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Editorial Notes

We take great pleasure in announcing the upcoming release of Jahangirnagar University Journal of Business Research (JUJBR), Volume 23, Number 02, scheduled for December 2023. Going forward, we plan to publish two journals annually, with releases in June and December. The successful culmination of this journal involved a distinguished Advisory Board from national and international business schools, a robust Reviewer Board from renowned business institutions, and a supportive Editorial Board.

JUJBR is dedicated to showcasing high-quality, authentic, and invaluable research focused on contemporary aspects of business, commerce, and the economy. The publication process includes a rigorous double-blind peer-review, ensuring the quality of the selected papers. Out of a substantial pool of scholarly articles, only eight have been chosen, each addressing different facets of business.

In the very first paper, the researchers have measured the influence of e-servicescape dimensions on consumers' E-Grocery shopping intention by applying the Stimulus-Organism-Response (S-O-R) framework. The second paper explores how lending decision quality affects the financial performance of shariah-based banks in Bangladesh, emphasizing potential implications such as negative returns or capital deficiencies. The third paper investigates factors influencing customer loyalty in the Bangladeshi telecommunications industry, utilizing the Theory of Reasoned Action.

The fourth paper assesses the impact of selected macroeconomic indicators on the liquidity of Bangladesh, employing an ARDL-ECM method where the ratio of excess reserve and total deposit liability is used to represent the liquidity and total domestic credit, lending rate, consumer price index (CPI) with exchange rate are selected as the macroeconomic forces. The fifth paper delves into the payment methods preferred by online food purchasers in Bangladesh, with cash on delivery emerging as the most favored followed by mobile financial services (MFS) and internet banking.

The sixth paper identifies crucial factors shaping consumers' attitudes towards using food delivery apps (FDAs), highlighting the significant positive impact of satisfaction and social influence on continuance usage intention among Bangladeshi consumers. The seventh paper compares factors influencing stock price volatility in listed banks in Bangladesh, considering dividend policy, macroeconomic, and company-specific aspects. The eighth and final paper presents a comprehensive research model

exploring users' biometrics authentication adoption behavior, particularly in the field of e-payment.

We have successfully been able to publish this journal with the grace of the Almighty. We extend our gratitude to all who supported us physically and intellectually, acknowledging the invaluable suggestions of reviewers that enhanced the articles. Special thanks to the Advisory Board members who have provided their insightful suggestions for the enrichment of this journal.

In addition, I would like to express my thanks to Mr. Matiur Rahman Khan, and Mr. Delwar Hossain of IBA-JU for their administrative support. Our appreciation also goes to Mr. Shahjahan and Mr. Noor Mohammad of Natundhara Printing Press for accommodating constant changes and timely completion

Finally, we express heartfelt thanks to Professor AK Zahidul Islam, Director of IBA-JU, and all esteemed members of the Editorial Board for their unwavering support throughout this journey.

Ireen Akhter, PhD
Professor, IBA-JU

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Unraveling the Dimensions of E-Servicescape and its Influence on E-Grocery Shopping Intention: Application of Stimulus-Organism-Response (S-O-R) Framework

Nayeema Ahmed[*]
Muhsina Jannat[**]

Abstract: *This study aims to measure the influence of e-servicescape dimensions on consumers' attitude, trust on e-grocery purchase intention. Based on the dimensions of e-servicescape proposed by Harris and Goode (2010) and the S–O–R framework proposed* by *Mehrabian and Russel (1974), a conceptual model was developed, which considered e-servicescape environment as 'stimuli', internal response as 'organism' and e-grocery purchase intention as 'behavioral response'. Through conducting an online survey,* data *were collected from 200 respondents who purchase grocery items from e-commerce websites in Bangladesh by a structured questionnaire where the five-point Likert scale was used. The conceptual model was evaluated by PLS-SEM using SmartPLS V.3.3.3. The results revealed that financial security has positive influence on attitude towards website, and shows a significant positive impact of aesthetic appeal, layout & functionality, and financial security on trust in website. Besides, consumers' attitude and trust had different levels of indirect (mediating) impacts on consumers' e-grocery purchase intention. This study suggests that e-grocery retailers and web developers should focus on the different dimensions of e-servicescape and give importance on the development of consumers' positive attitude and trust in websites. Therefore, present study added important theoretical and managerial implications for future researchers and e-grocery retailers of Bangladesh.*

Keywords: *E-servicescape, e-commerce website, e-grocery, S-O-R framework, Bangladesh.*

1 Introduction

Because of the diversification of trade and commerce in the twenty-first century, multichannel has emerged where the online method is one of the most significant methods throughout the world (Johnson et al., 2001). As the top-most vital and rapid industry in the world, the retail industry is now operating in two methods. First, traditional brick and mortar retail stores and second, digitally designed e-

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commerce stores (Jagani et al., 2020). As a result, consumers are increasingly motivated for online shopping at retail level. Online shopping means electronic commerce for purchasing goods or services from the vendor using the internet (Rahman et al., 2018). According to the report of Grand View Research (2019), the worldwide e-commerce market value was USD 9.09 trillion in 2019 that is anticipated to increase at a compound annual growth rate of 14.7% from 2020 to 2027. Given this state of global e-commerce market, e-commerce business in Bangladesh is estimated to increase US$70 billion because of growth in ICT and smart technologies (The Financial Express, 2021). The Daily Star (2019) anticipated that by 2023 the e-commerce market in Bangladesh will grow up to $3.77 billion from $1.6 billion in 2019.

The rise of ICT stimulates the purchase of lifestyle and fashion products of everyday groceries. As reported by Grand View Research (2021), the worldwide e-grocery market value was USD 285.70 billion in 2021 that is anticipated to increase at a compound annual growth rate of 25.3% from 2022 to 2030; and within the global e-grocery market, Asia Pacific region holds the major market share in 2021 that is anticipated to continue holding the largest market share and raise at a compound annual growth rate of nearly 28% from 2022 to 2030. Again, Bangladesh grocery market is expected to observe the reckless expansion with a compound annual growth of 11.3 percent by 2023 (IGD, 2018). In the Bangladesh e-grocery market, many retail companies are operating (e.g., Chaldal, DarazMart, Shwapno, KhaasFood, Pandamart, Jogaan, Othoba.com) that offer various items, including meat & fish, fruits & vegetables, beverages, cleaning products, home appliances, cooking essentials, and so on (Sarkar, 2020).

Although the e-commerce market is expanding, the profits made by the electronic retailers are not enough (Harris & Goode, 2004). As an essential predictor of consumer behavior, purchase intention is regarded as a vital indicator of repeat purchase (Schiffman and Kaunk, 2000). Thus, researchers shift their attention from physical servicescape to the virtual one which is also known as e-scape, cyberscape, online servicescape, virtual servicescape, digital servicescape and e-servicescape (Tankovic & Benazic, 2018). An e-servicescape refers to “the characteristics of the physical environment in virtual spaces such as websites” (Harris & Goode, 2010), which is one of the antecedents of consumers’ behavioral intention (Huang et al., 2017). An e-servicescape can stimulate customer feelings and perceptions toward a website and impact their perceptions, trusts, attitudes and purchase intentions (Wu et al., 2016), whereas, a lack of trust, negative attitudes toward websites, and brands were identified to be critical issues that affect purchase intention (Harris & Goode, 2004). The trust-building is crucial for attracting customers to an e-commerce website because of the risky and unsafe nature of the internet, (Jafarpour and Andalib, 2016). Thus, trust and attitude are important for purchase intention.

Hence, several research gaps have been identified from the above discussions. First, the industry participants do not have enough information about the reasons behind consumers’ enthusiasm in this new method of purchasing. In Bangladesh

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context, although some previous studies (Islam et al., 2022) have identified some factors (i.e., user influence, user experience, facilitating conditions, payment methods, fear of Covid-19 and social distancing) affecting consumers' attitude and intention to purchase e-grocery, but the study on identifying the effect of e-servicescape on consumers' purchase intention is very rare. Hence, there is a need to reveal the dimensions of e-servicescape of e-grocery sites and the effect of e-servicescape dimensions on consumers' attitude, trust and purchase intention towards e-grocery in Bangladesh.

Second, the mediating role of attitude and trust in between the relationships of e-servicescape dimensions and purchase intention are yet unrevealed in Bangladesh, which is essential to investigate how trust affects purchase intentions directly and indirectly in developing nations in Bangladesh (Yadav and Mahara, 2020). Although, some previous studies measured the impacts of e-servicescape on trust (Amer, 2021) and e-servicescape on attitude (Wu et al., 2016), but they considered trust and attitude as dependent variable only, not the mediating variable for purchase intention. Therefore, scholars are now interested in the mediating role of trust (Chaudhuri & Holbrook, 2001). Thus, the researchers can say that trust and attitude both raised as a potential mediator between e-servicescape and online purchase intention.

Therefore, the present research proposing and testing a model of e-servicescape and e-grocery purchase intention showing direct and indirect relationships between e-servicescape dimensions, attitude towards website, trust in website and e-grocery purchase intention in Bangladesh. E-commerce market of Bangladesh was thought to be worth US$109 billion by 2023 as the seventh-largest Asian market and twentieth largest global e-grocery market (IGD, 2018). This study has three specific objectives. First, to measure the influence of e-servicescape dimensions on consumers' attitude towards website and trust in website. Second, to analyze the influence of attitude towards website and trust in website on consumers' e-grocery purchase intention. Third, to reveal the mediating role of attitude towards website and trust in website between the relationships of e-servicescape dimensions and e-grocery purchase intention.

2 Literature Review

2.1 Theoretical Background

2.1.1 E-servicescape Dimensions

E-servicescape, an internet-based web environment (Dailey, 2004), indicates all the environmental aspects present during service delivery process (Huang et al., 2017). In this study, researchers selected the three dimensions proposed by Harris and Goode (2010), who are considered as the pioneers to conceptualize and validate the comprehensive scale of e-servicescape in the online services literature (Sreejesh & Ponnam, 2016). The three dimensions of Harris and Goode (2010) are: aesthetic appeal, layout & functionality and financial security. They also proposed that, the construct of e-servicescape is composed of three measures, nine scales, and fifty-two items. Many studies have applied the model

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of Harris and Goode (2010) in different online contexts such as e-commerce sites (Hermantoro & Albari, 2022), digital Islamic banking (Andriani et al., 2021), online shopping (Wu et al., 2016) and online booking intentions (Amer, 2021).

2.1.2 The Stimulus-Organism-Response (S-O-R) Framework

According to Mehrabian and Russell (1974), environmental stimuli (S) induce an emotional reaction (O) and consequently result in behavioral response (R). The S–O–R framework was applied to examine travel website's atmosphere (Kurniawan et al., 2022), virtual reality tourism (Kim et al., 2018), online shopping behavior (Amatus & Gisip, 2022) and online customer loyalty (Amatus & Gisip, 2022). The results of these studies support the S-O-R theory as stimuli significantly predict consumers' emotions, which in turn, directly influence their response. Many studies applied S-O-R framework to introduce a theoretical background for the e-servicescape effects (Wu et al., 2018; Tankovic & Benazic, 2018). When focusing on the online environment, researchers operationalized *stimuli* (S) as aesthetic appeal, layout & functionality, financial security (Hermantoro & Albari, 2022), website appearance, security, eWOM (Amatus & Gisip, 2022), authentic experience (Kim et al., 2018). *Organism* (O) was operationalized as trust (Andriani et al., 2021; Amatus & Gisip, 2022; Amer, 2021), attitude (Wu et al., 2016), emotional purchases (Peng & Kim, 2014), perceived value (Amer, 2021; Hermantoro & Albari, 2022). The *responses* (R) were reflected by purchase intention (Wu et al., 2016; Kurniawan et al., 2022), online booking intentions (Amer, 2021), visit intention (Kim et al., 2018), eWOM intention (Wu et al., 2016), virtual WOM (Andriani et al., 2021).

Based on the literature review, the Stimulus-Organism-Response (S-O-R) framework (Mehrabian & Russell, 1974) considered as the most appropriate theoretical lens for this study. This study considered and assessed 'e-servicescape dimensions' as external stimuli (S), 'attitude towards website' and 'trust in website' as organism (O) and 'purchase intention' as response (R). Hence, aesthetic appeal, layout & functionality and financial security (stimulus) were modelled as the antecedents of consumers' attitude and trust (organism) that directs consumers' purchase intention (response).

2.2 Hypotheses Development

2.2.1 Interrelationships between Stimulus and Organism Variables (E-servicescape, Trust and Attitude)

According to Harris and Goode (2010), aesthetic appeal is one of the dimensions of e-servicescape which can be defined as the overall impressiveness and attraction of a website that is a way to distinguish itself from its competitors. It has been proved that there is a positive linkage between the aesthetics appeal and consumers attitudes toward the website (Wu et al., 2013; Suh & Pedersen, 2010). Previous research findings of several researchers (Montoya-Weiss et al., 2003; Tractinsky and Lowengart, 2007) recommended that, characteristics of website aesthetic appeal are essential for e-servicescape. Following this line of research, present study intends to hypothesize that:

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H1a. Aesthetic appeal of e-commerce website has a significant positive influence on consumers' attitude towards website.

Besides, Amer (2021); Harris and Goode (2010); Wu et al. (2018) revealed that the appearance of a website develops trust toward the website, as, there is a strong link between the aesthetic appeal of the e-servicescape and customers' trust development Chen and Chang (2003). In fact, Fusaro et al. (2002) draw the conclusion that the amount of online trust displayed by customers depends on the signals or reference points offered on websites. Hence, this study intends to hypothesize that:

H1b. Aesthetic appeal of e-commerce website has a significant positive influence on consumers' trust in website.

Layout & functionality are defined as the design aspects of a website that create enjoyable interactions and experiences for users (Harris & Goode, 2010). According to the findings of Donnelly (2001), website functionality, usability, ease of use are important to influence consumers' online behaviors. According to Wu et al. (2013), customers will have a favorable attitude towards website if online merchants have a good design for layout and attractive environment. According to Donnelly (2001), functionality is the most crucial factor that customers consider while evaluating websites. Hence, the following hypothesis is proposed:

H2a. Layout & functionality of e-commerce website has a significant positive influence on consumers' attitude towards website.

According to Constantinides (2004), consumers expect an easy, fast, and interactive website. In e-commerce, website layout & functionalities (e.g., ease of use) of a virtual store help to build consumer trust (Amer, 2021). The empirical study of Manganari et al. (2011) found that layout & functionality can affect website trust. Accordingly, the following hypothesis is proposed:

H2b. Layout and functionality of e-commerce website has a significant positive influence on consumers' trust in website.

Lastly, financial security is defined as the security tools that consumers use to make a payment (Harris & Goode, 2010). According to Chen and Chang (2003) and Szymanski & Hise (2000), one important factor that consumers consider when assessing how websites is easy it is to make and process payments. Security has emerged as one of the most critical issues in e-commerce as there are risks associated with online activity (Cristobal et al., 2007). Customer attitude is influenced by both perceived security and the ease of money transactions (Montoya-Weiss et al. 2003)**.** With that, the following hypothesis is formed:

H3a. Financial security of e-commerce website has a significant positive influence on consumers' attitude towards website.

Consumers' trust is also greatly influenced by perceived security, which is a critical aspect of the online environment (Andriani et al., 2021). Concerns for payment security (Kim et al., 2006) and data privacy have become crucial for

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increasing customers' trust in e-commerce transactions (Anic et al., 2019). Online users want to believe that the web page provides secure transactions and the information (e.g., credit card information) will not be used for fraudulent purposes (Cristobal et al., 2007). Tatar, & Eren-Erdoğmuş (2016) also claimed that a trustworthy website can be boosted through online interactivity and a clear, safe website. With that, the following hypothesis is formed:

H3b. Financial security of e-commerce website has a significant positive influence on consumers' trust in website.

2.2.2 Interrelationships between Organism and Response Variables (Trust, Attitude and Purchase Intention)

Previous studies have proven that purchase intention can be influenced through internal responses (Wu et al., 2016). According to Ajzen (1991), people's attitude toward an action is determined by how positively or negatively they perceive the behavior in question. Kim and Park (2005) provided evidence that favorable attitude toward online shopping regularly affect consumers' willingness to make purchases online. Drawing on these studies, it is hypothesized that:

H4. Attitude towards e-commerce website has a significant positive influence on consumers' e-grocery purchase intention.

According to Fusaro et al. (2002), without trust e-commerce is condemned to stagnation. Luo (2002) suggests that the development of trust should be the primary goal of online businesses. Some recent evindences also support that, trust on the website enhances the online purchasing intentions (Andriani et al., 2021; Amer, 2021; Baki, 2020; Yadav & Mahara, 2020). Considering these, it is hypothesized that:

H5. Trust in e-commerce website has a significant positive influence on consumers' e-grocery purchase intention.

2.2.3 Mediating Roles of Organism Variables (Trust and Attitude)

Ajzen and Fishbein (1980) stated that attitude pertains to evaluations of individuals, objects and issues. Park et. al. (2013) noted that customers' attitude mediates the relationship between psychological characteristics of consumers and online purchase intention and they came to the conclusion that attitudes of consumers toward an object are a key factor in the intention to buy. In the study of Pop et al., (2023) based on S-O-R framework, attitude found to be a mediator which affects purchase intention. The current study accordingly proposes the following hypotheses:

H6. Attitude towards e-commerce website mediates the relationship between (a) aesthetic appeal and e-grocery purchase intention, (b) layout & functionality and e-grocery purchase intention and (c) financial security and e-grocery purchase intention.

According to Harris and Goode (2010), one of the most important aspects that clients typically consider while using an e-service is trustworthiness. E-servicescape is an antecedent of trust (Andriani et al., 2021). Tri Kurniawati et al.

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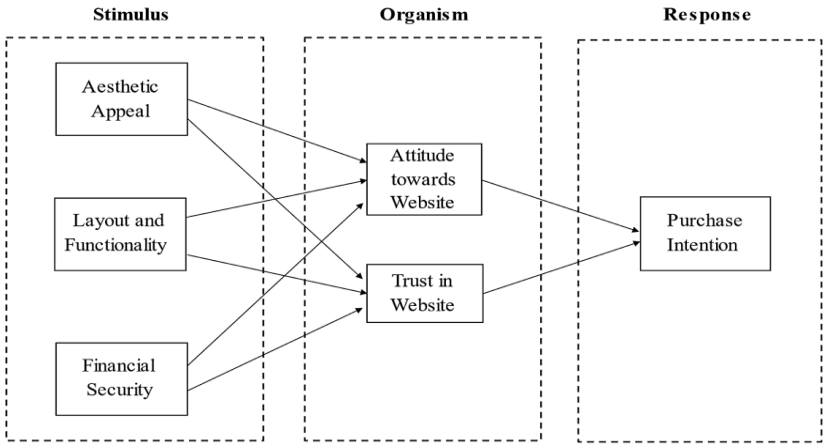
(2021) highlighted that promoting trust through e-servicescape is one of the best strategies for e-commerce merchants to keep their current consumers and draw in new ones. According to Cuong (2020) trust serves as a mediator for the buying intention. The current study accordingly proposes the following hypotheses:

H7. Trust in e-commerce website mediates the relationship between (a) aesthetic appeal and e-grocery purchase intention, (b) layout & functionality and e-grocery purchase intention and (c) financial security and e-grocery purchase intention.

2.3 Conceptual Framework

Considering e-servicescape dimensions as the antecedents of consumers' attitude and trust that affects the e-grocery purchase intention, this study proposes the conceptual framework, where the researchers considered and assessed e-servicescape dimensions as external stimuli (S), attitude towards website and trust in website as organism (O) and purchase intention as response (R).



3 Research Method

3.1 Study Population and Sampling Procedure

This study followed a quantitative research design. The consumers who buy groceries from different e-commerce websites in Bangladesh are the study's target population. According to Kline (2012), a sample size of 100 is considered as little, 100 to 200 as medium, and 200 or more as large. Thus, a total of 200 respondents of Bangladesh who purchase grocery items were surveyed. As there is no specific database of the customers of e-grocery sites are available in Bangladesh, the researchers used the purposive sampling method to gather cross-sectional data because of its popularity (Ritchie et al., 2014).

3.2 Methods of Data Analysis

For data analysis and the evaluation of the proposed model, partial least square structural equation modeling (PLS-SEM) was applied using SmartPLS V.3.3.3. According to Hoyle (1995), structural equation modeling (SEM) is a wide-

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ranging statistical method for analyzing relationships between observed and latent variables. In addition, SEM can reduce measurement errors and it is very helpful technique to evaluate the direct and indirect relationships between variables (Civelek, 2018). Hair et al. (2014) claimed that PLS-SEM can be used to measure more relationships than covariance-based structural equation modeling. PLS-SEM can estimate formative constructs and uses component-based techniques.

3.3 Research Instrument and Measures of the Study

The main data collection instrument used in this study was a structured questionnaire where five-point Likert scale. Data were collected using an online survey. The scale items for aesthetic appeal (AA) were based on seven items adapted from Harris and Goode (2010). However, two items (AA3 and AA7) were deleted for low factor loadings. Five items concerning layout & functionality (LF) were based on the suggestions by Harris and Goode (2010). Financial security (FS) was measured with five items derived from Harris and Goode (2010). Attitude towards website (ATT) included five items based on the study of Chen and Wells (1999), Castaneda et al. (2007). Trust in website (T) included four items suggested by Harris and Goode (2010) and Filieri et al. (2015). With regard to e-grocery purchase intention (PI), four items were adapted from Namkung and Jang (2009) and Castaneda et al. (2007).

4. Data Analysis and Results

Table 1 represents the demographic profile of the respondents. Among the final group of participants, the majority of respondents were male (63.5%). Regarding the age group, most of the respondents were aged between 20-30 (87.5%), followed by an age group of 30-40, which constituted 9% of the sample.

Table 1 Sample Profile

		Frequency	Percentage (%)
Gender	Male	127	63.5
	Female	71	35.5
	Prefer not to say	2	1
Age	Below 20	5	2.5
	20-30	175	87.5
	30-40	18	9
	40-50	2	1
	50-60	0	0
	Above 60	0	0
Educational Qualification	Below SSC	0	0
	SSC	0	0

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		Frequency	Percentage (%)
	HSC	69	34.5
	Bachelor's degree	97	48.5
	Master's degree	34	17
Employment Status	Full-time employment	51	25.5
	Part-time employment	20	10
	Unemployed	129	64.5
Income	No personal income	112	56
	Below Tk. 30,000	52	26
	Tk. 30,000-40,000	13	6.5
	Tk. 40,000-50,000	6	3
	Tk. 50,000-60,000	3	1.5
	Above Tk. 60,000	14	7
Total Sample		200	100

4.1 Measurement Model

The measurement model assessed the reliability (cronbach's alpha and rho_A) and convergent validity of the constructs (outer loadings, average variance extracted and composite reliability).

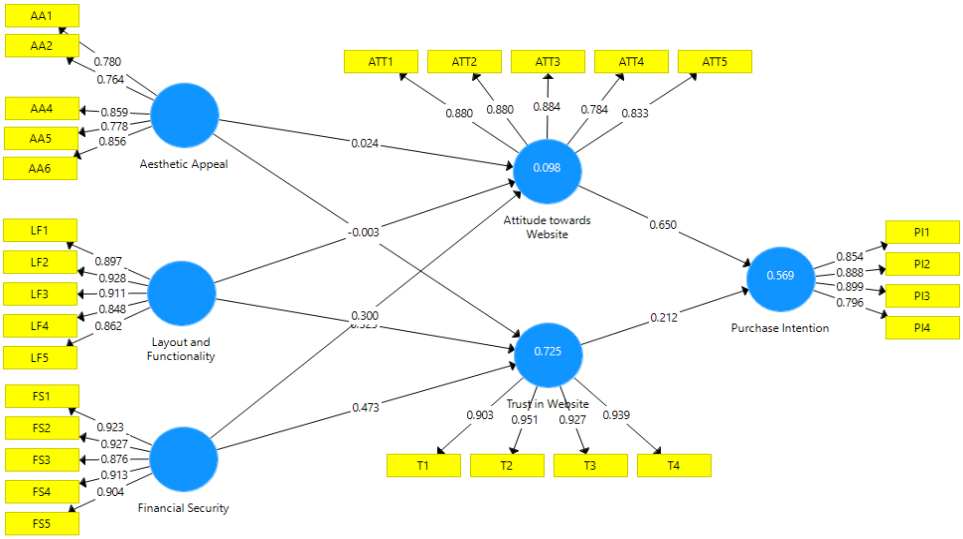

Figure 1 Measurement Model

Table 2 presents convergent validity indices. Here, outer loadings of all the indicators meet the recommended level 0.708 (Hair et al., 2014). As summarized in this table, CR and AVE also fulfill the recommended levels (Vinzi et al.,

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2010), with the CR ranging from 0.904 to 0.962 and the AVE ranges from 0.654 to 0.865. Moreover, the values of Cronbach's alpha (ranges from 0.868 to 0.948) and Dillon-Goldstein's rho (ranges from 0.880 to 0.949) ensured adequate construct reliability of the measurement model (Hair et al., 2011)

Table 2 Factor Loading, Construct Reliability and Convergent Validity

Constructs	Items	Loadings	α	rho_A	CR	AVE
Aesthetic Appeal (AA)*	AA1	0.780	0.868	0.880	0.904	0.654
	AA2	0.764				
	AA4	0.859				
	AA5	0.778				
	AA6	0.856				
Layout & Functionality (LF)	LF1	0.897	0.934	0.939	0.950	0.792
	LF2	0.928				
	LF3	0.911				
	LF4	0.848				
	LF5	0.862				
Financial Security (FS)	FS1	0.923	0.947	0.949	0.959	0.825
	FS2	0.927				
	FS3	0.876				
	FS4	0.913				
	FS5	0.904				
Attitude towards Website (ATT)	ATT1	0.880	0.906	0.910	0.930	0.728
	ATT2	0.880				
	ATT3	0.884				
	ATT4	0.784				
	ATT5	0.833				
Trust in Website (T)	T1	0.903	0.948	0.949	0.962	0.865
	T2	0.951				
	T3	0.927				
	T4	0.939				
Purchase Intention (PI)	PI1	0.854	0.882	0.883	0.919	0.740
	PI2	0.888				
	PI3	0.899				
	PI4	0.796				

Note.
α = Cronbach's Alpha, CR = Composite Reliability, AVE=Average Variance Extracted
* Two items were dropped for low factor loadings

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As shown in the Fornell and Larcker criterion assessment in table 3, the square root of AVE for each construct (shown on the diagonals) are greater than the off-diagonal values which demonstrated adequate discriminant validity of the constructs (Fornell & Larcker, 1981).

Table 3: Discriminant Validity (Fornell-Larcker Criterion)

	AA	ATT	FS	LF	PI	T
Aesthetic Appeal (AA)	0.809					
Attitude towards Website (ATT)	0.208	0.853				
Financial Security (FS)	0.617	0.313	0.909			
Layout and Functionality (LF)	0.698	0.270	0.850	0.890		
Online Purchase Intention (PI)	0.232	0.728	0.346	0.341	0.860	
Trust in Website (T)	0.635	0.369	0.821	0.808	0.451	0.930

Note: The diagonal values refer to the square roots of AVEs and the off-diagonal values represents the correlations between constructs

Results of the measurement model indicate a satisfactory level of reliability and validity, indicating that the constructs are adequately fit for the assessment of the structural model.

4.2 Structural Model

PLS-SEM was used to test the relationships of the proposed model where the bootstrapping method with 5,000 iterations of resampling was adopted.

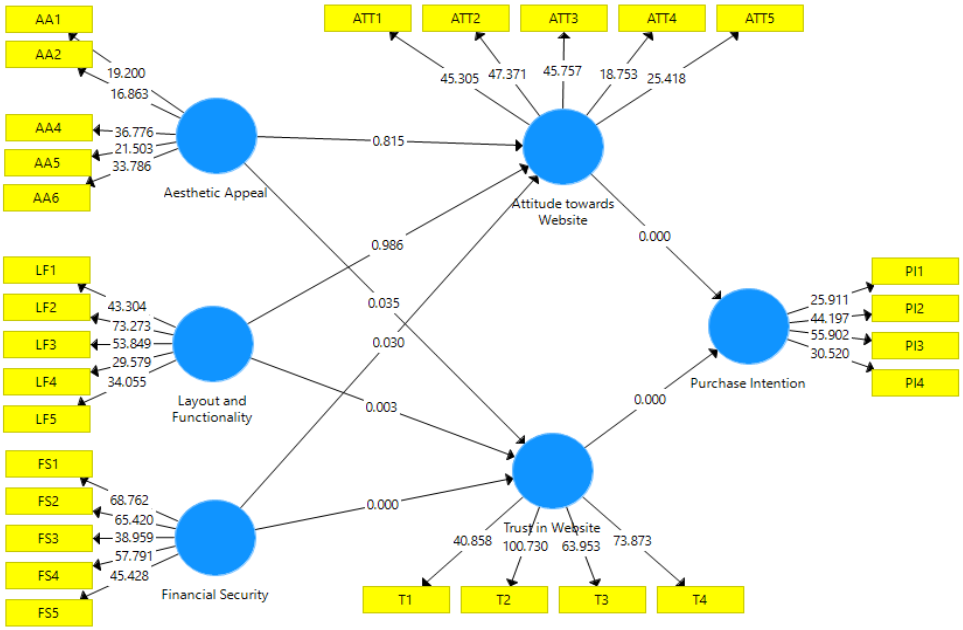

Figure 2 Structural Model

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Table 4 and table 5 shows the estimated path coefficients and associated t-values of the paths of the conceptual model. The path analysis (table 4) revealed that, the effect of aesthetic appeal on attitude towards website was insignificant (t=0.234, p>0.05), whereas, on trust in website was statistically significant (t=2.114, p< 0.05). Thus, H1a was not supported while H1b was supported in this study. Furthermore, the effect of layout & functionality on attitude towards website was insignificant (t=0.017, p>0.05) whereas its effect on trust in website was statistically significant (t=2.985, p<0.01). Therefore, H2a was not supported but H2b was supported in this study. Also, financial security had significant effect on attitude towards website (t= 2.165, p< 0.05) and on trust in website (t=4.078, p< 0.001). Hence, H3a and H3b were supported. So, this study found that only one dimension (financial security) affects consumers' attitude towards website. However, all three dimensions of e-servicescape affect consumers' trust in website. With regard to purchase intention, attitude towards website showed a significant positive relationship (t=11.703, p< 0.001), thus supporting H4. Also, trust in website was found to have a significant positive impact on purchase intention (t=3.934, p< 0.001), thus supporting H5. So, it can be summarized that, both the organism variables (attitude and trust) affect the response variable (i.e., purchase intention) in this study.

Table 4 Hypotheses Test Results

Hypothesis		t Statistics	p Values	Decision
H1a	AA -> ATT	0.234	0.815	Not supported
H1b	AA -> T	2.114	0.035*	Supported
H2a	LF -> ATT	0.017	0.986	Not supported
H2b	LF -> T	2.985	0.003**	Supported
H3a	FS -> ATT	2.165	0.030*	Supported
H3b	FS -> T	4.078	0.000***	Supported
H4	ATT -> PI	11.703	0.000***	Supported
H5	T -> PI	3.934	0.000***	Supported

Note: * p < 0.05, **p < 0.01, ***p < 0.001; AA=Aesthetic Appeal, LF=Layout & Functionality, FS=Financial Security, ATT=Attitude towards Website, T=Trust in Website, PI=Purchase Intention

The indirect test results are presented in table 5. It was found that attitude towards website does not mediate the relationship between aesthetic appeal and purchase intention (t = 0.235, p> 0.05). Hence, H6a was not supported. Similarly, attitude towards website does not mediate the relationship between layout & functionality and purchase intention (t= 0.017, p> 0.05). Consequently, H6b was not supported as well. On the other hand, attitude towards website mediates the relationship between financial security and purchase intention (t=2.201, p< 0.05). Therefore, H6c was supported. That means, among the three dimensions of e-servicescape, attitude towards website only mediates the relationship between financial security and purchase intention.

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Furthermore, trust in website was not found to have any mediating relationship between aesthetic appeal and purchase intention (t= 1.792, p>0.05). Thus, H7a was not supported. Interestingly, though attitudes towards website did not mediate the relationship between layout & functionality and purchase intention, trust in website mediates this relationship (t=2.269, p<0.05). Hence, H7b was supported. Likewise, trust in website mediates the relationship between financial security and purchase intention (t=2.880, p<0.01). Thus, H7c was supported. That means, among the three dimensions of e-servicescape, trust mediates the relationship between layout & functionality and purchase intention. Also trust mediates the relationship between financial security and purchase intention.

Table 5 Mediation Test Results

	Hypothesis	t Statistics	p Values	Decision
H6a	AA -> ATT -> PI	0.235	0.815	Not supported
H6b	LF -> ATT -> PI	0.017	0.987	Not supported
H6c	FS -> ATT -> PI	2.201	0.028*	Supported
H7a	AA -> T -> PI	1.792	0.073	Not supported
H7b	LF -> T -> PI	2.269	0.023*	Supported
H7c	FS -> T -> PI	2.880	0.004**	Supported

Note.: * p < 0.05, **p < 0.01, ***p < 0.001; AA = Aesthetic Appeal, LF=Layout & Functionality, FS=Financial Security, ATT=Attitude towards Website, T=Trust in Website, PI=Purchase Intention

5. Discussion

The study results revealed that, among the three dimensions of e-servicescape, only financial security has a significant positive influence on consumers' attitude towards website. However, current findings are contrary to the studies of Suh & Pedersen (2010) and Wu et al. (2013). The possible reason behind the current finding may be that, attitude formation is a complex mechanism which cannot be explained properly. Besides, the e-grocery industry of Bangladesh is just expanding, it's not a mature industry till now. The developers of e-commerce websites do not have clear idea about the importance of visual appeal and functionality of websites. The insignificant result may also be due to unattractive product display, non-user-friendly websites and not having easy access of product details in the ecommerce websites in Bangladesh (Islam et al., 2022). As a result, the attitude of consumers formed merely by the security system of the websites.

Next, results confirmed that all three dimensions of e-servicescape affect Bangladeshi consumers' trust in e-grocery websites which is like the findings of Harris and Goode (2010), Amer (2021), Anic et al., (2019) and Wu et al. (2016). That means if customers of Bangladesh get a visually appealing, user-friendly website as well as secured payment system while purchasing e-grocery, their trust in that website will be enhanced positively.

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Next, this study also found that both the organism variables (attitude and trust) affect the response variable (purchase intention), means, consumers' attitude towards website has significant effect on their e-grocery purchase intention, which is consistent with the previous research of Kim and Park (2005). That means, when consumers of Bangladesh feel that e-commerce website is a good way to purchase groceries, they like the idea of purchasing groceries from website. Results of this study also revealed that trust in website plays a significant role in influencing consumers purchase intention, which is similar with the findings of Yadav and Mahara (2020), Andriani et al. (2021) and Amer (2021). That means, if customers think that ecommerce websites are trustworthy and reliable, they are willing to purchase and recommend others to purchase e-grocery.

Lastly, the study found that among the three dimensions of e-servicescape, attitude mediates the relationship between financial security and purchase intention, but does not mediate the relationships of aesthetic appeal, layout & functionality and purchase intention. May be the direct effects of aesthetic appeal and layout & functionality on attitude were found to be insignificant in this study. Although it was found that, attitude affects purchase intention directly. Besides, among the three dimensions of e-servicescape, trust mediates on two dimensions (layout & functionality and financial security). The three dimensions of e-servicescape have direct influence on trust, though trust does not mediate the relationship between aesthetic appeal and purchase intention. That means, the three dimensions of e-servicescape can generate trust in website but when the indirect effect of trust is considered, only layout & functionality and financial security can affect the ultimate purchase intention. This is an interesting finding with regard to e-servicescape studies of e-grocery industry of Bangladesh.

6. Implications

6.1 Theoretical Implications

This study contributes to e-servicescape literature and explores a variety of ways in which e-servicescape influences behavioral outcomes. First, this study proposed and tested the conceptual model based on direct and indirect relationships between e-servicescape and behavioral outcomes. It should be noted that, this study measured the individual effects of various e-servicescape dimensions in the development of consumer attitude and trust in websites, rather than accepting the integrated approach of analyzing e-servicescape at a general level. Second, this study integrates the dimensions of e-servicescape within the framework of S-O-R that establishes an added level of sophistication to the literature. Finally, it is worthy to mention that present study is one of the pioneer studies in Bangladesh to test the mediating role of attitude and trust between the relationships of e-servicescape dimensions and purchase intention. Although Wu et al. (2016) and Harris and Goode (2010) discovered direct relationships among e-servicepae, trust, attitude and purchase intention, they did not test the mediating role of attitude and trust. The present study thus confirms that indirect relationships among the stated constructs do exist.

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6.2 Managerial Implications

On the practical side, this research is useful for marketers aiming to promote consumers' positive attitude and encourage purchase intention through website design. A notable finding of this study is that, financial security influences consumers' attitude towards website, which implies that consumers want to know where they are spending money and it will have a positive influence on their attitude. Therefore, e-grocery retailers should focus on making their websites more secured and reliable in order to build consumers' positive attitude by developing a straightforward & security conscious payment system and providing reassurance of security procedures in e-grocery websites. Next, all of the three dimensions of e-servicescape influence trust in website which in turn influences consumers' purchase intention from e-commerce websites. Therefore, marketers must make their websites aesthetically attractive and financially secured. Utilizing suitable color, entertaining web features and other aesthetic elements can improve the aesthetic appeal. Besides, making user-friendly websites with quick access to product details can enhance the design and performance of websites. These three attributes are therefore predicted to make the websites more dependable and trustworthy, which will draw more customers.

7. Limitations & Scope for Future Research

Although this noteworthy study has potential implications for e-grocery industry of Bangladesh, there exists some limitations. Present study included and tested two mediators (attitude and trust) in the model that further needs to be validated by other developing as well as developed country context. The sample size used here was limited to 200 and purposive sampling method was applied for selecting the samples. The sample profile showed that majority of the study sample belong to young generation (age 20-30). So, it is suggested that, future studies can be conducted by employing greater sample size with the probability sampling technique. Besides, comparative studies between various age groups can also be conducted in future. In addition, the study model did not test the effect of any moderating variables like income, gender and age. So future research can be conducted by including various moderating variables in the model.

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The Effect of Lending Decision Quality on the Performance of Shariah Based Banks: Empirical Evidence from Bangladesh

JUJBR

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Abstract: *The study tries to find how lending decision quality impacts the financial performance of shariah-based banks from a Bangladeshi perspective. A strongly balanced panel data set encompassing eleven years of data from seven shariah-based banks has been used to run the econometric model required for this paper. The study uses the total Classified Loan to Total Loans (CLTL), Provision Maintained to Total Loan (PMTL), Provision Maintained to Classified Loan (PMCL), and Capital Adequacy Ratio (CAR) as a proxy for lending decision quality, whereas the Return on Asset (ROA) and Net Interest Margin (NIM) serves the role of performance indicator. Bank Size is also used here as a control independent variable. This paper finds that both CLTL and Bank Size have a significant negative relationship with profitability, and PMCL shows a positive impact on performance. The study does not find any meaningful relationship between CAR and PMTL with bank performance. The contribution from this study suggests that any additional nonperforming loan strain on the shariah-based banking system could result in catastrophic implications such as a negative return or a capital deficiency.*

Keyword: *Islamic Banking, Lending Decision, Non Performing Loan, Bank Performance*

1. Introduction

It is a common trend in developing economies that the financial assets are controlled by commercial banks mainly. The size of financial assets controlled by commercial banks is almost 90 percent (ADB, 2013). So, to increase the economic growth of the developing economies, commercial banks' efficient performance is mandatory, while those banks' insolvency will result in an economic crisis. Nevertheless, the intermediation role banks play involves different sorts of risks of a different extent, such as liquidity risk, operational risk, credit risk, market risk, and so forth (Van Gestel and Baesens, 2008). Kargi (2011) argued that credit risk and risk involved in the bank's operational activities could hamper the bank's efficient operations, which eventually can be resulted in bankruptcy. Compared to other banking risks, the most significant is credit risk (Hussain and Al-Ajmi, 2012; Perera et al., 2014). Additionally, among all the balance sheet components, credit risk is found above 80 percent (Van Greuning

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and Brajovic Bratanovic, 2009). Besides, researchers found that aggressive expansion of credit, bad lending quality, and insufficient efforts in managing credit risk are the prime causes of failure of banks, leading to global economic crisis (Gropp et al., 2011; Romānova, 2012).

