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# Editorial Notes

We take great pleasure in announcing the release of Jahangirnagar University Journal of Business Research (JUJBR), Volume 24, Number 01, scheduled for June 2024. Going forward, we are publishing two journals annually, with releases in June and December. The successful culmination of JUJBR involved a distinguished Advisory Board, a robust Reviewer Board, and a supportive Editorial Board from renowned national and international business schools along with IBA-JU.

JUJBR is dedicated to showcasing high-quality, authentic, and invaluable research focused on contemporary aspects of business, commerce, and the economy. For this issue, out of a substantial pool of scholarly articles, only six have been chosen, each addressing different facets of business.

In the very first paper, the researcher scrutinized the impact of language barriers on trade disputes. A panel data set of 565 trade dispute cases from the World Trade Organization (WTO) spanning the years of 1995 to 2018 has been utilized by using the panel probit model. The result of this study indicated that language barriers contribute to increase trade costs and hamper bilateral trade relations.

The second paper examined the significance of subsidiaries in improving the sugar industry's financial performance in Bangladesh by applying the multiple regression analyses. The study reveals that some of the units of sugar industry are profitable, where some of them are incurring loss. Thereby, the profitable units may play the role of cash-cow to prevent the loss of other units, and from bankruptcy in some cases.

The third paper indicates that asset screening criteria of Islamic funds do not have any negative impact on the risk exposure of Islamic funds compared to unrestricted conventional funds. For analysis a total of 2320 observations of each risk measure have been computed by using a 12-month rolling window method.

The fourth paper empirically investigates the association between credit risk management and commercial banks' performance in Bangladesh. A panel data is used over a period of 13 years from 23 listed conventional commercial banks of Dhaka Stock Exchange. The results indicate that there is a significant positive long run as well as short-run relationship between capital adequacy ratio (CAR) and return on asset (ROA), and a short-run negative relationship between non-performing loan ratio (NPLR) and ROA.

The fifth paper studied 219 young individuals to know the key factors influencing customers' attitudes towards purchasing on Facebook. By applying the Structural Equation Model, the study's findings indicate that trust-related concerns significantly shape the buying decisions of young customer groups in the case of f-commerce purchasing, while sales services, prompt delivery, cash on delivery, warranty and promotional activities affect young customers' opinions of f-commerce.

The sixth and final paper indicated that the macroeconomic factors significantly influence mutual fund risk exposure, as well as the risk-adjusted return in Bangladesh. The findings of this research can be directly applied by practitioners and institutional investors in their decision-making, particularly in the situation of market asymmetric.

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 all 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.

Finally, we express heartfelt thanks to Professor K.M. 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

# Language Barriers Impact on Trade Disputes: Evidence from the WTO Trade Disputes Cases

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**Fahmida Mostafiz**[*]

***Abstract:*** *This study examines the impact of language barriers on trade disputes using a panel data set of 129 countries and 565 trade dispute cases from the World Trade Organization (WTO) spanning the years 1995 to 2018. The language barrier index is employed as a metric to assess the extent of language barriers between trade nations, while the panel probit model is utilized for conducting the empirical analysis. The empirical evidence indicates that language barriers exert a substantial and favorable impact on trade disputes. Language obstacles in trading countries have been found to heighten the probability of trade disputes, indicating that language barriers contribute to increase trade costs and hamper bilateral trade relations. Moreover, the Armington model is employed to elucidate the theoretical aspects of the impact of language barriers on trade disputes, with trade costs serving as the mediating factor. The findings of the study also validated the notion that linguistic barriers contribute to an elevated likelihood of trade disputes. This study presents empirical findings regarding the influence of linguistic barriers on trade disputes. Additional investigation can be undertaken to examine the impact of language competency on trade disputes, given the substantial role that language plays in the realm of international trade.*

***Keywords:*** *Trade Disputes, Trade Conflicts, Language Barriers, Language Barrier Index, Linguistic distance, WTO, Armington Model*

## 1. Introduction

Language constraints pose a significant challenge in international trade conflicts, as trade partners strive to effectively explain their desires and obtain crucial information pertaining to policies and regulations. Trading countries face challenges in accurately identifying each other's trade legislation and guidelines due to variations in languages, norms, and attitudes (Korneliussen & Blasius, 2008). Misunderstanding (Gokan et al., 2019) and haziness of information (Konara, 2020) about trade rubrics, procedures create ambiguity, increase trade costs and hamper trade relationships. Besides, communication incapability arises when countries have no similarity in their spoken as well as official languages. Language dissimilarity cause uncertainty, a lack of detail, and a loss of trust in countries embroiled in trade disputes (Sun et al., 2023). Due to linguistic barriers, governments must employ people to perform a trade dispute resolution process that increases trade costs. World Trade Organization (WTO) members with

[*] Assistant Professor, Department of International Business, University of Dhaka, Dhaka, Bangladesh; Email: fahmida@du.ac.bd

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language diversity are more likely to participate in trade disputes; therefore, it is time to study the language components of trade disputes, which have yet to be investigated.

