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Electronic Payment in Interbank Settlement in Bangladesh: An Empirical Study of Its Adoption and Forecasting Using the ARIMA Model

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ABSTRACT

For over a decade, the Bangladesh government, regulators, and commercial banks have been investing in the Electronic Payment and Settlement System (EPSS) to accelerate economic development, ensure financial stability, and promote financial inclusion. This study examines the adoption of EPSS in Bangladesh and forecasts its trend. The focus is specifically on a component of EPSS – the Real Time Gross Settlement (RTGS). We analyse the historical trend of EPSS and its traditional substitute in detail. The Box-Jenkins methodology is employed to develop an appropriate autoregressive integrated moving average (ARIMA) model for forecasting the increasing share of EPSS in Bangladesh. Our findings reveal that the share of EPSS will be 93.20% and 57.75% with respect to amount and number, respectively, after about three years. The adoption of EPSS with respect to amount shows a steeper upward trend than its adoption with respect to number. Because RTGS adoption is limited to a certain threshold, the number of small-amount transactions is still captured by traditional substitutes. A pervasive lack of digital financial literacy among a subset of the population also drives the adoption of traditional substitutes. Unlike prior works on digital adoption that are based almost exclusively on consumers' perceptions, this study is grounded in actual data to investigate the adoption of EPSS and its forecasted trend at a country level. It highlights the effectiveness and shortcomings of EPSS in the context of an emerging economy. Our findings can assist policymakers in formulating strategic decisions for the adoption of electronic payment systems in emerging economies.

Keywords: Electronic Payment, Electronic Settlement, Adoption, Innovation, RTGS, Digital Banking, Bangladesh

JEL Classification: E42, E44, O32

1 Introduction

Interbank payment and settlement systems settle financial transactions by transferring monetary value rather than presenting cash in domestic and international transactions. They are essential components of modern economies in channelling the flow of financial resources from one economic segment to another (Nedozi & Omoregie, 2019). Safe, affordable, and accessible payment systems facilitate economic development, enhance financial stability, and broaden financial inclusion (World Bank, 2023; Del Sarto & Ozili, 2025).

Our focus in this study is on the adoption of a specific category of digital innovation: the Electronic Payment and Settlement Systems (EPSS). In the contemporary banking and finance literature, the question of what constitutes EPSS remains unresolved. In this work, we consider EPSS to embody all types of payments through electronic platforms. These payments are made through digital, internet, or mobile banking media. Payment and settlement systems implemented electronically, in which neither paper checks nor physical terminals are used, are classified as EPSS. In contrast, checks and physical terminal-based payment and settlement systems are referred to as Traditional Payment and Settlement Systems (TPSS).

Like other emerging economies, EPSS is becoming increasingly popular in Bangladesh, where people and businesses find it a more secure, convenient, and time-saving way to conduct day-to-day transactions. EPSS plays a significant role in keeping the economy active and resilient (Bangladesh Bank, 2022). Government initiatives can accelerate EPSS in a country (Griffiths et al., 2025). Bangladesh, being an emerging market with favorable government policies to expand EPSS to ensure inclusive finance for inclusive growth, has achieved much in recent times. The endeavors of Bangladesh Bank, the country's central bank, to promote EPSS to ease financial transactions and reduce cash transactions, lead the country toward a less-cash economy. State-of-the-art payment systems are established as part of its inclusive digitalisation initiative, which has helped bring the rural and urban unbanked population into the financial arena at an affordable cost and with convenience. These initiatives ushered in a new horizon in the country's payment landscape (Bangladesh Bank, 2019). The government's ambitions, efforts, and rapid implementation of EPSS, along with the preparedness of industry players and consumers in the country, are the fundamental reasons we selected Bangladesh for our study.

In the current literature, the adoption of EPSS is studied primarily based on individual-level customer opinions (Gupta & Arora, 2020; Souiden et al., 2021). Considerations of aggregate EPSS adoption at the country level, based on actual data, are still few and far between. This reveals a gap in the literature regarding the adoption of EPSS in an emerging economy such as Bangladesh. The present study addresses this gap.

The contribution of this paper lies in analysing the actual adoption of EPSS in a country and forecasting its trend from historical data. The study would be useful for policymakers, central bankers, commercial bankers, and industry practitioners to understand and consolidate the adoption trend of EPSS.

Section 2 of this paper describes the context of the study. Section 3 discusses the related research literature. Section 4 details the methodology. Section 5 reports the results. Section 6 presents the policy implications of the findings. Section 7 provides the conclusion.

2 The study in context

Several countries, including Bangladesh, recognised the limitations of the TPSS in smooth business transactions. The country's central bank, the Bangladesh Bank, acknowledged that the manual clearing system was inefficient and risky (Bangladesh Bank, 2006). Customers previously had to wait more than two days to receive their funds in the manual check-clearing process, which was labor-intensive, requiring numerous officers to work beyond regular hours to finalise settlements. Commercial banks were compelled to maintain idle funds in each clearing center, which served no economic or business purpose. The resulting liquidity burden was significant, as banks could not utilize surplus funds at one clearing center to offset deficits at another. Consequently, the transfer of funds between centers led to inefficient liquidity management.

TPSS was associated with several inherent risks. Credit risk was present when a bank entered liquidation after issuing numerous checks to be settled through clearing houses. Liquidity risk arose if a bank failed to settle due to insolvency, liquidation, temporary liquidity constraints, or technical issues, thereby exposing the net receiving bank to the risk of not receiving its expected dues in full on the designated day. Systemic risk could develop if a major bank was unable to fulfill its payment obligations, potentially triggering a chain reaction among other banks and their customers, which could ultimately result in the collapse of the entire system (Bangladesh Bank, 2006).