Basel Committee for Banking Supervision initiated Basel I policy in 1988 and Basel II in 2004 for providing a proper credit risk management guideline taking the consequences caused by credit risk into account. Making necessary amendments addressing the flaws of the past accords to cope with credit risk while confronting the financial crisis, Basel III is in effect now (Jayadev, 2013; Ouamar, 2013).

The global financial recession in 2007 made financial experts look differently at shariah or Islamic religious practice backed banking concept as several researchers presented shariah based banking as a sustainable solution to financial crises in the banking system (Said, 2012; Zarrouk, 2012; Hasan and Dridi, 2011). Many studies argue that interest-free shariah-based banks have a higher chance to deal with financial shock efficiently than the conventional or traditional financial institutions (Zehri and AL-Herch, 2013; Ftiti et al., 2013; Mat Rahim and Zakaria, 2013). This situation gives rise to the popularity of shariah-compliant banks as these banks seem to follow better risk management practices.

At present, Islamic banking is being practiced by many Muslim countries, whereas few non-Muslim countries are also practicing this. During the period of upsetting global economic crisis, particularly in 2008, some Islamic banks were started, for example, Gatehouse Bank in 2008. A report on the competitiveness of Islamic banks estimated that by 2020 Islamic banking will achieve a banking market of 1.6 trillion U.S. Dollars (EY, 2016).

Bangladesh is one of those Muslim countries that has a substantial Muslim population. So, people here who lead their lives according to the Quran and hadith accepted and greeted Islamic Banking warmly when this Islamic banking system was established for the first time in 1983. In 1983, the first completely Shariah-compliant bank of Bangladesh, 'Islamic Bank Bangladesh Limited (IBBL)' was established. After that, seven more banks were established in Bangladesh. Recently three more conventional banks got permission from Bangladesh Bank (central bank of Bangladesh) to convert their existing operation to shariah-compliant operation. Inspired by the success and popularity of these Islamic banks, several conventional banks started Islamic branches of their own. Since the beginning, these shariah-based banks demonstrated their contribution to the money market of the country and continuously showed harmonious growth along with the growth of the economy. According to Bangladesh Bank (June, 2018), in Bangladesh, full-grown Islamic banks were 8, with 1134 branches; 9 conventional banks operate Islamic banking through their 19 branches, and 8 conventional scheduled commercial banks give Islamic banking services by their twenty-five Shariah banking windows. Again, regarding deposits as well as investments, the Islamic banking sector of Bangladesh occupied more than 1/5 share of the whole banking industry (Bangladesh Bank, 2018). Compared to the

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conventional method of the banking system, Islamic banking shows impressive steady growth worldwide. The reason for this remarkable growth in the case of Islamic banks is their efficient performances and the extreme demand for Shariah-based banking products derived from the increasing number of Muslim population (Derbel et al., 2011). The investment of Islamic banking follows the principle that allows only the profit and loss sharing (PLS) and does not allow maysir (speculation), riba, which means interest, gharar (uncertainty), etc. This specialty facilitated steady growth all over the world.

However, the unique model of financing (PLS) in Islamic banks makes them exposed to a different level of credit risk exposure. In PLS, Islamic shariah-compliant banks may face relatively higher default cases as there is a psychological factor of borrowers associated with the possibility of sharing loss with banks (El-Hawary et al., 2007). The religious limitation on applying different sorts of conventional credit risk easing approaches such as credit derivatives also gives rise to shariah-compliant banks' exposure to credit risk (Errico and Farahbaksh, 1998). On the other hand, this PLS system requires the creation of a business partnership between borrowers and banks which can reasonably reduce the probability of non-repayment of loans as banks can have better capability to judge customers' default probability here (Errico and Farahbaksh, 1998). Abedifar et al. (2013) argue that borrowers' religious sentiment also decreases the chance of loan default.

Therefore, to manage the credit risk, the quality of lending decisions is a significant factor for Shariah-based banks as it is linked to the performance of the bank. The Researcher finds an increasing trend of non-performing loans and decreasing trend of profitability in Bangladeshi Islamic banks[1] (Figure-01 and Figure-02).

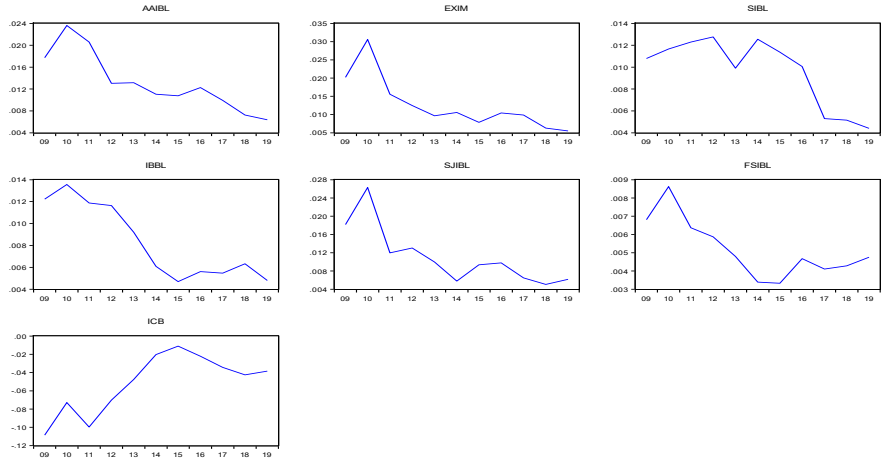

Figure 01: Bank-wise Return on Asset trend.

[1] **List of banks:** Al-Arafah Islami Bank PLC (AAIBL), EXIM Bank Limited (EXIM), First Security Islami Bank PLC (FSIBL), ICB Islamic Bank Ltd (ICB), Islami Bank Bangladesh PLC (IBBL), Shahjalal Islami Bank PLC (SJIBL), and Social Islami Bank PLC (SIBL)

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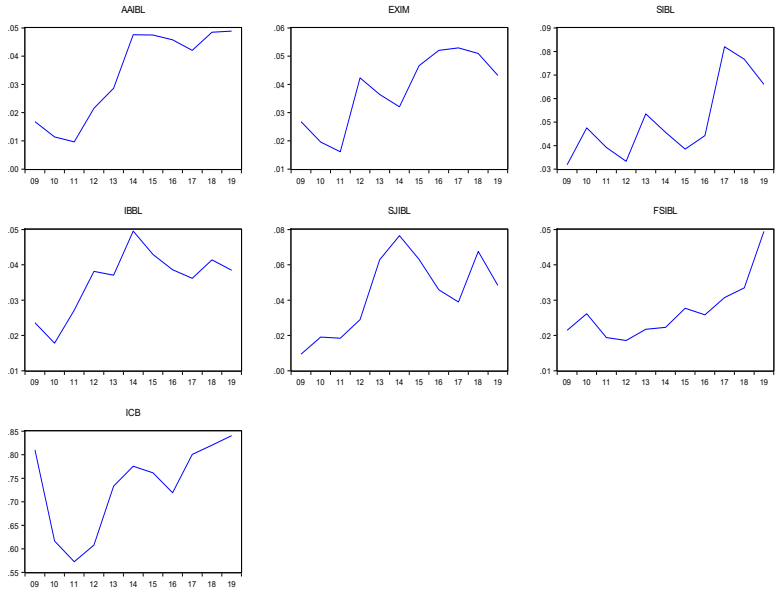

Figure 2: Bank-wise classified loan trend.

This creates a necessity to inquire about the impact of lending decision quality on Islamic banks' performance in Bangladesh. While previous studies have explored the banking industry in Bangladesh, they have predominantly focused on conventional banks, neglecting the distinctive features of Islamic banking (Mozumder et al., 2022). Furthermore, the existing research on Islamic banks in Bangladesh has predominantly centered around Shariah compliance (Ahmad and Hassan, 2007; Alam et al., 2022).

Thus, the broad goal of this study is to analyze the effect of the quality of lending decisions on the financial performance of Shariah-based banks in Bangladesh. The specific objectives include identifying the nature of the relationship between lending decision quality and Shariah-based banks' performance and proposing some recommendations to policymakers based on the empirical result of this study.

2. Literature Review

This paper makes an attempt to examine the effect of lending decision quality on the financial performance of Bangladeshi banks which comply with Shariah. The review of the existing literature in these areas will guide this research. Many studies also tried to contribute to the literature on the relationship of credit performance and profitability of banks (Hosna et al., 2009; Kithinji, 2010; Kolapo et al., 2012; Ruziqa, 2013).

Haslem (1968), in earlier work on banking profitability, found that the managerial capacity of bank executives, location, and time has an effect on a bank's profitability. Researchers showed a great curiosity to inquire how credit risk affects profitability. For instance, Berger (1995) discovered that there

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remains a strong positive relationship between the capital adequacy ratio and US bank's profitability during the 1980s. However, he postulated that this relationship could take the opposite direction too under certain conditions. In a further study, Berger and DeYoung (1997) posited that poorly capitalized banks could face the problem of higher non-performing assets as these banks tend to take more risks in credit granting. Goddard et al. (2004) studied the profitability of banks in Europe and found that profitability is greatly affected by capital to asset ratio. Bofondi and Gobbi (2003) showed that poor lending decisions like selecting borrowers with questionable capacity caused piling up banks' non-performing assets, which eventually led to higher credit risk exposure. In another study conducted in the Indian context, Rajan and Dhal (2003) showed better credit practices help to lower the poorly performing assets in the bank's portfolio.

Analyzing the data of commercial banks, Kithinji (2010) found that credit risk impacts financial performance neutrally. A study on Sweden's commercial banks throughout 2000-2008 discovered a positive connection between profitability and credit risk (Hosna et al., 2009). However, some papers found a negative relationship between credit risk exposure and profitability (Kolapo et al., 2012; Ruziqa, 2013). Ruziqa (2013) also found that liquidity risk has a positive effect on bank profitability.

There are some studies on the profitability of shariah-compliant banks. Focusing on the finding determinants of the shariah-based banks' profitability worldwide, Hassan and Bashir (2003) conducted a study and found that Islamic banks' profitability increases with the capital increase, but it does not change with reserve. Their study also postulated a negative relationship between size and profitability. Muhamad et al. (2013) identified the deposit ratio as a determinant of the profitability of Islamic banks, and the direction of their relationship is positive. The work of Shah and Khan (2017) also confirmed a significant positive association of deposit and profitability.

Most of the research on Islamic banking in Bangladesh tried to shed light on profitability and legal issues concerning shariah-compliant banking. In an early study, Sarker (1999) used ratio analysis and found that the first shariah-compliant Bangladeshi bank (Islami Bank Bangladesh Limited (IBBL)) had been successful in maintaining positive growth in profitability since inception. Ahmad and Hassan (2007) stressed the necessity of a clear framework for shariah compliance in the banking system of Bangladesh as they found the present framework is not sufficient. They pointed out that the constraints in the investment in the capital market, absence of shariah-compliant money market, and unjust reserve requirement made it troublesome for shariah-based banks to operate efficiently in Bangladesh. They recommended a completely different banking regulation for banks that are shariah-compliant. Through the data envelopment technique, Abduh, et al. (2013) examined the efficiency level of the Islamic banking system of Bangladesh and showed evidence of improving the trend of bank efficiency. Alam, et al. (2022) confirmed that the quality of management of Shariah practices impacted the performance of Islamic banks in Bangladesh, both

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positively and negatively. Some other papers also confirmed the satisfactory level of performance and better future of shariah-compliant banking in Bangladesh (Sadekin et al., 2014; Ibrahim et al., 2014).

Many studies on lending decision quality and profitability in the banking industry have been undertaken. Those studies attempted to determine the nature of their association. Similarly, the profitability of shariah-based banking has been investigated in several academic papers. The researcher attempts to establish a link between these two fields of study. Keeping the peculiarities of Islamic banking in mind, this paper empirically investigates how lending decision quality affects profitability in the context of Bangladesh where Islamic banking has been experiencing rapid growth.

3. Research Methodology

3.1 Selection of Variables

Existing literature emphasizes the importance of lending decision quality in conventional banking (Al-Husainy and Jadah, 2021; Ekinci and Poyraz, 2019). There is a discernible research gap regarding its specific impact within the unique context of Islamic banking in Bangladesh. To identify the effect of lending decision quality on the financial performance of Shariah-based banks, the following hypothesis has been tested here in this paper.

Null Hypothesis: Lending decision quality does not have a significant impact on shariah based banks' financial performance.

Different financial ratios have been used here to test the hypothesis mentioned above. Classified Loan to Total Loan (CLTL) is one of the significant indicators of the quality of loans of any bank's investment portfolio. A classified loan or non –performing loan is a bank loan that is at risk of nonpayment. Hence, lower CLTL indicates better quality of the lending decision. Many of the previous studies have used this ratio and identified this ratio as an indicator of lending decision quality (Berger and DeYoung, 1997; Rajan and Dhal, 2003; Brewer and Jackson; 2006; Kolapo et al., 2012; Noman et al., 2015)

Provision Maintained to Total Loan (PMTL), and Provision Maintained to Classified Loan (PMCL) indicates the amount of fund is kept reserved for loan loss relative to total loans and total classified loans, respectively. These are used as a proxy for credit decision quality in multiple works of literature (Samad, 2004; Boahene et al., 2012; Kolapo et al., 2012; Noman et al., 2015). The higher value of PMTL indicates a poorer loan portfolio as provision is mainly kept for the classified loan. An increase in the non-performing loan will result in an increase in PMTL. Conversely, the higher PMCL indicates the better quality of loan portfolio as sufficient provision kept against classified loans communicates the soundness of the bank's financial health.

Basel Accord considers the requirement of minimum capital for banks as a cushion against exposure to credit risk (Rafique et al., 2020). A Higher Capital adequacy ratio (CAR) helps banks to reduce the credit risk exposure and

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consequently to have better asset quality (Boudriga et al., 2009). Saha and Fatema (2018) also found the capital adequacy ratio to positively contribute to profitability. Therefore, this study uses CLTL, PMTL, PMCL, and CAR as indicators of lending quality. Additionally, Bank size has been incorporated as a control variable in this study as many previous studies find a significant impact of size on the profitability of banks (Mullineaux, 1978; Drake and Hall, 2003; Redmond and Bohnsack, 2007; Murthy et al., 2008). However, there is no conclusive finding on the direction of impact of bank size on profitability.

As for indicators of the financial performance of banks, Return on Asset (ROA) and Net Interest Margin (NIM) serve as dependent variables in this study. ROA helps to understand the profit made by the bank in comparison to the size of the bank. In contrast, NIM gives information about the gap between investment income and profit paid on deposits in the case of shariah-compliant banks. The use of these two ratios as profitability indicators is consistent with many studies similar to this one (Lee et al., 2014; Noman et al., 2015; Tan et al., 2017; Saha and Fatema, 2018). Measures of all the variables used here in this study are shown in Table 1.

Table 1: Notation, Measurement, and Expected Impact of Different Variables.

Variable	Notation	Measurement	Expected Impact
Return on Asset	ROA	Net Profit after Tax/Total Asset	Dependent Variable
Net Interest Margin	NIM	Net Income from Investments/Average Earning Asset	Dependent Variable
Classified Loan to Total Loan	CLTL	Total Classified Loan/Total Investments	-
Provision Maintained to Total Loan	PMTL	Total Provision maintained/ Total Investments	-
Provision Maintained to Classified Loan	PMCL	Total Provision maintained/ Total Classified Loan	+
Capital Adequacy Ratio	CAR	Tier I capital + Tier II capital/ Risk-Weighted Assets	+
Bank Size	SIZE	Total Asset	+/-

3.2 Sampling & Data Collection

This study considers 7 out of 8 shariah-based banks of Bangladesh over the study period (2009-2019). The researchers excluded one from the study as that bank started its operation in 2013. Three conventional banks got permission of converting their operation into shariah-based ones after 2019. Those banks were not also included in this study. These seven fully-fledged Islamic banks accounted for 89.23% of the total investment made by Islamic financial institutions (Bangladesh Bank, 2020). This shows that data of these seven banks is reflective of the Islamic banking industry of Bangladesh. Annual reports of the

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selected banks have been collected from the Dhaka Stock Exchange library. Data of selected variables have been collected from those yearly reports.

3.3 Model Specification

This paper deals with the panel data of 7 banks (cross-sectional units) over the period of 2009 to 2019. Usually, three different models, namely pooled ordinary least square (OLS) model, fixed-effect model, and random effect model, are estimated when research involves panel dataset. Pooled OLS estimation ignores variation in the data set due to different cross-sections and time periods involved in the observations (Hill et al., 2011). This model also assumes that error terms originating from several cross-sections across different observed periods will not be correlated $COV(\varepsilon_{it}, \varepsilon_{ju})=E(\varepsilon_{it}, \varepsilon_{ju})=0$ for $i \neq j$ or $t \neq u$. According to Park (2011), pooled OLS estimation provides efficient results only when there is no individual effect ($\mu_i = 0$) due to cross-sectional units or time period in the observations of consideration. If this assumption holds true, the pooled OLS models of this study can be formed as follows:

$$ROA_{it} = \beta_0 + \beta_1 CLTL_{it} + \beta_2 PMTL_{it} + \beta_3 PMCL_{it} + \beta_4 CAR_{it} + \beta_5 SIZE_{it} + \varepsilon_{it} \ldots\ldots\ldots \text{(1a)}$$

$$NIM_{it} = \beta_0 + \beta_1 CLTL_{it} + \beta_2 PMTL_{it} + \beta_3 PMCL_{it} + \beta_4 CAR_{it} + \beta_5 SIZE_{it} + \varepsilon_{it} \ldots\ldots\ldots \text{(2a)}$$

The fixed-effect model addresses heterogeneity at the individual level by allowing individual intercepts to change across the cross-sections but assumes individual intercepts are time-invariant. Additionally, the presence of individual fixed effects eases the assumption of pooled OLS that states the error terms of different cross-sections will not be correlated over the period ($COV(\varepsilon_{it}, \varepsilon_{ju})=0$).

The fixed-effect model required for this study can be shown in the following equations:

$$ROA_{it} = (\beta_0 + \mu_i) + \beta_1 CLTL_{it} + \beta_2 PMTL_{it} + \beta_3 PMCL_{it} + \beta_4 CAR_{it} + \beta_5 SIZE_{it} + \varepsilon_{it} \ldots\text{(1b)}$$

$$NIM_{it} = (\beta_0 + \mu_i) + \beta_1 CLTL_{it} + \beta_2 PMTL_{it} + \beta_3 PMCL_{it} + \beta_4 CAR_{it} + \beta_5 SIZE_{it} + \varepsilon_{it} \ldots \text{(2b)}$$

Contrary to fixed-effect estimation, the random effect model allows intercept terms to be constant across all individual entities over all the time periods when individual effect, μ_i is considered as part of a variable called composite error term, δ_{it}. This term includes individual effect and random disturbance term of the regression model: $\delta_{it} = \mu_i + \varepsilon_{it}$. The following equations will present the random effect model for this study:

$$ROA_{it} = \beta_0 + \beta_1 CLTL_{it} + \beta_2 PMTL_{it} + \beta_3 PMCL_{it} + \beta_4 CAR_{it} + \beta_5 SIZE_{it} + (\mu_i + \varepsilon_{it}) \ldots\text{(1c)}$$

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$$NIM_{it} = \beta_0 + \beta_1 CLTL_{it} + \beta_2 PMTL_{it} + \beta_3 PMCL_{it} + \beta_4 CAR_{it} + \beta_5 SIZE_{it} + (\mu_i + \varepsilon_{it}) \ldots(2c)$$

4. Findings

4.1 Descriptive Statistics

The descriptive statistics of the variables included in this study are presented below.

Table 2: Presentation of Descriptive Statistics.

	Mean	Median	Maximum	Minimum	Std. Dev.
ROA	0.001220006	0.00786935	0.030589055	-0.10853413	0.025178725
NIM	0.036640451	0.03741534	0.061157014	-0.01056068	0.012883228
CLTL	0.1372552	0.042057197	0.840401439	0.009400604	0.24735961
PMTL	0.077235392	0.025947396	0.446691564	0.013614925	0.129362009
PMCL	0.744272603	0.667088814	1.846451104	0.293382759	0.300300059
CAR	-0.022436364	0.1159	0.153	-1.3311	0.374468568
SIZE	237876931471.81	173161626610.00	1142181887387.00	11240140191	229597482037.86

From table 2, it is evident that median values of variables, namely ROA, NIM, and CAR, are greater than their mean values, which suggests that these variables are left-skewed. Additionally, the Standard deviations of most of the variables presented here are high, which shows the variability of the performances of the selected banks. Positive mean and median values of ROA and NIM show that shariah-based banks in Bangladesh are operating profitably. The CLTL is used as a proxy of the quality of lending of banks. The mean value of CLTL is 13 % which is an alarming sign for the industry. This means a great portion of the loan portfolio maintained by shariah-compliant banks is considered a nonperforming loan. Moreover, the mean value of PMCL (Total Provision Maintained to Total Classified Loan) is 74 percent which indicates provision is not kept for more than 25% of the classified loan portfolio. The mean capital adequacy ratio is negative, which is actually not reflective of the overall scenario. Researcher finds that serious shortfall of capital in ICB Islamic bank is the reason behind this negative mean ROA. From the year 2019 central bank of Bangladesh required all the banks to preserve CAR of 12.50 % to be consistent with best global practice. The researcher finds that except for ICB Islamic Bank (-122%) and First Security Islami Bank (11.26%), all other banks maintain CAR more than 12.50 % in the year 2019.

4.2 Diagnostic Test

The pair-wise correlation between the variables included in the study is illustrated below.

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Table 3: Presentation of the correlation matrix.

Correlation Matrix							
	ROA	**NIM**	**CLTL**	**PMTL**	**PMCL**	**CAR**	**SIZE**
ROA	1.0000						
NIM	0.5696	1.0000					
CLTL	-0.6244	-0.2565	1.0000				
PMTL	-0.7219	-0.3128	0.7674	1.0000			
PMCL	0.2650	0.0503	-0.7729	-0.2328	1.0000		
CAR	0.3455	0.3547	-0.0922	-0.2455	-0.0718	1.0000	
SIZE	0.0104	0.2830	-0.1107	0.0157	0.2056	0.5238	1.0000

Table 3 shows that the pair-wise correlation coefficients between the variables considered here are below 0.80. These findings demonstrate that severe multicollinearity is not present in this data set. This study uses two models considering ROA and NIM as the dependent variable. The researcher ran tests for detecting problems, namely heteroscedasticity, autocorrelation, and cross-sectional dependence in all two models.

Modified Wald test has been conducted to identify heteroscedasticity, whereas Pesaran CD test and Wooldridge test have been run to detect cross-sectional dependence and autocorrelation in the data set. The result of these tests is presented in the following table.

Table 4: Summary of Diagnostic tests for the models.

Model 1: ROA as Dependent Variable			
Test Name	**Wooldridge Test**	**Modified Wald Test**	**Pesaran CD Test**
Null Hypothesis	No first order Autocorrelation.	Homoscedasticity	No cross-sectional Dependence.
Test Statistic	F (Prob> F)	Chi^2 (Prob> Chi^2)	Pesaran's CD Statistic
Result	37.362***(0.0009)	8364.82 ***(0.0000)	0.011 (0.9910)
Model 2: NIM as Dependent Variable			
Test Name	**Wooldridge Test**	**Modified Wald Test**	**Pesaran CD Test**
Null Hypothesis	No first order Autocorrelation.	Homoscedasticity	No cross-sectional Dependence.
Test Statistic	F (Prob> F)	Chi^2 (Prob> Chi^2))	Pesaran's CD Statistic
Result	5.340 *(0.0602)	75.78 ***(0.0000)	6.227 ***(0.0000)

***, **, and * denote significance at 1%, 5%, and 10% level respectively

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The result from table 4 concludes the presence of autocorrelation and heteroscedasticity in both cases. However, Cross-sectional dependence is found only when NIM has been used as a dependent variable.

4.3 Appropriate Model Selection

In this study, to select the best possible model for the precise estimation, an approach suggested by Park (2011) has been used. The researcher began with a simpler pooled OLS regression model. According to Park (2011), the random effect is preferred when individual variability is represented in the disturbance term and the individual (group or temporal) effect is not connected with any regressors. In contrast, if heterogeneity can be managed with individual intercepts and that individual effect can be associated with any regressor, the fixed effect model is preferred over pooled OLS. To decide the better model between Pooled OLS and Fixed effect model, F test has been used. Likewise, the Breusch-Pagan *LM* test introduced by Breusch and Pagan (1980) has been used to find an appropriate model between pooled OLS and random effect model. The result of these two tests is shown below.

Table 5: Result of the *F* test and Breusch-Pagan *LM* test.

Test Groups		
Model 1: ROA as Dependent Variable		
Test Name	F-test	Breusch-Pagan LM test
Null Hypothesis	(Pooled OLS is suggested)	(Pooled OLS is suggested)
Test Statistic	F (Prob> F)	Chi^2 (Prob> Chi^2)
Result	7.71*** (0.0000)	2.68* (0.0509)
Model 2: NIM as Dependent Variable		
Test Name	F-test	Breusch-Pagan LM test
Null Hypothesis	(Pooled OLS is suggested)	(Pooled OLS is suggested)
Test Statistic	F (Prob> F)	Chi^2 (Prob> Chi^2)
Result	5.67*** (0.0001)	14.34 ***(0.0001)

***, **, and * denote significance at 1%, 5%, and 10% level respectively

The findings from Table 5 show the evidence of rejection of null hypotheses for all the cases. This confirms that both the random effect model and fixed effect model provide a better result than pooled OLS for both the cases investigated here. Therefore, the researcher estimates both fixed effect and random effect models and uses the Hausman test, a test proposed by Hausman (1978), to decide the better model between the two. The result of the Hausman test is presented below.

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Table 6: Summary of Hausman Test.

	Model 1: ROA as Dependent Variable			Model 2: NIM as Dependent Variable		
	Coefficients			Coefficients		
	Fe	RE	Difference	Fe	RE	Difference
CLTL	-.0454261	-.2205439	.1751178	-.0773101	-.0251519	-.0521582
PMTL	.1233762	-.0870726	.2104489	.0969955	.1604603	-.0634649
PMCL	.0047521	-.0021219	.006874	-.0069427	-.0031812	-.0037615
CAR	-.0595367	-.1256314	.0660947	.0455277	.0666012	-.0210735
SIZE	-1.88e-14	-1.37e-15	-1.74e-14	-1.58e-14	-1.20e-14	-3.71e-15
Chi^2	25.46***			15.38***		
Chi^ 2 (prob)	0.0000			0.0040		
Decision:	**As prob. Chi^2 < 0.05 (i.e. significant) use fixed effect**			**As prob. Chi^2 < 0.05 (i.e. significant) use fixed effect**		

*** denote significance at 10% level

Table 6 confirms fixed-effect model gives a better estimate in both cases. Moreover, as this dataset suffers from problems like heteroscedasticity, autocorrelation, and cross-sectional dependence, Driscoll-Kraay standard error estimation is used. When a panel dataset suffers from such issues, this estimate can provide robust estimates (Driscoll and Kraay, 1998).

5. Discussion

Table 7 demonstrates the outcome of all the projected models in addition to the finally selected fixed effect model ((Drisc/Kraay Std. Error). The selected model for ROA in the table 7 shows that PMCL and SIZE significantly impact the profitability of shariah-based banks of Bangladesh. These findings suggest if provision maintained against classified loan increases, profitability also increases. This finding is consistent with several previous studies (Boahene et al., 2012; Kolapo et al. 2012; Noman et al., 2015). Conversely, size affects the bank's profitability negatively which is consistent with the findings of previous works (Hassan and Bashir, 2003; Redmond and Bohnsack, 2007).

On the other hand, the final model for NIM shows that there is a significant negative impact of CLTL on the profitability of Banks. This result indicates poor lending decision quality will result in a reduction in profit. This result conforms to the findings of previous research (Rajan and Dhal, 2003; Brewer and Jackson, 2006; Kolapo et al., 2012, Noman et al., 2015).

However, this study finds no significant impact of CAR and PMCL on the performance of the shariah-compliant banks. R-sq value of the selected models, which is 65 % for the ROA model and 44% for the NIM model, show reasonable explanatory power.

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Table 7: Estimated Result.

	ROA as Dependent Variable			NIM as Dependent Variable		
	Coefficients of Variables					
Variables	Pooled OLS (Drisc/Kraay Std. Error)	**Fixed Effect (Drisc/Kraay Std. Error)**	Random Effect (Drisc/Kraay Std. Error)	Pooled OLS (Drisc/Kraay Std. Error)	**Fixed Effect (Drisc/Kraay Std. Error)**	Random Effect (Drisc/Kraay Std. Error)
CLTL	-.2247548 (.0256602)***	**-.0454261 (.0738284)**	-.2205439 (.0181619)***	-.0211699 (.0121821)	**-.0773101 (.0314631)****	-.0251519 (.0120761)**
PMTL	-.081705 (.1839671)	**.1233762 (.1847865)**	-.0870726 (.1917645)	.1710126 (.0583952)**	**.0969955 (.0913734)**	.1604603 (.0581989)**
PMCL	-.0048215 (.0033568)	**.0047521 (.0019345)****	-.0021219 (.0025092)	-.0023041 (.0054003)	**-.0069427 (.0043439)**	-.0031812 (.005463)
CAR	-.1228253 (.0458712)**	**-.0595367 (.0465781)**	-.1256314 (.0494561)	.0711016 (.0163897)***	**0455277 (.0262467)**	.0666012 (.0159387)***
SIZE	-1.48e-15 (5.68e-15)	**-1.88e-14 (8.57e-15)***	-1.37e-15 (7.17e-15)	-7.46e-15 (5.70e-15)	**-1.58e-14 (9.97e-15)**	-1.20e-14 (6.39e-15)*
_CONS	.039569 (.0069643)***	**-.0024768 (.0185649)**	.0373091 (.0074717)***	.0314263 (.0055235)***	**.0497009 (.0081365)*****	.0344306 (.0062079)***
R-sq.	0.8563	**0.6589**	0.8543	0.5818	**0.4486**	0.5741
F or Chi^2	431.51	**66.17**	824.58	156.28	**8.29**	353.80
Prob> F or Prob>Chi^2	0.0000	**0.0000**	0.0000	0.0000	**0.0000**	0.0000

Note: Drisc/Kraay std. errors of estimates are given in parentheses. *, **, and *** denote significance at 10%, 5%, and 1% level respectively.

6. Recommendations

Due to popular demand, the Islamic banking sector in Bangladesh has experienced rapid growth, which is accounting for more than a quarter of the total banking sector (Bangladesh Bank, 2020). The recent increase in the amount of classified loans in the banking sector presents critical hurdles for Islamic banking institutions as it is hurting profitability. The findings of this study will help the banks to prioritize their actions. Analyzing the estimated result of the tested models, the researcher points out the following areas that may require the respective authorities' attention.

1. As CLTL, a proxy used to portray the condition of lending decision quality, negatively affects the performance of Shariah-compliant banks, the responsible authority should take the initiative of strengthening the present credit granting and monitoring policy incorporating the globally applied effective practices. The amount of classified loans in the current investment portfolio of the banks studied is alarming. Therefore, any more pressure of nonperforming loans on the banking system may lead to severe consequences like a negative return or capital shortfall.

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2. According to the final estimation, PMCL (Provision maintained to classified loan) positively impacts the Return on Asset of shariah-compliant banks in Bangladesh. This result indicates that proper maintenance of provision against classified loans helps to improve the overall financial performance of the shariah-based banks. Though maintaining provision results in less funds for investment, it indicates the sound financial condition of the banks, which helps the banks to have a positive image among the depositors. So, banks should try to maintain provision as per the guideline of the regulatory authority.
3. This study finds a negative relationship between bank size and financial performance in the case of shariah-compliant banks of Bangladesh. This suggests that small and mid-sized banks' financial performance is relatively better than that of larger-sized shariah-based banks. The plausible reason for this could be the higher portion of classified loans in the bank's investment portfolio. Hence, bank management should try to increase their asset size or investment portfolio by ensuring proper due diligence so that risk of rising non-performing loans can be reduced. Aggressive expansion of asset size should be avoided.

7. Conclusion

The central drive for this research is to examine how lending decision quality affects the profitability of shariah-compliant banks in the context of Bangladesh. To achieve this goal, this research has used financial ratios as a proxy for lending decision quality and profitability. Return on Asset and Net Interest Margin have been used as an indicator of profitability, whereas four different ratios have been used as a proxy for the quality of the lending decision. Bank size as calculated by total asset size is also incorporated in this study as a control variable. Additionally, this paper tries to give some recommendations for bank management for better financial performance. The researcher estimates the best model explaining the relationship between financial performance and lending decision quality by using the panel dataset of seven shariah-based banks of Bangladesh over the period of 11 years (2009-2019). This paper finds classified loans to total loan ratio, and bank size hurt profitability, and provision maintained to classified loans positively impact the financial performance of shariah-based banks negatively. Capital adequacy ratio and Provision Maintained to Total Loan ratio have no significant relationship with any of the proxy indicators of profitability. The researcher recommends that banks should maintain proper due diligence in credit granting and monitoring to control the increasing trend of non-performing loans. Sufficient provisioning should be maintained against the classified loans as this has a positive impact on profitability. This insight from the study would help policymakers and bank management to manage the banks properly.

This study leaves scope for further investigation in this area of banking. As this paper solely focuses on the context of shariah-based banks in Bangladesh, future studies can try to present a comparative analysis between conventional banks and Islamic banks. Cross-country data can also be used to determine the magnitude of the relationship across different countries.

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Antecedents of Customer Loyalty in The Telecommunications Industry -Evidence from Bangladesh

JUJBR

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Abstract: *This study primarily investigates the factors that impact customers' loyalty in the Bangladeshi context of the telecommunications industry. The Theory of Reasoned Action (TRA) is used as the underlying theory to explain customers' loyalty. A quantitative research strategy was employed, and data were collected through a self-administered questionnaire survey. With 360 out of 382 collected questionnaires being usable for analysis, resulting in a 94.24% usable data response rate. Partial Least Square Structural Equation Modeling (PLS-SEM) with the assistance of Smart PLS 4.0 was used to analyze the collected data. The study's findings indicate that price and consumers' trust significantly affect customer satisfaction and loyalty in telecommunications industry of Bangladesh, allowing telecommunications industry managers to identify the specific antecedents of loyalty and focus their policies on these, particularly in terms of price and consumers' trust in Bangladesh. While the validation of this model in the telecommunications sector provides a novel perspective on comprehending customer loyalty from both theoretical and practical standpoints, it is important to acknowledge that there might exist additional factors influencing customer loyalty that warrant inclusion in future research endeavors. This research is one of the few to conceptually underpin the theoretical concept of exploring customer loyalty in a developing country like Bangladesh. Similarly, these findings may be applicable to other similar developing countries.*

Keywords: *Customer Loyalty, Customer Satisfaction, Consumer Trust, Price Sensitivity, Telecommunication Industry, Service Quality, Smart PLS.*

1.0 Introduction

The telecommunications industry plays a crucial role in the economic progress of a nation. It has a significant impact on various sectors like education, healthcare, and banking. In Bangladesh, the telecommunications sector has experienced rapid growth in recent years (Rahman & Chowdhury, 2022), where it is imperative for businesses to understand the factors that impact customer loyalty (Morgan & Govender, 2017). Loyal customers are valuable as they can serve as

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brand advocates, spreading positive word-of-mouth about the brand (Narasimhan, 2004). However, effective strategies for customer retention rely on a comprehensive understanding of the factors that contribute to customer loyalty (Makurumidze et al., 2022). Bowen and Chen (2001) define loyal customers as those with favorable attitudes toward a company, committed to repurchasing, and recommending the product to others. Companies prioritize cultivating loyalty because of retaining existing customers is more cost-effective than acquiring new ones (Lee-Kelley et al., 2003).

Many companies employ loyalty programs as a means to retain customers and maintain competitiveness. Prior studies have thoroughly investigated the variables that influence consumer loyalty and happiness, utilizing theories such as Social Exchange, Expectancy, and Theory of Reasoned Action (TRA) to redefine loyalty. According to Iglesias et al. (2020), consumer loyalty is significantly influenced by trust and corporate social responsibility (CSR).

1.1 Justification of the study

Bangladesh's telecom sector, led by major players like Grameenphone, Banglalink and Robi, indulge in intense competition and high customer turnover. This industry significantly impacts other sectors like education and healthcare (Ahsan, 2017), driving the need to understand what drives customer loyalty to maintain their competitive edge. Its insights will aid telecom firms in bolstering retention strategies, expanding market share, and fostering economic growth (Dey et al., 2019). Policymakers can also use these findings to craft effective industry policies (Ali et al., 2018). Additionally, this study lays the groundwork for comprehending customer loyalty in Bangladesh's telecom industry, paving the way for future research.

The lack of research on customer loyalty in the telecommunications industry in Bangladesh necessitates this study's significance (Dey et al., 2019), as most existing research has primarily focused on developed countries, highlighting the need for context-specific studies (Kumar et al., 2021). This research also significant in enhancing current literature, guiding companies in enhancing their customer retention strategies, aiding policymakers in formulating industry-enhancing policies, and filling the research gap in customer loyalty within the Bangladeshi telecommunications sector.

1.2 Objectives of the study

The primary aim of this research is to thoroughly analyze the factors that exert influence on customer loyalty within the telecommunications industry of Bangladesh.

Specific Objectives:

- To investigate the factors that significantly impact customer loyalty through the lens of customer satisfaction in the telecommunications industry.
- To explore and assess the direct influence of customer satisfaction on customer loyalty in the telecommunications industry.

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- To conduct a comprehensive analysis of control variables that may affect both customer satisfaction and customer loyalty in the telecommunications industry.

2.0 Literature Review

2.1 The foundational framework - based on the Theory of Reasoned Action (TRA)

Ajzen's (1991) Theory of Reasoned Action (TRA) forms the theoretical cornerstone of this study, highlighting the significant impact of individual intentions and motivation on behavior. TRA provides a robust framework for understanding the intricate relationship between consumer attitudes and behavioral intentions, making it well-suited for investigating the influence of factors like brand image, price, service quality, switching costs, and consumer trust on consumer satisfaction. Within the TRA framework, attitude towards the behavior and subjective norms play crucial roles in shaping the intention to engage in a specific behavior (Hansen et al., 2004).

Aligned with TRA, the researchers have developed a conceptual model (Figure 1) emphasizing the influence of customer satisfaction on users' continuance intention, serving as a substitution for loyalty. The rationale for employing TRA in this context lies in its ability to elucidate the complexities of consumer attitudes and their subsequent impact on behavioral intentions, such as continued product or service usage (Lam & Hsu, 2006). Ajzen's (1991) extension of TRA into the Theory of Planned Behavior (TPB), incorporating 'Perceived Behavioral Control,' further underscores the ongoing applicability of TRA-related concepts in understanding and predicting consumer behavior.

