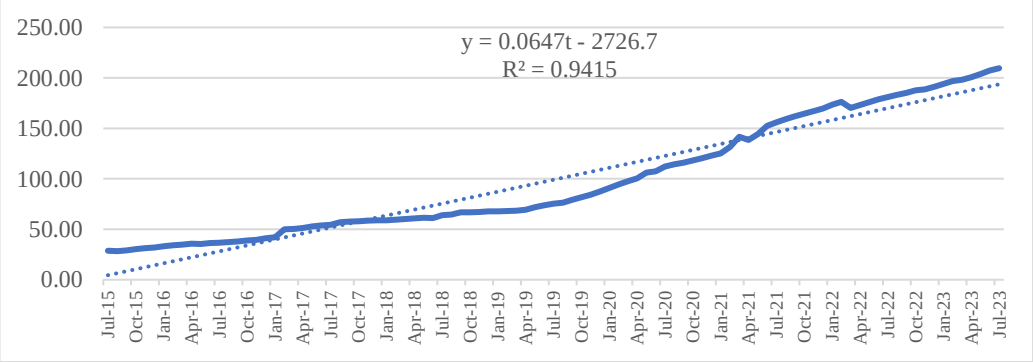
The descriptive statistics of the variables related to MFS trends in the country are shown in Table-5.

Table 5: Descriptive Statistics (MFS trends)

Variable	Obs	Mean	Std. Dev.	Min	Max
MFSCustomer	97	99.11	57.15	28.30	209.57
MFSAgent	97	1.05	0.34	0.53	1.60
MFSTranNo	97	258.44	123.32	97.70	572.62
MFSTranAmt	97	492.80	299.82	128.40	1321.75

Source: Bangladesh Bank; Author's Compilation & Calculation

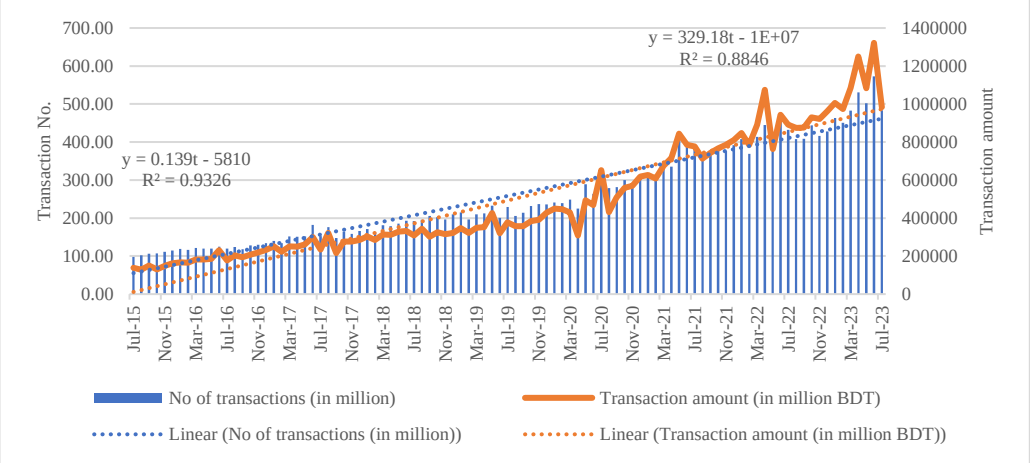
Figure 1: MFS Adoption (Number of Registered MFS Customers in a Million)



Source: Bangladesh Bank; Author's Compilation and Calculation

Figure-1 shows the increasing trends of MFS customers. Within 97 months of the study period, from July 2015 to July 2023, MFS registered customers grew 630% with a cumulative average growth rate (CAGR) of 28%.

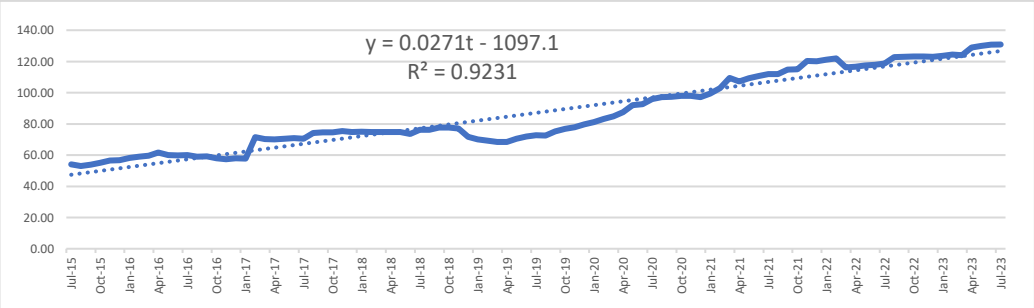
Figure 2: MFS adoption (Number and amount of MFS transactions in a million)



Source: Bangladesh Bank; Author's Compilation and Calculation

Significant growth in MFS transactions occurred over the period (Figure 2). Within 97 months of the study period from July 2015 to July 2023, MFS transactions grew 395% and 612%, with a CAGR of 22% and 27% in number and amount, respectively.