The traditional paper-based settlement system was reformed in accordance with the core principles established by the Basel Committee on Payment and Settlement Systems (CPSS). Bangladesh Bank, similar to other central banks globally, undertook initiatives to modernise its payment and settlement systems (Bangladesh Bank, 2006). The CPSS, comprising the central banks of G10 countries, monitored developments in payment, settlement, and clearing systems to enhance their overall efficiency.

Recent modernisation initiatives have expanded Bangladesh's payment and settlement systems to include (i) the Bangladesh Automated Clearing House (BACH), which consists of the Bangladesh Automated Check Processing Systems (BACPS), the Bangladesh Electronic Funds Transfer Network (BEFTN), (ii) the National Payment Switch Bangladesh (NPSB), and (iii) the Bangladesh Real Time Gross Settlement (RTGS) (Bangladesh Bank, 2022).

Among existing payment and settlement systems, BACPS uses physical paper-based checks. Although checks placed for interbank settlement are now settled through a modern automated clearing process, the time required depends on the check's value. The interbank check settlement process is not instant and requires the use of a physical instrument, such as a check. This is the primary reason we consider BACPS as TPSS in our study. However, by RTGS, transactions can be settled instantly through banking apps or Internet banking. Therefore, we consider RTGS to be EPSS in this study. Considering the value of monthly transactions over the period studied, BACPS and RTGS, on average, cover close to 93% of total interbank transactions in Bangladesh.

Bangladesh Bank implemented RTGS in October 2015 to support real-time settlement of high-value and time-critical payments (Bangladesh Bank, 2016). The RTGS system allows banks, corporations, and individual customers to settle transactions of BDT 0.1 million or more (approximately USD 820) instantly. Transactions are processed between 10:00 am and 3:30 pm on business days, ensuring immediate settlement for large-value and urgent payments.

RTGS offers a secure mechanism for the immediate transfer of large-value funds. As an electronic settlement method, RTGS facilitates the transfer of funds between

bank accounts both in real time and on a gross basis. Real time refers to the immediate settlement of transactions, eliminating any waiting period. In contrast, traditional check-based transactions, which RTGS is intended to replace, involve waiting periods that vary depending on the check's value. Furthermore, check-based systems often require users to visit bank branches, resulting in inconvenience. RTGS therefore represents a more efficient and user-friendly alternative.

3 Literature Review

Electronic payments and settlement systems (EPSS) consolidate all types of payments through electronic platforms. In terms of EPSS, digital banking, internet banking, and mobile banking appear naturally. Although these three modes serve the same purpose of ensuring that banking services are available electronically, they differ to some extent in their approach to service. Digital banking is the digitisation of traditional banking services, allowing customers to access products and services via electronic platforms and eliminating the need to visit physical branches (Haralayya, 2021). Internet banking specifically allows customers to perform financial transactions on their bank accounts using web-enabled computers via their banks' websites at any time (Ongkasuwan & Tantichattanon, 2002). Using mobile banking, customers can conduct necessary banking transactions via a mobile device (Barnes & Corbitt, 2003).

A significant portion of research on mobile, internet, and digital banking examines adoption using various theoretical models to explain consumer behaviour or behavioral intention. The Technology Acceptance Model (TAM) proposed by Davis (1989) is widely regarded as a foundational framework. Other influential models include the Unified Theory of Acceptance and Usage of Technology (UTAUT) by Venkatesh et al. (2003), the Innovation Diffusion Theory by Rogers (1962), and the Task Technology Fit Model by Goodhue and Thompson (1995) (Souiden et al., 2021).

With the advent of financial technologies, EPSS solutions emerged to replace the TPSS (Dennis, 2004). The EPSS introduces various electronic payment methods, enabling financial institutions to provide customers with diverse e-payment options and services, including credit cards, debit cards, online banking, and mobile banking (Premchand & Choudhry, 2015). EPSS is increasingly regarded as a preferred payment method in contemporary business environments because of its efficiency, convenience, and timeliness (Kabir et al., 2015).

The factors that influence the adoption of EPSS have been explored in existing literature in multiple channels, such as (i) a digital banking attributes-based perspective, where the factors are perceived usefulness, perceived ease of use, facilitating conditions, compatibility, among others; (ii) a customer-based perspective, where, the factors are self-efficacy, attitude, habit, satisfaction; (iii) trust-based perspective, where, the factors are trust, perceived security, and perceived privacy (Souiden et al., 2021).

The fundamental reasons consumers expect to adopt electronic banking are applicability, security, reliability, ease of use, trust, interoperability, scalability, efficiency, convertibility, anonymity, traceability, and authorisation type (Kumar, 2019). Xena & Rahadi (2019) identified technology acceptance, performance expectancy, security, culture, social influence, and effort expectancy as factors in EPSS adoption. Agrawal & Bansal (2018) identified four factors, which include perceived usefulness, perceived social esteem, perceived security, and perceived reliability, that influence consumers' intention to adopt electronic banking in India. In Bangladesh, Azam et al. (2021) found that perceived cost,

personal awareness, perceived usefulness, and facilitating conditions influence consumer behavioral intention, while facilitating conditions and behavioral intention positively influence the adoption of e-commerce transactions. For Malaysian consumers' attitudes toward adopting electronic banking, Teoh et al. (2013) found three factors: self-efficacy, benefits, and ease of use. In contrast, security and trust were not significantly associated with consumers' intention toward electronic banking. In adopting electronic banking in Ethiopia, Bultum (2014) identified lack of a legal and regulatory framework, security risks, lack of trust, lack of ICT infrastructure, and the absence of competition between local and foreign banks as significant barriers.