The concept of perceived behavioral control within the TRA framework revolves around an individual's perception of their ability to perform a behavior (Ajzen, 1991). In this study, factors such as ease of use, accessibility, and personal capabilities may fall under perceived behavioral control. For instance, if a consumer perceives it as easy to continue using a product or service (low perceived behavioral control), this perception may influence his/her satisfaction and loyalty.

2.2 Factors Affecting Customer Satisfaction and Loyalty

Drawing upon the existing literature (Deng et al., 2010), this study primarily examines the influence of five key factors on customer satisfaction and loyalty within the telecommunications industry in Bangladesh. The factors under investigation include Brand Image, Price, Service Quality, Consumer Trust, and Switching Cost.

2.2.1 Brand Image

The term "brand" encompasses distinctive features, such as a name, symbol, sign, term, or design, utilized to identify the origin of a product or service (Lai et al., 2014). In contrast, brand image involves a set of values and beliefs that enable consumers to form a comprehensive impression of a firm's offerings, which significantly influences consumer satisfaction and loyalty by fostering positive

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relationships (Kaur and Soch, 2013). According to Chen et al. (2022) and Wu et al. (2011), loyalty and satisfaction are likely to develop when consumers choose products or services from reputable companies. Conversely, a negative brand image has the opposite effect, leading to customer dissatisfaction and diminished loyalty (Yazid et al., 2020). Dam and Dam (2021) introduce a nuanced perspective, highlighting brand image as a multifaceted element crucial for consumer loyalty, demanding vigilant attention from customers to comprehend the evolving dynamics of a company. Despite existing findings, Hu et al. (2009) advocate for additional assessment and testing to further validate the relationship between brand image and customer satisfaction.

As Telecommunications companies' image is crucial for providing information, distinguishing among brands, and offering compelling reasons for consumer purchase decisions (Manzoor et al., 2020), the following hypothesis has considered for this study:

H1: Brand image positively influences consumer satisfaction in the telecommunication industry.

2.2.2 Price

Consumers see price as the cost of getting a product or service. In the competitive telecom industry, price hugely affects what consumers choose (Al-Hawary, 2013), though subscribers' usage habits or service bundles can affect their telecom costs (Ribeiro et al., 2023). Determining telecom prices involves legal rules, government policies, customer willingness to buy, profit margins, and competition levels (Khatibi et al., 2002). The link between price, satisfaction, and loyalty varies in research. Price matters for satisfaction and loyalty in places like Jordan (Al-Hawary, 2013) and Nigeria (Inegbedion & Obadiaru, 2019), but other studies haven't found a clear link (Uddin, 2019).

The ability to compare prices among providers (Al-Hawary, 2013) makes consumers more sensitive to price changes, a sensitivity that is mitigated by higher satisfaction with pricing. Melović et al. (2014) found that content customers with a company's pricing tend to exhibit higher loyalty. Consequently, this study posits the following hypothesis:

H2: Price positively influences consumer satisfaction in the telecommunication industry.

2.2.3 Service Quality

Service quality evaluation comprises technical quality, pertaining to tangible outcomes upon purchase, and functional quality, emphasizing service presentation and delivery. The alignment of provided service with customer expectations denotes high quality and satisfaction (Rashid & Rokade, 2019). Several studies consistently highlight service quality's profound impact on customer satisfaction, loyalty, and telecom providers' overall performance. For instance, Cronin et al. (2000) emphasize role of service quality in shaping satisfaction and loyalty in telecom industry, and Nsiah and Mensah (2014) on better customer retention. Thus, it can be posited that:

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H3: Service quality influences consumer satisfaction in the telecommunication industry.

2.2.4 Consumer Trust

According to McKnight et al. (2002), trust involves both a belief in and an intention to trust which reflects the willingness and intention of individuals to rely on the service provider. In the era of electronic and mobile commerce, customers have little power over business agreements, therefore they must trust service providers not to be unfair or opportunistic (Gefen, 2002), which is essential for developing and sustaining relationships (Lee & Turban, 2001). During subscription, mobile phone users must provide their address, national ID number, and phone numbers to select telecommunication service providers. When consumers see no hazards or unexpected disruptions in service or provider communication, trust is established.

Consumer trust reduces transactional risks and boosts sales by building long-term connections Sarkar et al. (2020). The telecommunications industry exhibits numerous customer-trust inducing characteristics, which include security and privacy, product authenticity, and companies' positive attitudes and behaviors towards customers (Kalia et al., 2021). Moreira et al. (2017) established the association between consumer trust, loyalty, and satisfaction. Based on these arguments, the following hypothesis is proposed:

H4: Consumer trust positively influences customer satisfaction in the telecommunication industry.

2.2.5 Switching Cost

Switching cost, encompassing both monetary and psychological aspects of transitioning service providers (Kim et al., 2003), serves as a barrier to switching, fostering customer satisfaction and loyalty (Dick & Basu, 1994). It directly influences customers' loyalty, reducing sensitivity to price and satisfaction with alternative brands (Fornell, 1992), which enables customers to distinguish brands with similar features (Klemperer, 1987). When individuals perceive high switching costs associated with changing mobile service providers, they tend to experience greater satisfaction as customers. Therefore, the following hypothesis is formulated:

H5: Perceived switching cost positively influences consumer satisfaction in the telecommunication industry.

2.3 Customer satisfaction and Loyalty

Customer satisfaction, the psychological outcome of meeting or missing expectations in prior consumption experiences (Sirgy, 1984), significantly influences repurchase intent (Liao et al., 2009) and loyalty (Eggert & Ulaga, 2002). Research categorizes satisfaction into transaction-specific and overall satisfaction, representing singular purchases and cumulative brand evaluations, respectively (Fornell & Johnson, 1993). In mobile commerce, perceiving and managing customers' emotions towards service providers becomes crucial.

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Moreover, heightened satisfaction strongly correlates with increased customer loyalty (Mittal et al., 1998).

The five key factors—brand image, price, service quality, switching cost, and consumer trust—are interconnected and collectively influence customer satisfaction, impacting consumer loyalty. Studies by Chen et al. (2022) and Morgan and Govender (2017) in Malaysia and South Africa, respectively, demonstrate a positive link between satisfaction and loyalty. In the telecom industry, loyalty tends to rise with satisfied customers making repeat purchases and spreading positive experiences. Rasheed and Abadi (2014) found a weaker link between satisfaction and loyalty in Nigerian consumers. Rizan et al. (2014) argue that trust and commitment wield a stronger influence on loyalty, suggesting that mere satisfaction doesn't guarantee loyalty—satisfied customers might switch for better quality and value elsewhere. Consequently, the following hypothesis is formulated:

H_6: Customer satisfaction positively influences consumer loyalty in the telecommunication industry.

Based on the aforementioned literature, the proposed conceptual framework is as follows:

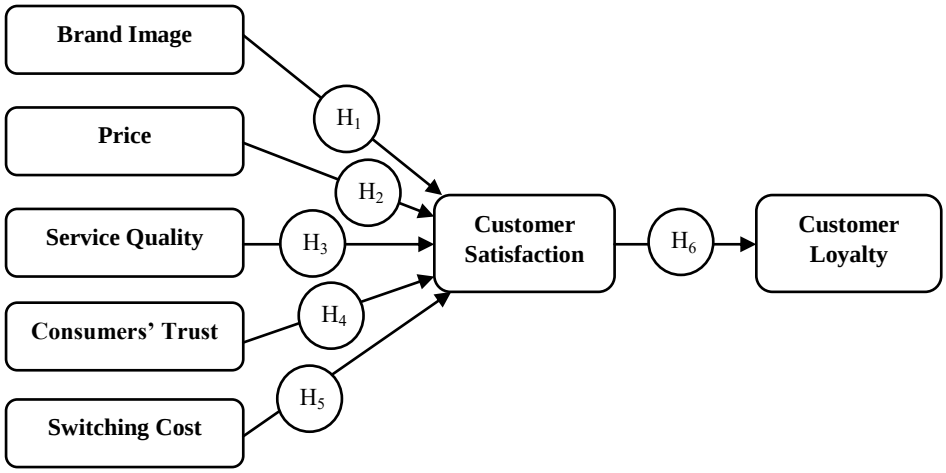

Figure 1: Conceptual Framework

3.0 Research Methodology

3.1 Sampling and data collection

To ensure Structured Equation Model (SEM) estimation adequacy, Austin and Calderón (1996) recommend a minimum of 100 samples, with 200 samples for reliable estimation. This study collected data from 360 respondents, surpassing these criteria. Convenience sampling was chosen for its effectiveness in reaching the target respondents.

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Table 1 outlines respondents' demographic characteristics. Of the participants, 63% were male, and 37% were female. The majority (73%) fell between 20 and 25 years old. Respondents below 20 and those aged 35 and above constituted only 1%. However, those aged 25 to 30 and 30 to 35 accounted for 17% and 8%, respectively. In terms of education, 58% held a bachelor's degree, 24% had completed Higher Secondary Certificate (HSC), and 18% possessed a master's degree. No respondents had a PhD. Regarding mobile phone usage duration, 33% had used services for 3 to 6 years, 28% for less than 3 years, 18% for 6 to 9 years, 13% for over 12 years, and 9% for 9 to 12 years.

Table 1: Demographics of the respondents

Variable	Categories	Frequency	Percentage
Gender	Male	226	63
	Female	134	37
Age	Below 20 years	5	1
	20 – 25 years	261	73
	25 – 30 years	60	17
	30 – 35 years	29	8
	35 and above	5	1
Educational Qualification	HSC	87	24
	Bachelor	208	58
	Masters	65	18
	PhD	0	0
Tenure of subscription	Below 3 years	100	28
	3 – 6 years	115	33
	6 – 9 years	66	18
	9 – 12 years	31	9
	Above 12 years	47	13

3.2 Measure development

A questionnaire survey gathered data from cell phone users in the telecommunications industry. To ensure content validity, measurement instruments were adapted from existing research, assessing factors like brand image, price, service quality, consumer trust, switching cost, customer satisfaction, and loyalty. Table 2 summarizes the various items, each measured on a five-point Likert scale, ranging from "strongly disagree" to "strongly agree."

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Table 2: Construct Measuring

Factor	Code	Item	Adapted From
Brand Image (BI)	BI1	The company is perceived as fulfilling its promises and commitments to its customers, which contributes to its reputation.	Deng et al. (2010)
	BI2	The company is known for its fair and honest practices towards its customers.	Woo and Fock (1999)
	BI3	Customers view the company as reliable and trustworthy.	McKnight and Chervany (2001)
	BI4	The company is recognized as a forward-thinking and innovative telecom company.	Deng et al. (2010)
	BI5	The company has a strong commitment to social responsibility and is actively involved in contributing to society.	Aydin and Özer. (2005)
Price (P)	P1	I consider the prices of the telecom products and services to be affordable.	Tseng (2011)
	P2	The promotional activities of my telecom company are more extensive compared to its competitors.	Chen and Dubinsky (2003)
	P3	I perceive the products and services offered by the company to be a good value for my money.	Inegbedion and Obadiaru (2019)
	P4	The discounts and incentives offered by the company provide me with benefits.	Morgan and Govender (2017)
	P5	I believe that the prices offered by my company are unbeatable compared to other telecommunication operators.	Aydin and Özer (2005)
Service Quality (SQ)	SQ1	The company consistently delivers the promised standard of service to its customers.	Cheng and Dubinski (2013)
	SQ2	The services provided by the company are viewed as reliable by its customers.	Caruana (2002)
	SQ3	The company regularly introduces innovative and new services to its customers.	Inegbedion and Obadiaru (2019)
	SQ4	The employees of the company have a good understanding of the specific needs of its customers.	Chen et al. (2022)
	SQ5	The company effectively and efficiently handles customer complaints.	Negi (2010)
	SQ6	The service provider consistently delivers superior service in every aspect.	Shin and Kim (2008)
Customer Trust (CT)	CT1	I trust the company to consistently deliver standard quality services.	Morgan and Hunt (1994)

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Factor	Code	Item	Adapted From
	CT2	The company always acts with good intentions towards its customers.	Karjaluoto et al. (2012)
	CT3	The company prioritizes the best interests of its customers.	Koufaris and Hampton-Sosa (2004)
	CT4	The commitments and promises made by the company are trustworthy to me.	Moreira et al. (2017)
	CT5	The company has a well-organized and thorough understanding of its customers.	Karjaluoto et al. (2012)
	CT6	Based on my experience, I know this service provider is not opportunistic.	Shin and Kim (2008)
Switching Cost (SC)	SC1	The process of switching to another operator is perceived as inconvenient and troublesome.	Gefen (2002)
	SC2	The cost associated with switching to another operator is considered to be high.	
	SC3	The process of learning and adapting to another telecommunication service is viewed as complex and time-consuming.	
Customer Satisfaction (CS)	CS1	I am satisfied with the products and services offered by the company.	Wu et al. (2011)
	CS2	The products and services provided by the company meet my expectations.	Utkutuğ (2021)
	CS3	I am confident in my decision to choose this telecommunications operator.	Moreira et al. (2017)
	CS4	The company consistently strives to fulfill my needs and wants.	K. Chen and Liu (2004)
	CS5	Overall, I am satisfied with my experience with this company.	Cronin et al. (2000)
Customer Loyalty (CL)	CL1	I am loyal to my telecommunication service provider and have no plans to switch to another operator in the near future.	Deng et al. (2010)
	CL2	I plan to purchase more products and services from my company in the future.	Morgan et al. (2017)
	CL3	I would recommend my company's products and services to my friends and family members.	Ribeiro et al. (2019)
	CL4	Even if my company's competitors offer price cuts, I will remain loyal to my company.	Akroush et al.(2011)
	CL5	I will continue to use this operator as long as they continue to provide satisfactory products and services.	Lin and Wang (2006)

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3.3 Normality Check

Tests were conducted to assess the normality of measurement items for the confirmatory factor analysis (CFA) model, employing both multivariate and univariate normality tests. The Mardia test revealed non-normality, with p-values below 0.05, rejecting the null hypothesis. Similarly, the Shapiro-Wilk test for each measurement item produced p-values below 0.05, also rejecting the null hypothesis of normality. Due to observed non-normality, the researchers deliberately chose the maximum likelihood robust (MLR) estimator, specifically the Satorra-Bentler rescaling method, to estimate the measurement model, deviating from the proposed maximum likelihood (ML) estimator by Rosseel (2012).

3.4 Reliability and Validity

The study focused on ensuring construct validity, examining measurement tools' accuracy in capturing intended constructs. Hair et al. (2011) proposed two methods: convergent validity and discriminant validity, where convergent validity requires factor loadings above 0.70 for each item and an average variance extracted (AVE) over 0.5. Table 3 presents the convergent validity analysis, revealing enhanced validity by eliminating items like P2, CT6, and CL5 with lower factor loadings. The remaining items in Table 3 exhibited factor loadings exceeding 0.70, confirming convergent validity with AVEs surpassing 0.5 for each construct.

Discriminant validity was established through the Fornell-Larcker criterion, as indicated in Table 4, where each construct's square root of the AVE exceeded its correlations with other constructs. Construct reliability was evaluated using Cronbach's Alpha (CA) and Composite Reliability (CR). Table 3 displays CA and CR results, with CA values ranging from 0.755 to 0.925 and CR statistics from 0.855 to 0.943. These values exceeded 0.70, affirming the reliability of the constructs (Hair et al., 2011).

This study employs various validity tests to ensure a comprehensive and robust assessment of the measurement tools, as well as to address various dimensions and potential sources of measurement error for enhancing the overall validity of the study. The rationale for using multiple validity tests lies in the recognition that different aspects of validity capture distinct facets of the measurement process.

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Table 3: Validity measurement

Factor	Items	Loadings	Cronbach's Alpha (CA)	Rho_A	Composite Reliability (CR)	AVE
Brand Image (BI)	BI1	0.837	0.871	0.903	0.905	0.657
	BI2	0.890				
	BI3	0.818				
	BI4	0.726				
	BI5	0.773				
Price (P)	P1	0.726	0.865	0.869	0.903	0.649
	P3	0.847				
	P4	0.749				
	P5	0.795				
Service Quality (SQ)	SQ1	0.791	0.875	0.880	0.914	0.728
	SQ2	0.819				
	SQ3	0.714				
	SQ4	0.754				
	SQ5	0.797				
	SQ6	0.817				
Customer Trust (CT)	CT1	0.827	0.925	0.925	0.943	0.769
	CT2	0.809				
	CT3	0.793				
	CT4	0.817				
	CT5	0.783				
Switching Cost (SC)	SC1	0.724	0.786	0.795	0.862	0.609
	SC2	0.890				
	SC3	0.827				
Customer Satisfaction (CS)	CS1	0.896	0.875	0.887	0.905	0.613
	CS2	0.899				
	CS3	0.844				
	CS4	0.858				
	CS5	0.886				
Customer Loyalty (CL)	CL1	0.860	0.755	0.800	0.856	0.667
	CL2	0.865				
	CL3	0.870				
	CL4	0.817				

Note: P2, CT6, and CL5 have been dropped due to lower factor loadings which were below 0.7.

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Table 4: Discriminant validity- Fornell-Larcker criterion

	BI	CT	CL	CS	P	SQ	SC
BI	**0.811**						
CT	0.554	**0.806**					
CL	0.454	0.698	**0.853**				
CS	0.484	0.773	0.783	**0.877**			
P	0.445	0.589	0.507	0.618	**0.781**		
SQ	0.581	0.727	0.570	0.641	0.603	**0.783**	
SC	0.309	0.320	0.342	0.345	0.359	0.333	**0.817**

4.0 Results and Discussion

The determination coefficient (R^2) for the endogenous latent variable, customer loyalty, stands at 0.613, denoting that 'customer satisfaction' reasonably accounts for 61.3% of the variability in customer loyalty. In contrast, the R^2 for customer satisfaction is 0.644, signaling that brand image, price, service quality, consumer trust, and switching costs collectively elucidate 64.4% of the variability in customer satisfaction. Notably, consumer trust exerts the most substantial impact on customer satisfaction, succeeded by price, which demonstrates a more pronounced effect compared to brand image, service quality, and switching costs (refer to Figure 2).

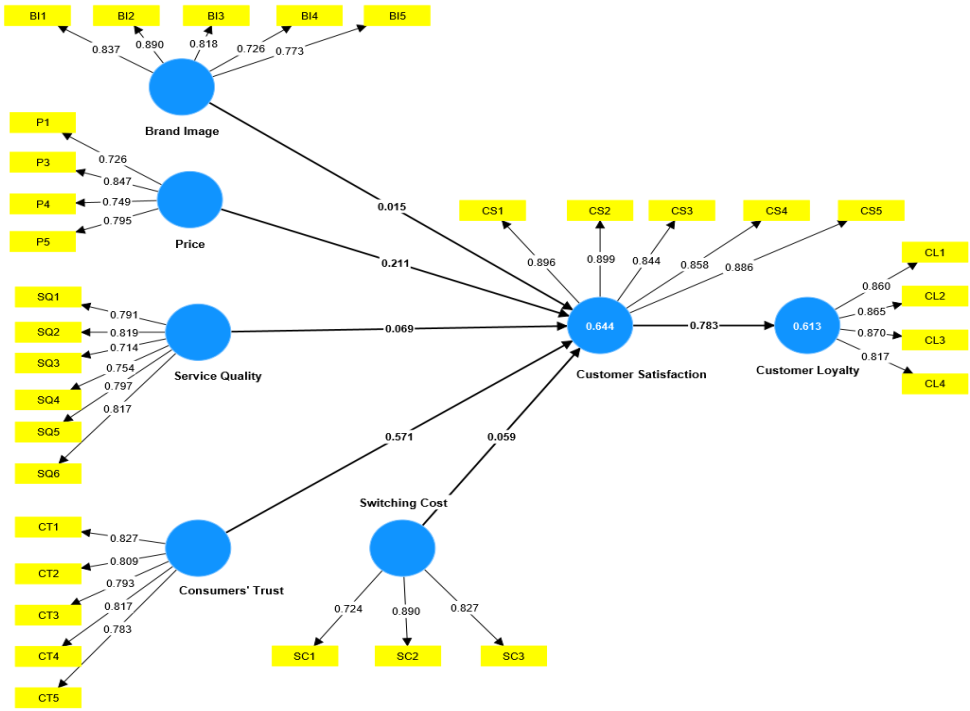

Figure 2: The estimated structural equation model

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Table 5: Path Coefficient and Indirect effect

Hypothesis	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	*P values*
H1: Brand Image -> Customer Satisfaction	0.015	0.016	0.04	0.366	0.357
H2: Price -> Customer Satisfaction	0.211	0.215	0.049	4.317	0
H3: Service Quality -> Customer Satisfaction	0.07	0.072	0.059	1.179	0.119
H4: Consumers' Trust -> Customer Satisfaction	0.571	0.566	0.063	9.093	0
H5: Switching Cost -> Customer Satisfaction	0.059	0.058	0.035	1.704	0.044
H6: Customer Satisfaction -> Customer Loyalty	0.783	0.784	0.025	31.11	0
Indirect effect					
Brand Image -> Customer Satisfaction -> Customer Loyalty	0.011	0.013	0.031	0.366	0.357
Switching Cost -> Customer Satisfaction -> Customer Loyalty	0.046	0.046	0.027	1.709	0.044
Consumers' Trust -> Customer Satisfaction -> Customer Loyalty	0.447	0.444	0.055	8.153	0
Price -> Customer Satisfaction -> Customer Loyalty	0.165	0.169	0.038	4.299	0
Service Quality -> Customer Satisfaction -> Customer Loyalty	0.055	0.056	0.046	1.186	0.118

Note: $P < 0.05$

However, the testing of hypotheses and exploration of indirect effects of independent variables on customer loyalty through customer satisfaction required clarification of the mediating process. The bootstrapping method was employed for this purpose, involving the random sampling of a subsample size of 1000 from the dataset. Significance was determined through a one-tailed test at a significance level of 0.05, assuming hypothesized relationships to be one-directional. Analysis of path coefficients (refer to Table 5/ Appendix B) led to the following summarized decisions:

Table: 6 Summary of hypothesis

Hypothesis	Remarks
H1: Brand Image -> Customer Satisfaction	Not Supported
H2: Price -> Customer Satisfaction	Supported
H3: Service Quality -> Customer Satisfaction	Not Supported
H4: Consumers' Trust -> Customer Satisfaction	Supported
H5: Switching Cost -> Customer Satisfaction	Supported
H6: Customer Satisfaction -> Customer Loyalty	Supported

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Indirect/ Mediation effects	
Brand Image -> Customer Satisfaction -> Customer Loyalty	No mediation
Switching Cost -> Customer Satisfaction -> Customer Loyalty	Partial mediation
Consumers' Trust -> Customer Satisfaction -> Customer Loyalty	Partial mediation
Price -> Customer Satisfaction -> Customer Loyalty	Partial mediation
Service Quality -> Customer Satisfaction -> Customer Loyalty	No mediation

Control variables are utilized in research to account for potential confounding factors or variables that may influence the relationship between the independent and dependent variables. The inclusion of control variables aims to enhance the internal validity of the study by minimizing the impact of extraneous variables, thereby isolating the specific effects of the variables of interest.

In the context of this research, four control variables—namely age, gender, educational qualification, and tenure of subscription—were introduced into the Structural Equation Modeling (SEM) model. The rationale behind incorporating these control variables is to ensure that the observed relationships between the independent variables (brand image, price, service quality, consumer trust, and switching costs) and the dependent variables (customer satisfaction and loyalty) are not confounded or distorted by the influence of these additional factors. The results, as presented in Appendix B and Appendix C, prompted a revision in one hypothesis. Initially, it was posited that switching cost positively influenced customer satisfaction. However, the inclusion of control variables revealed that switching cost does not positively impact customer satisfaction in the context of Bangladesh.

Regarding the impact of control variables on endogenous variables, it was observed that, except for educational qualification and tenure of subscription, there was minimal influence on the endogenous variables. Specifically, customer satisfaction remained unaffected by the control variables. However, two control variables—educational qualification and tenure of subscription—were found to exert a significant influence on customer loyalty (with a *p-value* less than 0.05).

5.0 Theoretical and Practical Implications

This study introduces a novel theoretical framework grounded in the Theory of Reasoned Action (TRA) to comprehensively explore customer loyalty within the telecommunications industry. Examining factors such as brand image, price, service quality, switching cost, and trust, the refined theoretical model derived from TRA significantly contributes to the existing knowledge on customer loyalty and satisfaction, providing a robust foundation for future research.

The validated model unequivocally confirms the substantial influence of both price and consumer trust on customer satisfaction and loyalty in the telecommunications sector. These influential constructs seamlessly integrate into services management, marketing, and branding literature, offering valuable insights for future studies. The study extends theoretical understanding by

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introducing a new model, supplementing the existing body of knowledge with insights into customer loyalty and satisfaction.

Implications of the findings are significant for operators, and service providers aiming to enhance customer satisfaction and loyalty in the competitive telecommunications sector, specific context of Bangladesh, where demographic shifts and an aging population, price takes precedence as a crucial consideration, particularly given the predominantly middle to lower-middle-class population.

Strategies to strengthen consumer trust, including genuine engagement on social media platforms, are highlighted. Telecommunication providers are advised to actively engage in building trust through authentic testimonials and compassionate communication. Policymakers are also encouraged to leverage emotionally driven communication strategies, showcasing a dedicated approach to meeting the diverse needs of the customer base.

6.0 Conclusion

This study, grounded or the Theory of Reasoned Action (TRA) and existing literature, explores the determinants of customer satisfaction and loyalty in Bangladesh's telecommunications industry. Using Smart-PLS 4 software, the research investigates the influence of Brand Image, Price, Service Quality, Consumers' Trust, and Switching Cost on customer loyalty among Bangladeshi customers. The findings highlight the pivotal role of two constructs in shaping satisfaction and loyalty within the Bangladeshi telecom sector.

Acknowledging the study's limitations is crucial for cautious interpretation. The sample size constraint may impact generalizability, urging future studies to employ larger samples for more precise conclusions. Incorporating qualitative methods alongside deductive approaches could enhance research by capturing local contextual factors. Multi-Group Analysis (MGA) could further explore how these constructs vary in influencing satisfaction and loyalty across diverse consumer categories.

To bolster the study's findings, future research employing advanced statistical methods like CB-SEM can delve deeper into the impact of key constructs—price and consumer trust—on enhancing satisfaction and loyalty. Despite its limitations, this research illuminates critical factors driving satisfaction and loyalty, setting the stage for further studies aimed at bolstering customer loyalty in the telecom industry.

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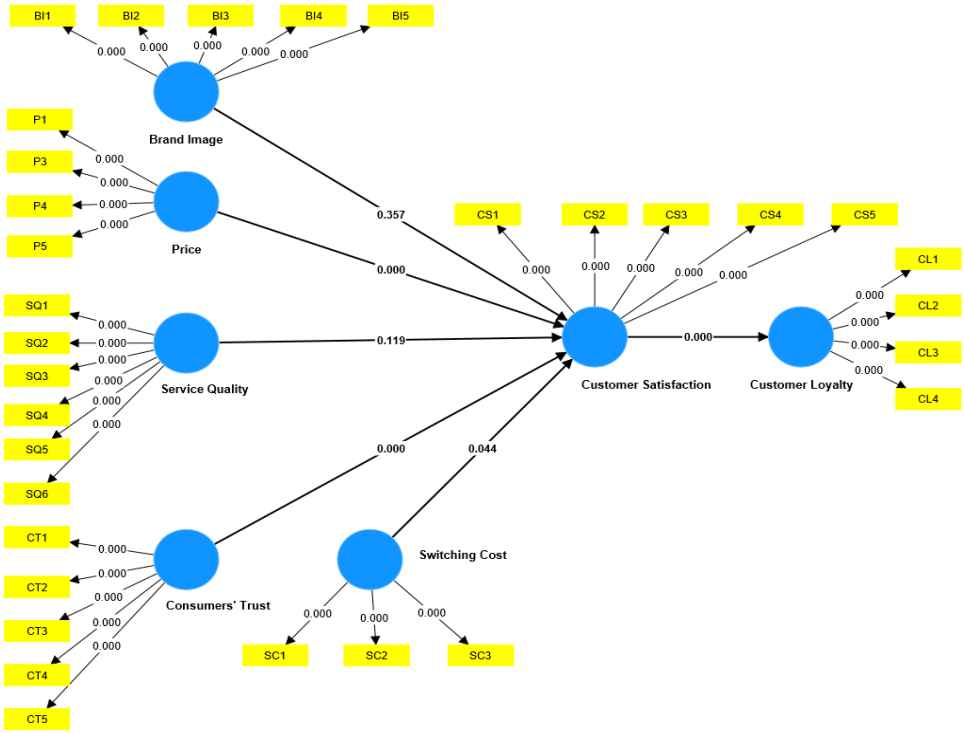
Appendix A: PLS-SEM estimation result for robustness check



Appendix B: Adding the control variables to check the effect on endogenous variables

	Model 1			Model 2		
	Sample mean (M)	**Standard deviation (STDEV)**	**P values**	**Sample mean (M)**	**Standard deviation (STDEV)**	**P values**
Brand Image -> Customer Satisfaction	0.016	0.04	0.357	0.017	0.041	0.349
Price -> Customer Satisfaction	0.215	0.049	0	0.212	0.051	0
Service Quality -> Customer Satisfaction	0.072	0.059	0.119	0.068	0.06	0.134
Consumers' Trust -> Customer Satisfaction	0.566	0.063	0	0.563	0.062	0
Switching Cost -> Customer Satisfaction	0.058	0.035	0.044	0.056	0.035	0.051
Customer Satisfaction -> Customer Loyalty	0.784	0.025	0	0.766	0.026	0
Educational Qualification -> Customer Loyalty				0.068	0.04	0.041
Educational Qualification -> Customer Satisfaction				0.048	0.043	0.134
Tenure of subscription -> Customer Loyalty				-0.076	0.041	0.029

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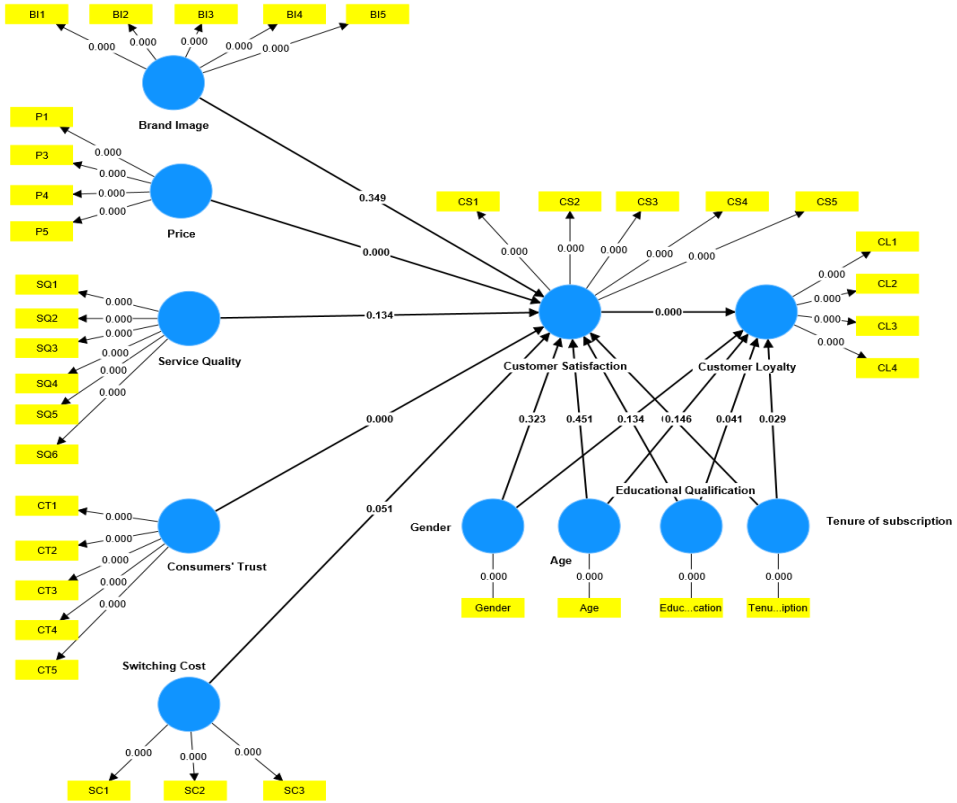
	Model 1			Model 2		
	Sample mean (M)	Standard deviation (STDEV)	P values	Sample mean (M)	Standard deviation (STDEV)	P values
Tenure of subscription -> Customer Satisfaction				-0.029	0.039	0.222
Age -> Customer Loyalty				0.033	0.031	0.146
Age -> Customer Satisfaction				0.004	0.034	0.451
Gender -> Customer Loyalty				0.093	0.072	0.087
Gender -> Customer Satisfaction				0.029	0.066	0.323

Appendix C: PLS-SEM estimation result after adding control variables



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Liquidity Dynamics in Bangladesh: Investigating the Impact of Selected Macroeconomic Indicators Using an ARDL-ECM Method

JUJBR

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Abstract*: The study scrutinizes the influence of the selected macroeconomic forces on the liquidity of Bangladesh during the period 1986-2021. The ratio of excess reserve and total deposit liability is used to represent the liquidity of Bangladesh while total domestic credit, lending rate, consumer price index (CPI) and exchange rate are selected as the macroeconomic forces. As the data become stationary at both level and intercept, the ARDL bounds testing approach has been used to investigate the long-run linkage among the variables. Through the ARDL bounds test, it has been confirmed that there exists a long-run impact of consumer price index, domestic credit and exchange rate on liquidity. In both the long-run and short-run, domestic credit has a statistically significant impact on liquidity whereas lending rate have poor prediction of liquidity in both the long-run and short-run. From the result of the lag order selection criteria, the maximum lag of the series is one. From the stability test and diagnostic test, it has been found that the model seems stable in predicting the behaviour of the variables. The use of the ARDL approach in examining the short-run and long-run effects of selected macroeconomic variables makes the present study unique. There are limited studies on analysing the liquidity dynamics of Bangladesh using the ARDL approach.*

JEL Classification: *B22, C32, C82, P44.*

Keywords: *Macroeconomic variables, Time series models, Liquidity, Bangladesh, Econometrics.*

1.0 Introduction

In banking, liquidity is a term that indicates having cash investment in marketable securities issued by the government to fulfil regulatory requirements which are easily convertible into cash without incurring substantial loss. However regulatory requirement like cash reserve ratio (CRR) and statutory

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liquidity ratio (SLR) set by the central bank of a country is not considered as the part of excess liquidity. Currently, Bangladeshi commercial banks are obligated to keep 4% as CRR and 13% as SLR of their total deposits in Bangladesh Bank (2017), the central bank of Bangladesh in cash and non-cash form respectively. According to Ahmed (2021), 60 commercial banks are operating in Bangladesh, among those conventional banks 48, Islamic banks 9 and specialized banks 3 to serve a particular objective for the economy. In compliance with the Basel Accord, Bangladesh Bank has executed the Basel Accord III to alleviate the liquidity shockwaves and reinforce the capital base to face adverse outcomes of investments.

Banks run the business by collecting deposits or by borrowing from the money markets. Banks accumulate funds from different surplus units of the economy like individuals, businesses, financial institutions, and governments. Then banks use the collected funds to provide loans and advances to different deficit units of the economy like real estate, commercial and industrial units. Historically economic development starts in all places with the help of the banking system and its contribution to the financial growth of a country like Bangladesh is the highest in the early stage (Chowdhury, 2021). Ahmad et al. (2022) studied the correlation between bank stability and excess liquidity of conventional and Islamic banks and found excess liquidity decreases banks' stability rather than improves. Their findings also revealed that Islamic banks unveil greater elasticity to the adverse outcomes of excess liquidity than conventional banks.

In Bangladesh, the banking sector is under great pressure because of its unusually high liquidity which already crosses 1 lac crore. To minimize cost, commercial banks deploy most of the excess funds in treasury securities and it brings a huge problem for both legislators and practitioners. On May 17, 2017, the excess liquidity was 11% of the overall market compared to 13% in 2016. The liquidity position of the banking sector of Bangladesh showed a rising trend from 2010 to 2013, a stable trend from 2013 to 2015, and then a declining trend (Bangladesh Bank, Jul-Dec 2017). Ansari and Sensarma (2022) investigated the Indian banking industry with a span of 2005 to 2020 and found some factors like required reserves have a negative effect, private sector credit have a positive effect and government securities have negative effects on the excess liquidity, respectively. Other issues like inter-bank call rate and exchange rate have fluctuating effects at different levels.

At the end of June 2022, Bangladesh Bank reported that the idle funds in the banking sector of Bangladesh rose to Tk. 203,435. The amount of idle funds crossed Tk. 2 lakh crore in April 2021, which created a record of taka 2.31 lakh crore in August 2021 during the driving of money by Bangladesh bank through the COVID-19 incentive package. But, due to severe scarcity of dollars in banks,

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the amount fell below Tk. 2 lakh crore in March 2022 (The Business Standard, 13 August 2022). It is very vital to have a healthy level of liquidity for the smooth running of the economy of a country. Balanced liquidity is an integral part of the economy to ensure a stable financial sector (Nwakanma & Mgbataogu, 2014).

Agénor & Aynaoui (2010) found some structural and cyclical dynamics which are liable for excess liquidity. Structural issues consist of risk aversion and financial development. They also found that banks and other interested parties in the countries, where financial sectors are least developed, try to ensure a greater level of liquidity. A high-risk aversion tendency would lead to greater risk premium and less demand for credit. The degree of risk aversion may have a direct correlation with prolonged macroeconomic volatility, and it may clarify a progressive, long-lasting association amid high inflation and excess liquidity. The global financial crisis (GFC) has increased their consideration in understanding the connection between financial solidity and financial connectivity. When there are excessive funds in the economy, it may create systemic catastrophe by expediting undesirable spillover effects all over the world through cross-border possessions, as detected in the recent GFC (Demir & Önder, 2019).

If an economy runs with more liquid funds than its necessity, the economy will face the problem of excess liquidity. The liquidity position of a country is generally measured by the money supply index compared with nominal GDP. If the nominal GDP seems less than the money supply, the economy will face excess liquidity. From the beginning of the 21st century, the expansionary monetary policy taken by the advanced nations, the continual rise of oil prices and the increase in the trade surplus of Asian countries have steered to an outcome of excess liquidity throughout the globe (Tu et al., 2012).

Excess liquidity generates numerous abnormalities in the banking sector. It reduces banks' asset utilization capacity and overall competitiveness. It also creates inconsistencies in the transmission of effective monetary policy and the expansion of the financial market. The existence of short-term Sukuk in the economy creates a statistically significant negative effect on excess liquidity (Ali et al., 2019).

Liquid assets are the lifeblood of an economy. However excess or less liquidity can create hazards to the economy. So, it is important to maintain a healthy level of liquidity to have a stable economic condition. Through investigating macroeconomic variables, policymakers can forecast the future liquidity condition of an economy and formulate policy consequently. Bangladesh is a developing country and its economy is growing rapidly. This study is trying to find out the impact of macroeconomic variables like CPI, lending rate, domestic

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credit, exchange rate, GDP, money supply etc. on the liquidity position of Bangladesh.

2.0 Literature Review

Though there remains significant doubt about the precise nature of the link and the direction, historical experience implies a somewhat substantial association between surplus liquidity and asset values. If excess liquidity is prevalent and a fixed supply of assets is present, there may be an inflation in asset values. Next, if both result from better economic prospects, asset values may rise concurrently with an increase in liquidity. For instance, a cyclical upturn may also be accompanied by higher stock prices, stronger company profitability forecasts, and more money demand.