Figure 3: MFS customers to MFS agents' ratio



Source: Bangladesh Bank; Author's Compilation and Calculation

Figure-3 exhibits that the ratio of registered MFS customers to MFS agents during the study period reached 130.89 in July 2023 from 53.98 in December 2018, which shows that the rate of increase for MFS customers is consistently getting higher than that of agents. The increasing trend of electronic mode of MFS

transactions may be a reason for the sharply consistent rate of increase in MFS customers with respect to that of agents. Because, unlike cash-in and cash-out, the transactions made in electronic mode on the MFS platform do not require any support or involvement from the MFS agents. The necessity of agents with respect to total customers will gradually decrease with the pace of adopting the MFS customers' electronic mode of MFS transactions.

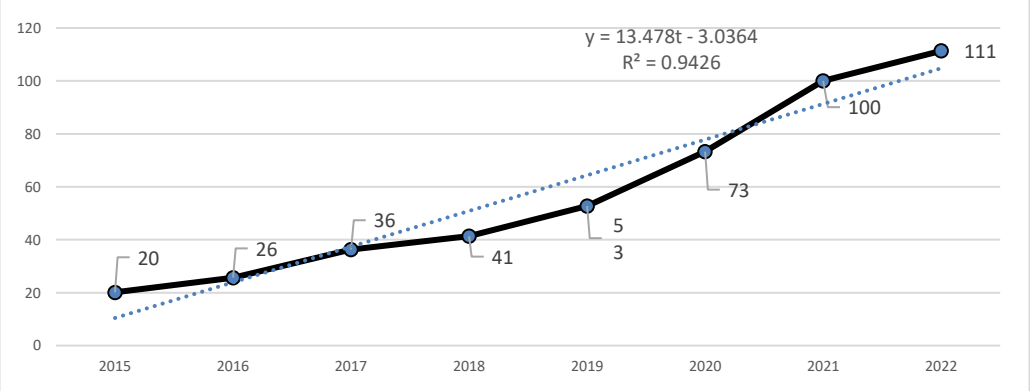
Table 6: Male/Female and Urban/Rural MFS Customers as % of Total MFS Customers

	Male Account	Female Account	Urban Account	Rural Account	Urban Male Account	Urban Female Account	Rural Male Account	Rural Female Account
At Starting month (Dec 18)	53%	47%	35%	65%	22%	13%	31%	34%
At Ending month (July 23)	58%	42%	44%	56%	26%	18%	32%	24%
Minimum	51%	41%	35%	55%	22%	13%	28%	23%
Maximum	59%	49%	45%	65%	28%	18%	33%	35%
Average	55%	45%	40%	60%	24%	16%	31%	29%
Standard Deviation	3%	3%	3%	3%	2%	2%	2%	4%

Source: Statistics Department, Bangladesh Bank; Author's Compilation and Calculation

It is observed (Table-6) that MFS accounts are more in rural parts than in urban parts, and male accounts are higher than female accounts, on average, both in urban and rural areas, during the study period. The financial literacy rate in urban parts is usually higher than in rural parts. There are different types of financial services available in urban areas. People living in urban areas and having adequate levels of financial literacy mostly like transactions through commercial banks because of the nature and variety of the services. So, as an option, MFS is mostly preferable in rural areas among low-income people to make small value transfers.

Figure 4: MFS Accounts per 100 People



Source: MFS account data from Bangladesh Bank and population data from Macro trends, 2023; calculation by author.

MFS accounts per 100 people (other than institutional accounts) in Bangladesh reached 111 in 2022 from 20 in 2015 (Figure-4). It is worth mentioning that a person cannot open more than one account on a particular MFS platform as it is linked with a National Identity Document (NID). However, some people have more than one MFS account on different MFS platforms based on their needs. So, the number of MFS accounts has reached more than the country's total population. The gradual increase in MFS accounts per 100 people proves increasing access to a formal financial system.