A robust digital infrastructure is essential for accelerating EPSS within a country. However, inadequate digital infrastructure remains a prevalent challenge in many developing nations. In Indonesia, Yucha et al. (2020) reported that while EPSS are expanding rapidly, TPSS continue to dominate, primarily due to insufficient facilities and infrastructure supporting EPSS outside urban areas. Rafferty and Fajar (2022) identified additional barriers to digital payment adoption in Indonesia, including limited financial inclusion, insufficient digital literacy, high reliance on cash, and inadequate public awareness. In a comparative cross-country study, Ansari et al. (2025) demonstrated a significant positive correlation between broadband internet coverage and digital transaction volume. Their analysis also indicated that the presence of national real-time payment systems and interoperable infrastructure is associated with increased EPSS adoption. On average, 53 percent of sales in high-infrastructure countries were processed through digital payment channels, compared to 28 percent in countries with lower infrastructure levels. Demographic analysis revealed that high-infrastructure countries exhibited a gender gap of 3.9 percentage points in digital payment usage, whereas low-infrastructure countries had a gap of 13.7 percentage points. Furthermore, EPSS adoption rates among rural populations reached 71 percent in high-infrastructure countries, but only 37 percent in low-infrastructure countries. The study concluded that investments in open and interoperable systems, along with the development of supportive regulatory frameworks, are critical for fostering scalable and inclusive digital financial ecosystems.

The adoption of instant payment systems may enhance competition within the deposit market, potentially resulting in increased deposit volumes and reduced deposit rates. Universally accessible payment systems promote banking competition, which enhances consumer welfare. Greater competition in deposit markets can strengthen monetary policy transmission channels and influence credit provision (Sarkisyan, 2024).

Studies of EPSS adoption predominantly use surveys of individual consumers. The existing papers on EPSS adoption focus mainly on determining factors of EPSS adoption and users' perceptions of EPSS platforms. The majority of prior research in this domain focuses on EPSS adoption based on users' opinions or satisfaction levels. They use responses from individual consumers to predict adoption using the TAM or UTAUT models. They studied perceived usefulness and perceived ease of use, not actual use. The review of prior literature clearly indicates a gap in research on the empirical analysis of EPSS adoption at the country level using actual data.

4 Methodology

4.1 Data

To analyse the use of RTGS in Bangladesh, we examine time-series data published by Bangladesh Bank on transactions and their values processed through the country's different payment and settlement systems. Although RTGS was launched in Bangladesh on 29 October 2015, data are available for 87 months, from December 2018 to February 2026. We collected the data from the Bangladesh Bank's website. The data set covers several types of payment and settlement transactions. We use only data on interbank transactions processed through RTGS[1], (EPSS), and BACPS (TPSS). The time series is analyzed using the STATA 19.5 econometric software package.

The number of BACPS transactions in a month represents the total number of transactions that occurred in that month across all commercial banks by their customers using physical checks as the mode of interbank transaction. The amount of BACPS transactions in a month is the aggregate amount (value) of transactions that occurred in that month across all commercial banks by their customers using physical checks as the mode of interbank transaction. In the same way, the number of RTGS transactions in a month represents the total number of transactions executed by their customers through RTGS instructions as the mode of interbank transaction across all commercial banks in that month. Since the volume and value of transactions change over time, we use the monthly shares of EPSS and TPSS to represent their adoption. The larger the share, the higher the adoption.

4.2 Computational Methods

We computed the share of EPSS and TPSS transactions in each of 87 months as follows:

$$ {}^{N}_{S}EPSS_t = \frac{N_{EPSS_t}}{(N_{EPSS_t} + N_{TPSS_t})} \tag{1} $$

$$ {}^{N}_{S}TPSS_t = \frac{N_{TPSS_t}}{(N_{EPSS_t} + N_{TPSS_t})} \tag{2} $$

$$ {}^{AMT}_{S}EPSS_t = \frac{AMT_{EPSS_t}}{(AMT_{EPSS_t} + AMT_{TPSS_t})} \tag{3} $$

$$ {}^{AMT}_{S}TPSS_t = \frac{AMT_{TPSS_t}}{(AMT_{EPSS_t} + AMT_{TPSS_t})} \tag{4} $$

Here, ${}^{N}_{S}EPSS_t$ is the share of EPSS transactions with respect to the number of interbank transactions in the month t; ${}^{N}_{S}TPSS_t$ is the share of TPSS transactions with respect to the number of interbank transactions in the month t; ${}^{AMT}_{S}EPSS_t$ is the share of EPSS transactions with respect to the amount of interbank transactions in the month t; ${}^{AMT}_{S}TPSS_t$ is the share of TPSS transactions with respect to the amount of interbank transactions in the month t; N_{EPSS_t} is the total number of EPSS transactions done by the customers of all the banks in the month t; N_{TPSS_t} is the total number of TPSS transactions done by the customers of all the banks in the month t; AMT_{EPSS_t} is the aggregate amount of EPSS transactions done by the customers of all the banks in the month t; AMT_{TPSS_t} is the aggregate amount of TPSS transactions done by the customers of all the banks in the month t.

1 RTGS operations remained closed for about two months (April-May 2020) at the inception of the COVID-19 pandemic in the country.

4.3 ARIMA forecasting

To forecast the share of RTGS (EPSS) transactions in both number and amount over the next 36 months (February 2029), we employ the autoregressive integrated moving average (ARIMA) model (Box & Jenkins, 1970; Shumway & Stoffer, 2017) on the time-series data.

For forecasting RTGS transactions, ARIMA is suitable for time series with temporal correlations, non-stationarity, and patterns such as trends and seasonality. They explicitly account for time trends in both the autoregressive (AR) and moving average (MA) components. ARIMA's integrated (I) component differs across series to render them stationary. The model is designed to be more accurate at predicting future values of a time series by explicitly accounting for temporal dependencies and patterns in the data (Shumway & Stoffer, 2017).