Recent research has devoted considerable attention to the significance of language barriers to trade in light of declining tariffs and transportation expenses (Deltas & Evenett, 2020; Y. Li & Sai, 2020; Šaban & Schmidt, 2021). Language barriers intuitively increase costs due to communication gaps, flawed information, vagueness (Guiso et al., 2016), doubt, and misunderstanding (Y. Li & Sai, 2020). The study of Fink et al. (2005) and Gokan et al. (2019) define communication and information costs incurred from language barriers negatively affect trade-related activities such as understanding local market conditions, consumer preferences, navigating foreign regulations and standards, and accurate translation of shipping documents, customs declarations, and other logistical paperwork. Firms find it difficult to understand the export market rules and regulations due to language barriers. Language barriers can impose high costs on bilateral trade between countries that do not share any common language, either an official language or a widely spoken foreign language in terms of communication and information. Language constraints impact contract terms, trade rules, negotiations, and dispute resolution (Maggi & Staiger, 2018; Melitz & Toubal, 2014; Šaban & Schmidt, 2021; Wilkinson, 2009) . Language barriers in international trade are an important but frequently overlooked aspect that might affect trade dispute participation and outcomes. Addressing these hurdles can improve parties' participation and outcomes in international trade disputes.

The purpose of the study is to investigate the impact of language barriers in international trade disputes. This study employs a comprehensive dataset of 129 countries, 8,256 country pairs, and 565 WTO trade conflict cases from 1995 to 2018. The language barrier in international trade refers to communication issues that develop as a result of language disparities between individuals or organizations from various nations. These hurdles can include issues understanding, interpreting, and effectively expressing information, which can lead to misconceptions and misinterpretation, eventually affecting the success of commercial transactions and relationships. To measure the language barriers between trading partners, use Language barrier index (LBI) developed by Lohmann (2011), which reflects no similarities in the major official languages. Using panel probit regression, it is shown that the language barrier has a positive effect on trade disputes at the 1% significance level. The average marginal probability effects suggest that countries having language barriers with trading partners have an average 0.17% greater likelihood of trade disputes. The additional estimations further support these findings and therefore act as a robustness check.

Thus, the Armington model (Armington, 1969) is used to describe the theoretical background of the impact of language barriers on trade disputes considering trade costs as the channel. Trade costs arise from language barriers have tariff equivalent impact on trade and deteriorate the trade relationship that leads to

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disputes. Trade flows are subject to trade costs which increase price of related goods as well reduce trade volume. Due to language differences, exporting countries face extra costs such as language barriers raise contact and information costs, and countries face difficulties in communication. Therefore, the language barriers hypothesis is proposed to explain this positive relationship between language barriers and trade disputes. This study makes a distinctive contribution to the field by concentrating on the often-overlooked influence of language barriers on participation in WTO trade disputes. It is the first study to thoroughly explore this impact, offering a fresh perspective on the difficulties encountered by member nations that do not speak English. The findings add to theories of international trade law by emphasizing the importance of language in legal involvement and dispute settlement.

The rest of the article is organized as follows: Section 2 discusses the related literature review. Section 3 explains the theoretical frameworks and hypotheses. Section 4 describes the data used and the research methods applied. Section 5 presents the empirical analysis with robust checks. Section 6 discusses major findings, policy implications, contributions, limitations, and future research areas. Finally, Section 7 describes the concluding remarks.