5.2 Hypothesis Test

The descriptive statistics of the variables related to MFS usage are shown in Table-7.

Table 7: Descriptive Statistics (MFS Usage)

Variable	Obs	Mean	Std. Dev.	Min	Max
CashInAmt	56	0.33	0.04	0.27	0.40
CashOutAmt	56	0.31	0.04	0.25	0.40
P2PAmt	56	0.26	0.04	0.16	0.31
MerPayAmt	56	0.03	0.02	0.01	0.06
G2PAmt	56	0.01	0.01	0.00	0.05
SalDisbAmt	56	0.03	0.01	0.02	0.07
UtiBillPayAmt	56	0.02	0.01	0.01	0.03
CashInNo	56	0.30	0.04	0.23	0.41

Variable	Obs	Mean	Std. Dev.	Min	Max
CashOutNo	56	0.30	0.03	0.24	0.37
P2PNo	56	0.25	0.04	0.15	0.32
MerPayNo	56	0.05	0.01	0.03	0.08
G2PNo	56	0.03	0.03	0.00	0.13
SalDisbNo	56	0.02	0.01	0.01	0.04
UtiBillPayNo	56	0.05	0.02	0.01	0.07

Source: Bangladesh Bank; Author's Compilation & calculation.

The results of the unit root test conducted to find out whether the time series data set is stationary at level or stationary at first difference have been shown in Table 8. Augmented Dickey-Fuller test (ADF) and Phillips-Perron Test (PP) have been used at the level and first difference under the assumption of constant and constant & trend.

Table 8: Results of ADF and PP Tests for Stationarity

Variable	Level				First Difference			
	Intercept		Intercept and Trend		Intercept		Intercept and Trend	
	ADF	PP	ADF	PP	ADF	PP	ADF	PP
CashInNo	0.19	-0.01	-3.06	-19.95*	-5.18***	-58.53***	-5.13***	-58.43***
CashOutNo	0.81	0.15	-1.57	-6.15	-8.44***	-64.48***	-9.61***	-65.74***
P2PNo	-1.34	-0.56	-2.31	-10.34	-7.71***	-67.87***	-8.55***	-70.19***
MerPayNo	-1.70*	-0.37	-2.86	-20.34*	-6.55***	-74.00***	-6.70***	-75.06***
G2PNo	-1.13	-3.96	-5.50	-40.92***	-8.47***	-62.50***	-8.29***	-62.50***
SalDisbNo	-0.13	0.01	-2.51	-33.74***	-6.36***	-90.43***	-6.29***	-90.30***
UtiBillPayNo	-2.21**	-0.53	-2.24	-13.36	-6.63***	-74.08***	-7.69***	-75.02***
CashInAmt	0.52	0.12	-2.07	-8.94	-4.32***	-60.01***	-4.38***	-61.01***
CashOutAmt	1.15	0.20	-1.39	-5.74	-5.47***	-70.63***	-6.16***	-72.73***
P2PAmt	-1.62*	-0.54	-2.45	-7.51	-5.46***	-55.16***	-6.10***	-59.16***
MerPayAmt	-1.59	-0.36	-1.308	-6.29	-4.98***	-77.43***	-5.08***	-78.24***
G2PAmt	-0.80	-1.88	-5.41	-40.74	-7.66***	-62.52***	-7.48***	-62.49***
SalDisbAmt	-0.28	-0.04	-2.56	-40.69***	-8.43***	-90.35***	-8.45***	-90.29***
UtiBillPayAmt	-1.36	-0.32	-3.06	-26.32***	-5.64***	-76.10***	-5.74***	-76.56***

Note: Logarithmic transformations of the series are applied to the test.
Null Hypothesis: Series contain unit root; significance at 1% ***, 5% **, and 10% *.
Source: Author's Calculation with Stata 14.2.

The results in Table-8 show that all of the variables under study are non-stationary at level as no variable complies with both ADF and PP simultaneously. However, at first differences, both ADF and PP tests reject the null in the cases of all variables and in both cases of 'constant' and 'constant and trend'. This signifies that all variables are stationary at first difference. The ADF and PP test

results confirm that the variables are integrated in order 1. This satisfies the condition of running the cointegration test.