Liquidity has numerous theoretical definitions and is frequently employed in a variety of circumstances. In brief, (Ross et al., 2015) noted liquidity refers to how quickly assets can be changed to cash with minimum value loss. Another scholar Jordan et al. (2020) mentioned that liquidity is a condition in which an asset can be converted quickly without price concession. Agbada and Osuji (2013) defined liquidity in the banking context as the bank's ability to keep sufficient money to pay for maturing liabilities. Although liquidity is a desirable phenomenon, it becomes an issue when it is in excess in the financial system. The definitions in the preceding sections provide an intuitive understanding of liquidity. Many research on excess liquidity, however, provides an empirical computation of excess liquidity.

Although liquidity is a favourable circumstance, it poses concerns when it surpasses the required levels. In their findings of the effect of surplus cash on monetary policy, Bathaluddin et al. (2012) found that surplus money decreases the rate of success of monetary policy by affecting the demand side and thereby encouraging inflation.

According to Saxegaard (2006), A study of surplus money and the success of monetary policy in the African Sub-Saharan area found that the amount of funds placed with the regulatory bank by financial institutions, plus cash kept in vaults that exceeds what is needed or statutory numbers. He added that excess reserves may be cautious or involuntary, with precautionary excess reserves held consciously by banks to meet prudential requirements or liquidity needs, and involuntary excess reserves because of structural impediments in the financial system. In the research, they conducted on the surplus money in a free economy and its proper utilization, TU et al. (2012) identified surplus liquidity as the phenomenon whereby an economy's governable currency exceeds the necessary amount.

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Gray (2006) defined excess liquidity from the standpoint of the central bank, indicating that a liquidity surplus happens when the central bank has net currency-related obligations versus the banking industry as a whole. Although being defined from surplus money is said what bank holds more than the desirable or required levels from various views or approaches. The question remains as to why banks would keep surplus reserves. The section that follows attempts to answer this question.

Banks hold a specific percentage of reserves as insurance against unexpected withdrawals, often known as precautionary reserves. Khemraj (2006) gathered the findings of research initiatives conducted in the latter part of the 20th century for his study on Guyana. These research projects along with studies done by Agénor et al. (2004) tested the theory that banks select reserve funds that maximize earnings or minimize losses. These studies found that (i) banks want more reserves when adjustment costs increase, (ii) necessary bank reserves grow or decrease depending on the statutory liquidity ratio and (iii) the level of reserves increase as uncertainty increases.

Adalid and Detken (2007) use credit growth and structural money shocks to assess excess liquidity, which is obtained by VAR estimation using a larger set of endogenous variables. Since the 1970s, quarterly data from 18 OECD nations have been collected using a panel regression model, and the authors have discovered that excessive liquidity only influences real estate prices during surge times. However, under typical circumstances, the surplus liquidity's predictive power tends to switch from asset price inflation to consumer price inflation.

Saxegaard (2006) splits bank demand for surplus cash into two categories: precautionary and involuntary; based on his research in the Central African countries. Involuntary liquidity is influenced by demand forces, whereas defensive excess reserve is somehow determinable. Spontaneous funds would increase if requirement conditions were adverse for a variety of reasons, such as economic and political instability. So is for adverse global conditions. Moreover, reason is more likely to result in inflation if demand conditions improve, but precautionary surplus reserves do not alter the composition of bank portfolios, making them less inflationary.

Using the model of Agénor et al. (2004), Saxegaard (2006) identified the relevant elements that contribute to the accumulation of spontaneous liquidity: (i) international aid donation by the rest of the world (ii) newly discovered oil earnings, (iii) increased government deposits in banks; (iv) sluggish private sector loan demand. More factors impacting surplus liquidity were discovered by Khemraj (2006); which are: (i) a huge underground economy generating bank deposits, (ii) inbound remittances, and (iii) government involvement in the foreign exchange market.

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Empirical studies by Nwakanma and Mgbataogu (2014) reveal top three factors are; money supply level, monetization of foreign exchange, and surplus liquidity lagged as the prime elements of surplus liquidity in Nigeria. They also suggest that a proper amount of fund availability is possible by ensuring efficient foreign exchange management.

In a study by Aikaeli (2006) titled "Determinants of Excess Liquidity in Tanzanian Commercial Banks" to reveal the reasons for the surplus fund, the autoregressive distributed lag model was used. The unpredictability of depositors' cash preference, higher lending risk, increasing cost of funds, and finally mandatory reserves requirement rate directed to build up of funds in excess of requirements was the prime outcome.

The empirical analysis was done by Hasanovic and Latic (2017) on 19 commercial banks in Bosnia and Herzegovina based on the generalized method of moments (GMM) methodology for the 2006-2015 time period. By using dynamic panel analysis, they tried to determine the relationship between surplus fund and selected key variables. The outcome was bank size, NPL, total outstanding loans as well as consumer price index are the noteworthy indicators.

Similar kinds of studies were done by Moussa (2015) in Tunisia on 18 banks for 10 years (2001-2010) time frame. Results of the study indicate that financial results, invested capital, debt to assets ratio, operating expenses to total assets ratios, GDP growth rate and CPI rises have a remarkable influence on available funds in Banks.

Some other distinguished scholars also found the same result as those who mentioned the challenges created by a surplus of liquidity in economies including Caprio and Honohan (1990), Aryeety and Nissanke (2005), Agénor et al. (2004), and Bathaluddin et al. (2012). According to Agenor and El Aynaoui (2010), excess liquidity in the financial system provides an important hurdle to central bank policymaking and the economy in general. The researchers acknowledge that too much liquidity hinders the efficiency of the implementation of monetary policy mechanisms. As a consequence, the fulfilment of macroeconomic goals like full employment, greater GDP rates, price stability, and so on is jeopardized.

Lag of Additional Liquidity, Money Supply lag, and the surplus funds of financial institutions as further sources of excess liquidity in the country's economy Bathaluddin et al. (2012). According to findings, in a general price-increasing condition, unplanned surplus cash will be distributed rapidly as the financial system's general demand becomes higher.

A Study was done (Trenca et al., 2015) to find the macroeconomic factor's effects on bank liquidity for the countries that have lately experienced unfavourable financial and economic conditions. They discovered that the

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macroeconomic parameters that affect liquidity levels include the rate of inflation, the public deficit, the unemployment rate, the GDP, and the liquidity ratio, among others. Of these, the effects on liquidity and inflation were greatest, while those on the GDP were least. While Dinger (2009) demonstrated the opposite association between GDP growth rate and bank liquidity, (Bunda & Desquilbet, 2008) study indicated a positive influence of GDP rate on liquidity in financial institutions. Furthermore, the research by (Horvath et al., 2012) demonstrated that while the unemployment rate hurt bank liquidity and that high unemployment rates reduce loan demand, which affects bank liquidity, inflation rates did not affect bank liquidity. Tasnova (2022) examined how macroeconomic and bank-specific factors affected the liquidity of 29 Bangladeshi commercial banks that were listed. Bank funds availability was inversely impacted by the business cycle and the interest rate of the monetary policy. In contrast, nonperforming loans, capital adequacy, profitability, and interest rate spread are all positively correlated with bank liquidity.

It is more significant to consider the expected impacts of surplus funds on important macroeconomic indicators when deciding on monetary policy. The availability of money in the financial market may result in a drop in interest rates, which would increase loanable funds for people and private businesses if all other factors remained constant. Imports would be impacted by the rise in total demand. If export growth is not accompanied by an increase in imports, current account imbalances and trade deficits will arise, which will have an impact on the foreign currency conversation rate and rising prices.

3.0 Objective of the study

The aim of the study is to scrutinise the effect of inflation, domestic credit, lending rate, and exchange rate (in dollar terms) on the liquidity of Bangladesh. The study purposes at discovering the fluctuation of liquidity for these selected macroeconomic variables.

4.0 Data and Variable Definition

To meet the objective of this study, yearly data for the period 1986 to 2021 has been collected. The timeframe has been chosen resolutely since the economy of Bangladesh has faced many fluctuations during this period like capital market developments, trade liberalisation, etc. Analysing the association between liquidity and macroeconomic variables during this period will be helpful for the upcoming periods for predicting the abrupt swing in liquidity. It will also help the analysts to predict the changes in the liquidity of the country due to changes in any of the macroeconomic variables. Firstly, the data on liquidity has been taken from the website of Bangladesh Bank. Then, five macroeconomic variables have been chosen including the domestic credit (DC), lending rate (LR), exchange rate (Exchange), and consumer index price (CPI, base year 2010). Data on liquidity

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(LLQ), domestic credit (DC) and exchange rate (Exchange) have been collected from the Bangladesh Bank website whereas (Bangladesh Bank, n.d.) lending rate (LR) and consumer index price (CPI) have been collected from the data bank of the World Bank Statistics (World Bank Open Data, n.d).

Table 1: Sources of Data

Variable	Concept	Description	Units	Data Source	Literature
LLQ	Natural logarithm of the amount of liquidity	Excess reserve/ total deposit liability	The ratio of the total amount of excess reserve and total deposit liability (in crore)	Bangladesh bank website	Ross et al., 2015 Jordan et al. (2020) Agbada and Osuji (2013) Kuwornu and Owusu-Nantwi, (2011), Nwakanma and Mgbataogu (2014)
LDC	Natural logarithm of yearly domestic credit	Credit/loan given to the public and private sector within the national boundary	Yearly amount in crores	Bangladesh bank website	Adalid and Detken (2007) Gozgor, (2014) Agenor et al. (2004) a sanovi c and Lati c (2017)
LLR	Natural logarithm of the Lending rate	Monthly average call money market rates (weighted average)	Average yearly percentage	World Bank data statistics	Matemilola et al. (2015). Gupta and Modise (2013) Aikaeli (2006)
LCPI	Natural logarithm of consumer price index	Changes in the Consumer Price Index (CPI). Base year:2010	Yearly percentage	World Bank data statistics	Bathaluddin et al. (2012) Bryan and Cecchetti (1993) Adalid and Detken (2007) a sanovi c and Lati c (2017)
LExchange	Natural logarithm of exchange rate	The average buying and selling rate of US dollar (The rate of Bangladesh bank)	Average yearly rate against US dollar	World Bank data statistics	Williamson (1983), Dornbusch (1982), Agenor et al. (2004), Khemraj (2006), Nwakanma and Mgbataogu (2014)

5.0 Methodology

The aim of the study is to examine the association between macroeconomic factors and liquidity in Bangladesh.

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The hypothesized model for the paper is as follows:

$$\ln LQ_t = \beta_0 + \beta_1 \ln CPI_t + \beta_2 \ln DC_t + \beta_3 \ln LR_t + \beta_4 \ln EXCHANGE_t + \varepsilon_t$$

Where LQ=Excess liquidity/Deposit Liability; Exchange= Exchange Rate; LR = Lending rate; DC = Total Domestic Credit; CPI= Consumer Index Price; ε_t = The standard error term, and β_0 is the constant and, β_1 β_2 β_3 β_4 and represent the respective parameters. The paper uses the ARDL approach proposed by Pesaran et al. (2001) because the ARDL approach has some advantages over the other cointegration approaches like the Engle-Granger (Engle & Granger, 1987) and Johansen cointegration test (JJCA). These traditional cointegration approaches need all the variables to be integrated into the same order. However, the ARDL test effectively processes the data, whether the variables are integrated/stationary at the level I(0) or at the first difference I(1) or mutually co-integrated (Pesaran et al., 2001). Because of having a small number of observations and various order of integration, the study variables make ARDL the most appropriate method for this study.

The equation of an ARDL model can be specified as follows:

$$\Delta \ln LQ_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta \ln LQ_{t-i} + \sum_{i=1}^{p} \beta_{2i} \Delta \ln CPI_{t-i} + \sum_{i=1}^{p} \beta_{3i} \Delta \ln DC_{t-i} + \sum_{i=1}^{p} \beta_{4i} \Delta \ln EXCHANGE_{t-i}$$

$$+ \sum_{i=1}^{p} \beta_{5i} \Delta \ln LQ_{t-i} + \beta_6 \ln LQ_{t-1} + \beta_7 \ln CPI_{t-1} + \beta_8 \ln DC_{t-1} + \beta_9 \ln EXCHANGE_{t-1} + \beta_{10} \ln LQ_{t-1} + \varepsilon_t$$

Where Δ stands for the difference operator. The test includes the F-test of the joint significance of the coefficient of lagged variables to verify that there exists a long-term relationship among the variables. The Pesaran (2001) test has been followed to validate the null hypothesis of having no long-term relation exits among the variables (H_0: β_6= β_7= β_8= β_9= β_{10}=0). The decision of the null hypothesis (H_0) being rejected or accepted is generally based on the following conditions: if the value of the F-test is greater than the value of the upper critical bound (UCB), the null hypothesis will be rejected which means the variables of the study are co-integrated. On the other hand, if the value of the F-test statistic is less than the lower critical bound (LCB), the null hypothesis is accepted which means that the study variables are not co-integrated. Lastly, the decision will be inconclusive if the F-test value is greater than or equal to the lower critical bound (LCB) and less than or equal to the upper critical bound (UCB).The error correction model (ECM) for the estimation of the short-run association can be stated as follows:

$$\Delta \ln LQ_t = \beta_0 + \sum_{i=1}^{p} \beta_{1i} \Delta \ln LQ_{t-i} + \sum_{i=1}^{p} \beta_{2i} \Delta \ln CPI_{t-i} + \sum_{i=1}^{p} \beta_{3i} \Delta \ln DC_{t-i} + \sum_{i=1}^{p} \beta_{4i} \Delta \ln EXCHANGE_{t-i}$$

$$+ \sum_{i=1}^{p} \beta_{5i} \Delta \ln LQ_{t-i} + \alpha_1 ECT_{t-1} + \varepsilon_t$$

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If the ECM_{t-1} coefficient (α_1) has a negative sign and is statistically significant, the model implies that any long-run disequilibrium among the dependent variables and a number of independent variables will converge back to the long-term equilibrium association.

6.0 Results and Discussions

6.1 Descriptive statistics and correlation analysis

The descriptive statistics table presented the mean, median, standard deviation, maximum and minimum values over the period from 1886 to 2021. From the table, the average log value of the consumer price index, domestic credit, exchange rate liquidity and lending rate shows 4.2, 9.2, 4.0, -4.4, and 2.5 representing average values of 1708019.81, 4343884542, 1048576, 2719736.09, 9536.74 respectively. The descriptive analysis table also represents the pair-wise correlation analysis among the variables.

Table 2: Descriptive Statistics

	LLQ	LEXCHANGE	LDC	LCPI	LLR
Mean	-4.407240	4.007914	9.177006	4.231459	2.508006
Median	-4.144758	4.062966	9.163149	4.131661	2.560227
Maximum	-2.428220	4.440370	14.18008	5.300500	2.697711
Minimum	-8.334363	3.410157	6.697382	3.189653	1.991179
Std. Dev.	1.317184	0.347468	1.612287	0.634875	0.166831
Skewness	-1.038248	-0.371064	0.591830	0.143848	-1.327871
Kurtosis	3.835634	1.732908	3.759614	1.780617	4.395156
Jarque-Bera	7.515180	3.234411	2.967097	2.354496	13.49913
Probability	0.023340	0.198452	0.226831	0.308126	0.001171
Sum	-158.6606	144.2849	330.3722	152.3325	90.28823
Sum Sq. Dev.	60.72406	4.225696	90.98142	14.10734	0.974146
Observations	36	36	36	36	36
LLQ	1.000000				
LEXCHANGE	-0.373871	1.000000			
LDC	0.472514	-0.336392	1.000000		
LCPI	-0.336160	0.967092	-0.169992	1.000000	
LLR	-0.002312	-0.670072	-0.082972	-0.733082	1.000000

Source: Researcher's own calculation

The coefficient measures of the correlation analysis have pointed out that exchange rate and consumer price index lending rate are negatively correlated

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with liquidity where only domestic credit is positively associated. The consumer price index is positively correlated with the exchange rate and both domestic credit and lending rate are negatively related. In the case of domestic credit consumer price index and lending rate, both are negatively correlated with domestic credit. A negative correlation exists between the consumer price index and lending rate.

6.2 Lag length selection criteria

It is necessary to ensure the order of integration among the variables for model estimation. And so the unit root test is the primary requirement for time series analysis for the presence of stationarity of the variables. To confirm the order of integration, Perron (1997) and Dickey & Fuller (1979) developed unit root test and the test was directed for all the variables having structural breaks. The test results show the values for both the intercept and time trend. The test statistics with a greater value than the critical value indicate the rejection of the null hypothesis which assumes the presence of unit root and vice versa. If the value show that the data have unit root, then the researchers suggest to have the first difference. The aim of the test is to make the data stationary at the first difference. In this paper time trend is being used to make the data stationary. Results of the ADF test for unit root explicate that at the first difference without trend LLQ, LCPI, LDC, LLR and Lexchange become stationary at the significance level of 1%. Simultaneously, at the first difference with trend and intercept, only domestic credit (LDC) becomes stationary at 5% significance level and other variables like exchange rate, lending rate, excess reserve, consumer price index and liquidity become stationary at the first difference with significance level of 1%. Phillip Perron (PP) test also be used to make the data set stationary. From PP test results, it is found that, at first difference, without trend and intercept, LCPI, LDC and LLR become stationary at the significance level of 1% where LLQ become stationary at level with the significance level of 1% critical value level and Lexchange become stationary at level with 5% significance level. In the case with trend LDC and LLR become stationary at the first difference with the significance level of 5 % critical value and all other variables like LLQ, LCPI, and Lexchange become stationary at the first difference with the significance level of 1% critical value. The ARDL approach is the valid approach if the data series becomes stationary both at level and at interval or with mixed order. One of the most important assumptions of ARDL approach is to have the data integrated at level or intercept and if the data becomes stationary at second difference, the F-test will be invalid to access the long-term association among the variables. Table 3 reveals the unit root test of the variables and it can be inferred that the data become stationary at level or intercept. So, ARDL approach will give the prediction of the variables in the long run.

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Table 3: Unit root test

Variables	ADF test				PP test			
	Without trend		With trend		Without trend		With trend	
	Level	1st difference	Level	1st difference	Level	1st difference	Level	1st difference
LLQ	-2.732*	-7.441***	-2.849	-7.360***	-2.739*	-7.559***	-2.892	-7.487***
LCPI	0.293	-4.381***	-2.272	-4.411***	0.206	-4.339***	-1.452	-4.421***
LDC	-1.012	-3.925***	-0.420	-4.067**	-1.072	-3.925***	-0.420	-4.0564**
LLR	1.181	-4.123***	-0.987	-4.276***	0.704	-4.073***	-0.591	-4.218**
Lexchange	-1.467	-5.029***	-1.062	-5.064***	-3.114**	-4.962***	-0.831	-8.359***

Source: Researchers' Own Calculation

6.3 Lag length selection criteria

According to Chaudhuri and Smiles (2004), To choose the measurement of the co-integration model, the number of lags is required to find out before applying the ARDL bounds test. For selecting the lag, several criteria are required to test such as Akaike information criteria, Likelihood Ratio, Schwarz information criterion, Final Prediction Error and Hannan-Quinn Information Criterion (HQIC). Based on all these criteria, one is the maximum lag that has been selected. Inappropriate lag can predict biased results and will not be accepted for policy analysis. Among all the criteria, in this paper, Akaike information criteria (AIC) is given the highest priority over the other lag length selection criteria because AIC provides more robust results to explain the lag length.

The study tools, being used to calculate the optimum lag length, suggest the lag of one. It will be a great mistake to select no lags in the study as most of the tools suggest selecting one lag. The result of the VAR lag order selection criteria is supported by all of the criteria like AIC, FPE, HQ and SBIC that the maximum lag of the series is one. Khan and Yousuf (2013) have selected the optimum five lag length according to AIC. Naik and Padhi (2012) showed that lag of one has been selected from VAR lag order selection criteria in their respective similar paper.

Table 4: Lag selection criterion

Endogenous variables: LCPI LDC LEXCHANGE LLQ LLR						
lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-70.681	NA	5.90e-05	4.451837	4.676	4.528
1	119.277	312.873*	3.67e-09*	-5.251637*	-3.904848*	-4.792*
2	132.679	18.131	8.05e-09	-4.569340	-2.100228	-3.727

* Indicates lag order selected by the criterion
* Source: Researchers' Own Calculation
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SIC: Schwarz information criterion

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6.4 Eigenvalue stability condition

For the stability test, roots of characteristic polynomial is essential to check whether the VAR model is stable for predicting the long-run relationship with the variables. Hamilton (1994) and Lutkepohl (2005) suggested that if the VAR model needs to be stable the modulus value of the eigenvalue must be less than one and that should be within the circle. Based on the analysis of the paper we can conclude that the VAR model used in the paper is stable as all the modulus values are less than one and stay within the eigenvalue circle.

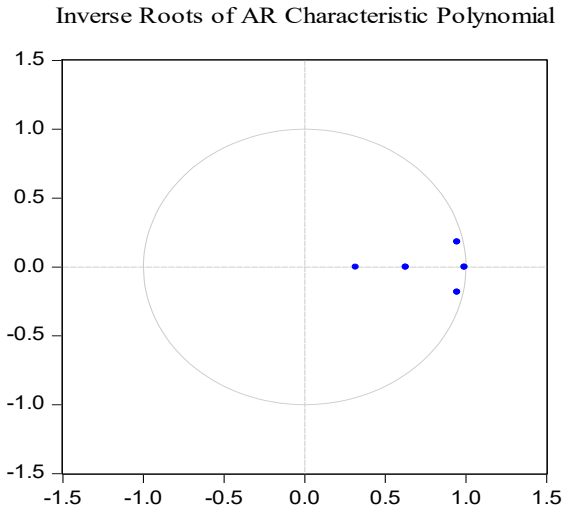

Figure 1: Optimal lag selection criteria under VAR model in polynomial graph

Source: Researchers' Own Calculation

As the VAR model shows the stability in the model, it can be stated that the estimations would be appropriate to the model.

6.5 Bound Test Approach

Following the approach proposed by Pesaran et al. (2001) and Narayan and Narayan (2005), this paper used the AIC criteria for selecting the optimum lag length for ARDL approach. Table 5 reveals the results of the cointegration test based on ARDL bounds test and it has been found that the value of the f-statistic is 4.46 which is greater than the UCB (upper critical bound) at 1 and 5 percent of significance level where consumer price index, lending rate, exchange rate and domestic credit are dependent variables.

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Table 5: Bounds Test Results

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	**Value**	**Significance**	**I(0)**	**I(1)**
F-statistic	4.461169	10%	2.2	3.09
k	4	5%	2.56	3.49
		1%	3.29	4.37

Source: Researcher's own calculation

Based on the result, it can be concluded that the null hypothesis of having no levels relationship is rejected and there exists long-term association among the variables.

6.6 Long run and short run analysis

From the ARDL bound test, it has been confirmed that there exists long-run cointegration among the dependent and independent variables. Table 6 exhibits the long-run and short-run elasticities of the variables. In the long-run, the consumer price index, exchange rate and domestic credit, negatively and significantly affect the liquidity whereas the lending rate has negative impact on liquidity with no significance. A 1 percent increase in liquidity will have an 8 percent positive change in the exchange rate. Similarly, a 1 percent change in liquidity will result in an 0.55 percent change in domestic credit in the same direction.

In case of the consumer price index, 1 percent change in the liquidity will result in a 4.91 percent change in the opposite direction. The lending rate seems insignificant in explaining the liquidity in the long run. In the short-run, the result demonstrates that only domestic credit has positive and significant impact on liquidity. A 1 percent change in the liquidity will have 0.65 percent change in the domestic credit in the same direction. The value of R2 and adjusted R2 confirm that there exists no spurious regression and have indicated a strongly good fitted model. The criteria of good fitted model have also been confirmed by the f-statistic with less than 0.05 probability value. Error correction model with a negative and statistically significant value indicates that the disequilibrium and any prior shock in the exploratory variables can be adjusted with higher speed in the long run.

Table 6: Results of long-run and short-run coefficients applying the ARDL approach

Dependent variable is LLQ: ARDL (4, 4, 1, 4, 3) selected based on AIC				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
Panel A: Long run estimation				
LEXCHANGE	8.367341	3.080562	2.716174	0.0201
LDC	0.550232	0.137991	3.987455	0.0021

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Dependent variable is LLQ: ARDL (4, 4, 1, 4, 3) selected based on AIC				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
LCPI	-4.915303	1.726894	-2.846325	0.0159
LLR	-0.333066	1.498908	-0.222205	0.8282
C	-17.58923	8.047291	-2.185733	0.0513
Panel B: Short-run estimation				
D(LEXCHANGE)	8.331197	5.668072	1.469847	0.1696
D(LDC)	0.651444	0.229641	2.836792	0.0162
D(LCPI)	-19.56889	12.69728	-1.541187	0.1515
D(LLR)	-3.296680	6.330726	-0.520743	0.6129
ECM	-1.793932	0.302367	-5.932958	0.0001
EC = LLQ - (-4.9153*LCPI + 0.5502*LDC + 8.3673*LEXCHANGE -0.3331 *LLR -17.5892)				
Panel C: residual diagnostic tests				

R squared	0.805364
Adjusted R squared	0.597753
Durbin Watson stat	2.541438
F statistic	3.879193
Prob(F-statistic)	0.026645

Source: Researcher's own calculation

In previous studies, to specify the model fit, (Narayan and Narayan, 2005; Qamruzzaman & Jianguo, 2017) some of the diagnostic tests have been done and so in this paper for ensuring the stability of the model, normality test of the model, LM serial correlation test, Ramsey Reset test, Breusch-Pagan-Godfrey heteroscedasticity test have been carried out. The results of the diagnostic test have been presented in Table 7. The normality test result shows that the study variables are normally distributed, as indicated by Jarque-Bera statistics. Based on the result of the serial correlation LM test, heteroscedasticity test and Ramsey RESET test, it can be inferred that the ARDL model has confirmed all the diagnostic tests successfully meaning that there exists no serial correlation among the variables and no heteroscedasticity.

Table 7: Diagnostic Tests

Diagnostic test(s)	**Statistic(s)**	**Test statistic**	**p value**
Normality	Jarque-Bera	0.198	0.91
Breusch-Godfrey serial correlation LM	F-statistic	4.024372	0.0522
Breusch-Pagan-Godfrey heteroskedasticity	F-statistic	1.882303	0.1319
Ramsey RESET	F-statistic	0.467387	0.5083

Source: Researcher's own calculation

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Based on the diagnostic test, the model has passed all the standards. Meanwhile, in this paper, two stability tests have been conducted such as CUSUM and CUSUMSQ for analysing the stability of long-run and short-run parameters. The graph of the stability tests presented in Figures 2 and 3 have identified that the plots for stability test are within the critical thresholds at the significance level of 5 percent.

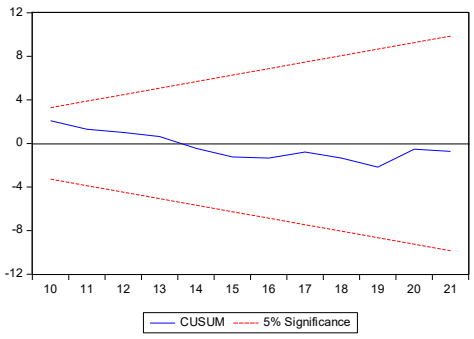

Figure 2: Plot of cumulative sum of recursive residuals

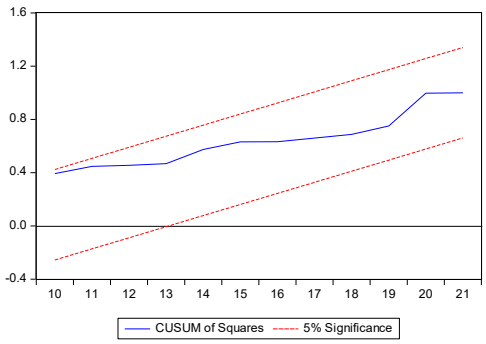

Figure 3: Plot of cumulative sum of squares of recursive residuals

The findings have confirmed the accuracy of long-run and short-run parameters which have an impact on the liquidity over the period 1986-2021.

7.0 Conclusion

The study examines the long-term co-integrating relationship between the liquidity of the country and selected macroeconomic variables using the ARDL approach proposed by Pesaran et al. (2001). The stationarity test reveals that the data become stationary at both level and intercept and so the paper followed the ARDL approach to investigate the long-run impact of the macroeconomic variables on liquidity. ARDL bound test results predicted that there exists long-run relation between liquidity and selected macroeconomic variables as the value of f-statistic is greater than the upper critical bound at 1 and 5 percent significance level. It is also tried to find out the predictability of changes in liquidity due to the changes in selected macroeconomic variables. From the results, it can be concluded that, in the long run, consumer price index, exchange rate and domestic credit can predict liquidity with significance but lending rate have poor predictability of liquidity. In the short-run, only domestic credit has a significant influence over liquidity. In addition, the correction intensity of liquidity value has been analyzed to find out. Error correction term shows that the disequilibrium will be corrected significantly in the long-run. From the result of the VAR lag order selection criteria, it is supported by both AIC and SBIC that the maximum lag of the series is one. From the stability test and diagnostic test, it has been found that the model seems stable in predicting the behaviour of the variables. Economic policymakers will be able to predict the behaviour of the

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selected macroeconomic variable when any change is observed in liquidity and vice versa. Belke and Keil (2016) found that financial integration drives the prices of the commodity. They also find that the break between financial flow and dynamics of the commodity prices is corrected by the global liquidity managed by central bank. Qehaja et al. (2022) investigated the relationship between macroeconomic variables and liquidity of the banks where they found that per capita GDP and unemployment rate have positive effect inflation have negative impact on the bank liquidity. Analyzing the previous similar studies, it is evident that the macroeconomic forces have significant impact on the liquidity of the banking sector but the direction of the effect varies from country to country and market to market. As the liquidity is associated with exchange rate, consumer price index and domestic credit, policy makers should be very careful about the amount of the liquidity to meet the economic crisis. Acharya and Kulkarni (2012) suggested banking sector to maintain high level of liquidity to absorb any economic shock. For the future study, researchers can investigate the impact of a large number of macroeconomic variables on liquidity as in this paper only four of the macroeconomic variables have been included.

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HOW DO CUSTOMERS PAY FOR THEIR ONLINE FOOD PURCHASES? A Study on the Online Food Purchasers in Bangladesh

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Abstract: *This paper investigates the choice of payment methods by online food purchasers in Bangladesh. The objective is to identify the factors influencing the choice of payment methods and factors influencing the choice. Responses are collected from 540 respondents through an online questionnaire survey. Cross-tabulation, frequency analysis, the Chi-square independence test, and binary logistic regression are used for in-depth analysis of the data. Cash on delivery is found to be the most favored method of payment followed by mobile financial services (MFS) and internet banking and/or debit/credit cards. Among the demographic variables, purchasers' gender showed a significant but weak influence on the choice of payment method. MFSs are the most preferred payment method for men. A larger percentage of women prefer the cash-on-delivery method. The use of debit/credit cards is more prevalent among the female purchasers. Other demographic variables such as household income, age, and profession did not portray any significant influence on the choice of payment method. However, frequent buyers are found to prefer online payment (MFS, card, or internet banking) to occasional buyers. The findings of the study contribute to business literature by shedding light on an inadequately tapped area of research. Factors identified to be significant in the choice of payment methods will help online food traders address issues related to their business process and effectively communicate the improvements they can make. The findings of the study may also instigate the financial service providers to be motivated to focus on educating customers about online payment systems and their built-in security.*

Keywords: *Cash on delivery, Demographic factors, Online purchase, Online payment, Payment method, Purchase frequency, Ready-to-eat food.*

JEL Classification: *D12, E40, M31, O31, R10.*

1. Introduction

Purchasing ready-to-eat food online has become quite common these days among the city dwellers of Bangladesh. Busy lifestyles, dual-career nuclear families, the

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rising middle class, and heavy traffic are the major reasons behind this new trend (Amir and Rizvi, 2017). People use several apps and/or just make phone calls to order ready-to-eat food (Ali et al., 2023). Most online orders ask the caterer or the restaurant to deliver the food to consumers' destinations. Only a few online orders are picked up by the customers. However, payment of these orders is not necessarily online. Like other e-commerce businesses, caterers and restaurants allow customers to choose from different payment methods (Ghosh and Saha, 2018) such as mobile financial services (MFSs) like bKash, Nagad, Rocket, and Upay, debit or credit cards, etc.

Offering diverse payment options caters to varying customer preferences, enhancing their overall experience. Some customers prefer credit/debit cards, others might prefer digital wallets, and some might even prefer cash on delivery. Understanding and accommodating these preferences can attract and retain customers. Thus, in a competitive market, providing a wide range of payment methods can set a business apart. It makes service more accessible to a larger audience and can influence a customer's decision when choosing between similar food providers. Furthermore, different payment methods come with different levels of risk. Understanding these risks helps businesses mitigate fraud and security threats associated with online transactions. For instance, credit card payments might entail chargeback risks, while cash-on-delivery might have its own set of challenges.

A lot of research has been done on e-commerce, especially on online food business's growth, challenges, (Liu and Lin, 2020) adaptability (Coghlan et al., 2020), and customers' attitudes and behavior toward online food purchases (Fatima, 2023; Rasoli et al., 2021). However, only a few studies have focused on the choice of payment methods by the customers. The study on the preference of payment methods in the context of online food businesses isn't just about facilitating transactions; it's about understanding consumer behavior, managing risks, and ultimately enhancing the customer experience to drive business growth.

Now the choice of payment mechanisms might depend on several factors like security, convenience, trust, device compatibility, purchase frequency, etc. Nevertheless, these factors may vary with several demographic characteristics of the consumers such as gender, age, education, occupation, income as well as expenditure. Understanding these demographic influences is essential for online food businesses as it allows them to tailor their payment offerings to match the preferences of their target demographics, ultimately enhancing customer satisfaction and boosting sales. The current study focuses on consumers' choice of payment method for purchasing food online and the factors influencing the choice.

2. Literature Review and Research Model

A study by Lestari and Genoveva (2021) asserts that online food purchases have burgeoned across the globe during the COVID-19 period. Bangladesh has rallied

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to this trend (Akter and Disha, 2021). Saad (2021) investigated the factors affecting online food delivery services in Bangladesh. The delivery time, service quality, price, and condition of food delivery are the primary or direct factors and the variety and number of restaurants, menu, delivery tracking service, and attitude of a delivery person are found to be the indirect or secondary factors of success of the online food delivery service. On the other hand, a study by Ali et al. (2023) reviewed the determinants of consumers' motivation to use online food delivery apps. The results of the study reveal that social influence, perceived trust, perceived safety, performance expectancy, and effort expectancy significantly affect the consumers' usage intention of food delivery apps. A similar study was done by Haque (2023) in the context of Bangladesh. Another study by Fatima (2023) investigated the influence of consumer demographics on the online food purchase behavior of Dhaka city dwellers. The study discovers that youngsters, adolescents, and private job holders are likely to spend more on buying online food. While purchasing online customers from all demographic groups prefer fast food.

None of the studies mentioned above have focused on the choice/prevalence of payment methods. One study by Ghosh and Saha (2018) focused on the e-payment system of the food delivery industry. The study revealed that customers' gender, age, education, marital status, income, and profession have some association with their online payment behavior. However, the study was done only on 100 customers of a particular food delivery company, Swiggy from West Bengal, India. Hence, the results are not generalizable, and further research is worth exploring. Amofah and Chai (2022) and Heiskanen (2016) investigated the payment methods of e-commerce businesses. Card (Debit/Credit), electronic money transfer on Internet banking, telephone banking, MFSs, e-wallet, and digital payment gateways are identified as e-payment or online payment methods. Cash on delivery and pay later are other payment methods. See-To et al. (2014) delineated that income has a mediating role in customers' choice of online vs offline payment methods regarding their e-commerce transactions.

A study by Mahensaria and Patra (2020) presented that consumers' preferred mode of payment significantly varies with age but not with gender in India. Only these two demographic factors were considered in their study. Alternatively, the choice of payment method for online food purchases can be influenced by multiple demographic factors other than gender and age, and the interplay between these factors can be complex. In addition, how frequently consumers order online food might also influence their choice of payment media. To the authors' knowledge, the impact of such demographic factors and order frequency has not yet been investigated on the preference of payment methods for buying food online.

The purpose of this study is to identify the payment methods that consumers utilize while buying ready-to-eat foods online. Specifically, this study investigates the preferred payment platforms of online food shoppers.

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Figure 1 represents the conceptual framework of the study.

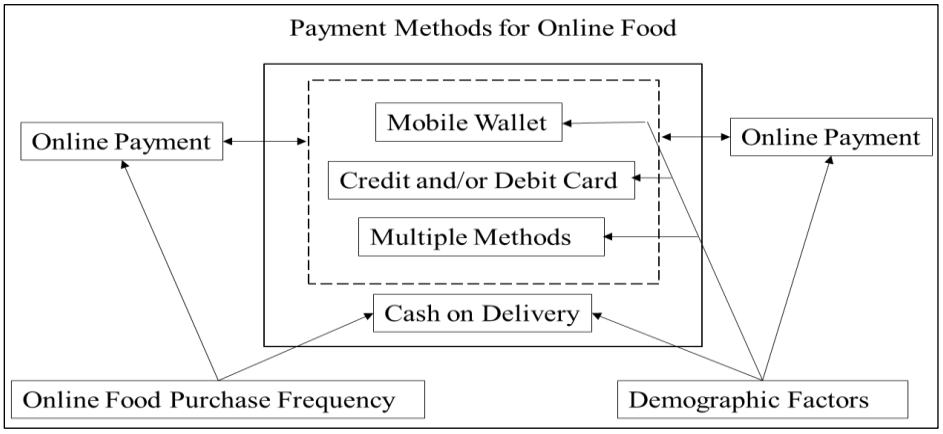

Figure 1: Research Framework

3. Methodology

All current consumers who order ready-to-eat food online make up the study's population. Both primary and secondary data and pertinent literature reviews are used in this research work. A systematic questionnaire survey that was circulated over both online and offline media was used to gather the primary data. Samples are chosen using a convenience, quota, and non-probabilistic judgmental sampling mix. 626 residents of Dhaka city took part in the study. However, only 540 respondents were found to buy food online. Therefore, only these respondents' data were used for analysis in this study. To provide a framework for the study, secondary sources including numerous research reports, publications, and websites have been examined. To comprehend the need for and relevance of such a study on the preferred payment methods used by online food consumers in Dhaka city, a thorough literature review is conducted. Only people who live in Dhaka, the capital of Bangladesh, are included in the survey. The scope of this research does not include a study of all Bangladeshis. This study is only able to analyze information that was gathered between March and May 2023, a three-month timeframe.

Descriptive statistics, frequency analysis, and cross-tabulation was used to present a descriptive overview of the sample, relative preferences of the payment methods by the sampled respondents and the impact of the demographic factors on the preference of payment methods respectively. The Chi-square independence test was used to determine whether there is significant difference among the different demographic groups in terms of their choices of payment methods.

A binary logistic regression has been conducted to

1. Model the link between payment methods for online food purchases and the demographic characteristics and purchase frequency.

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2. Identify which of the factors has a statistically significant effect on how people pay for food when they shop online.
3. Evaluate how effectively the model predicts the method of payment used by online food buyers.