Incorporating external predictors using the AutoRegressive Integrated Moving Average with exogenous inputs (ARIMAX) model improves forecast accuracy, especially when the time series is affected by factors beyond its historical values. EPSS adoption is likely to be influenced by several factors, such as regulatory policy, internet penetration, digital financial literacy, and broader economic conditions. Because the study's historical time series data are influenced by the same factors that are likely to affect the forecast data, incorporating external predictors is unnecessary. Moreover, it is not feasible to quantify these factors monthly and to estimate their relevance and significance, both of which are necessary for ARIMAX. So, for the present study, ARIMA is considered the most suitable model for forecasting EPSS.

ARIMA is a combination of three processes: (i) AR, in which a variable regresses on its own lagged values; (ii) differencing (the I component), which transforms raw observations to achieve stationarity in the time series; and (iii) MA, which models the dependency between an observation and a residual error from a moving average of lagged observations. The full ARIMA(p,d,q) forecasting equation is given by a combination of the differenced AR component with the MA component as follows:

$$\tilde{y}_t = \gamma + \alpha_1 \tilde{y}_{t-1} + \alpha_2 \tilde{y}_{t-2} + \cdots + \alpha_p \tilde{y}_{t-p} + \epsilon_t + \theta_1 \epsilon_{t-1} + \theta_2 \epsilon_{t-2} + \cdots + \theta_q \epsilon_{t-q} \qquad (5)$$

The γ component suggests that the observations are replaced with differences of order d to achieve stationarity. The predictors in the above model are the lagged p observations for the AR component and the lagged q errors for the MA component, all differenced $\tilde{y}_t$ resolved to the d^{th} order.

Using ARIMA, we analyse the time series data as follows. First, we check whether the variables were stationary. At the level of the first differences, we achieved stationarity. This indicates that the time series is 1st-order integrated ($d = 1$) or $I(1)$. Then, we plot the autocorrelation function (ACF) and the partial auto-correlation function (PACF) of the series to identify which autoregressive or moving-average component should be employed in our model. Second, we estimate the best ARIMA model based on the significance of the ARMA components, using Akaike's information criterion (AIC), the Bayesian information criterion (BIC), maximum likelihood, and sigma-square. Third, as a requirement for a stable univariate process, we check whether the model residuals are white noise using the portmanteau test; we found the estimated ARMA model to be stationary and invertible. Finally, with the results conforming to the specifications of a stationary univariate process, we employ the improved model to forecast an additional 36 time points (36 months) (Chatfield & Xing, 2019; Abonazel & Abd-Elftah, 2019). It is worth mentioning that

at the inception of the COVID-19 pandemic, the RTGS system remained closed for two months (April-May 2020). During these two months, in the absence of RTGS, BACPS captured a 100% share of interbank transactions. To avoid extreme values, the data from these two months was excluded from the models.

5 Results

The descriptive statistics of the variables are exhibited in Table 1.

Table 1. Descriptive Statistics

Variable	Variable Definition	Obs	Mean	Std. Dev.	Min	Max
N_{TPSS_t}	BACPS No (in million) in a month	87	1.75	0.27	0.45	2.31
AMT_{TPSS_t}	BACPS Amount (trillion BDT) in a month	87	1.91	0.32	0.95	2.81
N_{EPSS_t}	RTGS No (in million) in a month	87	0.61	0.34	0	1.14
AMT_{EPSS_t}	RTGS Amount (trillion BDT) in a month	87	3.40	1.82	0	6.83
${}^{N}_{S}TPSS_t$	Share BACPS No in a month	87	0.76	0.12	0.59	1
${}^{AMT}_{S}TPSS_t$	Share BACPS Amount in a month	87	0.42	0.18	0.19	1
${}^{N}_{S}EPSS_t$	Share RTGS No in a month	87	0.24	0.12	0	0.41
${}^{AMT}_{S}EPSS_t$	Share RTGS Amount in a month	87	0.58	0.18	0	0.81

Source: Calculation and compilation by the author using Bangladesh Bank data

5.1 Share of EPSS (RTGS) and TPSS (BACPS)

As shown in Figures 1 and 2, for total interbank transactions, the share of RTGS, in both amount and number, increases over time. By contrast, the check-based system (BACPS) displays a decreasing trend. With the inception of the COVID-19 pandemic, the RTGS system remained closed for 2 months (April-May 2020). During these two months, in the absence of RTGS, BACPS captured a 100% share of interbank transactions. RTGS accounted for 34% (amount) and 5% (number) at the study's inception period (December 2018). However, it accelerated to 77% (amount) and 41% (number) at the end of the study period (February 2026). Simultaneously, the share of the check-based system dropped from 66% to 23% by amount and from 95% to 59% by number.

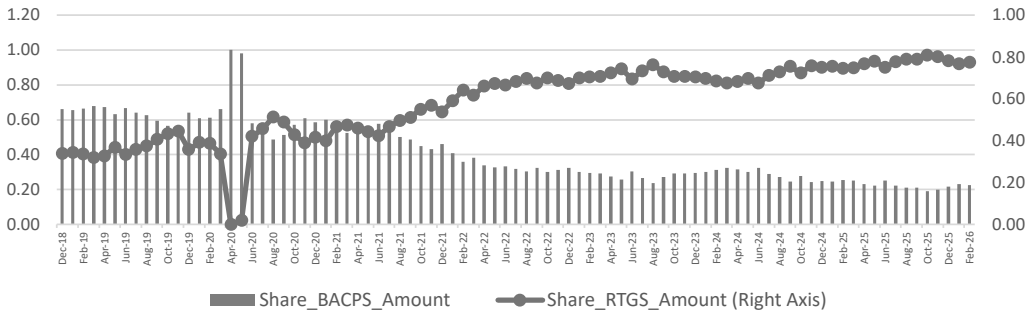

Figure 1. Share (%) of EPSS (RTGS) and TPSS (BACPS) with respect to amount of interbank transactions