Table-9 shows optimal lag length results. Akaike Information Criterion, Schwarz Bayesian Criterion, Hannan-Quinn, and Log Likelihood are the most common measures to determine the number of lags. Based on these criteria, the optimal lag length for all models has been found.

Table 9: Optimal Lag Length Results

Model I				
Variable	**CashInNo**	**P2PNo**	**SalDisbNo**	**G2PNo**
Optimal lag length	1	1	0	0
Model II				
Variable	**CashInAmt**	**P2PAmt**	**SalDisbAmt**	**G2PAmt**
Optimal lag length	1	1	3	4
Model III				
Variable	**CashOutNo**	**P2PNo**	**MerPayNo**	**UtiBillPayNo**
Optimal lag length	1	1	1	1
Model IV				
Variable	**CashOutAmt**	**P2PAmt**	**MerPayAmt**	**UtiBillPayAmt**
Optimal lag length	1	1	1	0

Source: Author's Calculation with STATA 14.2.

Then, we proceed with ARDL cointegration tests (F-bounds test). It becomes evident that for each of the models, there is a long-run relationship among the variables (Table-10).

Table 10: ARDL Cointegration Tests (F Bounds Test) Results

Model	**F-statistic**	**F-critical value**	**t-statistic**	**t-critical value**
Model I	52.604	2.720	-8.903	-2.570
Model II	19.424	2.720	-8.508	-2.570
Model III	35.869	2.720	-10.702	-2.570
Model IV	54.115	2.720	-14.275	-2.570

Source: Author's Calculation with STATA 14.2.

As F-statistics are greater than F-critical value and t-statistics are less than t-critical value in for all models, the null of no cointegration can be rejected at a 1% level. This confirms the long-run relationship among the variables in all models.

After being confirmed of a long-run relationship, the full ARDL estimation has been conducted using the optimal lag length to explore the impact of the electronic mode of MFS usages on traditional cash-based MFS usages.

The values of the models' Coefficient of Determination (R square and Adjusted R square) are 0.8560 and 0.8410 respectively for Model-I (Table-11a); 0.8499 and 0.8025, respectively for Model-II (Table-11b); 0.8555 and 0.8335 respectively for Model-III (Table-11c); and 0.8599 and 0.8420, respectively for Model-IV (Table-11d). These values show that the independent variables under reference correlate highly with the dependent variable in all four models. The variation caused by independent variables on the dependent variable is significant and cannot be left to chance factors.

Table 11a: ARDL Estimation Results (Significant Regression Coefficients) of the Long-run and Short-run Impacts: Model-I

Variable	Coefficient	Standard errors	P-values
CashInNo (L1)	-0.807***	0.091	0.000
Long Run			
P2PNo	-0.340*	0.184	0.071
SalDisbNo	-0.155***	0.040	0.000
G2PNo	-0.027***	0.006	0.000
Short Run			
P2PNo	0.256***	0.081	0.003

Table 11b: ARDL Estimation Results (Significant Regression Coefficients) of the Long-run and Short-run Impacts: Model-II

Variable	Coefficient	Standard errors	P-values
CashInAmt (L1)	-1.271***	0.149	0.000
Long Run			
P2PAmt	-0.382***	0.084	0.000
SalDisbAmt	-0.181***	0.055	0.002
G2PAmt	-0.037***	0.008	0.000
Short Run			
SalDisbAmt (D1)	0.171***	0.063	0.010

Variable	Coefficient	Standard errors	P-values
SalDisbAmt (LD)	0.084*	0.043	0.059
G2PAmt (D1)	0.028***	0.009	0.004
G2PAmt (LD)	0.020***	0.007	0.006
G2PAmt (L2D)	0.010***	0.005	0.037
G2PAmt (L3D)	0.006***	0.003	0.030

Table 11c: ARDL Estimation Results (Significant Regression Coefficients) of the Long-run and Short-run impacts: Model-III

Variable	Coefficient	Standard errors	P-values
CashOutNo (L1)	-1.294***	0.121	0.000
Long Run			
P2PNo	-0.367***	0.058	0.000
MerPayNo	-0.144***	0.042	0.001
Short Run			
P2PNo (D1)	0.207***	0.054	0.000

Table 11d: ARDL Estimation Results (Significant Regression Coefficients) of the Long-run and Short-run impacts: Model-IV

Variable	Coefficient	Standard errors	P-values
CashOutAmt (L1)	-1.522***	0.107	0.000
Long Run			
P2PAmt	-0.429***	0.057	0.000
MerPayAmt	-0.118***	0.025	0.000
Short Run			
P2PAmt (D1)	0.377***	0.065	0.000
MerPayAmt (D1)	0.066***	0.024	0.008

Source: Author's Calculation with STATA 14.2.
Note: Significance at 1%=***; 5%=**; and 10%=*; In time series ARDL estimation, L1 indicates the lagged value of a variable based on its value in the previous period; D1 indicates level or zero lag, LD indicates lag difference; L2D indicates one-period lag, and so on.