For the logistic regression, age, household monthly income, and expenditure are used as continuous variables. On the other hand, gender, education, occupation, and purchase frequency serve as nominal variables. Therefore, the logistic regression model stands at

$$logit(payment\ method) = \beta_0 + \beta_1\ (Gender) + \beta_2\ (Monthly\ Income) + \beta_3(Education) + \beta_4(Age) + \beta_5\ (Occupation) + \beta_6\ (Monthly\ Expenditure\ for\ Online\ Food) + \beta_7(Purchase\ frequency) + \in$$

Where $\in$ *is the residuals.*

The linearity of the continuous variables concerning the logit of the payment method was assessed via the Box-Tidwell procedure. A Bonferroni correction was applied using all 23 terms in the model to adjust significance level to control the probability of type I error (false positive association). Statistical Product and Services Solutions (SPSS) 26 is used to do the analysis.

4. Findings and Analysis

4.1 Descriptive Statistics

The respondent profile is summarized in Table 1 by gender, age group, income group, education, occupation, and expenditure group. About 42% of respondents are women and 58% are men. 56.5 percent of those surveyed had earned their Bachelors. A significant percentage of individuals (28.9%) also have postgraduate degrees under their belts. 26.7% of respondents work in the private sector, and 60% are students. Adolescence (15–20), early adulthood (20–30), middle adulthood (30–45), late adulthood (45–60), and early old age (60–75) are the age categories for the participants. The early adulthood group (20–30) includes nearly 70% of the participants. 23.7% of the respondents are middle-aged adults (30-45). One-fourth of participants' wages are in the range of BDT 45,000 to 84,999. BDT 125,000-164,999 (23.7%) is the following income group range. Slightly more than one-fourth (28%) of the users spend BDT 2,000–2,999 each month on food purchases online. Responses for three variables - age, monthly household income, and monthly expenditure to buy food online have been collected as scale data. Their minimum, maximum, mean, and standard deviation are reflected in Table 2.

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Table 1: Respondent Profile

Characteristics	Category	Frequency	Percentages
Gender	Male	313	58%
	Female	227	42%
Age Group	<20	27	5%
	20-30	375	69.4%
	30-45	128	23.7%
	45-60	9	1.7%
	>60	1	0.2%
Income Group	<45000	92	17%
	45000-84999	135	25%
	85000-124999	83	15.4%
	125000-164999	128	23.7%
	165000-204999	43	8%
	>205000	59	10.9%
Education	Higher Secondary	50	11.1%
	Bachelor	214	56.5%
	Masters	96	28.9%
	Other	44	2.6%
Occupation	Student	324	60%
	Public Service	35	6.5%
	Private Service	144	26.7%
	Business	17	3.1%
	Homemaker	11	2%
	Other	6	1.1%
Expenditure Group	<1000	36	6.7%
	1000-1999	141	26.1%
	2000-2999	151	28%
	3000-3999	78	14.4%
	4000-4999	26	4.8%
	5000-5999	71	13.1%
	6000-9999	13	2.4%
	10000-13999	12	2.2%
	>=14000	12	2.2%
Total		540	100

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Table 2: Descriptive Statistics of Selected Variables

	N	Minimum	Maximum	Mean	Std. Deviation
Age (in years)	524	18	62	26.04	7.017
Household monthly income (in BDT)	449	4000	6000000	146993.32	322213.103
Monthly expenditure to purchase food online (in BDT)	494	200	55000	3294.03	4505.623

4.2 Preference for Payment Methods and Impact of Demographic Factors

The majority of participants chose cash on delivery as the mode of payment, as shown in Figure 2. A little over half of them do so via mobile financial services (MFS). Only 16.3% and 4.3%, in contrast, utilize net banking and credit and/or debit cards, respectively. 58.4% of those surveyed utilize more than one platform to make such payments.

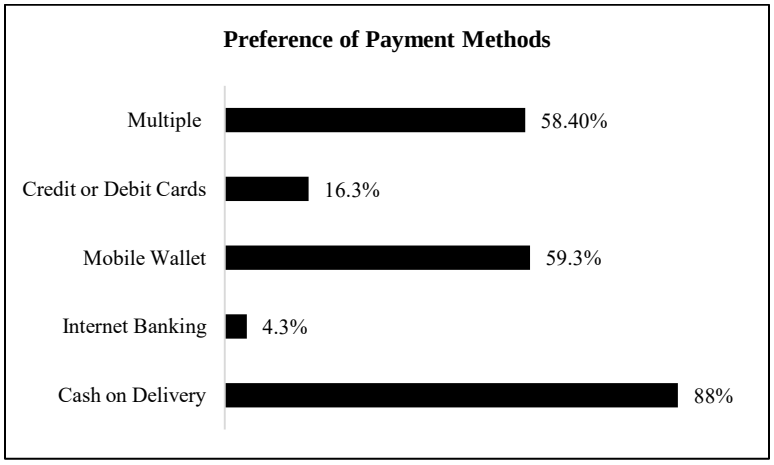

Figure 2: Payment Methods Used by the Participants

Online food buyers appear to have a strong preference for using cash on delivery as their method of payment. Chi-square tests have been carried out to determine whether any demographic factors affect their preference for payment methods. In the first stage of the Chi-square test, four kinds of payment methods—cash on delivery, mobile wallet, cards, and multiple payment methods—are taken into account to examine the impact of demographic characteristics and purchase frequency.

The choice of a certain payment method has been found to have a significant but weak relationship with gender [$\chi^2(3) = 13.087$, $p = 0.004$, Cramer's $V = 0.156$, $p = 0.04$]. Males (28.8%) utilize cash on delivery less frequently than females (40.3%) as shown in Table A1. Debit or credit card use is higher among females

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than males (4% vs. 1.6%). Males use MFS (6.7%) and various payment platforms (62.9%) more frequently than females (3.5% and 52.2%, respectively).

Except for late adults, all other age groups use a mix of payment methods. Only the 45-60 years age group is observed to rely more (66.7%) on cash as a method of payment compared to others (Table A2). Consumers are comfortable with multiple payment mechanisms across some demographic profiles such as their monthly income (Table A3) educational background (Table A4), and monthly expenditure for online food (Table A6). Exceptions are found for public service holders and homemakers. They prefer to pay cash on delivery to other payment processes (Table A5). Customers spending less than BDT 1000 also are more comfortable with cash as a payment mechanism (Table A6). As depicted in Tables A2, A3, A4, A5, and A6, the sample size is insufficient to produce an anticipated count of more than 5 in each cell for the other demographic characteristics and purchase frequency, hence chi-square tests cannot produce relevant findings.

4.3 Preference for Online Payment Methods vs. Cash on Delivery across Demographic Factors

Only two types of payment mechanisms—cash on delivery and online payment—have been considered in the second Chi-square test phase. i.e., except for cash payments, all other forms of payment systems are categorized as online payments at this stage. Here also gender exhibits a weak but significant association [$\chi^2(1) = 7.797$, $p = 0.005$, Cramer's $V = 0.120$, $p = 0.05$] with customers' preference for payment mechanisms. As shown in Table 3, males (71.2%) prefer online payment over females (59.7%), and females (40.3%) prefer cash on delivery over males (28.8%).

Table 3: Gender and Payment Methods

Gender	Cash on Delivery	Online Payment
Male	90 (28.8%)	223 (71.2%)
Female	91 (75.9%)	135 (59.7%)

Expected counts were less than five in the cases of age group, education, occupation, and expenditure group. Thus, these demographic parameters have not shown meaningful findings from the Chi-square tests due to insufficient sample size (Table A7). This was not the case for household monthly income. However, the choice of payment methods (online vs. cash on delivery) by consumers is not significantly correlated with household monthly income [$\chi^2(5) = 5.083$, $p = 0.406$] (Table A8).

Early adults (71.1% vs. 28.9%) and middle adults (58.6% vs. 41.4%) use digital payments more than cash on delivery as opposed to other age groups. Participants are found to prefer online payment methods to cash on delivery irrespective of educational background and the amount they spend for purchasing

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food online. Students (68.8% vs. 31.2%), private service holders (70.8% vs. 29.2%), and business executives (64.7% vs. 35.3%) also follow them. However, public service holders, homemakers, and consumers from other walks of life use cash on delivery more than cashless payment techniques (Table A7).

4.4 Preference for Payment Platforms vs. Purchase Frequency

Purchase frequency resulted in a moderately significant association [$\chi^2(4) = 47.028$, $p = 0.00$, Cramer's $V = 0.295$, $p = 0.00$] with the choice of payment platforms – online and cash. Table 4 shows that consumers prefer to pay online more frequently, the more frequently they buy food online. Those who place fewer orders, however, rely more on cash payment at the time of delivery. Almost 50% of the consumers who use online payment, order online food almost every week (Table A9). On the contrary, as depicted by Table A9, slightly more than half of the respondents who pay cash on delivery buy online food almost every month.

Table 4: Purchase Frequency and Payment Methods

Purchase Frequency	Cash on Delivery	Online payment
Once or twice a year	28 (62.2%)	17 (37.8%)
Monthly	96 (42.9%)	128 (57.1%)
Weekly	48 (22.1%)	169 (77.9%)
Almost everyday	4 (10.5%)	34 (89.5%)
Other	5 (33.3%)	10 (66.7%)

4.5 Impact of Demographic Factors and Order Frequency on Preference for Payment Platforms

Bonferroni correction using all 23 terms in the model resulted $p < 0.002174$, which indicate that the model is statistically significant. Also, the $\chi2(16) = 76.055$, $p < .001$ found from the overall model evaluation and goodness of fit (Table 5) indicate that the logistic regression model is statistically significant. Hosmer and Lemeshow test results in nonsignificant outcome ($p > 0.05$) indicating model fits strongly with the dataset (It is evident from the value of Exp(B) or the odds ratio that males have a 1.858 times higher likelihood of making online payments than females. In the context of Bangladesh, male population have broader access to technology, financial services in general and specifically credit cards and other online payment services. So, it is very much usual that male population will have higher likelihood to pay online. Purchasers older by a year are 0.921 times less likely to prefer online payment than a one-year younger purchasers. It is evident that younger generation are more adoptable to new technologies. Older population usually prefer old ways of doing things and often are hesitant to adopt to new technologies especially when dealing with money. Compared to the participants with HSC backgrounds, graduates have 2.18 times, postgraduates have 4.284 times and other background people have

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34.032 times higher odds to pay online. Education has direct relationship with adoption to technology and access to online financial services, especially credit cards and debit cards. Hence higher the education level higher the odds of preferring online payment methods. However, while observing the influence of occupation on the preference of online payment method, results seem apparently perplexing. Public service holders have only 0.202 times the chance to use online payment methods as compared to students. The odds ratios are higher for private sector employees (1.218), business men/women (1.948) and home makers (4.376). That means home makers are 4.376 times more likely to pay online than students. Here, home makers mean stay home moms, who may have access to online payment services from the family and perhaps order food for the family. Respondents purchasing online food every week have 4.142 times and those buying online food almost every day have a 12.444 times greater likelihood to prefer online payment than those buying only once or twice a year. Higher the frequency of online food purchase, better acquaintance developes in making online payment and also the food delivery companies and online payment platforms often offer certain perks such as discount, reward points etc. to entice customers make online payment. These may be the reason behind the higher odds ratio of more frequent online food purchasers.

). The model explained 22.9% (Nagelkerke R2) of the variance in the selection of payment methods (Table A10) and correctly classified 73.6% of cases as depicted in Table 6.

Table 5: Overall Model Evaluation and Goodness of Fit

Tests	χ^2	df	P
Omnibus test of model coefficients	76.055	16	0.000
Hosmer and Lemeshow test	3.705	8	0.883

Table 6: Classification Table

Observed		Predicted		
		Online Payment		Percentage Correct
		No	Yes	
Online Payment	No	43	95	31.2
	Yes	17	269	94.1
Overall Percentage				73.6

Table 6 delineates that sensitivity i.e., online payment predicted truly as online payment was 94.1%, and specificity indicating cash on delivery predicted as cash on delivery was 31.2%.

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The positive predictive value was 73.9% indicating the proportion of the participants predicted by the model as paying online are truly paying online (269) among the total number of respondents the model is predicting to pay online (95+269=364). Similarly negative predictive value was 71.67% reflecting the proportion of respondents truly paying cash on delivery (43) among the total number of participants the model is forecasting to pay cash on delivery (43+17=60).

The results of the Binary Logistic Regression are presented in Table 7. As evident from Sig. value less than 0.05, of the seven predictor variables, five are statistically significant namely, gender (0.01), education level (0.017), age (0.015), occupation (0.029), and purchase frequency (0.001). The other two variables namely household monthly income (0.946) and monthly expenditure to purchase food online (0.688) do not have statistically significant influence on the preference of online payment method. The signs of the coefficient B indicate the direction of the relationship between the independent and the dependent variables. Education level and frequency of ordering online food show positive association with the preference of online payment method, where as age has negative association. Younger people prefer to pay online. Occupation has mixed influence on the preference of online payment.

Table 7: Results of Binary Logistic Regression

Predictors	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Gender (1)	.620	.240	6.656	1	.010	1.858	1.161	2.976
Household monthly income (in BDT)	.000	.000	.005	1	.946	1.000	1.000	1.000
Education level			10.130	3	.017			
Education level (1)	.779	.352	4.912	1	.027	2.180	1.094	4.343
Education level (2)	1.455	.519	7.863	1	.005	4.284	1.550	11.844
Education level (3)	3.527	1.483	5.658	1	.017	34.032	1.860	622.504
Age (in years)	-.082	.034	5.958	1	.015	.921	.862	.984
Occupation			12.499	5	.029			
Occupation (1)	-1.601	.686	5.441	1	.020	.202	.053	.774
Occupation (2)	.197	.431	.210	1	.647	1.218	.524	2.835
Occupation (3)	.667	.821	.660	1	.417	1.948	.390	9.739
Occupation (4)	1.476	1.141	1.674	1	.196	4.376	.468	40.952
Occupation (5)	-22.442	19519.645	.000	1	.999	.000	.000	.
Monthly expenditure to purchase food online (in BDT)	.000	.000	.161	1	.688	1.000	1.000	1.000
Frequency of ordering			19.664	4	.001			

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Predictors	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Frequency of ordering (1)	.573	.418	1.876	1	.171	1.773	.781	4.023
Frequency of ordering (2)	1.421	.439	10.501	1	.001	4.142	1.753	9.784
Frequency of ordering (3)	2.521	.778	10.509	1	.001	12.444	2.710	57.142
Frequency of ordering (4)	.775	.757	1.050	1	.306	2.171	.493	9.571
Constant	.643	.869	.548	1	.459	1.903		

Gender: Reference: Female, (1) Male.

Education level: Reference HSC, (1) Bachelor, (2) Masters, (3) Other.

Occupation: Reference Student, (1) Public service holder, (2) Private service holder, (3) Business, (4) Homemaker, (5) Other.

Frequency of ordering: Reference Once or twice a year, (1) Monthly, (2) Weekly, (3) Almost every day, (4) Other.

It is evident from the value of Exp(B) or the odds ratio that males have a 1.858 times higher likelihood of making online payments than females. In the context of Bangladesh, male population have broader access to technology, financial services in general and specifically credit cards and other online payment services. So, it is very much usual that male population will have higher likelihood to pay online. Purchasers older by a year are 0.921 times less likely to prefer online payment than a one-year younger purchasers. It is evident that younger generation are more adoptable to new technologies. Older population usually prefer old ways of doing things and often are hesitant to adopt to new technologies especially when dealing with money. Compared to the participants with HSC backgrounds, graduates have 2.18 times, postgraduates have 4.284 times and other background people have 34.032 times higher odds to pay online. Education has direct relationship with adoption to technology and access to online financial services, especially credit cards and debit cards. Hence higher the education level higher the odds of preferring online payment methods. However, while observing the influence of occupation on the preference of online payment method, results seem apparently perplexing. Public service holders have only 0.202 times the chance to use online payment methods as compared to students. The odds ratios are higher for private sector employees (1.218), business men/women (1.948) and home makers (4.376). That means home makers are 4.376 times more likely to pay online than students. Here, home makers mean stay home moms, who may have access to online payment services from the family and perhaps order food for the family. Respondents purchasing online food every week have 4.142 times and those buying online food almost every day have a 12.444 times greater likelihood to prefer online payment than those buying only once or twice a year. Higher the frequency of online food purchase, better acquaintance developes in making online payment and also the food delivery companies and online payment platforms often offer certain perks such as discount, reward points etc. to entice customers make online payment.

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These may be the reason behind the higher odds ratio of more frequent online food purchasers.

5. Conclusion

This research aims to identify the demographic factors that determine the various payment mechanisms used by online food purchasers. It has been found that among the different methods consisting of cash and cashless payments (MFS, net banking, debit, and credit cards) most of the buyers prefer a cash payment to non-cash payment techniques. Further investigation depicts that, women prefer cash on delivery over men. However, the possibility of using digital payment increases with the volume of orders they place. Both the Chi-square test and logistic regression support such findings. In addition, logistic regression offers a meaningful model to explain how respondents behave when paying for the food they order online. Despite being significant, the model can only account for 22.9% of the variance in the preferred payment systems. The model demonstrates that in addition to gender and order frequency, other factors such as age, education, and occupation can accurately predict the preferred payment method. The findings from this research assist food vendors and marketers in comprehending consumers' payment practices. Understanding how customers' demographic characteristics and purchase frequency influence payment method preferences helps online food businesses tailor their offerings, and hence, attract and retain customers from different demographic segments. Providing a range of payment options that cater to the needs of both occasional and frequent buyers can enhance the overall shopping experience, encourage repeat purchases, and foster customer loyalty.

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APPENDIX

Table A1: Choice of Payment Methods across Gender

			Payment Method				Total
			Cash on Delivery	Mobile Wallet	Credit and/or Debit Card	Multiple Payment Methods	
Gender	Male	Count	90	21	5	197	313
		Expected Count	105.1	16.8	8.1	182.9	313.0
		% within Gender	28.8%	6.7%	1.6%	62.9%	100.0%
	Female	Count	91	8	9	118	226
		Expected Count	75.9	12.2	5.9	132.1	226.0
		% within Gender	40.3%	3.5%	4.0%	52.2%	100.0%
Total		Count	181	29	14	315	539
		Expected Count	181.0	29.0	14.0	315.0	539.0
		% within Gender	33.6%	5.4%	2.6%	58.4%	100.0%

Table A2: Choice of Payment Methods across Age Groups

			Payment Method				Total
			Cash on Delivery	Mobile Wallet	Credit and/or Debit Card	Multiple Payment Method	
Age Group (in years)	<20	Count	14	0	0	13	27
		Expected Count	9.1	1.5	.7	15.8	27.0
		% Age in years	51.9%	0.0%	0.0%	48.1%	100.0%
	20-30	Count	108	19	6	241	374
		Expected Count	125.6	20.1	9.7	218.6	374.0
		% Age in years	28.9%	5.1%	1.6%	64.4%	100.0%
	30-45	Count	53	8	8	59	128
		Expected Count	43.0	6.9	3.3	74.8	128.0
		% Age in years	41.4%	6.3%	6.3%	46.1%	100.0%
	45-60	Count	6	2	0	1	9
		Expected Count	3.0	.5	.2	5.3	9.0
		% Age in years	66.7%	22.2%	0.0%	11.1%	100.0%
	>60	Count	0	0	0	1	1
		Expected Count	.3	.1	.0	.6	1.0
		% Age in years	0.0%	0.0%	0.0%	100.0%	100.0%
Total		Count	181	29	14	315	539
		Expected Count	181.0	29.0	14.0	315.0	539.0
		% Age in years	33.6%	5.4%	2.6%	58.4%	100.0%

Note: EC = Expected Count; % Age in years= % within Age Group (in years)

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Table A3: Choice of Payment Methods across Income Groups

			Payment Method				Total
			Cash on Delivery	Mobile Wallet	Credit and/or Debit Card	Multiple Payment Method	
Household monthly income group (in BDT)	<45000	Count	32	6	0	54	92
		Expected Count	30.9	4.9	2.4	53.8	92.0
		% Household in BDT	34.8%	6.5%	0.0%	58.7%	100.0%
	45000-84999	Count	47	7	2	79	135
		Expected Count	45.3	7.3	3.5	78.9	135.0
		% Household in BDT	34.8%	5.2%	1.5%	58.5%	100.0%
	85000-124999	Count	32	5	0	46	83
		Expected Count	27.9	4.5	2.2	48.5	83.0
		% Household in BDT	38.6%	6.0%	0.0%	55.4%	100.0%
	125000-164999	Count	45	7	7	68	127
		Expected Count	42.6	6.8	3.3	74.2	127.0
		% Household in BDT	35.4%	5.5%	5.5%	53.5%	100.0%
	165000-204999	Count	10	3	0	30	43
		Expected Count	14.4	2.3	1.1	25.1	43.0
		% Household in BDT	23.3%	7.0%	0.0%	69.8%	100.0%
	>=245000	Count	15	1	5	38	59
		Expected Count	19.8	3.2	1.5	34.5	59.0
		% Household in BDT	25.4%	1.7%	8.5%	64.4%	100.0%
Total		Count	181	29	14	315	539
		Expected Count	181.0	29.0	14.0	315.0	539.0
		% Household in BDT	33.6%	5.4%	2.6%	58.4%	100.0%

Note: EC = Expected Count; % Household in BDT= % within Household monthly income group (in BDT)

Table A4: Choice of Payment Methods across Education

			Payment Method				Total
			Cash on Delivery	Mobile Wallet	Credit and/or Debit Card	Multiple Payment Method	
Education level	Higher Secondary	Count	22	5	0	33	60
		Expected Count	20.0	3.1	1.6	35.3	60.0
		% Education level	36.7%	8.3%	0.0%	55.0%	100.0%
	Bachelor	Count	92	9	7	197	305
		Expected Count	101.5	16.0	8.0	179.6	305.0
		% Education level	30.2%	3.0%	2.3%	64.6%	100.0%
	Masters	Count	58	12	7	79	156
		Expected Count	51.9	8.2	4.1	91.9	156.0
		% Education level	37.2%	7.7%	4.5%	50.6%	100.0%
	Other	Count	6	2	0	6	14
		Expected Count	4.7	.7	.4	8.2	14.0

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			Payment Method				Total
			Cash on Delivery	Mobile Wallet	Credit and/or Debit Card	Multiple Payment Method	
		% Education level	42.9%	14.3%	0.0%	42.9%	100.0%
Total		Count	178	28	14	315	535
		Expected Count	178.0	28.0	14.0	315.0	535.0
		% Education level	33.3%	5.2%	2.6%	58.9%	100.0%

Note: EC = Expected Count; % Education level = % within Education level

Table A5: Choice of Payment Methods across Occupation

			Payment Method				Total
			Cash on Delivery	Mobile Wallet	Credit and/or Debit Card	Multiple Payment Method	
Occupation	Student	Count	101	14	2	207	324
		Expected Count	108.6	17.5	8.4	189.5	324.0
		% Occupation	31.2%	4.3%	0.6%	63.9%	100.0%
	Public Service	Count	21	5	0	9	35
		Expected Count	11.7	1.9	.9	20.5	35.0
		% Occupation	60.0%	14.3%	0.0%	25.7%	100.0%
	Private Service	Count	42	9	10	83	144
		Expected Count	48.3	7.8	3.8	84.2	144.0
		% Occupation	29.2%	6.3%	6.9%	57.6%	100.0%
	Business	Count	6	0	2	9	17
		Expected Count	5.7	.9	.4	9.9	17.0
		% Occupation	35.3%	0.0%	11.8%	52.9%	100.0%
	Homemaker	Count	6	1	0	4	11
		Expected Count	3.7	.6	.3	6.4	11.0
		% Occupation	54.5%	9.1%	0.0%	36.4%	100.0%
	Other	Count	4	0	0	2	6
		Expected Count	2.0	.3	.2	3.5	6.0
		% Occupation	66.7%	0.0%	0.0%	33.3%	100.0%
Total		Count	180	29	14	314	537
		Expected Count	180.0	29.0	14.0	314.0	537.0
		% Occupation	33.5%	5.4%	2.6%	58.5%	100.0%

Note: EC = Expected Count; % Occupation = % within Occupation

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Table A6: Choice of Payment Methods across Expenditure Group

			Payment Method				Total
			Cash on Delivery	Mobile Wallet	Credit and/or Debit Card	Multiple Payment Method	
Expenditure Group (in BDT)	<1000	Count	17	2	4	13	36
		Expected Count	12.1	1.9	.9	21.0	36.0
		% Expenditure	47.2%	5.6%	11.1%	36.1%	100.0%
	1000-1999	Count	57	9	2	73	141
		Expected Count	47.3	7.6	3.7	82.4	141.0
		% Expenditure	40.4%	6.4%	1.4%	51.8%	100.0%
	2000-2999	Count	51	7	1	91	150
		Expected Count	50.4	8.1	3.9	87.7	150.0
		% Expenditure	34.0%	4.7%	0.7%	60.7%	100.0%
	3000-3999	Count	24	2	5	47	78
		Expected Count	26.2	4.2	2.0	45.6	78.0
		% Expenditure	30.8%	2.6%	6.4%	60.3%	100.0%
	4000-4999	Count	6	3	0	17	26
		Expected Count	8.7	1.4	.7	15.2	26.0
		% Expenditure	23.1%	11.5%	0.0%	65.4%	100.0%
	5000-5999	Count	19	4	0	48	71
		Expected Count	23.8	3.8	1.8	41.5	71.0
		% Expenditure	26.8%	5.6%	0.0%	67.6%	100.0%
	6000-9999	Count	2	1	0	10	13
		Expected Count	4.4	.7	.3	7.6	13.0
		% Expenditure	15.4%	7.7%	0.0%	76.9%	100.0%
	10000-13999	Count	2	1	0	9	12
		Expected Count	4.0	.6	.3	7.0	12.0
		% Expenditure	16.7%	8.3%	0.0%	75.0%	100.0%
	>=14000	Count	3	0	2	7	12
		Expected Count	4.0	.6	.3	7.0	12.0
		% Expenditure	25.0%	0.0%	16.7%	58.3%	100.0%
Total		Count	181	29	14	315	539
		Expected Count	181.0	29.0	14.0	315.0	539.0
		% Expenditure	33.6%	5.4%	2.6%	58.4%	100.0%

Note: EC = Expected Count; % Expenditure = % within Expenditure Group (in BDT)

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Table A7: Choice of Online Payment Methods Vs. Cash on Delivery across Age Groups, Education, Occupation, Expenditure Groups

			Online Payment		Total
			No	Yes	
Age Group (in years)	<20	Count	14	13	27
		Expected Count	9.1	17.9	27.0
		% within Age Group (in years)	51.9%	48.1%	100.0%
	20-30	Count	108	266	374
		Expected Count	125.6	248.4	374.0
		% within Age Group (in years)	28.9%	71.1%	100.0%
	30-45	Count	53	75	128
		Expected Count	43.0	85.0	128.0
		% within Age Group (in years)	41.4%	58.6%	100.0%
	45-60	Count	6	3	9
		Expected Count	3.0	6.0	9.0
		% within Age Group (in years)	66.7%	33.3%	100.0%
	>60	Count	0	1	1
		Expected Count	.3	.7	1.0
		% within Age Group (in years)	0.0%	100.0%	100.0%
Total		Count	181	358	539
		Expected Count	181.0	358.0	539.0
		% within Age Group (in years)	33.6%	66.4%	100.0%
Education level	Higher Secondary	Count	22	38	60
		Expected Count	20.0	40.0	60.0
		% within Education level	36.7%	63.3%	100.0%
	Bachelor	Count	92	213	305
		Expected Count	101.5	203.5	305.0
		% within Education level	30.2%	69.8%	100.0%
	Masters	Count	58	98	156
		Expected Count	51.9	104.1	156.0
		% within Education level	37.2%	62.8%	100.0%
	Other	Count	6	8	14
		Expected Count	4.7	9.3	14.0
		% within Education level	42.9%	57.1%	100.0%
Total		Count	178	357	535
		Expected Count	178.0	357.0	535.0
		% within Education level	33.3%	66.7%	100.0%
Occupation	Student	Count	101	223	324
		Expected Count	108.6	215.4	324.0
		% within Occupation	31.2%	68.8%	100.0%
	Public Service	Count	21	14	35
		Expected Count	11.7	23.3	35.0
		% within Occupation	60.0%	40.0%	100.0%
	Private	Count	42	102	144

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			Online Payment		Total
			No	Yes	
	Service	Expected Count	48.3	95.7	144.0
		% within Occupation	29.2%	70.8%	100.0%
	Business	Count	6	11	17
		Expected Count	5.7	11.3	17.0
		% within Occupation	35.3%	64.7%	100.0%
	Homemaker	Count	6	5	11
		Expected Count	3.7	7.3	11.0
		% within Occupation	54.5%	45.5%	100.0%
	Other	Count	4	2	6
		Expected Count	2.0	4.0	6.0
		% within Occupation	66.7%	33.3%	100.0%
Total		Count	180	357	537
		Expected Count	180.0	357.0	537.0
		% within Occupation	33.5%	66.5%	100.0%
Expenditure Group (in BDT)	<1000	Count	17	19	36
		Expected Count	12.1	23.9	36.0
		% within Expenditure Group (in BDT)	47.2%	52.8%	100.0%
	1000-1999	Count	57	84	141
		Expected Count	47.3	93.7	141.0
		% within Expenditure Group (in BDT)	40.4%	59.6%	100.0%
	2000-2999	Count	51	99	150
		Expected Count	50.4	99.6	150.0
		% within Expenditure Group (in BDT)	34.0%	66.0%	100.0%
	3000-3999	Count	24	54	78
		Expected Count	26.2	51.8	78.0
		% within Expenditure Group (in BDT)	30.8%	69.2%	100.0%
	4000-4999	Count	6	20	26
		Expected Count	8.7	17.3	26.0
		% within Expenditure Group (in BDT)	23.1%	76.9%	100.0%
	5000-5999	Count	19	52	71
		Expected Count	23.8	47.2	71.0
		% within Expenditure Group (in BDT)	26.8%	73.2%	100.0%
	6000-9999	Count	2	11	13
		Expected Count	4.4	8.6	13.0
		% within Expenditure Group (in BDT)	15.4%	84.6%	100.0%
	10000-13999	Count	2	10	12
		Expected Count	4.0	8.0	12.0

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			Online Payment		Total
			No	Yes	
		% within Expenditure Group (in BDT)	16.7%	83.3%	100.0%
	>=14000	Count	3	9	12
		Expected Count	4.0	8.0	12.0
		% within Expenditure Group (in BDT)	25.0%	75.0%	100.0%
Total		Count	181	358	539
		Expected Count	181.0	358.0	539.0
		% within Expenditure Group (in BDT)	33.6%	66.4%	100.0%

Table A8: Choice of Online Payment Methods Vs. Cash on Delivery across Income Groups

			Online Payment		Total
			No	Yes	
Household monthly income group (in BDT)	<45000	Count	32	60	92
		Expected Count	30.9	61.1	92.0
		% Household income	34.8%	65.2%	100.0%
	45000-84999	Count	47	88	135
		Expected Count	45.3	89.7	135.0
		% Household income	34.8%	65.2%	100.0%
	85000-124999	Count	32	51	83
		Expected Count	27.9	55.1	83.0
		% Household income	38.6%	61.4%	100.0%
	125000-164999	Count	45	82	127
		Expected Count	42.6	84.4	127.0
		% Household income	35.4%	64.6%	100.0%
	165000-204999	Count	10	33	43
		Expected Count	14.4	28.6	43.0
		% Household income	23.3%	76.7%	100.0%
	>=245000	Count	15	44	59
		Expected Count	19.8	39.2	59.0
		% Household income	25.4%	74.6%	100.0%
Total		Count	181	358	539
		Expected Count	181.0	358.0	539.0
		% Household income	33.6%	66.4%	100.0%

Note: EC = Expected Count; % Household income = % within Household monthly income group (in BDT)

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Table A9: Frequency of Purchasing Online Food vs. Online Payment

			Online Payment		
			No	Yes	Total
Frequency of online food ordering	Once or twice a year	Count	28	17	45
		Expected Count	15.1	29.9	45.0
		% of food ordering	62.2%	37.8%	100.0%
		% Online Payment	15.5%	4.7%	8.3%
	Monthly	Count	96	128	224
		Expected Count	75.2	148.8	224.0
		% of food ordering	42.9%	57.1%	100.0%
		% Online Payment	53.0%	35.8%	41.6%
	Weekly	Count	48	169	217
		Expected Count	72.9	144.1	217.0
		% of food ordering	22.1%	77.9%	100.0%
		% Online Payment	26.5%	47.2%	40.3%
	Almost everyday	Count	4	34	38
		Expected Count	12.8	25.2	38.0
		% of food ordering	10.5%	89.5%	100.0%
		% Online Payment	2.2%	9.5%	7.1%
	Other	Count	5	10	15
		Expected Count	5.0	10.0	15.0
		% of food ordering	33.3%	66.7%	100.0%
		% Online Payment	2.8%	2.8%	2.8%
Total		Count	181	358	539
		Expected Count	181.0	358.0	539.0
		% of food ordering	33.6%	66.4%	100.0%
		% Online Payment	100.0%	100.0%	100.0%

Note: EC = Expected Count; % of online food ordering = % within Frequency of online food ordering; % Online Payment =% within Online Payment

Table A10: Model Summary of Logistic Regression

-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
458.970	.164	.229

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Factors Influencing Consumers' Continuance Usage Intention Toward Food Delivery Apps during COVID-19 in Bangladesh

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Abstract: *The aim of this research is to identify the factors that are crucial to formulating consumers' attitude toward using food delivery apps (FDAs) continuingly during the coronavirus pandemic. Due to the pandemic, the catering enterprises changed their way of doing business significantly and gone through a digital transformation to survive. Consequently, this marked a shift in consumers' attitude towards FDAs. To understand the shift and how consumers' technological and mental perceptions are contributing to continuance usage intentions, a hypothetical model was proposed using variables from Unified Theory of Acceptance and Use of Technology (UTAUT), Expectancy Confirmation Model (ECM) and the Task-Technology fit Model. A structured questionnaire was used to collect feedback from the repeat users of the FDAs through online social media sites and food review groups. In total 198 valid responses were gathered and analyzed. Structural Equation Modeling (SEM) through AMOS 26 was utilized to test the proposed model fit. Some items in the constructs had to be dropped off to make the model fit. Initially four hypotheses were proposed. Among them only two were validated. The outcomes show that satisfaction and social influence have significant positive impact in determining continuance usage intention toward FDAs among Bangladeshi consumers. While perceived Task-technology fit and trust have non-significant relationship with consumers' continuance intention. These insights might prove helpful for both online food aggregators and catering businesses in designing marketing plan and formulating effective strategies to build a sustainable consumer base. Future research can extend the model by adding more variables to understand relevant technology's continuance usage intention. This paper is a unique contribution to the existing literature on FDA continuance intention on coronavirus emergency because no previous studies were undertaken to investigate Bangladeshi consumers. So, this is an original piece of work according to the best of the researchers' knowledge.*

Keywords: *Continuance usage intention; Satisfaction; Trust; Perceived Task-Technology Fit; Food Delivery Apps; COVID-19; Bangladesh.*

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1.0 Introduction

1.1 Background of Study

The rapid proliferation of cheap smart devices induced millions of people around the globe to adopt smartphones. The multiple functional benefits offered by smartphones have resulted in particular popularity among consumers. 62% of the population of Bangladesh will adopt smartphones by the year 2025 (GSMA, 2021). The robust development of internet infrastructure in Bangladesh has contributed to consumers using app-based services. FDAs are among the most popular mobile application-based services till date (Statistia, 2021a). The functionality of FDAs, convenient online order placement and offline doorstep delivery may be attributed to the popularity of FDAs among both consumers and restaurants alike. FDAs act as an interface for consumers and catering businesses to interact without meeting the actual staff of the catering enterprises.

Meanwhile, COVID-19 emerged as a global public health emergency with the first confirmed case found in Wuhan, China in December 2019 and gradually reaching all countries of the world (WHO, 2020). In Bangladesh, the first confirmed COVID-19 case was found on 8th March, 2020 (Islam et al., 2020). Health authorities emphasized hand washing, wearing masks, social distancing and avoiding gathering and travel restrictions to slow down the spread of coronavirus and contain it locally. Government authorities around the world enforced strict lockdowns from time to time during COVID-19, imposing restrictions on mobility and limiting public service. These measures severely affected restaurants and catering businesses. With no dine-in facility available, the revenue suffered (Statistia, 2021b). That is where FDAs and online food aggregators came to rescue the traditional restaurant businesses. More and more traditional restaurant businesses registered with FDAs providers and the traditional catering industry saw a digital transformation.

Moreover, FDAs started providing additional services to the consumers such as groceries, essentials, medicines and rations supply and COVID insurance to riders. In the new normal situation, FDAs satisfied consumers' food and daily necessities demand and provided safety and convenience (Zhao and Bacao, 2020).

To ensure sustained operations during and after the pandemic businesses need to understand the consumer landscape better. Although a number of works deal with FDA adoption, the literature on continuance intention is limited and focused on different cultural contexts. This study will try to explore factors crucial to FDAs continuance intention in Bangladesh context. The emergence of new strains and recurring waves of coronavirus across the countries imply that this pandemic is not going to be over very soon and the new normal situation will persist. Consequently, this study will help existing online food aggregators and catering enterprises to understand the Bangladeshi consumers better and formulate effective strategies.

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1.2 Research Gap

The existing literature on FDAs is quite scarce, as most of the relevant literature exists on online Food delivery service (OFDS). Even though some research exists on FDA adoption, the number of works on continuance intention is limited and deals with consumers of different cultural contexts. So, there is a gap in related research as it is well accepted in consumer behavior literature that findings of one country or cultural context may not be generalizable to another country or culture (Leo et al., 2005). As no prior work had been done in the context of Bangladesh, this work attempts to understand antecedents of continuance intention toward using FDAs during COVID-19 emergency situation among Bangladeshi consumers. Thus, it is a unique piece of work according to the best of the researchers' knowledge.

1.3 Research Objective

This study tries to sufficiently address the following two research questions:

1) What are the specific factors that are determining continuance usage intention of FDAs among Bangladeshi consumers amid COVID-19?
2) What can third-party online food aggregators do to influence consumers' continuingly using FDAs in Bangladesh?

1.4 Scope of the Research

This study only focuses on technological and mental expectations of consumers that are contributing to continuance intention of using FDAs in a specific emergency of coronavirus pandemic in Bangladesh context. Technology specific characteristics of FDAs are out of the scope of this study.

The data collection period of the study was from 6th January of 2021 to 3rd February of 2021. So, the results of this study only reflect consumers' perceptions regarding FDAs at that time frame.

1.5 Research Limitations

This study has a few limitations. Due to the COVID-19 crisis, data were collected through an online medium and practical one-to-one data collection was not possible. Due to internet connectivity not being the same among different groups of individuals thus, the variability of the response was not high. Again, this was the first attempt of the researcher in building a model and thus some items had to be dropped to make the model fit.

1.6 Structure of the paper

The next section provides a literature review and hypothesis development. The hypothesized model is showcased in section 03. Section 04 describes research methodology including measurement development and data collection. The reliability and validity tests as well as hypothesis tests are provided in section 05. Section 06 discusses the model results with implication towards marketing as well as theoretical perspectives. Section 07 concludes the paper with future suggestions.