Source: Calculation and compilation by the author using Bangladesh Bank data

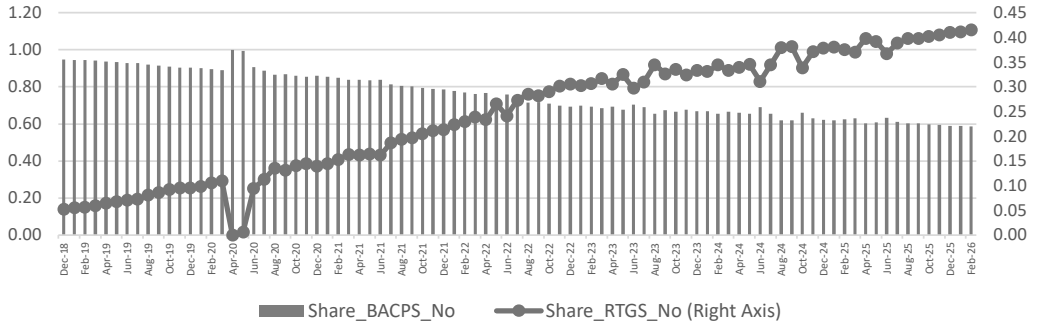

Figure 2. Share of EPSS (RTGS) and TPSS (BACPS) based on number of interbank transactions

Source: Calculation and compilation by the author using Bangladesh Bank data

5.2 Forecasting of the share of EPSS in amount (RTGS transactions)

For the share of RTGS amount, the variable is found to be stationary at the first difference according to both the Dickey-Fuller test (Dickey & Fuller, 1979) and the Phillips–Perron test (Phillips & Perron, 1988). The unit root test results of both criteria are consistent and displayed in Table 2.

Table 2. Stationarity test results (Share of EPSS Amount)

Dickey-Fuller test for unit root Number of obs = 75 --- Interpolated Dickey-Fuller (Critical value) ---					Phillips-Perron test for unit root Number of obs = 75; Newey-West lags = 3 --- Interpolated Dickey-Fuller (Critical value) ---				
	Test Statistic	1%	5%	10%		Test Statistic	1%	5%	10%
$Z(t)$	-9.283	-4.095	-3.475	-3.165	$Z(rho)$	-76.942	-26.550	-20.250	-17.150
					$Z(t)$	-9.351	-4.095	-3.475	-3.165
MacKinnon approximate p-value for $Z(t) = 0.0000$					MacKinnon approximate p-value for $Z(t) = 0.0000$				

Source: Author using Bangladesh Bank data

The optimal ARIMA model for forecasting the share of EPSS amount was identified using the significance of ARMA components, Akaike's Information Criterion (AIC), Bayesian Information Criterion (BIC), maximum likelihood, and sigma SQ. The results of the best model are exhibited in Table 3.

As a diagnostic test to assess the model's appropriateness, we performed the white noise test (Ljung & Box, 1978) to determine whether our model has adequately captured all patterns in the data.

For this model, all residual values are concentrated around the mean (Figure 3). This expresses the model's reliability, which has a constant mean, a constant variance, and no autocorrelation. Moreover, the Portmanteau (Q) statistic 28.7950 $\left[Prob > \chi^2_{36} = 0.7977\right]$ confirms the adequacy of the model.

To further test model stability, we performed the ARIMA root graph test. In time series analysis, particularly with autoregressive (AR) models, the location of the roots of the characteristic polynomial within the unit circle is crucial for determining the model's stability. The model is considered stationary and stable if all roots of the inverse have modulus less than 1.

Table 3. ARIMA regression of EPSS Amount (2,1,1)

D.Share_RTGS_Amount	Coef.	St.Err.	*t*-value	*p*-value	[95% Conf	Interval]	Sig
Constant	0.006	0.003	1.68	0.092	-0.001	0.012	*
L	0.73	0.109	6.69	0.000	0.516	0.944	***
L2	-0.356	0.089	-3.98	0.000	-0.531	-0.18	***
L	-0.804	0.099	-8.12	0.000	-0.998	-0.61	***
Constant	0.056	0.002	29.47	0.000	0.052	0.06	***
Mean dependent var		0.005	SD dependent var				0.063
Number of obs		86	Chi-square				156.806
Prob > chi2		0.000	Akaike crit. (AIC)				-241.462

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Note: L is the log-likelihood of the model at the earlier stage of optimisation and L2 is the log-likelihood of the model at the final iteration or after convergence

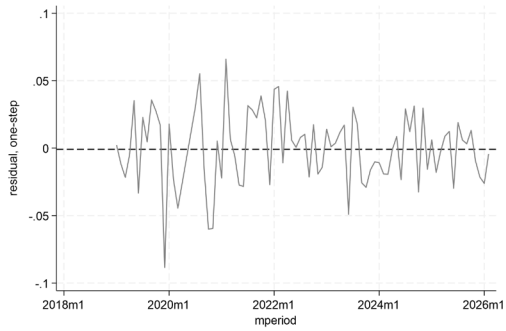

Figure 3. Residuals of the ARIMA regression model of EPSS Amount

Source: Author using Bangladesh Bank data

For our model, all the eigenvalues lie inside the unit circle. Therefore, AR parameters satisfy the stability condition, and MA parameters satisfy the invertibility condition.

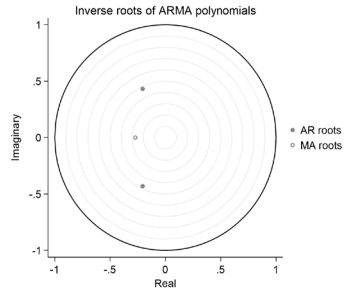

Figure 4. ARIMA root graph for EPSS Amount

Source: Author using Bangladesh Bank data

The inverse roots of ARIMA polynomials (Figure 4) exhibit that the AR and MA roots lie inside the circle. It proves that the residuals are white noise and stable. Thus, our model is appropriate for forecasting.