It is observed that in all four models, almost all the independent variables have a significant influence on the dependent variables in the long run. As hypothesized, in the case of cash-in transactions with respect to both number and amount, a negative and statistically significant (at 1% level) relationship with all independent variables is found in the long run. It is found that P2P transactions, salary disbursement (B2P), and G2P transactions have negative coefficients and are statistically significant at a 1% level in most cases. This means that all these independent variables negatively influence cash-in transactions in the long run.

The inclination of customers to use electronic modes of MFS transactions is causing a significant reduction in cash-in during the study period.

As expected, in the case of Cash-out transactions, with respect to both number and amount, a negative and statistically significant (at 1% level) relationship with all the independent variables, except utility bill payment, is found in the long run. With respect to both number and amount, it is found that P2P transactions and merchant payments (P2B, B2B, and P2G) have negative coefficients and are statistically significant at a 1% level in all cases in the long run. The inclination of electronic modes of MFS transactions among the customers is causing a significant reduction in cash-out during the study period in the long run.

In the short run, most variables are not statistically significant, and few have positive coefficients, contrary to our expectations. So, the impact of the variables is not found to be immediate. Only long-term impacts are found. This means all these independent variables negatively influence cash-out transactions only in the long run, not in the short run.

Table 12: Diagnostic Test Results

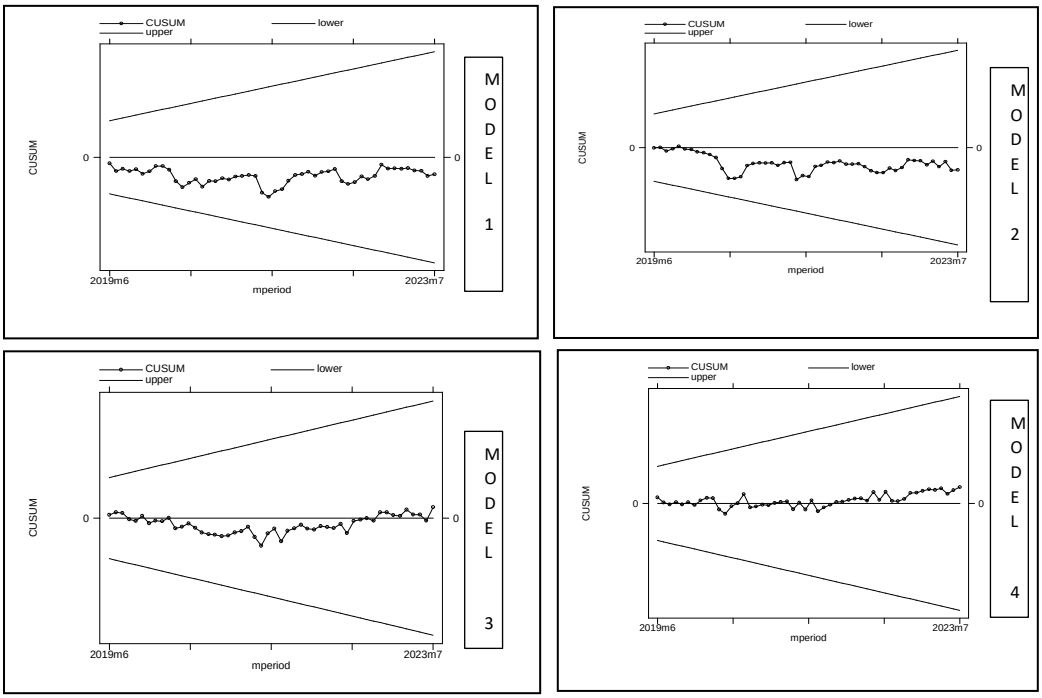
Model	Mean VIF	Durbin-Watson test	Breusch-Godfrey LM test (Prob>Chi2)	White's test (Prob > chi2)
Model I	2.25	d-statistic (6, 54) = 2.101003	0.628	0.542
Model II	3.99	d-statistic (13, 51) = 2.171245	0.179	0.434
Model III	3.99	d-statistic (8, 54) = 2.017113	0.328	0.306
Model IV	2.66	d-statistic (7, 54) = 2.016111	0.820	0.220

Source: Author's Calculation with STATA 14.2.