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2.0 Literature Review & Hypothesis Development

2.1 Food delivery apps

FDA is a mobile application-based service that allows consumers to place online order and receive offline delivery service. It offers convenience to the consumer by delivering food to their doorsteps and acts as a platform for catering businesses and consumers to interact. Well known restaurant chains such as Pizza Hut, Pizzaburg, Domino's or Sultan's Dine have developed their own FDA. Meanwhile the third-party online food aggregators' FDAs enjoy much more popularity as they offer consumers to order foods from a wide range of restaurants and catering enterprises. Examples of this category include FoodPanda, Pathao Food, Shohoz Food, HungryNaki, Khaas Food, Cookups, Foodfex, and Kludio. In the ongoing coronavirus epidemic context, the features of FDAs proved to be extremely beneficial to consumers, especially the contactless delivery service. Furthermore, FDAs started new ancillary services such as groceries and daily necessities supply, over-the-counter drugs and rations supply to the consumers. These extra services fulfilled the consumers' demand of enjoying food conveniently and enabled them to effectively maintain social distancing. Consequently, consumers' attitude towards FDAs has shifted positively and online food buying budgets have seen a significant increase. Previous researchers focused on FDA behavioral intention or adoption in varied cultural contexts. Yeo et al., (2017) applied Theory of Reasoned Action and Theory of Planned Behavior to investigate Malaysian consumers' behavioral intentions toward FDAs. They concluded that hedonic motivation, price and time-saving motivation, online purchase experience, convenience, perceived usefulness all have significant positive influence on behavioral intention. In the context of South Korean consumers, Lee et al., (2019) utilized the Unified Theory of Acceptance and Use of Technology 2 (UTAUT2) model and validated that social influence, habit and information quality is associated with FDA continuance intention. Additionally, Roh and Park (2019) used the Technology Acceptance Model (TAM) and concluded that subjective norm, compatibility and perceived usefulness are significant antecedents of FDA adoption. In one of the studies on Chinese consumers, Cho et al., (2019) showed trustworthiness to be the single most significant determiner of users' continuance intention while disregarding additional contributing factors. In another study, Zhao and Bacao (2020) integrated variables from Task-Technology fit model to confirm antecedents of Chinese consumers' continuance intention of using FDAs during the COVID-19 pandemic. Satisfaction, in their findings, had the most crucial role to play in formulating consumers' attitudes toward continuingly using FDAs. At one study in the Middle Eastern context of Jordanian consumers, UTAUT2 variables combined with online tracking, rating and reviews features were found to have significant positive relation with consumers' continuance intention during the new normal situation (Alalwan, 2020). Kapoor and Vij (2018), in India explored technology specific characteristics of FDAs and confirmed that navigational design, information design, visual design, and collaboration design

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had significant positive relationship with conversion rate. In another study on Indian consumers, Ray et al., (2019) validated that ease of use, customer experience had significant positive influence on the adoption intentions of consumers and this study largely overlooked technology characteristics of FDAs. Saad (2021) focused on online food delivery services in Bangladesh. Therefore, this study incorporates variables from UTAUT, ECM and Task-Technology fit model for better understanding Bangladeshi consumer dimension and identifying the factors critical to continuance intention during COVID-19 pandemic.

2.2 Relevant Theories

Unified Theory of Acceptance and Use of Technology (UTAUT)

The UTAUT model is extremely beneficial to explain consumers' adoption of emerging technologies. The model is a derivative of the TAM (Venkatesh et al., 2003). Several previous studies add extra variables with the UTAUT model to investigate continuance intention of mobile technologies. For instance, Abu-Taieh et al., (2022) expanded UTAUT with the theory of planned behavior (TPB) to prove significant positive influence on customers' continued intention to use mobile banking in Jordan. Furthermore, Alalwan (2020) showed that the extended UTAUT model can be combined with variables from other models to describe continued intention to reuse mobile food ordering apps.

Expectancy confirmation model (ECM)

The ECM model, developed by Bhattacherjee (2001) is quite popular among technology continuance usage researchers. The fundamental component of ECM is expectations, confirmation and satisfaction. Till its inception ECM is widely used in exploring mobile technology continuance intention. Tam et al., (2020) combined ECM variables with UTAUT2 variables to investigate mobile apps continuance intention. Wang et al., (2022) incorporated trust with the ECM and validated trust and satisfaction impact continuance intention positively in the case of mobile food ordering apps.

Task- Technology fit model

The Task-technology fit is extremely crucial in the technology adoption stage. Goodhue and Thompson (1995) argue that a particular technology will receive positive behavioral intention if the technology function matches the user's task. In this COVID-19 pandemic period, FDAs functions provide a contactless food delivery service which is beneficial to consumers as it helps them to effectively maintain social distancing. At the same time FDAs fulfill consumers' requirement of efficient food supply while dine-in options are limited. The Task-technology fit model was applied to explore determinants of information system or service adoption (Kuo and Lee, 2011). Moreover, Task-technology fit model is compatible with other models such as TAM to investigate continuance intention of using wireless technology (Yen et al., 2010).

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2.3 Hypothesis Development

The UTAUT and the Task-Technology Fit model's primary emphasis is on technology's initial adoption while the ECM focuses on technology's continuance intentions. Technological expectations are prime focus in both the UTAUT and the Task-Technology Fit model while ECM focuses on mental expectations. In other words, UTAUT, Task-Technology Fit, and ECM complemented each other in explaining technology's continuance usage intention. So, this study incorporates social influence from UTAUT, perceived task-technology fit from task-technology fit model, satisfaction from ECM and another additional variable trust to analyze continuance intention of FDAs usage during the COVID-19.

Perceived Task-Technology Fit

In terms of information systems adoption, Perceived task-technology fit (TTF) is a significant antecedent (Goodhue and Thompson, 1995). It is in the core of the task-technology fit model. It essentially argues that users' will adopt a certain technology if their individual task matches technology's functions. TTF as an extra variable with UTAUT2 variables explained continuance intention of certain mobile technologies such as mobile payments (Wu et al., 2021) and knowledge management systems (Kuo and Lee, 2011). FDAs allow the consumers to enjoy the delivered food at the safety of their home and maintain social distancing. In Bangladesh, FDAs providers launched contactless delivery amid the COVID-19 pandemic. These specific FDA functions are beneficial to consumers in the pandemic period. So, this study assumes that:

H1: Perceived Task-technology fit has a positive relationship with continuance intention of using FDAs during the COVID-19.

Social influence

As defined by Venkatesh et al., (2003) in the UTAUT, social influence is the influence of society on an individual's attitude to use particular technology. Social influence as an important variable of the UTAUT model has been proved to have a significant positive relationship with mobile technology adoption in many previous studies. For instance, Chopdar (2022) found social influence to be a significant determiner of Covid-19 contact tracing app adoption in India. Moreover, social influence was confirmed to have significant positive relationship with the continuance intention of mobile banking apps (Abu-Taieh et al., 2022) and FDAs (Muangmee et al., 2021). So, this study assumes that:

H2: Social influence has a positive relationship with continuance intention of using FDAs during the COVID-19.

Trust

In technological perspective, the definition of trust entails individuals' confidence or reliability in that technology. It is the faith that the individuals can rely on the technology service provider on their promised actions (Gefen, 2000). Trust as an additional variable of UTAUT2 was confirmed as a significant

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antecedent of behavioral intention of mobile banking adoption for both the Lebanese and English consumers (Merhi et al., 2019). Moreover, Kilani et al., (2023) incorporated trust with the extended UTAUT2 and validated trust impact continuance usage intention positively in the case of e-wallets. So, this study assumes that:

H3: Trust has a positive relationship with continuance intention of using FDAs during the COVID-19.

Satisfaction

Bhattacherjee (2001) defined satisfaction as expectation conformations regarding using a certain technology. Satisfaction will occur when technology performance exceeds an individual's prior expectations. Satisfaction is found over and over again in technology continuance literature. As a principal element of Expectancy confirmation model (ECM) satisfaction has a crucial role to play in determining continuance intention of using mobile technologies. For instance, Wang et al., (2022) confirmed that satisfaction impacts continuance intention positively in the case of mobile food ordering apps. Furthermore, satisfaction can be modified with variables from other models such as UTAUT2 to examine continuance intentions of mobile applications (Tam et al., 2020). So, this study assumes that:

H4: Satisfaction has a positive relationship with continuance intention of using FDAs during the COVID-19.

3.0 Hypothesized Model

Consulting previous studies and proposed hypotheses the authors propose the following hypothesized model to examine determinants of continuance intention of using FDAs amid COVID-19 pandemic.

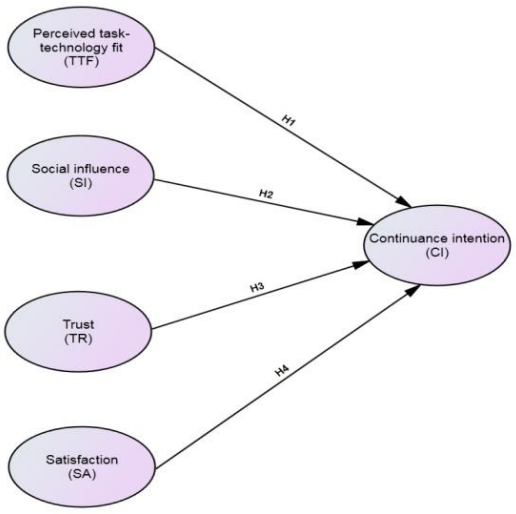

Figure 1. Hypothesized Model

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This proposed model contains four independent variables: Perceived task-technology fit (TTF); Social influence (SI); Trust (TR); Satisfaction (SA) and one dependent variable Continuance intention towards FDAs or (CI). The variables are incorporated from discussed models as no single model can provide comprehensive explanation to the complex phenomenon of consumers' continuance intention of using certain technology in particular emergency (Oliveira et al., 2014).

4.0 Methodology

4.1 Sampling & Data Collection

The questionnaire was distributed through online social media sites targeting the user of FDAs. Respondents belonged to a varied set in terms of gender, age, occupation, education level etc. The sample was obtained through a one month data collection period starting from 6th January 2021 and ending at 3rd February 2021. This was the time when due to COVID-19 lockdown was going on in Bangladesh and many individuals were purchasing food from the third-party online food aggregators. According to Saad (2021), FDAs usage increased to 70-80% in the period of 2020 than that of the previous year. A snowball sampling method was applied. The questionnaire was posted on different Bangladeshi online Food Blogging groups such as FoodBank and Facebook pages. A total of 198 responses were collected. According to Comrey & Lee (2013) sample size should be around 200 would be considered fair enough for SEM analysis. In this study, the sample size is 198 which is close to 200. Again, one of the most popular rules of thumb is to take 20 cases per indicator variable suggested by Nunnally (1978). Moreover, Field (2000) implied sample sizes can be small if the factor loadings are high. Then the sample data set was scrutinized for any kind of anomaly. No data were found missing.

4.2 Measurement

The measures used in this study had appropriate literature support. The items and the constructs used to operationalize the model were adopted from previous studies. The study measured five constructs that are modified for adjusting in the context for FDAs usage of Bangladeshi consumers during pandemic. Each of the constructs was measured with multiple items. The items have been measured with a five-point Likert scale ranging from "1 = Strongly Disagree" to the highest "5 = Strongly Agree". Perceived TTF was incorporated from Goodhue and Thompson (1995); Social influence (SI) was adopted from Venkatesh et al. (2003); Trust (TR) was modified from Cho et al., (2019); Continuance intention (CI) and Satisfaction (SA) were accepted from Bhattacherjee (2001). To ensure the validity of the response received through the questionnaire, each response was pre-tested and the validity of the instrument was tested.

4.3 Statistical Analysis Technique

Various statistical tools were utilized during this study. For Cronbach α coefficient and data validation SPSS 23 was utilized. The proposed model was

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tested using the SEM by AMOS 26 software utilizing the maximum likelihood estimation and bootstrapping technique (198 samples, and 95% significance level). This study followed the two-step approach suggested by Anderson & Gerbing (1988). The measurement model was evaluated before examining the structural model. The measurement model states how the proposed constructs are evaluated by the means of the indicator variables whereas the structural model reveals the underlying associations among the latent factors. Confirmatory factor analysis (CFA) was performed to establish the construct validity in the measurement model stage. After verifying internal reliability content and construct validity the structural model was examined to test the hypothesis and model fit.

5.0 Data Analysis and Results

5.1 Demographic Analysis

The demographic characteristics of the respondents are presented in Table 1. it shows a skewness in terms of gender, occupation, and educational level. Male respondents comprised almost 64.1% (n = 127) and females comprised (n = 71) and 35.9% in total. This number is a representation of the fact that male individuals are predominantly the users of FDAs. The majority of the respondents (77.8%) were between the age of 21 and 30 years old. This result is supporting the trend in the literature which reports that the majority of FDAs users are within a younger age as they are more responsive and innovative to technological advancements. The education level of 79.3% of respondents was bachelor's or equivalent degrees completed by individuals, and almost 15.2% of the respondents are currently students taking tertiary or higher degree education. Besides, Students and private service holders encompass the larger part of the group as it is no surprise that their busy work schedule in part contributes to their habit of ordering food using FDAs (Bezerra et al., 2013). Furthermore, 76.8% of the participants in this survey ordered anything using online FDAs during this pandemic.

Table 1. Demographic Characteristics

Measure	Item	Frequency	Percentage
Gender	Male	127	64.1
	Female	71	35.9
Age	<21	33	16.7
	21-30	154	77.8
	31-40	11	5.6
	41-50	0	0
	>50	0	0
Education	High School and lower	10	5.1
	Bachelor's or equivalent	157	79.3
	Master's	30	15.2
	PhD and above	1	0.5
Occupation	Student	161	81.3

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Measure	Item	Frequency	Percentage
	Private Service	26	13.1
	Govt. Service	3	1.5
	Business	3	1.5
	Unemployed	3	1.5
	Freelance	2	1
	Other	0	0
Frequency	At Least 1 Time Every 3 Days	20	10.1
	At Least 1 Time Per 1 Week	50	25.3
	At Least 1 Time Every 2 Weeks	31	15.7
	At Least 1 Time Per 1 Month	51	25.8
	Never Used During The Pandemic	46	23.2

5.2 Measurement Model

CFA has been utilized to evaluate the validity and reliability of the study instrument. The measurement model included twenty items explaining five constructs. Table-2 reveals the findings of the measurement model.

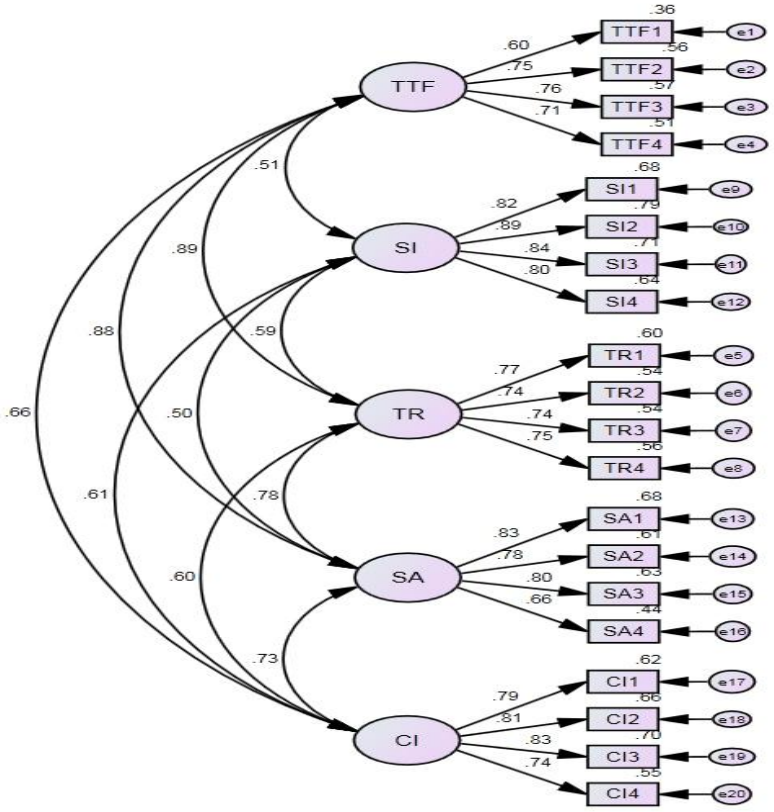

Figure 2. Primary Measurement Analysis

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From the initial measurement analysis, it was seen that any of the model fit indices did not reach the cut-off value point. To reach the factor loadings of 0.7 as suggested by SEM literature the constructs TTF1 and SA4 were dropped. The model fit indices were developed after doing the analysis in a loop. Five variables remained with eighteen items.

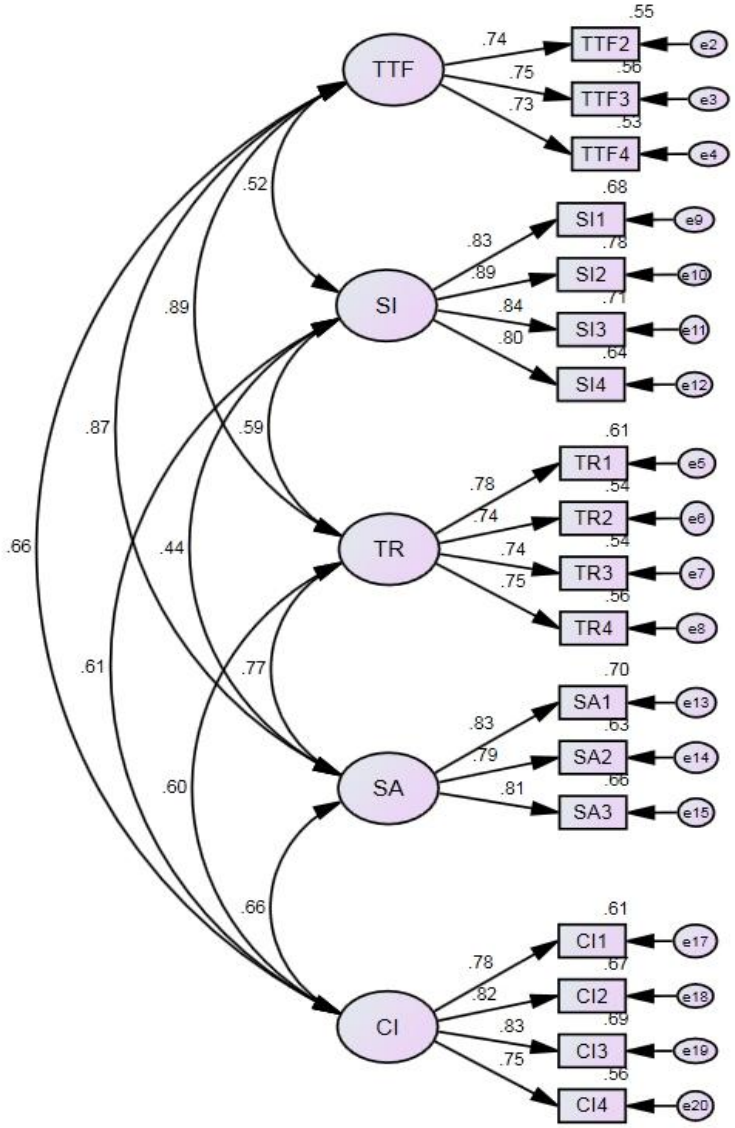

Figure 3. Measurement Model

Then internal consistency, and convergent validity, and discriminant validity were checked. Internal consistency has been examined by Cronbach α coefficient and composite reliability (CR). The construct reliability considers the real factor loadings. It is revealed from table 2 that the CR values of each construct safely

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surpassed the cut-off point 0.6 suggested by Bagozzi & Yi (1988). Since the latent constructs have been measured by multi-items, corresponding validity tests for each factor were carried out. Convergent validity signifies the degree to which manifold measures of every construct comply with each other. According to Bagozzi & Yi (1988) a low level of a sign of convergent validity is existent when factor loadings of items are not significant.

The average variance extracted (AVE) reflects the overall amount of shared variance among the indicators measuring a particular latent construct, in this case, the values for all are above the accepted level of 0.50 (Bagozzi & Yi, 1988). Table 2 depicts factor loadings, CR, and AVEs of all constructs. It can be seen that three of the constructs were deducted as they did not pass the cutoff point. Thus, ultimately three constructs and the statements presented in table two were the ones used for further analysis.

Table 2. Results of Measurement Model

Constructs	Items	Factor loadings	Internal reliability Cronbach α	Composite Reliability (CR)	Average Variance Extracted (AVE)
Perceived task-technology fit (TTF)	TTF2	0.742	0.782	0.78410883	0.74
	TTF3	0.75			
	TTF4	0.728			
Trust (TR)	TR1	0.778	0.837	0.837089657	0.74975
	TR2	0.737			
	TR3	0.737			
	TR4	0.747			
Social influence (SI)	SI1	0.826	0.904	0.904434811	0.838
	SI2	0.885			
	SI3	0.841			
	SI4	0.8			
Satisfaction (SA)	SA1	0.834	0.854	0.854387836	0.813333333
	SA2	0.794			
	SA3	0.812			
Continuance intention (CI)	CI1	0.781	0.871	0.872697	0.79425
	CI2	0.818			
	CI3	0.831			
	CI4	0.747			

Discriminant validity is defined as the extent to which a set of variables of a particular construct differ from other constructs in the model. This suggests that the variance shared among a set of items measuring a construct and their construct is higher than the variance shared with other constructs in the model. Following the criterion suggested by Fornell & Larcker (1981) the discriminant validity is determined by comparing the square root of the AVE values with the correlations among the constructs. The result is presented in Table 3. It indicates

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that the square root of AVE as represented in the diagonal is higher than other values in its row and columns. These results verify that the model has adequate discriminant validity.

Table 3. Results of Discriminant Validity

	CI	SI	TR	TTF	SA
CI	**0.891**				
SI	0.608	**0.915**			
TR	0.604	0.587	**0.866**		
TTF	0.662	0.519	0.687	**0.860**	
SA	0.657	0.437	0.771	0.761	**0.902**

5.3 Goodness of Fit Indicators

The measurement model was assessed on various goodness of indices. Including relative $\chi 2$; Approximate good of fit index (AGFI); Normed fit index (NFI); Comparative fit index (CFI); Standardized root-mean-square-residual (SRMR) and Root mean square of approximation (RMSEA). The overall goodness of fit of the model was acceptable when compared to the threshold values suggested in the SEM literature.

The observed normed $\chi 2$ for measurement model was 1.972 ($\chi 2 = 246.526$, df = 125) which is ≤ 3.000 suggested by Bagozzi & Yi (1988) so this fit is quite good.

Other fit indexes also indicated a good fit for the measurement model. The adjusted goodness of fit model (AGFI) was 0.832 which is higher than the threshold value of 0.800 as suggested in the SEM literature Chau & Hu (2001). The non-normed fit index (NNFI or TLI) and comparative fit index (CFI) were 0.932 and 0.944, respectively higher than 0.900 suggested by Hu & Bentler (1999).

Also, the root mean square error of approximation (RMSEA) was 0.070 which is lower than 0.08 which was proposed by Browne & Cudeck (1992). The combination of these indicators confirms that the measurement model has fitted the data and it can efficiently reproduce the covariance matrix

5.4 Model Fit Results for Measurement Model

Table 4. Model fit indices for the Measurement Model

Fit Indices	Score	Recommended value	Reference
CMIN/Df	1.972	≤ 3.000	(Bagozzi & Yi, 1988)
AGFI	0.832	≥ 0.800	(Chau & Hu, 2001)
CFI	0.944	≥ 0.900	(Hu & Bentler, 1999)
TLI	0.932	≥ 0.900	(Hu & Bentler, 1999)
RMSEA	0.070	≤ 0.080	(Browne & Cudeck, 1992)

*Notes: Diagonal values represent the square root of the average variance extracted (AVE) while the off-diagonal values represent the correlation among the latent constructs.

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5.5 Structural Model Results

Having confirmed the validity and reliability of the measurement model, the next step was to test the hypotheses by running the structural model. The structural equation model was developed according to the previous hypotheses. As the data was not normal, maximum likelihood estimation and bootstrapping technique (198 samples, and 95 % significance level) were used. Figure 3 shows the causal linkages and fit statistics for the structural model.

The overall goodness of fit of the model was acceptable when compared to the threshold values that were suggested in the SEM literature. The observed normed $\chi 2$ for the measurement model was 1.972 ($\chi 2 = 246.526$, df = 125) which is lower than 3.0; AGFI value was 0.832 greater than 0.800; CFI was 0.944 which is greater than 0.900 and RMSEA 0.070 which is less than 0.08.

Now the path analysis was done. Upon running the analysis, it was seen that the Social influence has a positive impact on Continuance intention with a (β = 0.395, p<.001). So, H2 is supported. Again, hypothesis H4 predicted that Satisfaction had an impact on Continuance intention which is found to be positive (β = 0.355, p<.05) at the significance level of .05. So H4 is supported. Hence H2 and H4 were supported as postulated in the study.

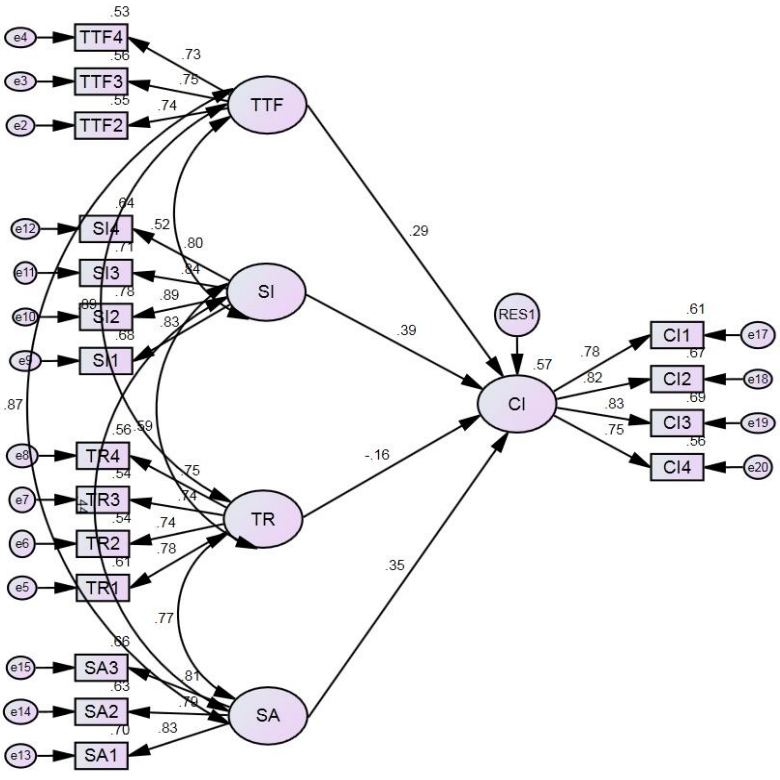

Figure 4. Structural Model Results

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On the other hand, the impact of Perceived task-technology fit had no impact on Continuance intention (β = -0.291, p> .05). Thus, H1 was not supported as it was proposed in the study.

Again, the impact of Trust had no impact on Continuance intention (β = -0.159, p> .05). Again, one thing to notice here it was assumed Trust would have a positive impact but here the path coefficient is showing negative. Thus, H3 was also not supported.

Table 5. Results of the Hypotheses tests

Hypothesis	Hypothesized direct effect	Path Coefficient	*p*-value	Decision
H1	Perceived task-technology fit has a positive relationship with continuance intention	0.291	0.352	**Not Supported**
H2	Social influence has a positive relationship with continuance intention	0.395	***	**Supported**
H3	Trust has a positive relationship with continuance intention	-0.159	0.483	**Not Supported**
H4	Satisfaction has a positive relationship with continuance intention	0.355	0.043	**Supported**

Notes: ***$p < 0.001$; **$p < 0.05$

The coefficient of determination, r2 is 0.57 for Continuance intention (CI) endogenous latent variable. This means that the latent variables explain only 57% of the continuance usage intention of consumers.

In this study, two of the four hypotheses were accepted as significant. Table 6 summarizes the standardized path coefficient and the probability level of it. Perceived task-technology fit and Trust had no causal relationship with Continuance intention towards FDA usage during pandemic.

6.0 Discussion

The study aimed to identify key drivers, driving consumers' continuingly using third-party FDAs amid the coronavirus pandemic. Initially, this paper assumed four main factors that would affect the continuance usage intention of FDAs among Bangladeshi consumers but in the end, it was seen that only two of the variables which are satisfaction and social influence were the two significant variables affecting FDA continuance intention.

The study findings validated that satisfaction significantly contributes to FDA continuance usage intention which is similar to the results found by Alalwan (2020); Chotigo and Kadono (2021). The positive beta coefficient (β = 0.355) indicates that consumers will continue using FDAs amid the pandemic if they are

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satisfied. An increase in 1 unit of satisfaction will increase the continuance intention by 0.355 unit or 35.5%.

Social influence was found to be significant and has a positive impact which again is similar to the results found by Muangmee et al. (2021) ; Abu-Taieh et al. (2022). Social influence ($\beta = 0.395$) had positive beta coefficients which indicate 1 unit increase in Social influence would increase 0.395 unit for continuance intention. From the values, it is clear that Social influence had a positive impact on Bangladeshi consumers' continuance usage intention. This may be a cultural effect of Bangladeshi consumers as they belong to a more collectivistic society.

However, Perceived task-technology fit as well as Trust had no significant relationship with FDA continuance usage intention. The results are against previous research done by Zhao and Bacao (2020) but consistent with a study done by Chotigo and Kadono (2021). The perceived task-technology fit and trustworthiness had become irrelevant in formulating continuance usage intention regarding FDAs as consumers are familiar with the apps' functions and services from their experience of initial adoption.

6.1 Theoretical Implications

The theoretical contribution of the paper is that it extends the technology continuance usage literature in specific emergency contexts (COVID-19) by exploring the case of FDAs in Bangladesh. Many previous researches used traditional technology adoption models to investigate mobile technology's continuance usage intention among consumers, but the unique contribution of this study is to incorporating variables from UTAUT, Task-technology fit model and ECM model, thus proposing a new model to identify both mental and technological factors regarding FDA continuance intention. This proposed model provides wider modeling flexibility to incorporate other variables in further examining mobile technology's continuance usage intention. Secondly, this empirical study was made on the Bangladeshi consumers and thus the findings are little bit different from some of the previous research done in the context of other countries. This may be partly attributed to cultural differences such as the effect of collectivist society. Further research may be able to unearth this.

6.2 Managerial Implications

The outcomes of the study have certain managerial implications for businesses. First, it equips relevant stakeholders such as catering enterprises and third-party online food aggregators with the insight that Bangladeshi consumers' continuance intention regarding FDAs is primarily determined by satisfaction and social influence. So, online food delivery aggregators should strive to enhance satisfaction by carefully monitoring the whole process from maintaining proper hygiene in food preparation to efficient and timely delivery. Thus, ensuring a high service quality and getting one step close to customer retention amid the coronavirus pandemic. Secondly, as social influence has a significant role to play in formulating Bangladeshi consumers' continuance attitude toward using FDAs, benefits of the specific functions of FDAs should be highlighted in designing

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marketing communications. The principles of social marketing such as selling attitudes and behaviors for greater good of the society must be on the background of any communication attempt by the FDA provider. As young people are the primary users of FDAs by default social networking sites should be the preferred communication medium. Therefore, drawing insights from the study, online food aggregators and catering enterprises will be able to develop effective strategies for retaining customers not only in the COVID-19 pandemic period but also in future after the crisis. Moreover, similar online order and offline delivery businesses such as mobile shopping can also apply the knowledge generated in this study.

7.0 Conclusion & Suggestion for Future Research

This study explored the understanding continuance intention of using FDAs by using variables from UTAUT, Task-technology fit model and ECM. This type of study has not been done much for an emerging country like Bangladesh. Careful attention was paid to avoid any kind of overlapping of attributes of constructs. This study found that satisfaction and social influence were the key constructs in shaping consumers' continuance intention toward FDAs amid the coronavirus pandemic. Trust as similar to some past studies was not significant here. But the astounding fact was the Perceived task-technology fit was found insignificant here. This fact needs to be researched more to find whether truly the consumers do not feel the need for FDAs when the specific situation is ideal for utilizing technology's functions and features.

Finally, the development of FDAs is in the nascent stages. Various companies are entering into the market and the food service market outside the traditional catering business is increasing. Yet, this particular study does not differentiate between the FDAs such as FoodPanda, Pathao Food, Shohoz Food, HungryNaki, Khaas Food, Cookups, Foodfex, and Kludio. Therefore, further study on these effects while considering different FDAs should be made at future to understand the effect of various attributes on the development of FDAs among consumers in the context of Bangladesh.

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Examining Volatility in Bank Stock Prices: A Comparative Exploration of Dividend Policies, Macroeconomic Influences, and Company-Specific Factors

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Abstract: *This study aims to ascertain and compare factors influencing stock price volatility in terms of dividend policy, macroeconomic and company specific aspects for selected subset of listed banks in Bangladesh. Eleven years of secondary data (from 2011 to 2021) for fifteen commercial banks (representing 61.5% market capitalization of the banking sector) was acquired from diverse sources. The dependent variable chosen is stock price volatility, whereas the dividend policy is initially represented by dividend payout ratio (PRt & PRt-1), dividend yield (DYt & DYt-1). Several firm and country-specific macroeconomic indicators are used as control variables. A methodical approach followed by panel data analysis has been employed to identify a suitable model that can yield more accurate estimators. Consequently, some diagnostic tests are also performed to account for diagnosed problems: contemporaneous cross-sectional correlation, group-wise heteroskedasticity and autocorrelation; Driscoll-Kraay standard error regression model is finally applied. The study not only found significant negative impact of dividend payout ratio but also spotted a significant influence of inflation, EPS, and firm size on stock price volatility. Price volatility influenced by "No dividend policy" can be reinvestigated from the aspect of behavioral finance in the future. Furthermore, this study also sheds light on to what extent firm-specific and macroeconomic influence impact stock price volatility in Bangladesh's banking sector.*

Keywords: *Stock Price Volatility; Dividend policy; firm-specific and macroeconomic variables, Banking sector; Panel data analysis.*

JEL codes: *G11, G35, G21*

1. Introduction

The stock market is regarded as one of the crucial and essential elements and acts as the primary channel of interactions between corporations and investors. The practice of investors in mobilizing savings and converting them into investments

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is what drives economic development. Many researchers have examined the financial decisions that concentrate to maximize a corporation's value, not only the distribution of earnings to the shareholders, but also the volatile circumstances experienced by corporations that eventually give rise to more difficulty in achieving acceptable level of performance, especially financial performance (Nguyen et al.,2021; Das, 2020; Khan et al.,2019). Therefore, corporate dividend strategy is considered as one of the most significant financial pronouncements that executives may take but as it remains debatable among policy makers, managers, researchers year after year; it is still a widely researched topic in financial field. When a company announces to increase the payout ratio, it sends a message to investors that the corporation anticipates higher earnings. Most research in this topic has been conducted within developed markets. A small number of papers have studied this issue within the framework of Bangladesh in recent times. However, price volatility isn't being impacted only by dividend payout decisions rather can be influenced by macroeconomic issues and firm specific factors. Earlier researchers (Baskin, 1989; Allen and Rachim, 1996; Hussainey et al., 2011; Ali et al., 2015; Provaty and Siddique, 2021; etc.) already evidenced the effect of payout decision on stock price volatility after adjusting company specific factors such as size of the firm, degree of leverage, profitability ratios, tax effect and so on. But no comprehensive study having both macroeconomic and company specific factors have not been examined earlier, particularly for the context of banking industry in Bangladesh. Therefore, the goal is to ascertain and compare factors influencing stock price volatility in terms of dividend policy, macroeconomic and company specific aspects for Bangladesh banking industry.

This study's hypothesis was based on thorough literature review to achieve the aforesaid objective. It is expected that this study will enlighten how dividend policy affects stock price volatility and can help mostly to the investors of banking industry of Bangladesh as well as to the policy makers before formulation of dividend policy strategies by incorporating both country and company specific aspects.

2. Review of Literature

Dividend policy and its impact on stock price volatility have always played a considerable issue in management's decisions. For more than half a century, company's dividend policy has been a common research topic (Gordon, 1963; Lintner, 1956; Miller, 1986) and it has been associated to several crucial firm-specific and market-specific factors. Stock volatility measures risk and represents how quickly a security's price fluctuates over a particular period. Both theoretical framework and empirical studies on stock price volatility in relation to dividend policy have been conducted over the years. Contradictory results have been found by researchers across the market and industry.

Among the theoretical framework of dividend policy, dividend irrelevance theory as proposed by Miller and Modigliani (1961); demonstrates that a company's

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worth is simply based on its ability to produce money from investments and is unaffected by how its earnings are distributed between dividends and retained profits. According to this theory, stock price movements have no connection with dividend policy. The MM idea was first criticized by Gordon (1963) and Lintner (1956), who argued that investors preferred a definite dividend today to an unreliable capital gain in the future. The Gordon-Linter argument was dubbed the "bird in the hand fallacy" by MM because, in his opinion, the majority of investors intend to invest again in shares of the same or comparable businesses, and because the vulnerability of the firm's cash flows to investors is ultimately determined by the uncertainty of operating cashflow. However, Fama (1991), Fama and French (1992), to explain stock returns, focused on dividends or other cash flow factors such as accounting earnings, investment, industrial production etc.

According to Ross et al. (2022), variation in the dividend payout ratio indicates management's opinion of the company's prospects and earning ability. A solid sign that management is confident in increased future earnings to cover the dividend payout increase is the increase in dividend payments made by the companies. However, the tax preference theory states that dividends are subject to a greater tax rate than capital gains. Additionally, capital gains are not taxed until the stock is sold, whereas dividends are taxed right away. Investors desire corporations that retain most of their earnings instead of distributing them out as dividends and are willing to pay little tax due to the tax benefits of capital gains over dividends. Therefore, a minimal payment ratio will reduce the cost of equity and raise the stock price (Ali et al., 2015).

In the past, Baskin's (1989) US study indicated that dividends might be used as an indicator for the risk of potential earnings. He investigated the importance of dividend policy as a factor influencing return volatility. He claimed a deep correlation between the price volatility measure and dividend yield as well as between payout ratio and price volatility. The coefficient of dividend yield remained high and very significant even after he incorporated control variables to account for the impact of business size, leverage, and earnings volatility. He suggested that a 2.5% fall in the yearly standard deviation of stock price changes would result in an increase of 1% in dividend yield.

Numerous empirical studies have been done to learn more about the connection between dividend policy and stock market volatility as a result of these divergent viewpoints. Hussainey et al. (2011) investigated the relationship between share price change and dividend policy proxy variables and discovered that corporate dividend policy is a significant influencer of stock price changes in the UK market based on the sample derived from London stock Exchange. They discovered a favorable association between dividend yield and stock price fluctuations, but an adverse rapport between stock price changes and dividend payout ratio. Additionally, their findings indicate that a company's growth rate, size, debt load, and earnings can all help to explain fluctuations in stock price.

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Allen and Rachim (1996) examined the linkage amongst stock price risk and dividend policy for 173 Australian listed businesses. The paper presents a cross-sectional regression analysis of the link between stock price volatility and dividend policy after adjusting for business size, leverage, earnings volatility and growth. Contrary to Baskin's (1989) US findings, there is no indication that dividend yield is associated with stock price volatility. Contrarily, as predicted, it turns out that there is a large negative association with the payout ratio and substantial affirmative associations between stock price volatility and earnings volatility and leverage.

Another study conducted by Sharma and Pandey (2014); on Indian Stock market examined dividend signaling and market efficiency in emerging economies. Their study revealed that the signaling effect doesn't work for changes in stock price associated with dividend increase/decreases along with financial results announcements. Al-Malkawi (2007) also didn't support signaling hypothesis as derived from his result in Jordan market. However, his research identified some influencing variables, like business size, age, and profitability, that affect corporate dividend policy in Jordan.