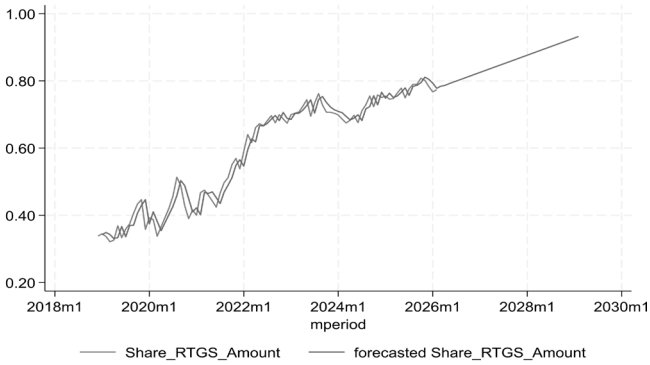

Figure 5. Forecast of the share of EPSS Amount

Source: Authors using Bangladesh Bank data

We find that the forecasted share of RTGS will be 93.20% with respect to the amount after three years in February 2029 (Figure 5). This provides statistical evidence of an upward trend in the adoption of EPSS.

5.3 Forecasting of the share of EPSS in number (RTGS transactions)

The share of RTGS number variable is stationary at the first difference, as indicated by the results of the Dickey-Fuller test (Dickey & Fuller, 1979) and the Phillips–Perron test (Phillips & Perron, 1988). The unit root test results of both criteria are consistent and shown in Table 4.

Table 4. Stationarity test results (Share of EPSS Amount)

Dickey-Fuller test for unit root Number of obs = 75 --- Interpolated Dickey-Fuller (Critical value) ---				Phillips-Perron test for unit root Number of obs = 75; Newey-West lags = 3 --- Interpolated Dickey-Fuller (Critical value) ---				
	Test Statistic	1%	5%	10%		Test Statistic	1%	5%	10%
$Z(t)$	-11.767	-4.095	-3.475	-3.165	$Z(rho)$	-81.374	-26.550	-20.250	-17.150
					$Z(t)$	-14.020	-4.095	-3.475	-3.165
MacKinnon approximate p-value for $Z(t) = 0.0000$					MacKinnon approximate p-value for $Z(t) = 0.0000$				

Source: Author using Bangladesh Bank data

The optimal ARIMA model for forecasting the share of EPSS numbers was identified using the significance of ARMA components, Akaike's Information Criterion (AIC), Bayesian Information Criterion (BIC), maximum likelihood, and sigma SQ. The results of the best model are exhibited in Table 5.

As a diagnostic test to check the appropriateness of the model, we performed the white noise test (Ljung & Box,1978) to assess whether our model had adequately captured all the patterns in the data.

For our model, all residual values are concentrated around the mean (Figure 6). This emphasises the model's reliability, which has a constant mean and variance; in addition, it is free of autocorrelation. Moreover, the Portmanteau (Q) statistic 35.6098 $\left[Prob > \chi^2_{36} = 0.4870\right]$ confirms the adequacy of the model.

Like the previous model of EPSS amount, the model of EPSS number is considered stationary and stable if all inverse roots lie inside the unit circle.

Table 5. ARIMA regression of EPSS Amount (2,1,1)

D.Share_RTGS_Amount	Coef.	St.Err.	*t*-value	*p*-value	[95% Conf	Interval]	Sig
Constant	-0.008	0.002	-4.16	0.000	-0.012	-0.004	***
ARMA							
AR							
L1.	0.835	0.092	9.00	0.000	0.647	1.007	***
L2.	-0.321	0.072	-3.61	0.000	-0.498	-0.148	***
MA							
L1.	-1	.	.	.	.	.	
/sigma	0.063	0.002	22.17	0.000	0.057	0.067	***
Mean dependent var		-0.005	SD dependent var				0.076
Number of obs		86	Chi-square				121.796
Prob > chi2		0.000	Akaike crit. (AIC)				-139.150

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Note: L is the log-likelihood of the model at the earlier stage of optimisation and L2 is the log-likelihood of the model at the final iteration or after convergence

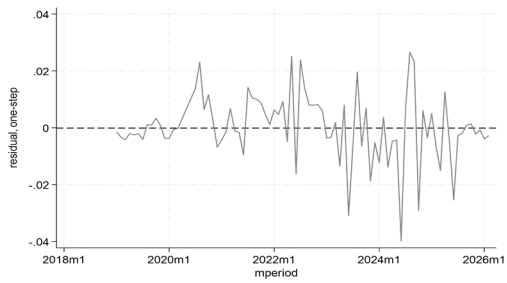

Figure 6. Residuals of the ARIMA regression model of EPSS Number

Source: Author using Bangladesh Bank data

For this model, all the eigenvalues lie inside the unit circle. Therefore, AR parameters satisfy the stability condition, and MA parameters satisfy the invertibility condition.

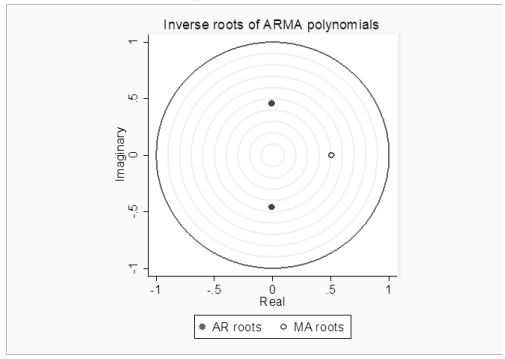

Figure 7. ARIMA root graph for EPSS Number

Source: Author using Bangladesh Bank data

The inverse roots of ARIMA polynomials (Figure 7) exhibit that the AR and MA roots lie within the circle. Therefore, the residuals are white noise and stable. This makes our model appropriate for forecasting.