## 2. Literature Review

The literature on trade disputes emphasizes the significance of effective communication and negotiation skills in resolving conflicts (Kitenge & Lahiri, 2022; Kruse & Willumsen, 2020; Medda-Windischer & Carlà, 2022). Language barriers often hinder the comprehension of legal frameworks and documentation involved in trade disputes (Alam & Mostafiz, 2022), leading to misunderstandings and misinterpretations (Selmier & Oh, 2013; Zhou & Wei, 2016). Manger & Peinhardt, (2017) highlights that disputed parties with limited language proficiency may struggle to express their arguments effectively, placing them at a disadvantage in negotiations and outcomes. Cohen (2020) found that language barriers can result in misinterpretations of contractual terms, legal documents, and trade regulations. This miscommunication escalates into disputes when parties have different understandings of their rights and obligations (Brutger & Marple, 2023). Zhou & Wei (2016) emphasized that clear communication is essential for effective negotiation. Language barriers impede the negotiation process, making it difficult for parties to reach mutual agreements or settlements before disputes escalate to formal trade dispute mechanisms (Medda-Windischer & Carlà, 2022; Wilkinson, 2009). Similarly, Garcia (2018) points out that the availability and quality of translation and interpretation services can impact the participation of parties in trade disputes. High-quality translations are crucial for understanding legal documents, submitting accurate claims, and presenting cases effectively. Additionally, Chua (2019) emphasizes that language barriers affect the choice and effectiveness of legal representation. Disputed parties may find it challenging to engage with lawyers who are proficient in the relevant languages and legal systems, potentially putting them at

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a disadvantage in dispute resolution processes (Cremades & Madalena, 2008). For a developing country like Bangladesh, which relies significantly on international trade, understanding the impact of language barriers is essential for enhancing its trade dispute participation and outcomes (Khan, 2018).

The WTO operates in three official languages: English, French, and Spanish (Selmier & Oh, 2013). Parties from countries where these languages are not widely spoken may face additional challenges in fully participating in dispute settlement proceedings (Davey, 2017; Wilkinson, 2009). Similar issues arise in regional trade agreements and bilateral treaties where the dispute resolution mechanisms may operate in specific languages that are not the mother tongue of one or more parties involved (Mavroidis, 2021; Zhou & Wei, 2016). Language barriers in international trade are a significant yet often overlooked factor that can influence the participation and outcomes of trade disputes (Smith, 2004; Whalley, 2010). Understanding the impact of these barriers is crucial for policymakers, businesses, and legal practitioners involved in international trade (Wilkinson, 2009). Language barriers can manifest in various forms, including misunderstandings in contract terms, misinterpretation of trade regulations, and challenges in negotiations and dispute resolutions (Maggi & Staiger, 2018; Melitz & Toubal, 2014; Šaban & Schmidt, 2021; Wilkinson, 2009). Addressing these barriers can improve the participation and outcomes of parties involved in international trade disputes. This paper examines the impact of language barriers in trade disputes.

### 3. Theoretical Frameworks and Hypothesis

### *3.1 Basic Model*

This study uses the Armington model (Armington, 1969) to describe how linguistic barriers affect trade conflicts by using trade costs as a channel (Bajzik et al., 2020). Consequently, consider a world in which two nations speak distinct languages from one another. Every worker provides one unit of labor inelastically and spends their earnings on both imported and domestically produced, differentiated products. Languages significantly impact all marketable products. A Constant Elasticity of Substitution (CES) utility function describes the preferences of the representative agents that populate each nation. Preferences are given by

$$U_j = \left( \sum_{i=1}^n \psi_{ij}^{1-\sigma/\sigma} \ C_{ij}^{\sigma-1/\sigma} \right)^{\frac{\sigma}{\sigma-1}} \dots\dots\dots\dots (1)$$

Where $C_{ij}$ is the demand for product $i$ in country $j$; $\psi_{ij} > 0$ is an exogenic penchant parameter $\sigma > 1$ is the elasticity of substitution between products from countries. The allied consumer price index as follows

$$P_j = \left( \sum_{i=1}^n \psi_{ij}^{1-\sigma} \ P_{ij}^{1-\sigma} \right)^{\frac{1}{1-\sigma}} \qquad \dots\dots\dots\dots (2)$$

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Where $P_{ij}$ is the price of product $i$ in country $j$.