The consequences of dividend yield, payout ratio, EPS, return on equity, and profit after tax on stock prices have also been researched in Pakistan (Hunjra, et al., 2014), using a sample of 63 companies (including those in the industries of sugar, food, personal care, chemical, and energy). The result also indicates significant impact of dividend policy on stock price. However, their results are against dividend irrelevance theory as it showed while dividend payout ratio and stock price are favorably correlated, dividend yield and stock price are adversely correlated. Shah and Noreen (2016) conducted another research on a sample of 50 firms from non-financial sector listed at the same bourse identified a significant negative correlation between SPV and the dividend policy indicators, namely dividend payout ratio and dividend yield. The study also discovered a strong positive association between the control variables (asset growth, earnings volatility, and earnings per share) and stock price volatility. In the context of Pakistan's banking sector, Rehman et al. (2018) discovered a substantial negative connection between stock price volatility and dividend yield.

A crucial element in an investor's success is the accessibility of information in the market. Dissanayake and Wickramasinghe (2016) studied the stock price volatility based on earnings changes for 30 listed firms in Sri Lanka, including those in manufacturing, beverage, food, and tobacco. Based on their findings and the P/E Ratio and EPS of Sri Lankan companies, it was evident that the share price was substantially more volatile. Another study by Dewasiri and Banda (2014) is based on Sri Lanka's economy where the sample size was chosen from plantation, food/tobacco/ beverages, service and manufacturing sectors. The findings indicated that dividend policy significantly affects stock price volatility. High dividend payment companies would result in less volatile stock prices after accounting for business size and asset growth.

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Lashgari and Ahmadi (2014) conducted research on the same topic based on 51company's data selected from Tehran stock exchange. The study also found a substantial consequence of dividend policy on stock price volatility applying a fixed effect regression model. By using the panel data regression estimation method, Lotto's (2021) latest research on Tanzanian listed industrial enterprises also found a strong negative influence of dividend policy on stock price volatility.

On a research based on the Bangladeshi financial service industry conducted by Provaty and Siddique (2021) discovered a substantial positive alliance between dividend yield and stock price volatility across the chosen companies. Hossin and Ahmed (2020) attempted to examine the same study on firms chosen from the Ceramics, Food & Allied, and Cement industries listed at DSE index. "Fixed effect" and "Random effect" models have been run using panel data to elucidate the link between dividend payments and stock prices after various variables, such as EPS, logarithm of growth of asset, profit after tax and dividend payout ratio, have been adjusted. This paper also reveals weak form of market existence in Bangladesh and concludes investor's preference for stock dividend instead of cash dividend.

Earlier research on Bangladeshi banking industry was examined by few researchers. Among them Rahman et al. (2012) collected their primary information for selecting variables through structured closed end questionnaire. After that empirical analysis was done to evaluate rigorously the effect of dividend policy on company value using data from four financial years. Their findings are consistent with dividend relevance theory. The study also showed that there are fourteen issues that affect dividend policy, but the primary six are shareholder preferences, dividend stability, cash flows, board decisions, inflation, and capital market conditions. Another study on banking industry performed by Masum (2014) discovered that dividend yield had a negligible influence on stock prices.

The consequences of dividend policy on price volatility have also been examined by Sultana (2021) through a comparative study of DSE listed 35 manufacturing companies having sixteen years study period. Multiple regression analysis has identified a significant inverse association between stock price volatility and dividend policy. Moreover, by employing a simultaneous equation model, a fixed effect model, and pooled OLS; comparative analysis has been performed. Earlier, Rashid and Rahman (2008) applied cross-sectional regression analysis to conduct a study on 104 nonfinancial companies chosen from a variety of industries, adjusting for payout ratio, earning volatility, company size, debt, and asset growth. Research has demonstrated a relationship between stock price volatility and dividend yield, though statistically insignificant.

3. Research Gap Identification Followed by Hypothesis Development

From the previous works in this area, it is identified that few research have been conducted in banking industry of Bangladesh in recent years. However, most of them considered those banks which are distributing only cash dividend. Also,

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their studies were limited to only firm specific variables, whereas macroeconomic indicators may have some impact on stock price volatility. Therefore, based on earlier research on this topic, this study aims to specify the legitimacy of the hypothesis-

Ho_1: Stock price volatility is not significantly influenced by Bank dividend policies.

Ho_2: Firm and country specific factors have less impact on stock price volatility than dividend policy decisions.

4. Sources and Sampling of Data

There are currently 34 Banks listed under DSE (Dhaka Stock Exchange). Among them, only fifteen commercial banks were selected that constitute about 61.5% of the market capitalization (Appended Part-Table:1) of the banking sector. Secondary data have been used in this research which is collected from the websites of the respective banks as well as from their annual reports. However, to get the best possible result from this research, 11 years of data are collected for the years 2011 to 2021. To acquire suitable variables required for this research, raw data were used to perform some calculations. Theoretical underpinnings developed by Baskin (1989), Allen and Rachim (1996), and Provaty and Siddique (2021) are presented prior to the investigation. However, it is different from them in the following ways:

i) It considers only selected banks that are listed in the primary bourse of Bangladesh.

ii) It includes banks that have been disbursing dividends (Cash/Stock i.e., no dividend policy/both cash & stock) for at least 11 years.

iii) It considers some country-specific control variables along with firm-specific control variables.

4.1 Description of the variables

4.1.1 Dependent Variable

Stock Price Volatility (SPV): Stock price volatility serves as dependent variable of the study. To obtain the required variable, firstly the monthly adjusted stock price for every single month of a year has been calculated. From there, both high and low price of share for every year is obtained to originate price volatility data. For this, the high and low prices have been averaged, then squared. This method involved averaging stock price over all available years, followed by a square root conversion to produce a variable that matched standard deviation. Instead of using closing and opening share price, this method is mostly used by previous researchers (Baskin, 1989; Shah and Noreen, 2016; Lotto, 2021; Provaty and Siddique, 2021; etc.) to get price volatility information. Stock price Volatility (PV) formula is as under:

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$$\textbf{Standard deviation of stock price} = \sqrt{\frac{\textbf{High} - \textbf{Low}}{\left(\frac{\textbf{High} + \textbf{Low}}{\mathbf{2}}\right)^{\mathbf{2}}}}$$

4.1.2 Independent Variables

Dividend Yield: A company's dividend yield measures how much of its annual dividend payments are made relative to the price of its stock. Dividend yield for the current year is computed by dividing dividend per share (DPS) by the current market value per share. However, based on dividend yield received in the previous year, investor trades in shares and expects dividend yield for present year. Therefore, dividend yield with a 1-year lag period is considered to find separate influence on stock price volatility. This same procedure is seemed to be more rational as used by most of the researchers. (Baskin, 1989; Shah and Noreen, 2016; Lotto, 2021; Provaty and Siddique, 2021; etc.). Formula for dividend yield of both present year and previous year is as follows:

$$(\mathbf{DY}) = \frac{\textbf{Dividend Per Share}}{\textbf{Market Price Per Share}}$$

$$(\textbf{DYt} - \mathbf{1}) = \frac{\textbf{Dividend Per Share of previous year}}{\textbf{Market Price Per Share of previous year}}$$

Dividend Payout ratio: Dividend payout ratio is the chunk of a company's net earnings that is paid out to shareholders as dividends. Dividend per share (DPS)is divided by earnings per share (EPS) to generate dividend payout ratio of the present year. Only cash dividend has been considered to calculate DPS. That means in case of stock dividend, DPS equals to zero has been considered. However, to find any lagged impact of the payout ratio, payout ratio of immediately preceding year has been considered too in this study. (Shah and Noreen, 2016; Lotto, 2021; Provaty and Siddique, 2021; etc.)

$$\textbf{PRt} = \frac{\textbf{Dividend Per Share}}{\textbf{Earnings Per Share}}$$

$$\textbf{PRt} - \mathbf{1} = \frac{\textbf{Dividend Per Share of previous year}}{\textbf{Earnings Per Share of previous year}}$$

4.1.3 Control Variables

Firm Size: Size of the firm has an impact on dividend policy and thus it is used as one of the control variables in this research. Natural logarithm of total asset of the banks is used to calculate firm size (Provaty and Siddique, 2021).

Size= Ln (Total Assets)

Leverage: To measure the degree of financial risk, the control variable leverage has been used. It is computed by dividing the bank's total debt by its total assets (Baskin, 1989; Shah and Noreen, 2016; Lotto, 2021; Provaty and Siddique, 2021).

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$$Leverage = \frac{Total\ Debt}{Total\ assets}$$

Earnings Per Share (EPS): As a proxy of profitability, earnings per share is used in this research. The variable earnings per share can be derived by dividing net income after taxes by the total number of outstanding shares (Ahmed et al., 2014; Hossin and Ahmed, 2020; Provaty and Siddique, 2021).

$$EPS = \frac{Net\ income}{Number\ of\ shares\ outstanding}$$

Asset growth (AG): Growth of assets can influence the dividend policy and thus can create stock price volatility. The control variable asset growth rate is calculated as the percentage increase or decrease in total assets from immediate last year's total assets (Hossin and Ahmed, 2020; Provaty and Siddique, 2021).

$$Asset\ growth = \frac{Total\ Asset(t) - Total\ Asset(t-1)}{Total\ Asset(t-1)}$$

Earnings volatility (EV): As a proxy of market risk, earnings volatility is used in this study by firstly dividing Earnings before interest and taxes (EBIT) by total asset and then the standard deviation of this result is used for all the years for each bank (Rashid and Rahman, 2008; Provaty and Siddique, 2021).

$$EV = \text{STDEV of } (\frac{EBIT}{Total\ Assets})$$

NPL ratio (NPL %): Non-performing loan to gross loan ratio is frequently used as a proxy for the health and asset quality of a bank. Bank's financial performance is highly impacted by bank's NPL ratio and thus there may have some impact on bank's stock price volatility.

$$NPL\ ratio = (\frac{Total\ nonperforming\ loans\ (NPLs)}{Total\ Gross\ Loans})$$

GDP growth Rate (GDP GR): Economic progression measured by gross domestic product (GDP) can help companies forecast and estimate how their industry will move in the near future and how they may make the best of the booming economy. On the flipside, companies may choose to spend consciously and prudently to sail through in a slow economy which can influence the company's stock price. Therefore, it demands to examine any impact of GDP growth rate on stock price volatility.

Inflation(I): Inflation is the rate of increase in prices or growth in cost of living in a country over a given time frame. With high inflation, companies face difficulties maintaining or improving their profit margins, which ultimately harms company's overall performance. Inflation volatility has impact on financial market volatility (Gruen 1996). The influence of inflation on stock price volatility has thus been examined in this study.

Broad Money Growth rate (MG): Broad money growth rate is an indicator/tool of country's monetary policy. When broad money growth rate is high resulting in

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greater money supply, people tend to invest in risky assets and vice versa. Therefore, to identify any impact on stock price volatility, broad money growth rate has been included.

Weighted Average Lending Rate (WALR): When lending rate is low in an economy, businesses can get finance easily at a cheaper rate. Consequently, the debt ratio of the respective company with increase. Fundamentally firms having higher debt ratio show greater EPS (Earnings per share). However, when lending rate goes up again, firms having higher debt ratio face drastic fall in EPS, creating subsequent stock price volatility.

5. Research Methodology

As mentioned in the above-proposed variables table, to inspect the association between earning distribution policy i.e., dividend policy and stock price volatility of selected companies listed in DSE, a generalized form of the statistical study can be represented as follows:

$$Y = f(P, C, \varepsilon)$$

Where,

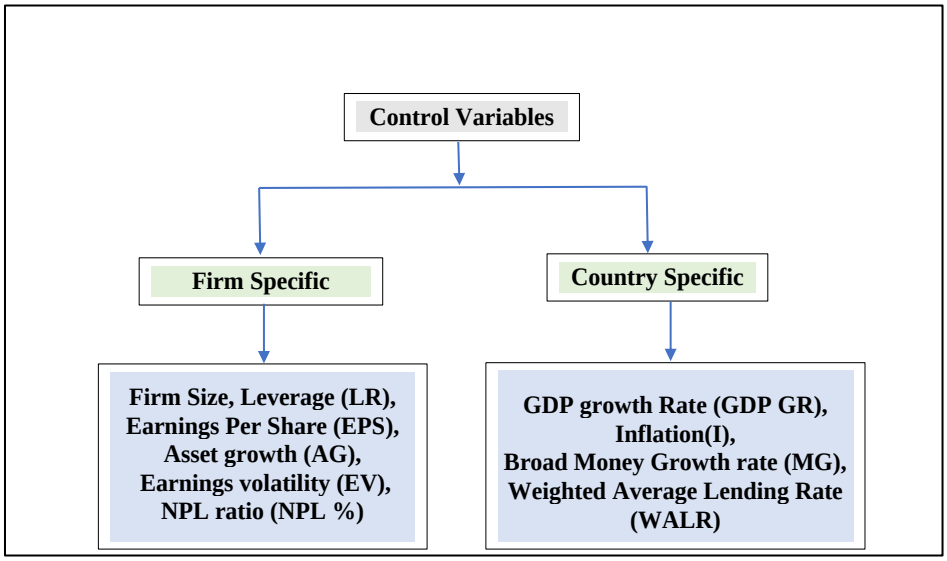
Y= stock price volatility proxy,

P= Dividend policy proxy variables,

C=control variables

and = error term.

Dividend yield for present year and dividend yield with a 1-year lag period; Dividend payout ratio of present year and Dividend payout ratio with a 1-year lag period are considered as dividend proxy variables. Control variables are considered based on two categories as follows.



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Therefore, the proposed study initially uses the following equation for running the regression model:

$$Y= \alpha+ \beta 1\ DY_t, + \beta 2\ DY_{t-1} + \beta 3\ PR_t + \beta 4\ PR_{t-1}+ \beta 5\ Size + \beta 6\ EPS + \beta 7\ EV + \beta 8\ LR + \beta 9\ AG + \beta 10 NPL\% + \beta 11 GDP\ GR + \beta 12 I + \beta 13 MG + \beta 14 WALR + \varepsilon$$

Where, β1, β2 ……. β 14 represents coefficients of parameter estimates.

α is constant.

ε the error elements, which considers additional potential influences that the model did not take into consideration.

Statistical Analysis Method

Numerous empirical tests were carried out to determine the validity of the research's hypothesis such as descriptive statistics, correlation matrix, Ordinary Least Squares (OLS) regression are run based on the specified regression model. After that, based on correlation analysis, a stepwise model selection strategy has been conducted to find appropriate model that can produce estimators with better accuracy.

Naturally, the data used in this research are panel data which is also termed longitudinal data or cross-sectional time-series data. Therefore, panel data analysis is applied to figure out the best-fitted regression model. Some diagnostic tests are also performed to discover whether there are any heteroskedasticity, cross-sectional dependency and autocorrelation effects present in the data set. Moreover, to account for contemporaneous cross-sectional correlation, group-wise heteroskedasticity and autocorrelation, Driscoll-Kraay standard error regression model is applied. Microsoft Excel, SPSS (version 26) and Stata (14) have been used for all the preparation & analysis of data.

6. Empirical Results and Discussions

The findings of individual statistical techniques are discussed in each subsection below.

6.1 Summary of descriptive statistics

Following table displays key outcomes of descriptive statistics:

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Table-1: Summary of Descriptive Statistics

Variables Name	Total observations	Mean	Standard Deviation	Min	Max
Stock Price Volatility (PV)	165	0.1417	0.0448	0.0548	0.2960
Dividend Yield (DYt)	165	0.0384	0.0333	0.0000	0.1400
Dividend Yield (Dyt-1)	165	0.0346	0.0335	0.0000	0.1400
Dividend Payout (PRt)	165	0.3143	0.2514	0.0000	1.1700
Dividend Payout (PRt-1)	165	0.2755	0.3043	-1.7900	1.1700
Firm Size (Size)	165	26.2511	0.5527	25.0400	28.1200
Profitability (EPS)	165	3.3915	2.6056	0.3300	21.0000
Earnings Volatility (EV)	165	0.0073	0.0018	0.0000	0.0100
Leverage (LR)	165	0.9119	0.0929	0.1200	1.2400
Asset Growth (AG)	165	0.1478	0.0749	-0.0600	0.4200
NPL Ratio (NPL%)	165	0.0463	0.0148	0.0137	0.0903
GDP Growth rate (GR)	165	0.0645	0.0108	0.0552	0.1017
Inflation(I)	165	0.0674	0.0148	0.0552	0.1017
Broad Money Growth (MG)	165	0.1423	0.0353	0.0924	0.2134
Weighted Average Lending Rate(WALR)	165	0.1065	0.0219	0.0718	0.1380

From the summary table of descriptive statistics, it is noted that the typical dividend yield (DYt) for the selected banks was 3.84%, dividend payout ratio (PRt) was 31.43% of total yearly net income. On average, the degree of leverage as measured by leverage ratio was around 91% whereas banks' assets were growing at 14.78% as indicated by asset growth. Average earnings per share for the selected period was BDT 3.39. Throughout the study period, banks' average percentage of NPL to total loans and advances and average GDP growth rate was around 4.6% and 6.45% respectively. Country faced highest inflation at the rate of 10.17% but mean inflation rate stands at 6.74%. Weighted average lending rate in the economy for the study period was 10.65%. Among all, the highest standard deviation is on the control variable-EPS due to variation in earnings from bank to bank. The lowest is found on control variable-Earnings volatility (0.18%).

6.2 Analysis of correlation among the variables

Table-2 portrays correlation among all the variables studied in this research. From the correlation matrix, it is seen that the dependent variable stock price volatility (PV) has an insignificant and very weak negative correlation with both dividend yield (DYt) of the present year and dividend yield of one year lag (Dyt-1). The dependent variable stock price volatility (PV) also shows insignificant negative correlation with independent variable payout ratio of one year lag (PRt-1) but significant negative correlation with payout ratio of present year PRt.

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Table-2:Correlation Matrix

Correlations

	PV	(DYt)	(Dyt-1)	(PRt)	(PRt-1)	Size	(EPS)	EV	LR	AG	NPL%	GDP GR	I	MG	WALR
PV	1														
(DYt)	-0.018	1													
	0.822														
(Dyt-1)	-0.056	.524**	1												
	0.479	0.000													
(PRt)	-.158*	.846**	.495**	1											
	0.043	0.000	0.000												
(PRt-1)	-0.115	.379**	.746**	.468**	1										
	0.141	0.000	0.000	0.000											
Size	-.442**	0.125	.218**	.226**	.232**	1									
	0.000	0.111	0.005	0.004	0.003										
(EPS)	-.356**	-0.117	-0.088	-0.123	-0.026	0.024	1								
	0.000	0.134	0.260	0.114	0.740	0.755									
EV	0.093	-0.015	0.006	0.030	0.041	0.029	-.215**	1							
	0.233	0.847	0.937	0.705	0.597	0.712	0.006								
LR	-0.072	-0.008	0.127	0.013	0.105	.173*	-0.033	0.042	1						
	0.361	0.920	0.104	0.865	0.181	0.026	0.675	0.593							
AG	-0.016	-.284**	-.300**	-.288**	-.280**	-.266**	0.082	-0.100	-0.043	1					
	0.834	0.000	0.000	0.000	0.000	0.001	0.293	0.201	0.585						
NPL%	.264**	-0.010	0.063	-0.013	0.048	-0.140	-.266**	0.054	-.161*	-.260**	1				
	0.001	0.895	0.421	0.866	0.540	0.073	0.001	0.490	0.039	0.001					
GDP GR	-0.029	-0.062	-0.064	-0.049	-0.065	-0.026	0.028	0.000	0.051	0.040	.214**	1			
	0.711	0.430	0.412	0.531	0.409	0.737	0.719	1.000	0.511	0.611	0.006				
I	0.052	-.300**	-.411**	-.266**	-.311**	-.629**	0.067	0.000	-0.144	.452**	-.199*	-0.150	1		
	0.507	0.000	0.000	0.001	0.000	0.000	0.392	1.000	0.066	0.000	0.011	0.054			
MG	0.113	-0.148	-.221**	-0.146	-.160*	-.570**	0.047	0.000	-0.120	.377**	-.182*	-.164*	.842**	1	
	0.148	0.058	0.004	0.062	0.040	0.000	0.546	1.000	0.124	0.000	0.019	0.035	0.000		
WALR	.165*	-.215**	-.381**	-.173*	-.273**	-.688**	0.036	0.000	-.188*	.332**	0.115	0.104	.794**	.661**	1
	0.034	0.006	0.000	0.026	0.000	0.000	0.642	1.000	0.016	0.000	0.141	0.185	0.000	0.000	

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Firm size, Earnings per share (EPS) have significant negative correlation with Stock price volatility. That means if stock price volatility reduces with the increase in firm size and earnings per share and vice versa. Moreover, the percentage of NPL to total loans & advances, Weighted Average lending rate has significant positive correlation with the dependent variable stock price volatility. That indicates a rise in NPL ratio and an increase in the weighted average rate of country will raise stock price volatility.

Apart from these, some significant strong correlation is detected among the independent and control variables. For example, dividend yield of one year lag period (Dyt-1), both payout ratio of present year (PRt) and payout ratio one year lag (PRt-1) period have significant strong correlation with other independent variable dividend yield of present year (Dyt). Control Variable asset growth (AG) has significant and strong correlation with almost all variables except our dependent variable. Moreover, Broad money growth also has a significant strong correlation with another control variable inflation. Therefore, including these correlated variables altogether in the same model can create multicollinearity problem and thus biased estimation of result. Hence it is necessary to reform regression model only with those variables which show significant correlation with dependent variable. As the independent variables are deeply correlated with

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themselves, stepwise model specification process has been performed next to select appropriate model in this study with better estimates.

6.3 Outcome from the initial OLS models and model selection

Based on our result from correlation matrix, step by step model selection procedure is performed (Table-3) for robust model improvement through OLS regression model. Here stock price volatility has been used as dependent variable; Size, EPS, NPL Ratio, GDP growth rate, Inflation and weighted average lending rate as control variables for all the models; Dividend yield of current year (Dyt),Dividend yield of 1-year lag period(Dyt-1), Payout ratio of present year(PRt) and Payout ratio of 1year lag period (PRt-1) has been considered as independent variable in Model-1, Model-2, Model-3 and Model-4 separately.

Table-3: Outcome from the initial OLS models and model selection

Dependent Variable: Stock Price volatility				
	Model-1	***Model-2***	***Model-3***	***Model-4***
Independent Variables	(DY)	(Dyt-1)	(PRt)	(PRt-1)
(DY)	-0.1269			
(Dyt-1)		-0.148		
(PRt)			-0.0299*	
(PRt-1)				-0.0146
Control variables				
Size	-0.0527**	-0.0528**	-0.0499**	-0.0513**
EPS	-0.0054**	-0.0053**	-0.0056**	-0.0052**
NPL Ratio	0.07807	0.12523	0.05443	0.13281
GDP Growth rate	-0.4764	-0.4738	-0.5077	-0.4707
Inflation	-1.2499**	-1.2131**	-1.3324**	-1.1726**
Weighted Average Lending Rate	0.09329	0.02184	0.17244	0.05701
Constant	1.64903**	1.65583**	1.58068**	1.60664**
R Squared	0.397	0.3992	0.4139	0.3981
Adjusted R Squared	0.3701	0.3724	0.3878	0.3712
F Stat	14.77	14.9	15.84	14.83
Prob > F	0.0000	0.0000	0.0000	0.0000

*. At 0.05 threshold level, the result is significant.
**. At 0.05 threshold level, the result is significant.

Model-1: Influence of Dividend Yield of present year (DY) on stock price volatility

From the result attained from model 1 it is seen that a 1 percent increase in stock price volatility occurs with 12.69% decrease in dividend yield insignificantly. R squared and adjusted R squared value for model 1 is 39.7% and 37% respectively.

Model-2: Impact of Dividend Yield of 1 year lag period (Dyt-1) on stock price volatility

In model 2, it is also found that dividend yield of 1 lag year period (Dyt-1) has insignificant negative impact on stock price volatility. However, the explanatory power has increased somewhat higher than the previous one as adjusted R squared has improved from 37% to 37.24%.

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Model-3: Effect of payout ratio (PRt) on stock price volatility

A significant negative influence of payout ratio on stock price volatility is observed in model-3. At present year, around 3% increase in payout ratio can decrease 1% stock price volatility. Like Model 1 & Model 2; firm size, EPS and inflation have significant impact on stock price volatility. R squared and adjusted R squared value for model 3 increases and stands at the highest at 41.39% and 38.78% respectively.

Model-4: Impact of payout ratio of 1year lag period (PRt-1) on stock price volatility

From the result of model-4, it is seen that, payout ratio of immediate previous year has no significant impact on stock price volatility. R squared and adjusted R squared value for model 4 becomes lesser than model 3 and thus it is not acceptable for further analysis in this study.

From the synopsis of Table: "Outcome from the initial OLS model and model selection", it is noted that adjusted R squared value improves and stood highest at Model 3. After that at Model 4 it reduces again. Firm size, EPS, Inflation and Value of constant shows significant impact on price instability in all models but among the independent variables, only payout ratio of the present year (PRt) shows significant impact on stock price volatility.

Therefore, from the comparative analysis of OLS models, Model 3 is the optimum model to be used in this study. So, after excluding variables, the new regression equation stands at as follows:

$$Y = \alpha + \beta 1\ PRt + \beta 2\ Size + \beta 3\ EPS + \beta 4NPL\% + \beta 5GDP\ GR + \beta 6I + \beta 7WALR + \varepsilon$$

Before Jumping into conclusion, with this newly developed equation, various diagnostics tests are run to understand any problem of multicollinearity, heteroskedasticity, autocorrelation within the data. From the "Breusch-Pagan / Cook-Weisberg test" for heteroskedasticity, it is determined that this model has no problem of heteroskedasticity (Prob > chi2 = 0.2314). (Appended Part-Table:2)

Also, the problem of multicollinearity has not been detected in the data set as measured by mean VIF=2.27 (Appended Part-Table:3) However, existence of autocorrelation in the panel data has been detected as measured by the "Wooldridge test" for autocorrelation in panel data (Prob>F = 0.0066). (Appended Part-Table:4) Therefore, Panel data analysis has been performed in the next.

6.4 Panel Data Analysis

In this section, both the "Random effect model" and "Fixed effect model" regressions are used to analyze the panel data set. Asset size, capital size, the number of shareholders and outstanding shares, the type of business, the amount of revenue generated by the company, etc. are all factors that vary depending on the company. Random Effect Model is therefore employed when the sample's

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attributes change. The technique of the Random effect model fits to clarify the differentiation among the companies. However, for a static period, the Fixed Effect Model is employed to constraint the stable features of the firms. This method is renowned for eliminating biased data and subsequently producing better statistical results. Moreover, between these two models, which one is appropriate for our study is determined by another test named the "Hausman specification test". Similar approaches are also applied in their research by Provaty and Siddique (2021), Hossin and Ahmed (2020), Rashid and Rahman (2008), and many more.

6.4.1 Random Effect Model

The outcome of random effect model is displayed in appended Part- Table:5. From the random effect regression model exhibited in appendix table 5. From the result table, it is observed that dividend payout ratio has an insignificant negative influence on stock price volatility respectively and firm size, EPS, GDP growth rate and inflation have significant negative impact on stock price volatility.

6.4.2 The 'Breusch and Pagan Lagrangian multiplier test' for random effects

Another test called "Breusch and Pagan Lagrangian multiplier test" has been undertaken to contrast the baseline OLS regression model and the random effect model (Appended Part Table:6). According to the result of this test, chibar2(01) = 109.39, Prob > chibar2 = 0.0000; between OLS and Random effect model regression, the Random effect model is best fitted.

6.4.3 Fixed Effect Model

Appended Part-Table:7 exhibits the outcome of fixed effect model. From the result of fixed effect model, it is understood that among all the variables, Dividend payout ratio has insignificant positive impact and firm size and GDP growth rate, inflation has significant negative effect on stock price volatility as per fixed effect model.

6.4.4 Hausman Specification Effect

Summary of the Hausman specification effect result is presented below in table 4. The Hausman specification test decides which of the Fixed effect and Random effect models is more applicable for this inspection. The alternative hypothesis is to use a fixed effect model in this situation, while the null hypothesis is to use a random effect model.

Table-4: Result of Hausman Specification Test

Coefficients				
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	fixed	random	Difference	S.E.
PRt	.0017996	-.0027205	.0045202	.0028763
Size	-.0739578	-.0639628	-.009995	.0109853

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EPS	-.0023325	-.0034774	.0011449	.0009383
NPL %	-.1227993	-.0947157	-.0280836	.0270288
GDP GR	-.460329	-.4550465	-.0052824	.
I	-1.523543	-1.421423	-.1021198	.112357
WALR	-.0829322	.0291659	-.1120981	.1277534

Test: Ho: Differences in coefficients are not systematic
$Chi^2(6) = 14.84$ $Prob>chi^2 = 0.0381$
Source: Using Stata 14, the authors' own estimation

Here from the output of Hausman specification test it is noted that chi-square value is 14.84 with a probability of 0.0381 which is less than 5%. Therefore, to portray the relationships between the study's variables, fixed effect model regression is more suitable than random effect model. Before making a final decision regarding the study, it is essential to conduct certain diagnostic tests. Several diagnostic tests have been performed at this stage concerning contemporaneous correlation test, group-wise heteroskedasticity test and also autocorrelation test.

Cross-sectional independence testing: From the "Pesaran's test" of cross-sectional independence, it is found that P value is 0.0050 which is less than 5%. Therefore, there is cross-sectional dependence in this data set. Result is presented in appended part on Table:8

Group-wise heteroskedasticity test:

According to the result achieved from Wald test for group-wise heteroskedasticity (appended part Table:9), P-Value > $Chi^2(11)$ 0.0000 which is less than 5%; it means the null hypothesis for the test is rejected and accepts the alternate hypothesis which indicates panel group-wise heteroskedasticity.

Test of autocorrelation:

Wooldridge test has been conducted to check autocorrelation in the dataset. In this test, Null hypothesis was No first-order autocorrelation. From the output result (Appended Part Table:10), Prob > F = 0.0066 which is less than 5%. That means null hypothesis for this test is rejected and we conclude the existence of autocorrelation in the dataset.

6.4.5 Driscoll-Kraay standard error regression model

To account for group-wise heteroskedasticity, cross-sectional dependence and autocorrelation, Driscoll-Kraay standard errors regression model is performed. Result of the test is summarized as below in table 5. From the above regression model, it can be understood that the group of predictor variables can reliably estimate the response variable as the Prob > chi^2 is minuscule. Coefficients in the model are different than zero. Our regression model stands as follows:

$$PV= 1.58 - 0.0298PRt - 0.0498\ Size– 0.0056EPS +0.0544NPL\%- 0.50768\ GDP\ GR -1.3323I +0.17244\ WALR +\varepsilon$$

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Table-5: Driscoll-Kraay standard errors regression model

			R-squared = 0.4139; F(7,10)=126.29 Prob > chi^2 = 0.0000	
PV	**Coef.**	**Drisc/Kraay Std. Err.**	**t**	**P>|t|**
PRt	-.0298943	.0084934	-3.52	0.006
Size	-.0498556	.0107636	-4.63	0.001
EPS	-.0056274	.0009387	-6.00	0.000
NPL %	.05443	.2040978	0.27	0.795
GDP GR	-.5076828	.2480085	-2.05	0.068
I	-1.332392	.452962	-2.94	0.015
WALR	.1724429	.2169111	0.79	0.445
Constant	1.580682	.3197064	4.94	0.001

After examining predictor variables separately, it can be reasonably declared that the higher dividend payout ratio of the present year (DYt) can reduce stock price volatility of the banks within the study period at a moderate level significantly. It means, stocks with higher dividend paying are considerably responsible for the change in price volatility. Firm size has substantial negative influence on stock price volatility. Holding others thing constant, around 5% increase in asset size can decrease stock price volatility. Other control variable, EPS as a proxy of profitability, also shows considerable and tiny negative impact on price volatility. Moreover, among the country specific control variables, inflation has shown a strong negative relationship with stock price volatility very significantly. Inflation impacts stock market adversely also detected by researchers (Boons et al., 2020). However, in an efficient market, asset price volatility would simply reflect volatile economic fundamentals as quoted by Gruen (1996). The control variables NPL% and weighted average lending rate of the country show positive but insignificant impact on stock price volatility. It means when the weighted average lending rate of the country and percentage of NPL to total loans and advances of a bank goes up, investors react positively and thus stock price volatility occurs.

7. Summary of the Key Findings and Conclusion

The table below provides a summary of the study's main findings:

Table-6: Summary of the findings

Variable Type	Factors	Proxy	Outcome	Magnitude Level
Dependent Variable	Stock Price Volatility	Standard Deviation of stock price	-	-
Independent Variables	Dividend Yield	Dividend Yield of the present year (DYt)	Insignificant	-
		Dividend Yield of immediate previous year (Dyt-1)	Insignificant	-

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Variable Type	Factors	Proxy	Outcome	Magnitude Level
	Dividend Payout Ratio	Dividend Payout Ratio of the present year (PRt)	Significant, Negative	-0.0298
		Dividend Payout Ratio of previous year (PRt-1)	Insignificant	-
Control Variables	Firm Specific	Natural log of total assets (Size)	Significant, Negative	-0.0498
		Earnings Per share (EPS)	Significant, Negative	-0.0056
		Earnings Volatility (EV)	Insignificant	-
		Leverage (LR)	Insignificant	-
		Asset Growth (AG)	Insignificant	-
		NPL Ratio (NPL%)	Insignificant	-
	Country Specific	GDP Growth rate (GR)	Insignificant	-
		Inflation(I)	Significant, Negative	-1.3323
		Broad Money Growth (MG)	Insignificant	-
		Weighted Average Lending Rate (WALR)	Insignificant	-

After analyzing our results, we can get the following findings:

i. Among the dividend policy proxy variables in this study Dividend payout ratio of present year has significant negative influence on the stock price volatility of the banking industry. That means this study rejects the (Ho_1) of this research and revealed that higher dividend paying banks have possibility to face lower stock price volatility and vice versa. The obtained result is in accordance with Baskin (1989); Hussainey et al. (2011); Dewasiri and Banda (2014); Lotto (2021); Provaty and Siddique (2021) etc.

ii. Among the other control variables, both firm size and EPS have significant adverse influence on stock price volatility. That means firms/companies that are large enough, shows lower stock price volatility. Normally information of larger firms is more available to public than that of lower size firms and thus size influences on stock price volatility. Smaller companies tend to be less diversified than larger companies, so their stock values will be more volatile when compared to those of larger companies (Allen and Rachim, 1996). On the other hand, if earnings per share inclines, stock price volatility declines and vice versa for the selected companies. The explanatory power of some control variables is somewhere stronger and somewhere weaker over stock price volatility. NPL% and weighted average lending rate of the country have insignificant positive impact on the dependent variable. However, we observed macroeconomic

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indicator inflation has a very significant adverse impact on stock price volatility. So, this research also rejects (Ho_2) as both firm and country specific factors have significant influence on price volatility.

In conclusion, it can be noted that dividend policy for the banking industry provides signal to the investors and can reduce stock price volatility. This result is quite similar to other studies as demonstrated by Baskin (1989); Hussainey et al. (2011); Dewasiri and Banda (2014); Lotto (2021); Provaty and Siddique (2021) etc; but in contrast to result obtained by Allen and Rachim (1996); Sharma and Pandey (2014); Masum (2014). However, it is also noted that dividend policy is not solely responsible for stock price volatility. The significant negative impact of some firm specific control variables (asset size and earnings per share) as well as country specific control variables (inflation rate) is responsible for price volatility of bank's stock. Any other explanatory factor such as investor's behavioral issues, degree of information asymmetry etc. which may impact both dependent and independent variables; can be included further to reduce endogeneity problem, if exists. Therefore, other than dividend policy, window for future research still opens for searching and incorporating other variables such as behavioral aspects of investors, degree of market efficiency, level of political turbulence, change in macroeconomic policy etc. when examining stock price volatility.

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Appended Part

Table 1: Market Share calculation based on Market Capitalization

Serial	Bank Names	Market Capitalization in BDT Million	% of Sector Total
1	Bank Asia Ltd.	23,551.319	3.54
2	BRAC Bank Ltd.	57,618.535	8.65
3	The City Bank Ltd.	26,173.227	3.93
4	Dhaka Bank Ltd.	12,535.047	1.88
5	Dutch-Bangla Bank Ltd.	43,553.95	6.54
6	Eastern Bank Ltd.	34,124.501	5.13
7	IFIC Bank Ltd.	20,537.976	3.08
8	Islami Bank Bangladesh Limited	53,129.692	7.98
9	Mercantile Bank Ltd.	14,754.339	2.22
10	National Credit and Commerce Bank Ltd.	14,594.132	2.19
11	Premier Bank Ltd.	14,915.911	2.24
12	Prime Bank Ltd.	21,626.614	3.25
13	Pubali Bank Ltd.	26,838.479	4.03
14	Trust Bank Limited	27,165.746	4.08
15	United Commercial Bank Ltd.	18,281.076	2.75
	Total	**409,400.544**	**61.49**
	Sector Total	**665,776.447**	

Table 2: Breuscg-Pagan/Cook-Weisberg test for heteroskedasticity

$Chi^2(1)=1.43$; Prob> $Chi^2 = 0.2314$

Source: Using Stata 14, the author's own estimation

Table 3: Test of multicollinearity

Mean VIF=2.27

Source: Using Stata 14, the author's own estimation

Table 4: Wooldridge test for autocorrelation in panel data

Ho: No first order autocorrelation; F(1,14)=10.132; Prob>F = 0.0066

Source: Using Stata 14, the author's own estimation

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Table 5: Summary result of Random effect model

Random-effects GLS regression — Number of obs = 165
Group variable: bankid — Number of groups = 15

R-sq:
within = 0.2501
between = 0.4552
overall = 0.3700

Obs per group:
min = 11
avg = 11.0
max = 11

Wald chi2(7) = 60.25
corr(u_i, X) = 0 (assumed) — Prob > chi2 = 0.0000

stockpricevolatilitypv	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
dividendpayoutprt	-.0027205	.010839	-0.25	0.802	-.0239647	.0185236
firmsize	-.0639628	.0117433	-5.45	0.000	-.0869793	-.0409463
profitabilityeps	-.0034774	.0015199	-2.29	0.022	-.0064563	-.0004985
nplratio	-.0947157	.197323	-0.48	0.631	-.4814617	.2920302
gdpgrowthrate	-.4550465	.2136643	-2.13	0.033	-.8738208	-.0362723
inflation	-1.421423	.333503	-4.26	0.000	-2.075077	-.7677691
weightedaveragelendingrate	.0291659	.2375452	0.12	0.902	-.4364141	.494746
_cons	1.959965	.3341209	5.87	0.000	1.3051	2.61483
sigma_u	.02271915					
sigma_e	.02650248					
rho	.42358828	(fraction of variance due to u_i)				

Source: Using Stata 14, the author's own estimation

Table 6: Breusch and Pagan Lagrangian multiplier test for random effects

Chibar2(01) =109.39; Prob>Chibar2 =0.0000

Source: Using Stata 14, the author's own estimation

Table:7 Summary result of Fixed Effect Model

Fixed-effects (within) regression — Number of obs = 165
Group variable: bankid — Number of groups = 15

R-sq:
within = 0.2555
between = 0.3987
overall = 0.3358

Obs per group:
min = 11
avg = 11.0
max = 11

F(7,143) = 7.01
corr(u_i, Xb) = -0.2069 — Prob > F = 0.0000

stockpricevolatilitypv	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
dividendpayoutprt	.0017996	.0112142	0.16	0.873	-.0203674	.0239666
firmsize	-.0739578	.0160805	-4.60	0.000	-.105744	-.0421715
profitabilityeps	-.0023325	.0017862	-1.31	0.194	-.0058632	.0011983
nplratio	-.1227993	.1991655	-0.62	0.538	-.5164883	.2708897
gdpgrowthrate	-.460329	.2115873	-2.18	0.031	-.878572	-.0420859
inflation	-1.523543	.351921	-4.33	0.000	-2.219182	-.8279033
weightedaveragelendingrate	-.0829322	.2697196	-0.31	0.759	-.6160848	.4502204
_cons	2.237509	.4575271	4.89	0.000	1.333119	3.141899
sigma_u	.02835212					
sigma_e	.02650248					
rho	.53368078	(fraction of variance due to u_i)				

F test that all u_i=0: F(14, 143) = 9.43 — Prob > F = 0.0000

Source: Using Stata 14, the author's own estimation

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Table:8 Pesaran's test of cross-sectional independence

Pesaran's test of cross-sectional independence = 2.804, Pr = 0.0050

Null: No contemporaneous correlation exists

Source: Using Stata 14, the author's own estimation

Table:9 Group-wise heteroskedasticity test((Modified Wald Test)

Modified Wald test for group-wise heteroskedasticity in fixed effect regression model

chi2 (15) = 91.92

Prob > chi2 = 0.0000; Null: No group-wise heteroskedasticity exists

Source: Using Stata 14, the author's own estimation

Table:10 Wooldridge test for autocorrelation

Wooldridge test for autocorrelation in panel data

H0: no first order autocorrelation

F(1,14) = 10.132 Prob > F = 0.0066

Source: Using Stata 14, the author's own estimation

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Biometrics Authentication for E-payment: An Empirical Approach to Understanding user Adoption

JUJBR

Abul Khayer*

Abstract: *This study is designed to assess several key predictors of user intention to accept biometrics authentication for e-payment. To do so, a research model is constructed based on the prominent unified theory of acceptance and use of technology (UTAUT) framework. Further, the UTAUT model is expanded by integrating three prevalent constructs that are essential to accept biometrics authentication. As the principal analytical tools, structural equation modelling (SEM) and importance performance map analysis (IPMA) are employed. The study reveals significant effects of performance expectancy, effort expectancy, social influence, perceived risk and perceived trust on attitude. Moreover, attitude, facilitating conditions, and perceived trust play a substantial role in predicting user adoption intention to biometrics authentication in e-payment. The IPMA suggests that perceived trust and facilitating conditions fall into the critical zone, requiring special managerial considerations. This research has offered a comprehensive research model to explore users' biometrics authentication adoption behaviour, particularly in the field of e-payment. This study assesses the initial adoption behaviour of biometrics authentication in e-payments; therefore, assessing users' continuance usage behaviour of this technology can be a potential for future research.*

Keywords: *biometrics authentication; electronic payment; technology adoption; SEM; IPMA*

1. Introduction

Tremendous advancement in financial technology has brought a new paradigm in the domain of electronic payment (e-payment). E-payment can be defined as the use of digital technologies for the payments of goods and services (Ogbanufe & Kim, 2018). In the context of e-payment, a key issue is the identification or authentication process for completing payment transactions. Identification refers to the establishment of someone's identity, answering the question "who this person is?", while authentication aims to confirm someone's identity, answering the question "is this person the one he claims to be?"