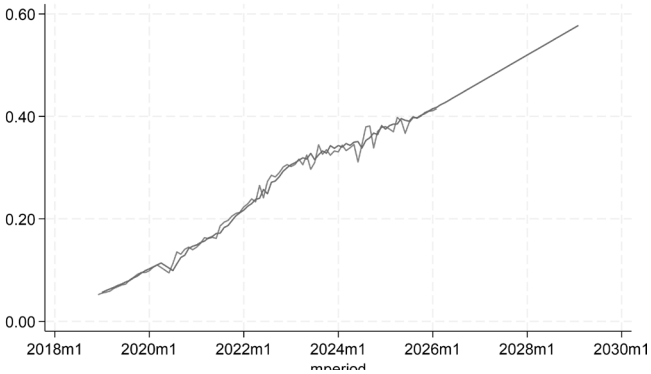

Figure 8. Forecast of the share of EPSS Number

Source: Authors using Bangladesh Bank data

The forecasted share of RTGS is 57.75% with respect to the number after three years in February 2029 (Figure 8). This provides statistical evidence of an upward trend in EPSS adoption.

6 Policy Implications

To accelerate economic development, ensure financial stability, and promote financial inclusion in an emerging economy, the financial landscape must be structurally shifted from TPSS to EPSS. In this regard, the results of the initiatives taken by the government, regulators, and industry practitioners in Bangladesh have become both practically and statistically significant.

In particular, our results show that the share of EPSS in Bangladesh will be 93.20% and 57.75% with respect to amount and number, respectively, after three years. The adoption of EPSS with respect to amount shows a steeper upward trend than its adoption with respect to number. Because RTGS adoption is limited to a certain threshold, the number of small-amount transactions is still captured by traditional substitutes. A pervasive lack of digital financial literacy among a segment of the population in the country is also a key driver of the adoption of its traditional substitute (Podder, 2025).

There is no denying that consumer behaviour and demand have also shifted toward EPSS in all emerging economies, including Bangladesh. However, not all electronic transactions are free of charges in Bangladesh. The charge for RTGS transactions is the same, regardless of the amount. It is very popular among consumers for high-value transactions. However, consumers hesitate to make comparatively low-value transactions through EPSS due to the transaction fee, even though it is very small compared to the convenience of TPSS. If RTGS operating hours could be extended to 24 hours, along with waiving its threshold and transaction fees, its adoption, in both amount and number, could accelerate, helping make the economy cashless.

To capture the EPSS share by number, digital financial know-how must be learned across all categories of bank customers. Initiatives in this direction will greatly benefit society as a whole in significantly reducing the digital divide. Governments and policymakers should

implement training programs and supply customers with comprehensive educational materials and information regarding electronic banking services.

In collaboration with government agencies, commercial banks can take steps to enhance the customers' digital know-how. Customers will then have the opportunity to educate and equip themselves not only to participate in digital banking activities but also to use a range of digital services in their daily lives, including purchasing products on e-commerce platforms or making stock market investments. Finally, getting society actively involved in the digitisation process will ensure greater financial inclusion and lower carbon emissions, leading to better health and time management for people. EPSS facilitate electronic banking and reduce carbon emissions by minimising the need for customer visits to physical branches, thereby serving as an effective tool for enhancing environmental sustainability.

As observed in Bangladesh, EPSS is expected to experience substantial growth in other developing and emerging economies, supported by expanding internet and mobile access, advancements in financial technology, favourable government policies, and evolving consumer behaviours. Therefore, the findings on EPSS in Bangladesh can serve as a guide for other developing and emerging economies. These findings can motivate policymakers in emerging economies to make strategic decisions regarding electronic payment systems.

7 Conclusion, Limitations, and Future Directions

The share of EPSS adoption in interbank transactions has been increasing rapidly over the last decade. With its advantageous, convenient, and instant value-transfer mechanism, RTGS, the dominant component of EPSS, has become a potential substitute for traditional check-based payment and settlement systems. The upward trend in EPSS clearly indicates its growing acceptability among users of modern banking facilities. The significant gap in EPSS adoption, in both number and amount, found in our study, reveals the immediate need to increase digital financial literacy among digitally laggard customers.

All the important findings notwithstanding, our study does have a few limitations. The empirical analysis was based on the aggregate adoption level of EPSS and TPSS in the country. It has yet to consider the adoption levels of different payment systems by geographical location (rural/urban) separately. Our current sample contains data for 87 months. The analysis would become stronger and more persuasive if the data windows were longer. Moreover, it is not tested whether there is any structural break during the COVID-19 period.

We find that TPSS persists even in the presence of many of EPSS's advantageous features. The three-year forecast shows a prominent presence of TPSS relative to the number of interbank transactions. Based on this evidence, the study of EPSS resistance in emerging economies has enormous potential for further investigation.

Disclosure

Conflict of Interest

The author declares no conflict of interest.

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Author's Contribution

The author himself conceived the research idea, designed the study, reviewed the literature, analyzed data, and prepared the manuscript.

Data Availability

The datasets generated or analysed during this study are available from the corresponding author upon reasonable request.

References

Abonazel, M. R., & Abd-Elftah, A. I. (2019). Forecasting Egyptian GDP using ARIMA models. *Reports on Economics and Finance, 5*(1), 35–47.

Agrawal, M., & Bansal, A. (2018). Factors influencing consumer's intention to use e-payment system: An empirical study. *International Bulletin of Management and Economics, 9*(1), 14–28.