The results in Table-12 show that there is no multicollinearity, autocorrelation, or heteroscedasticity in any of the models. This validated the reliability of the models.

Moreover, the CUSUM tests validate the stability of the models' estimated coefficients (Figure-5).

Figure 5: Cumulative Sum (CUSUM) Charts of All Models



Source: Author's Developed by STATA.

Figure-5 exhibits the CUSUM charts from the CUSUM test, which uses the sum of recursive residuals to determine random movements in the estimated parameters (Brown et al., 1975). As the plots of all the models in Figure 5 lie within the upper and lower control limits in the case of all four models, they confirm the stability of the estimated coefficients.

Based on the above findings and analysis, there seems to be a significant reduction in the share of cash-based usage of MFS transactions that is substituted by electronic modes of MFS transactions, such as P2P, P2B, B2P, B2B, G2P, and P2G transactions. However, the share of cash-based MFS transactions is still dominating. There is a necessity to increase the scopes of both getting and spending money in electronic modes in the MFS platform and increasing these scopes will accelerate MFS penetration in such a way that may reduce the cash-based mode of MFS transactions at a faster speed and electronic modes of MFS transactions will be a potential substitute for cash-based modes.

6. Conclusion, Limitations, and Areas of Further Research

With the global pace, in recent times, the financial landscape in Bangladesh is transforming from traditional to electronic. Consumer behavior and demand have also changed toward contactless and cashless transactions.

Usually, MFS transactions are made for a small amount of value transfer. It is observed that MFS customers and MFS transactions are increasing consistently. The ratio of the number of MFS customers to MFS agents is gradually becoming steeper, which shows that the rate of increase for MFS customers is consistently getting higher than that of agents. The necessity of agents with respect to total customers decreases gradually with the pace of the MFS customers' usage of electronic mode of MFS transactions.

MFS accounts in respect of the total population have reached such a height that it can be inferred that in Bangladesh, most adult people with the least financial literacy have at least one MFS account. It is an instance-creating phenomenon globally that Bangladesh, a country with many people lacking adequate financial literacy, has increased MFS accounts per hundred people more than five times within seven years (2015-2022), covering almost all eligible people. Favorable government policies, central bank initiatives, efforts of industry players, and people's inclinations have helped accelerate MFS penetration in the country. Regarding the rate of MFS penetration, Bangladesh may be a role model for countries where many people are unbanked.

Though the major portion of MFS usage still comprises traditional cash-based methods, like cash in and out, cash usage is significantly being replaced by other means of usage that do not require cash handling to make a transaction. It has been found that regarding different types of usages of MFS, traditional cash in and out methods are being reduced by modern electronic payment usages like P2P, B2B, B2P, P2B, P2G, and G2P transactions. Though the impact is not immediate, there is empirical evidence of significant long-run impact. P2P transactions are found to be the cause of the reduction of both cash-in and cash-out. Merchant payments (P2B and B2B) are found to be the cause of the decrease in cash-out, whereas G2P and salary disbursement (B2P) for cash-in.

Initiatives are required to create more scopes regarding MFS usage through electronic gateways in the country so that the transfer of funds can be initiated through the MFS electronic gateways, reducing the dependency on cash in and out.

This study has several limitations. Data for 56 months have been studied to analyze MFS usage patterns. If the data for more months can be studied, the analysis might be more convincing. The country-level aggregate data has been used to study usage patterns empirically. It expresses the country-level phenomenon at an aggregate level. In Bangladesh, most of the people live in rural areas. If the usage pattern of MFS can be investigated separately for rural and urban areas, the findings might be more robust.

In this study, MFS penetration and transaction level as a whole has been considered. Individual MFS provider-level impact analysis can be an area of further research to get more specific results related to the penetration of MFS regarding the particular MFS providers. Geographical area-wise analysis of MFS penetration may be another area of further research as it may provide another stream of specific findings based on the socio-geographical scenario.

Endnote:

In this paper, the local currency, the Bangladeshi Taka (BDT), has been used. For the convenience of comparing BDT to USD, the applicable conversion rate of BDT and USD was BDT 110 = USD 1 as of 31 July 2023.

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