Traditionally, authentication for e-payment was password-based or token-based, which suffered mainly from their security measures (Ogbanufe & Kim, 2018). Fraudsters often target conventional e-payment systems to steal consumers' valuable resources (i.e., sensitive information and financial resources) (Miltgen et

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al., 2013). Managing passwords is very difficult, and the token can easily be stolen.To face this challenge, e-payment service providers need to ensure an improved security system, as traditional methods cannot ensure the originality of the presence of the presenter of a password or token (Yang et al., 2013). Therefore, experts suggested biometrics as an alternative to conventional authentication systems for e-payment (Clodfelter, 2010), which is considered a safe, secure and convenient mechanism, particularly in the field of electronic payment (e-payment) systems.

Biometrics authentication provides significant benefits, such as increasing safe and secure transactions, reducing the risk of identity theft, enabling faster payments, and ensuring convenient payments. However, this technology has experienced various challenges toward its wider acceptance among consumers, as customers perceive the potential risks associated with the widespread adoption of this technology (Miltgen et al., 2013). Customers are very concerned about security and privacy issues (two vital components of perceived risk) of their sensitive information, which inhibits the acceptance of biometrics authentication, particularly in the e-payment context (Angst & Agarwal, 2009).

As the use of biometrics authentication in the context of payment is a relatively new phenomenon, empirical research on this issue is still at the nascent stage. The author observed a few related pieces of literature and divided them into three groups: (i) scientific studies focusing mainly on the design or feasibility of biometric technologies in the sense of payment (Yang et al., 2013), (ii) descriptive studies stating the meaning, categories, advantages and challenges of implementing biometrics authentication (Kumar & Ryu, 2009), and (iii) empirical studies investigating the determinants of biometrics authentication adoption (Ogbanufe & Kim, 2018). Most of the extant research on user adoption of biometrics authentication for payments is exploratory, which fails to measure the predictors of biometrics authentication adoption in e-payment.

Hence, this investigation has been designed to assess the subsequent research inquiries. (i) Which variables are crucial in the adoption of biometric authentication for electronic payments? Furthermore, what are the pivotal elements that require enhancement in order to promote the usage of biometrics authentication? In this study, the popular structural equation modelling (SEM) is employed. In addition, the author has augmented the SEM methodology by using the importance-performance map analysis (IPMA). The IPMA helps decision-makers recognize the critical factors that receive low concentration despite their high importance scores. The employment of the SEM-IPMA method may offer a shift in the methodological paradigm in the technology adoption research, which offers an innovative and comprehensive understanding of biometrics adoption in e-payment.

2. Literature Review and Model Development

2.1 Biometrics authentication

Biometric authentication is the process of using various physical or behavioural traits to verify and confirm a person's identification (Ogbanufe & Kim, 2018). Although biometric technology was accepted sporadically by customers in the

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past, in recent years, the application of this technology has experienced a steady increase (Miltgen et al., 2013).

Biometrics in the e-payment authentication system provides users with a reliable, convenient, secure, and cost-effective payment facilities (Stylios et al., 2022). According to a China's Payment and Clearing Association (CPCA) survey, nearly 95% of the interviewees declared that they "knew about" fingerprint recognition. Also, 70% of users said they were comfortable with biometrics authentication for making payments in 2016. This large number denotes that an increasing number of users diagnose the necessity of a user-friendly and secure biometric authentication system for e-payments. Yang et al. (2013) and Kumar & Ryu (2009) provided an explanation of the definition, various varieties, potential advantages, and difficulties associated with payments based on biometric authentication. Bilgihan et al., (2009) examined the factors that influence customers' acceptance of fingerprint technology for payments and concluded that perceived risk, personal innovativeness, and convenience play a key role in the adoption of fingerprint payment technology.

A major concern of adopting biometrics authentication is the privacy and security associated with that system. According to Kumar & Ryu (2009), biometrics systems have much more complex security measures compared to other information systems. While no biometric technology can offer absolute security, experts emphasize that high-cost systems such as iris scanners possess greater accuracy in making identifications compared to low-cost technologies like signature dynamics (Srivastava, 2009). Since there is a wide variety of biometrics technologies available to recognize the person, correctly or erroneously and with or without an individual's permission, biometrics authentication systems can threaten the total system's privacy and security (Hadzidedic et al., 2022).

2.2 Research model development

Within the realm of information systems research, two established theories are the theory of reasoned action (TRA) (Ajzen & Fishbein, 1980) and the theory of planned behaviour (TPB) (Ajzen, 1991), which are employed to evaluate an individual's behaviour towards the adoption of technology. These two theories claim that the primary determinants of the intention to adopt technology are the individual's attitude, which is shaped by their behavioural beliefs, and subjective norms, which are influenced by their normative beliefs.

Drawing on the TRA and the TPB, Davis (1989) subsequently developed the Technology Acceptance Model (TAM). Despite its widespread acceptance in the literature, the TAM has faced several criticisms. Firstly, it provides only general information about users' perceptions of innovations. Secondly, it places too much emphasis on a deterministic approach, disregarding individual characteristics. Lastly, it assumes that the use of technology is entirely voluntary. Rogers (2010) established innovation diffusion theory (IDT) in the IS literature, which has been validated as a solid framework for comprehending the spread of technology in both organizational and individual contexts. Nevertheless, IDT predominantly

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focuses on technological aspects while disregarding other individual, organizational, and societal issues. Another widely used paradigm is the technology-organizational-environmental (TOE) framework, which was introduced by Tornatzky et al. in 1990. Nevertheless, this framework is more appropriate for the context of organizations rather than individuals.

Corresponding to the limitations of past information technology (IT) adoption models, a widespread technology adoption model is the UTAUT constructed by Venkatesh et al. (2003) on the basis of a thorough analysis of eight popular IT adoption models. This model has been applied extensively in the extant research that seeks to assess the technology adoption behaviour. The UTAUT consists of four primary constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions. This integrated model has the capability to account for approximately 70% of the variability in user behaviour (Talukder et al., 2019).

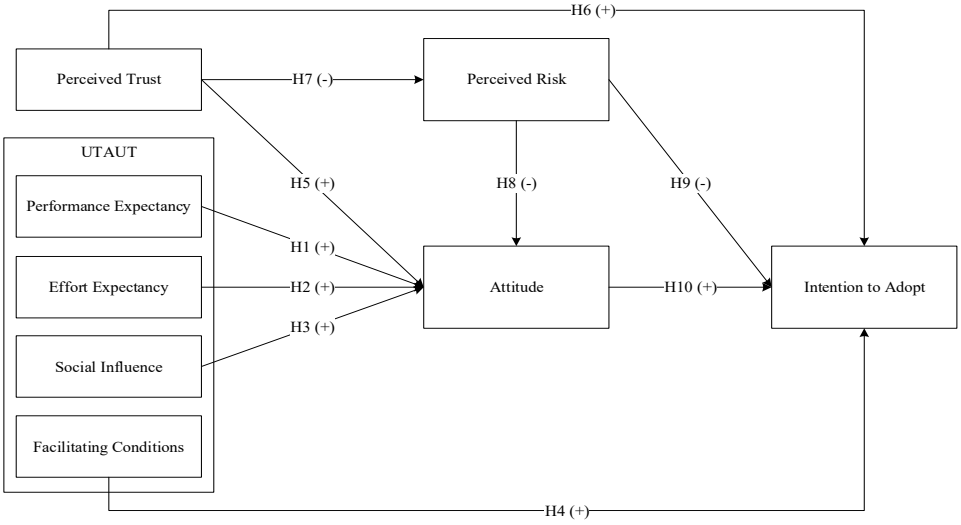

Figure 1. Research framework

The physiognomies of biometrics authentication (e.g., accessibility, security, trust, convenience) are connected to several determinants of organizational, individual, and technological characteristics. Hence, the author applies the UTAUT as the foundation of the research model for investigating biometrics authentication-enabled e-payment adoption. In addition, the author extends the UTAUT model by attitude, perceived trust, and perceived risk. Extending existing models with relevant contextual variables has gained tremendous popularity in modern research (Khayer & Bao, 2019). The author implants attitude as a mediator since the degree to which biometrics-enabled e-payment is useful, convenient, and simple can affect the consumers' attitude, and behavioural intention typically relies on attitude. The presence of risks in users'

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minds is a major inhibitor for accepting biometrics authentication, particularly in the e-payment context. Perceived trust also plays a positive role in diminishing perceived risk and motivating users towards accepting biometrics authentication for e-payment (Zhou, 2014). The study framework with appropriate hypotheses is depicted in Figure 1.

3. Hypotheses Development

3.1 Performance expectancy (PE)

When a person believes that the use of a technology will enhance the performance of achieving a task is known as performance expectancy. Within the realm of electronic payment systems, consumers typically prioritise precise, secure, convenient, and expeditious financial transactions. Ogbanufe & Kim (2018) did a comparison analysis of standard authentication methods and biometric authentication methods in the context of electronic payment systems and stated that biometrics authentication provides two types of benefits such as pre-transaction benefits (e.g., reduction in cognitive effort and enhanced convenience) and after-transaction benefits (e.g., deception reduction, quick transaction, and easy payment). In another study, Liébana-Cabanillas et al., (2023) revealed that performance expectancy is the most significant predictor of intention to adopt biometric mobile payment. Considering the various benefits offered by biometrics authentication in e-payment, this study assumes that consumers expect that the use of biometrics authentication may assist them in achieving financial transactions more quickly and increase productivity and flexibility in payments, which will lead to forming positive attitudes. Thus,

H1: Performance expectancy positively affects attitude toward biometrics authentication for e-payment.

3.2 Effort expectancy (EE)

The extent of ease of use associated with s technology is known as effort expectancy. Research in the field of Information Systems has established that the perception of ease of use significantly influences the development of a favourable attitude towards adopting new technology (Talukder et al., 2019). Contemporary biometrics systems are user-friendly and have the potential to enhance convenience for customers while conducting financial transactions Morosan (2011). According to Ogbanufe & Kim (2018), perceived convenience refers to the simplicity and ease of use offered by the payment method. The role of effort expectation is crucial in the use of a security-based system due to its potential time-saving benefits. The cognitive work of a consumer is diminished when they are not required to recall the accurate username and password for every transaction. Consumers can enjoy convenience and flexibility during payment, checkout, and travel, which is a key force to adopt biometrics (Ogbanufe & Kim, 2018). Biometrics authentication in e-payment is an easy-to-use and convenient system that may require little knowledge and effort, which influences consumers' attitudes positively. Thus, the author formulates the subsequent hypothesis.

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H2: Effort expectancy positively affects attitude toward biometrics authentication for e-payment.

3.3 Social influence (SI)

A person's perception can be changed by the views, opinions, and suggestions given by another person or group of persons. In China, the use of communication interfaces among the young generation is more subject to social influences (Bao et al., 2017). Transferred to the domain of biometrics authentication in e-payment, social influence could be a major determinant of user attitude. Modern people think that technological invasion into one's personal life is normal; therefore, social influence fosters acceptance of biometrics technology (Liu et al., 2019). However, in line with several prior studies, this study considers that social circles perceive biometrics technology as normal, and influences from social circles such as family, friends, and colleagues positively affect an individual's attitude towards a socially acceptable system like biometrics authentication for e-payment.

H3: Social influence positively affects attitude towards biometrics authentication for e-payment.

3.4 Facilitating conditions (FC)

Venkatesh et al. (2003) specified that the perception regarding the presence of organizational and technical enabling conditions would motivate the acceptance of a technology. The IS literature has proven a favourable correlation between enabling situations and adoption intention (Bhuasiri et al., 2016), when a strong relationship was found between facilitating conditions and biometric mobile payment adoption (Liébana-Cabanillas et al., 2023). For biometrics authentication for e-payment, facilitating conditions include enabling conditions that will support individuals to accept the system. Facilitating conditions include having the necessary infrastructure, providing practical instruction to use the system, 24/7 help desk facilities, compatibility with other systems, and delivering quick responses to queries. More extraordinary facilitating conditions will create more positive intentions to adopt biometrics authentication. Thus,

H4: The presence of facilitating conditions has a positive impact on the intention to employ biometrics authentication for e-payment.

3.5 Perceived Trust (PTR)

The importance of trust is emphasized in the electronic payment environment (Sulaiman & Almunawar, 2021), as there is a longitudinal and chronological distance between payer and payee, whereby payers need to provide personal information to others (Ogbanufe & Kim, 2018), The less transparency and poor control over personal data given during transactions could cause trust problems (Liebana-Cabanillas et al., 2017). Since trust has been critical in the domain of IS, researchers have extensively addressed trust from various viewpoints. In the context of biometrics authentication in e-payment, trust is even more critical as there is a possibility of being hacked off the sensitive consumers' financial and biometrics information. Hence, consumers frequently feel more uncertain about

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e-payment service providers and the consequences of online transactions (Slade et al., 2015). In terms of biometrics authentication for making e-payments, consumers need to provide their biometrics data to the service providers. Thus, if service providers fail to develop a trustworthy environment involved with the biometrics authentication-enabled e-payment, consumers will not be motivated towards its adoption. This research assumes that an upper level of trust in the biometrics authentication for e-payment will positively impact consumers' attitudes and further, affect consumers' intention to adopt biometrics authentication for e-payment. Thus,

H5: Perceived trust significantly influences attitude toward biometrics authentication for e-payment.

H6: Perceived trust significantly influences the adoption of biometrics authentication for e-payment.

Furthermore, by creating a positive perception regarding the system use, trust reduces perceived risk and helps overcome the uncertainty of the behaviour (Slade et al., 2015). The negative impact of trust on perceived risk is supported by several research pieces conducted in different technology contexts (Johnson et al., 2018). Being consistent with the above studies, the author conceptualizes that perceived trust negatively influences an individual's perceived risk of accepting biometrics authentication. Thus,

H7: Perceived trust negatively affects perceived risk.

3.5 Perceived risk (PR)

The perceptions of risk significantly influence consumers' adoption behaviour directly and indirectly through influencing attitudes. For example, any technology's adoption decision is affected by perceived risk, particularly when consumers perceive that the adoption of that technology will generate feelings of uncertainty, discomfort, anxiety, conflict, psychological discomfort, or cognitive dissonance (Shin, 2010). Wu and Wang (2005) claimed that the percentage of mobile commerce purchasing goods is negatively connected to the perceived risk involved in online purchasing. Bauer et al., (2005) argued that perceived risk is a significant inhibitor in mobile marketing adoption. In the e-payment context, risk perceptions play a more severe role in accepting emerging technology-enabled payment systems like biometrics payment. Extant literature extensively emphasizes the significance of assessing perceived risk (Liu et al., 2019). Chen (2013) conducted a study that evaluated the influence of perceived risk and discovered that users' perception of risk had a notable adverse impact on both their attitude and intention to embrace mobile banking services in the context of Taiwan. Within the realm of biometrics payment, individuals express concern regarding the potential compromise of security and privacy when engaging in online transactions. Therefore, the author establishes the following hypotheses.

H8: Perceived risk negatively influences user attitude toward biometrics authentication.

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H9: Perceived risk negatively affects the adoption of biometrics authentication for e-payment.

3.6 Attitude (AT)

Attitude and subjective norms collectively determine the likelihood of the person taking a specific action (Venkatesh et al., 2003). Extant literature on IS confirmed attitude as a strong predictor of adopting and using innovative technology (Angst & Agarwal, 2009; Shin, 2010). Extant literature revealed a favourable connection between attitude and adoption intention. For instance, Liébana-Cabanillas et al. (2014) revealed that attitude is an essential predictor of behavioural intention in the mobile payment context. Morosan (2011) conducted research investigating the determinants of biometrics authentication in restaurants and identified that attitudes act as a strong determinant of behavioural intention. Thus, this study posits that attitude has a favourable impact on predicting user intention to adopt biometrics authentication for e-payment.

H10: Attitude positively affects behavioural intention in adopting biometrics authentication for e-payment.

4. Methodology

4.1 Questionnaire formation

A close-ended questionnaire was created, which was segmented into two parts. Part A contained 32 questions about the various latent constructs of the model. In Appendix A, the corresponding measurement objects of each construct are given. The measuring instruments have been adapted from existing literature with minimum context-specific modifications to enhance the authenticity of the material. Two researchers proficient in technology adoption research conducted an initial pre-test of the questionnaire parts to enhance transparency, correctness, and comprehensibility. In order to collect data, the author employed a five-point Likert scale. Part B consisted of the demographic characteristics of the responder.

4.2 Data Collection

Before administering the survey, a pilot test was done to assess the effectiveness of the questionnaire with a sample of 40 from Huazhong University of Science and Technology, Wuhan, P.R. China. The results of the exploratory factor analysis indicate that each measurement item exhibits a strong loading on its respective construct (>0.70), which recommends that the scale fulfils the validity criteria. This study targets Chinese adults as the population. As there is no appropriate sampling frame, the author has applied a non-probabilistic convenience sampling. The author has collected data by conducting a cross-sectional survey at different important locations (e.g., shopping centres, supermarkets, and university campuses) in Wuhan, P. R. China. To avoid response bias, the author instructed respondents to exclude their names, living addresses, identification numbers, and contact information. The author distributed 350 questionnaires; among them, 309 were received. Due to incomplete responses, 24 questionnaires were rejected. Appendix B depicts the demographic physiognomies of respondents.

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4.3 Common method bias test (CMB)

In order to deal with the issue of CMB, the author has employed both procedural methods and statistical testing (Schwarz et al., 2017). As a procedural step, the identity of the responders was kept confidential. In addition, participants were encouraged to make unambiguous responses. The selection of the words was meticulously made to reduce the level of opacity. Furthermore, alongside the procedural measurements, certain statistical tests were conducted. The author assessed CMB using Harman's single-factor technique (Harman, 1976). Principal component factor analysis and varimax rotation were used to evaluate the dataset and determine the number of variables needed to explain variation. The test results notified that a single variable explained 40.42% of the variation, less than the required 50%. In addition, Table 2 shows how variance inflation factors (VIF) were used to detect CMB. Since these values were below 3.3 (Kock, 2015), the author may conclude that this study is CMB-free.

4.4 Data Analysis

The author has used the SEM approach to analyze the hypotheses, assess the predictive significance of the model, and interpret the validity and reliability of the components. The ability of the PLS-SEM technique to test several relationships at once made it the most suitable method. The relationship between each construct can only be examined separately using other traditional statistical techniques such as multivariate variance analysis (Hair Jr. et al., 2016). Additionally, when assessing a theoretical model, PLS-confirmatory SEM's approach supersedes other multivariate approaches. Additionally, the author has supplemented the SEM methodology by using the IPMA. SmartPLS version 4 was used to run the dataset.

5. Results

5.1 Measurement model

The measurement model is judged by testing internal reliability, convergent validity and discriminant validity. The constructs' internal reliability was checked by employing various criteria such as Cronbach's Alpha, rho (ρA), and composite reliability metrics. In order to assess internal reliability, it is necessary for the reliability parameters of each variable to be equal to or more than 0.70 (Henseler et al., 2014; Henseler et al., 2009). Items reliability was checked by their loading values. The values for the reliability criteria, as displayed in Table 1, satisfied the suitable range, hence guaranteeing the constructions' elevated internal reliability. The author evaluated the convergent validity using factors such as average variance derived (AVE) and item loading. In order to ensure the consistency of convergent validity, it is recommended that the values of AVE and loadings exceed 0.50, as suggested by (Fornell & Larcker, 1981). According to the data provided in Table 1, the AVE and loadings values were below the required threshold.

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Table 1. Measurement model

Constructs	Loadings range	Cronbach's Alpha	rho_A	CR	AVE
Attitude	0.864-0.916	0.858	0.861	0.914	0.779
Behavioural Intention	0.860-0.901	0.855	0.855	0.912	0.776
Effort Expectancy	0.841-0.858	0.804	0.805	0.884	0.718
Facilitating Conditions	0.742-0.889	0.762	0.818	0.861	0.677
Performance Expectancy	0.799-0.855	0.860	0.861	0.905	0.705
Perceived Risk	0.866-0.892	0.903	0.907	0.932	0.773
Perceived Trust	0.720-0.818	0.801	0.800	0.870	0.627
Social Influence	0.749-0.813	0.799	0.803	0.868	0.622

Source: Developed by the author

Table 2. Discriminant validity and VIF

	Correlation Matrix and Square Root of the AVE								VIF		
Constructs	**AT**	**BI**	**EE**	**FC**	**PE**	**PR**	**PTR**	**SI**	**AT**	**BI**	**PR**
AT	**0.883**									1.236	
BI	0.657	**0.881**									
EE	0.656	0.627	**0.848**						1.863		
FC	0.437	0.495	0.433	**0.823**						1.235	
PE	0.694	0.665	0.616	0.459	**0.840**				2.046		
PR	0.518	0.315	0.322	0.197	0.370	**0.879**			1.292		
PTR	0.652	0.582	0.582	0.431	0.572	0.441	**0.792**		2.515		1.000
SI	0.682	0.546	0.570	0.381	0.641	0.429	0.741	**0.789**	2.693		

Source: Developed by the author

Further, the author assessed the discriminant validity by evaluating the consistency of the Fornell-Larcker and Heterotrait-Monotrait Ratio (HTMT) parameters. All the square roots of the AVE values (as shown in Table 2) exceeded the respective coefficients of correlation, thereby satisfying the Fornell-Larcker recommendations. Furthermore, all HTMT ratio values (as shown in Table 3) were less than 0.90, which confirms sufficient discriminant validity for all constructs (Henseler et al., 2014).

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Table 3. Heterotrait-Monotrait Ratio (HTMT)

Constructs	AT	BI	EE	FC	PE	PR	PTR	SI
AT								
BI	0.764							
EE	0.788	0.755						
FC	0.526	0.595	0.525					
PE	0.805	0.775	0.738	0.545				
PR	0.586	0.357	0.374	0.251	0.414			
PTR	0.776	0.696	0.719	0.535	0.678	0.512		
SI	0.804	0.645	0.703	0.458	0.762	0.497	0.835	

Source: Developed by the author

5.2 Structural model

The key estimation of the structural model's goodness is R^2 and the degree of significance of the path coefficient. As this research model has the ability to explain 66.5% of the variability in attitude, 51.2% of the variability in intention to employ biometric payment, and 19.4% of the variability in perceived risk, it can be said that the model is statistically validated. The path significance level was assessed by employing the bootstrapping method with 5000 re-samples. Table 4 depicts the consequences of the hypotheses test.

Table 4. Structural model

Hypotheses	Paths	Coefficient (β)	*t*- statistics	Decision
H1	PE -> AT	0.282	4.929	Accepted
H2	EE -> AT	0.238	4.174	Accepted
H3	SI -> AT	0.184	3.161	Accepted
H4	FC -> BI	0.214	4.604	Accepted
H5	PTR -> AT	0.127	2.267	Accepted
H6	PTR -> BI	0.223	3.579	Accepted
H7	PTR -> PR	-0.441	8.421	Accepted
H8	PR -> AT	-0.203	4.191	Accepted
H9	PR -> BI	-0.057	1.185	Rejected
H10	AT -> BI	0.448	7.185	Accepted

Source: Developed by the author

The analysis revealed that all hypotheses, with the exception of H9, were statistically confirmed. It can be seen from the table that performance expectancy, effort expectancy, social influence, and perceived trust positively influence attitude. On the other hand, perceived risk has a negative influence on user

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attitude. Moreover, the presence of facilitating conditions, perceived trust, and attitude significantly influence the intention to accept biometrics authentication. This study further validates that there is a strong negative effect of perceived trust on perceived risk.

5.3 Importance-performance map analysis (IPMA)

In this analysis, by using the SmartPLS 4 version program, the author ran IPMA in SEM two times. Attitude and behavioural intention were selected as the target constructs. The author created two priority maps based on the importance and performance ratings, as shown in Figure 2 and Figure 3. Figure 2 shows that perceived trust, effort expectancy, and perceived risk have lower performance scores despite their higher importance in explaining attitude. Therefore, managers should focus more on these constructs in order to improve user attitudes toward biometrics authentication in e-payments. However, performance expectancy is a well-managed variable as it has both relatively higher importance and performance compared to other variables. Figure 3 indicates that facilitating conditions and perceived trust are low-performing variables despite their relatively higher importance compared to perceived risk. Hence, managers need to allocate more resources to developing facilitating conditions and trust to boost the adoption of biometrics authentication in e-payments. Finally, it is clear from Figure 3 that attitude is an effective and well-managed predictor of behavioural intention to adopt biometrics in authentication in the e-payment context.

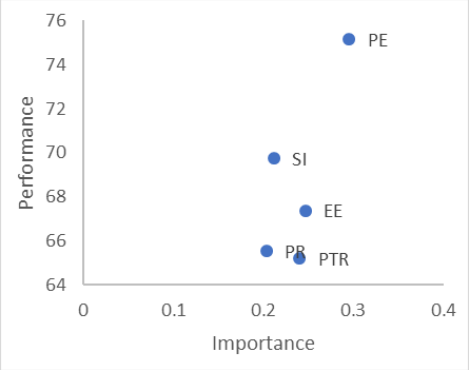

Figure 2: IPMA for attitude

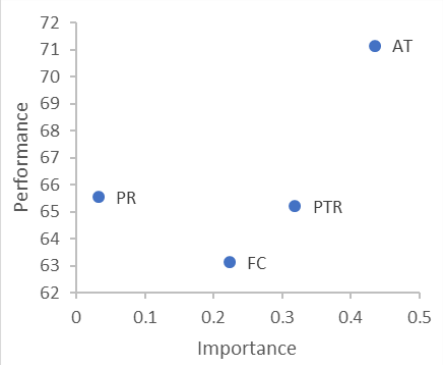

Figure 3: IPMA for behavioral intention

6. Discussion

One of the essential motivators for forming a positive attitude toward biometrics authentication for e-payment is effort expectancy. Individuals believe that biometrics authentication requires minimum time and effort compared to other old-fashioned authentication methods for e-payments, which motivates them to form a positive attitude toward this emerging technology. Also, performance expectancy was identified to have an influential role in forming a positive attitude toward the acceptance of biometrics authentication. This means that a

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user's attitude can be evaluated based on the degree to which it demonstrates usefulness and benefits to the users. Multiple previous studies on technology adoption have corroborated similar conclusions (Johnson et al., 2018; Oliveira et al., 2016; Slade et al., 2015). Social influence played a noteworthy role in influencing consumers' attitudes toward accepting biometrics authentication for e-payment. Consistent with the findings of (Liebana-Cabanillas et al., 2017), this study examines the impact of several reference groups, such as family members, friends, and peer groups, on consumers' attitudes, especially in voluntary situations.

This study found perceived trust as a vital factor that has direct effects on both consumers' attitudes and behavioural intentions to adopt biometrics authentication. This discovery aligns with previous research that demonstrated trust as a fundamental requirement for users to embrace electronic services (Adjei, 2015; Hampshire, 2017; Liebana-Cabanillas et al., 2017; Shin, 2010). This result is expected as Chinese people have trust in the adoption of any innovative payment technology. For example, in China, people from all walks of life use mobile payment services offered by Alipay and WeChat pay for their every financial transaction. Also, this study identified that perceived risk strongly and negatively impacted attitude. Consistent with some prior studies (Chen, 2013; Johnson et al., 2018; Yang et al., 2013), this result indicates that an individual's concerns over the violation of security and privacy associated with the utilization of biometric technologies lead to unfavourable views towards the adoption of these technologies. Moreover, individuals are very sensitive about their biometrics data, which can be used by other parties (i.e., credit card agents and insurance brokers) without their permission. Therefore, they expect to perform confidential and secured financial transactions through e-payment using biometrics payment technologies.

Interestingly, this study found that perceived risk indirectly affected behavioural intention to adopt biometrics authentication for e-payment. This finding contradicts the outcomes of several previous studies (Ogbanufe & Kim, 2018; Shin, 2010; Slade et al., 2015). One plausible reason is that perceived risk loses its importance when consumers exhibit more concern about perceived benefits and trust toward the service provider (Bhuasiri et al., 2016). In this study context, as biometrics authentication for e-payment provides safe, secure, fast, and convenient financial transactions, consumers mainly focus on benefits rather than risks. Moreover, this finding also indicates that service providers are quite efficient in developing trust among consumers. Another possible reason is that as Chinese people have the experience of using biometrics authentication for different purposes such as performing banking activities, fulfilling the immigration process, and performing various government activities, they have lower perceptions about the risk involved with biometrics authentication for e-payment. In short, perceived risk has no direct effect on behavioural intention, rather than behavioural intention affecting attitude toward biometrics authentication for e-payment. This outcome may arise due to the cognitive

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dissonance of the consumers. Also, the author found that perceived trust had a strong and negative impact on perceived risk; this indicates that if individuals' trust level rises, the risk of adopting biometrics payment will be reduced.

Additionally, this study observed that facilitating conditions is a positive and direct antecedent to adopting biometrics authentication for e-payment. This finding implies that users expect various facilitating services (e.g., proper instructions, awareness programs, training, and support) that can lead them toward the appropriate use of biometrics payment. Consumers also look into whether the providers have sufficient capacity to offer this hi-tech service. This study strongly indicates that attitude has a significant and prominent influence on the adoption of biometrics authentication for e-payment.

Finally, this study aims to determine the crucial factors that have a greater impact (total effects) but are less effective in describing attitude and behavioural intention. According to the IPMA data, it is clear that perceived trust, effort expectancy, and perceived risk are in the critical zone due to their lower performance, despite their great importance in moulding attitudes. Furthermore, the presence of facilitating conditions and trust are identified as crucial components in determining behavioural intention. Managers should increase resource allocation to encourage the adoption of biometrics authentication for e-payment by improving perceived trust, effort expectancy, and facilitating conditions.

7. Contributions of the Research

7.1 Theoretical contribution

This study is one of the few that, in the sense of e-payment, explores users' biometrics authentication acceptance behaviour. It has expanded the UTAUT by incorporating attitude to clarify the behavioural intent. This study evaluated the importance of a person's features, i.e., the attitude to the adoption of IS / IT, which was not counted in the original UTAUT model. In addition, this research expands the UTAUT model by introducing two constructs that are relevant to biometrics authentication, such as perceived trust and perceived risk. The existence of perceived trust and perceived risk explicitly supports the model's overall performance. Therefore, this research contributes to the field of system enhancement-based research on the acceptance of biometrics technology. In addition, the addition of perceived risk signifies the risk-taking attitude of customers towards the implementation of biometrics authentication in the sense of e-payment. Therefore, the proposed theoretical model makes substantial contributions to the current IS literature.

In addition, this study used IPMA to examine each latent variable's level of importance and performance in explaining target constructs. As this technique is relatively new in PLS analysis, very few studies applied this analysis. The IPMA provides us with the use of the priority chart to show the order of importance and performance, enabling researchers to visualize better and understand the predictors of the adoption of biometrics authentication. The use of IPMA helps

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distinguish which structures should be given extra concentration and which should be given less significance. It also lets researchers design their future studies on the basis of the constructs' priority.

7.2 Contribution to different stakeholders

The research has valuable insights for managers and practitioners to promote the widespread use of biometrics authentication for e-payments. Given the importance of attitude in influencing user adoption, service providers should prioritise the different aspects that contribute to users' favourable attitudes. To cultivate favourable consumer attitudes, service providers should give priority to augmenting customers' impression of the inherent advantages of utilizing biometric authentication for financial transactions. They are to identify and analyze user requirements, benchmark the systems with the widely accepted systems, and communicate the system's competencies through online and offline media (Slade et al., 2015). Likewise, collaborative efforts with consumers, designers, systems analysts, and software developers can play an important role in designing an effective and user-friendly biometrics system. Besides, decision-makers should undertake strategies to reap the benefits from social influence among customers for the widespread adoption of biometrics payment. They could boost social influence by establishing forums for sharing best-use practices and benefits of the systems; this could create favourable word of mouth and help develop protective measures to counter any unfavourable feedback.

Moreover, developing a trustworthy environment is essential for any technology adoption. In the context of biometrics payment, as consumers need to provide all the credentials, including biometrics data, managerial activities must concentrate on such activities, which can improve the consumers' trust level. Furthermore, the significant impact of perceived risk on attitude implies that biometrics payment service providers must develop and implement adequate privacy and security measures to protect consumers from security breaches and cyber-fraud. Social awareness of security threats should be promoted through online and offline media. Finally, improved facilitating conditions (e.g., technological, human, and infrastructural resources) increase the intention to accept biometrics authentication for e-payment. Therefore, merchants, suppliers, and application developers should build appropriate infrastructures, nurture human resources, and provide users valuable resources related to using biometrics authentication for e-payment.

8. Constraints and Potential Avenues of Research

This paper has certain shortcomings that give rise to prospective avenues for further investigation. Initially, this study utilized the UTAUT model as the theoretical basis. Subsequent investigations might be carried out employing alternative technology adoption models such as UTAUT2, TAM, and IDT. Second, this study does not assess the moderation effect; future studies can assess the moderation effect of different variables such as gender, age and culture. Third, this study has considered the sample taken from P. R. China; future

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researchers should consider wider geographic coverage; even cross-country analysis can be performed. Fourth, it could be interesting to compare different biometrics authentication users in e-payment as the adoption behaviour might vary among various biometrics authentication users. Finally, this study assesses the initial adoption behaviour of biometrics authentication in e-payments; therefore, assessing users' continuance usage behaviour of this technology can be a potential for future research.

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APPENDIX A. MEASUREMENT ITEMS

Construct	Equivalent Items	Sources
Performance expectancy	PE1 – I think that using biometrics authentication is useful to carry out my e-payment tasks. PE2 - I think that using biometrics authentication would enable me to conduct my e-payment tasks more quickly. PE3 - I think that using biometrics authentication for e-payment would increase my productivity. PE4 - I think that using biometrics authentication for e-payment would improve my performance.	(Oliveira et al., 2016; Venkatesh, Thong, & Xu, 2012)
Effort expectancy	EE1 - My interaction with biometrics authentication for e-payment would be clear and understandable. EE2 - It would be easy for me to become skilful at using biometrics authentication for e-payment. EE3 - I would find biometrics authentication for e-payment easy to use.	(Oliveira et al., 2016; Venkatesh et al., 2012)
Social influence	SI1- People who influence my behaviour think that I should use biometrics authentication for e-payment. SI2- People who are important to me think that I should use biometrics authentication for e-payment. SI3- People whose opinions I value prefer that I use biometrics authentication for e-payment. SI4 - Using biometrics authentication for e-payment is a status symbol in my society.	(Oliveira et al., 2016; Venkatesh et al., 2012)
Facilitating Conditions	FC1- Particular instructions regarding the biometrics authentication for e-payment would be available to me. FC2- Biometrics authentication for e-payment is compatible with other systems that I use. FC3- When I have difficulties using biometrics authentication for e-payment, I can get help from service providers.	(Oliveira et al., 2016; Venkatesh et al., 2012)
Perceived Trust	TR1. I think biometrics authentication for e-payment is a trustworthy system. TR2- I think biometrics authentication for e-payment provides reliable and safe financial services. TR3- I trust biometrics authentication for e-payment because they keep my best interests in mind. TR4- I think biometrics authentication for the e-payment system will preserve my biometric data safely.	(Slade et al., 2015; Zhou, 2014)
Perceived Risk	PR1- The use of biometrics authentication for e-payment may cause my personal information to be stolen. PR2 - If I use biometrics authentication for e-	(Johnson et al., 2018; Koenig-Lewis, Marquet,

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Construct	Equivalent Items	Sources
	payment, I feel psychological discomfort. PR3- I think that it is unsafe to use biometrics authentication for e-payment. PR4 - I believe that the use of biometrics authentication for e-payment may bring negative consequences.	Palmer, & Zhao, 2015)
Attitude	AT1- Using biometrics authentication for e-payment would be a good idea. AT2 - I like the idea of using biometrics authentication for e-payment. AT3 - Using biometrics authentication for e-payment would be pleasant.	(Chen, 2013; Shin, 2010)
Behavioural Intention	BI1- Given the chance, I intend to use biometrics authentication for e-payment. BI2- I have the intention to use biometrics authentication for e-payment. BI3- I intend to use biometrics authentication for e-payment in the next month.	(Oliveira et al., 2016; Venkatesh et al., 2012)

APPENDIX B. RESPONDENTS' DEMOGRAPHIC PROFILE

Descriptions		Frequency	Percentage
Gender	Male	179	62.81%
	Female	106	37.19%
Educational Qualification	Secondary	32	11.23%
	Bachelor	116	40.70%
	Masters	95	33.33%
	Others	42	14.74%
Age	20-30	155	54.39%
	31-40	90	31.58%
	41-50	30	10.53%
	More than 50	10	3.51%
Occupation	Employee – Private Sector	65	22.81%
	Employee – Public Sector	56	19.65%
	Student	117	41.05%
	Self-employed	43	15.09%
	Unemployed	4	1.40%
User adoption	Adopters	107	37.54%
	Non-adopters	178	62.46%

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