Ansari, I., Azim, K. S., Bhujel, K., Panchal, S. S., & Ahirrao, Y. S. (2025). Fintech innovation and IT infrastructure: Business implications for financial inclusion and digital payment systems. *Emerging Frontiers Library for The American Journal of Engineering and Technology, 7*(09), 49–73.

Azam, M. S., Morsalin, M., Rakib, M. R. H. K., & Pramanik, S. A. K. (2023). Adoption of electronic commerce by individuals in Bangladesh. *Information Development, 39*(4), 764–786.

Bangladesh Bank. (2006). *Bangladesh Bank annual report 2005–2006*. https://www.bb.org.bd/ pub/annual/anreport/ar0506/index0506.php

Bangladesh Bank. (2016). *Bangladesh Bank annual report 2015–2016*. https://www.bb.org.bd/ pub/annual/anreport/ar1516/index1516.php

Bangladesh Bank. (2019). *Bangladesh Bank annual report 2018–2019*. https://www.bb.org.bd/ pub/annual/anreport/ar1819/index1819.php

Bangladesh Bank. (2022). *Bangladesh Bank annual report 2021–2022*. https://www.bb.org.bd/ pub/annual/anreport/ar2122.pdf

Barnes, S. J., & Corbitt, B. (2003). Mobile banking: Concept and potential. *International Journal of Mobile Communications, 1*(3), 273–288.

Box, G. E. P., & Jenkins, G. M. (1970). *Time series analysis forecasting and control*. Holden-Day, San Francisco.

Bultum, A. G. (2014). Factors affecting adoption of electronic banking system in Ethiopian banking industry. *Journal of Management Information System and E-commerce, 1*(1), 1–17.

Chatfield, C., & Xing, H. (2019). *The analysis of time series: An introduction with R*. Chapman and Hall/CRC.

Del Sarto, N., & Ozili, P. K. (2025). FinTech and financial inclusion in emerging markets: A bibliometric analysis and future research agenda. *International Journal of Emerging Markets, 20*(13), 270–290.

Dennis, A. (2004). *Electronic payment system: User-centered perspective and interaction design* (pp. 1–12). Technical Universiteit Eindhoven.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319–340.

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association, 74*(366a), 427–431.

Goodhue, D. L., & Thompson, R. L. (1995). Task-technology fit and individual performance. *MIS Quarterly, 19*(2), 213–236.

Griffiths, P. D. R., Mukherjee, A., & Sinha, P. N. (2025). Determinants of FinTech diffusion in emerging markets: A service ecosystem perspective. *International Journal of Emerging Markets*, 20(13), 356–376. https://doi.org/10.1108/IJOEM-04-2024-0678.

Gupta, K., & Arora, N. (2020). Investigating consumer intention to accept mobile payment systems

through unified theory of acceptance model: An Indian perspective. *South Asian Journal of Business Studies, 9*(1), 88–114.
Haralayya, B. (2021). How digital banking has brought innovative products and services to India. *Journal of Advanced Research in Quality Control and Management, 6*(1), 16–18.
Kabir, M. A., Saidin, S. Z., & Ahmi, A. (2015). Adoption of e-payment systems: A review of the literature. In *International Conference on E-Commerce* (pp. 112–120).
Kumar, A. (2019). A study of significant characteristics of e-payment regime in India. *MERC Global's International Journal of Management, 7*, 168–174.
Ljung, G. M., & Box, G. E. P. (1978). On a measure of lack of fit in time series models. *Biometrika, 65*, 297–303.
Nedozi, F. O., & Omoregie, C. I. (2019). An empirical evaluation of different electronic payment channels in Nigeria. *Journal of Finance and Accounting*, Special Issue: *Financial Inclusion, Accounting Perspectives and Development, 7*(5), 146–152.
Ongkasuwan, M., & Tantichattanon, W. (2002, October). A comparative study of internet banking in Thailand. In *First National Conference on Electronic Business*, Bangkok.
Phillips, P. C., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika, 75*(2), 335–346.
Podder, B. (2025). Mobile financial services in Bangladesh: An empirical study of its usage. *Global Business Review*. https://doi.org/10.1177/09721509251333478
Premchand, A. & Choudhry, A. (2015). Future of payments-ePayments. *International Journal of Emerging Technology and Advanced Engineering*, 5(1), 110–115.
Rafferty, N. E., & Fajar, A. N. (2022). Integrated QR payment system (QRIS): Cashless payment solution in developing country from merchant perspective. *Asia Pacific Journal of Information Systems*, 32(3), 630-655.
Rogers, E. M. (1962). *Diffusion of innovations*. Free Press of Glencoe, NY.
Sarkisyan, S. (2024). Instant payment systems and competition for deposits. *Jacobs Levy Equity Management Center for Quantitative Financial Research Paper*.
Shumway, R. H. & Stoffer, D. S. (2017). ARIMA models. In *Time series analysis and its applications* (75-163). Springer.
Souiden, N., Ladhari, R. & Chaouali, W. (2021). Mobile banking adoption: A systematic review. *International Journal of Bank Marketing*, 39(2), 214–241.
Teoh, W. M., Chong, S. C., Lin, B. & Chua, J. W. (2013). Factors affecting consumer' perception of electronic payment: An empirical analysis. *Internet Research*, 23(4), 465–485.
Venkatesh, V., Morris, M. G., Davis, G. B. & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 425–478.
World Bank. (2023). *Payment systems*. https://www.worldbank.org/en/topic/paymentsystems remittances.
Xena, P. & Rahadi, R. A. (2019). Adoption of e-payment to support small-medium enterprise payment system: A conceptualised model. *International Journal of Accounting*, 4(18), 32–41.
Yucha, N., Setiawan, S., Muttaqin, N., Ekasari, R., & Mauladi, K. F. (2020). Digital payment system analysis of buying decision in Indonesia. *Journal of Asian finance, economics and business*, 7(10), 323-328.