International trade between nations is prone to trade costs. To sell one unit of a product in country $j$, companies from country $i$ must ship $\tau_{ij} \geq 1$ units, with $\tau_{ii} = 1$. For there to be no arbitrage opportunities, the price of product $i$ in country $j$ must be equal to $P_{ij} = \tau_{ij}P_{ii}$. The domestic price $P_{ii}$ of product $i$, in turn, can be expressed as a function of country $i$'s total income, *Yi,* and its endowment $P_{ii} = Yi/Qi$. Combining the two previous expressions can get

$$P_{ij} = \frac{Y_i \tau_{ij}}{Q_i} \quad \dots\dots\dots\dots\dots (3)$$

Let $X_{ij}$ denote the total value of country $j$'s imports from country $i$. Given CES utility, bilateral trade flows satisfy

$$X_{ij} = \left(\frac{\psi_{ij}P_{ij}}{P_j}\right)^{1-\sigma} E_j \quad \dots\dots\dots\dots\dots.. (4)$$

Where $E_j = \sum_{i=1}^{n} X_{ij}$ is country $j$'s total expenditure. Combining equations (2)–(4), can obtain

$$X_{ij} = \frac{(Y_i \tau_{ij})^{1-\sigma} \chi_{ij}}{\sum_{l=1}^{n}(Y_l \tau_{lj})^{1-\sigma} \chi_{lj}} E_j$$

Where $\chi_{ij} = \left(Q_i / \psi_{ij}\right)^{\sigma-1}$, In order to prepare further analysis, consider

$\varepsilon \equiv \partial \ln(\frac{X_{ij}}{X_{jj}}) / \partial ln\tau_{ij}$ denote the elasticity of imports relative to domestic demand, $\frac{X_{ij}}{X_{jj}}$, with respect to bilateral trade costs $\tau_{ij}$, holding income levels fixed. We will refer to $\varepsilon$ as the *trade elasticity*. In the Armington model it is simply equal to $\sigma - 1$. Using the previous notation, can rearrange the expression above as

$$X_{ij} = \frac{(Y_i \tau_{ij})^{-\varepsilon} \chi_{ij}}{\sum_{l=1}^{n}(Y_l \tau_{lj})^{-\varepsilon} \chi_{lj}} E_j \quad \dots\dots\dots\dots\dots\dots\dots (5)$$

In a competitive equilibrium, budget constraint and goods market-clearing imply $Y_i = E_i$ and $Y_i = \sum_{i=1}^{n} X_{ij}$, respectively, for both countries. Together with equation (5), these two conditions imply

$$Y_i = \sum_{j=1}^{n} \frac{(Y_i \tau_{ij})^{-\varepsilon} \chi_{ij}}{\sum_{l=1}^{n}(Y_l \tau_{lj})^{-\varepsilon} \chi_{lj}} Y_j \quad \dots\dots\dots\dots\dots\dots\dots (6)$$

**Trade costs arise from language barriers:**

Now consider costs that arise from language barriers have tariff equivalent impact on trade and deteriorate the trade relationship. Trade flows are subject to trade costs which increase price of related products as well reduce trade volume. Due to language differences, exporting countries face extra costs. Then the price of good i is

$$P_{ij} = \frac{Y_i \tau_{ij} \theta_{ij}}{Q_i} \quad \dots\dots\dots\dots\dots.. (7)$$

Given CES utility, the value of bilateral trade flows is this given by the following gravity equation

$$X_{ij} = \frac{(Y_i \tau_{ij} \theta_{ij})^{-\varepsilon} \chi_{ij}}{\sum_{l=1}^{n} (Y_l \tau_{lj} \theta_{lj})^{-\varepsilon} \chi_{lj}} \ E_j \qquad \text{.....................} \ (8)$$

In the competitive equilibrium,

$$Y_i = \sum_{j=1}^{n} \frac{(Y_i \tau_{ij} \theta_{ij})^{-\varepsilon} \chi_{ij}}{\sum_{l=1}^{n} (Y_l \tau_{lj} \theta_{lj})^{-\varepsilon} \chi_{lj}} \ Y_j \qquad \text{.....................} \ (9)$$

Here, $\theta_{ij}$ is treated as a cost by the producer and hence from the firm's perspective a $\theta_{ij}$ works exactly like an iceberg trade cost.

**Welfare:**

In the Armington model, changes in real consumption only depend on the change in the relative price of imported versus domestic products $P_j^M / P_{jj}$ (where $P_j^M = \left[ \sum_{i \neq j} P_{ij}^{1-\sigma} \right]^{1/1-\sigma}$ is the constituent of the price index related with imports, which depends on the share of expenditure on domestic products $\lambda_{jj}$ and the elasticity of substitution $\sigma$ thus changes in real consumption

$$U_j = (d \ lnE_j - d \ln P_{jj}) + (d \ln \lambda_{jj}/(1-\sigma))$$

The definition of the trade elasticity $\varepsilon \equiv \sigma - 1$ and get from the above equation

$$d \ lnU_j = -d \ln \lambda_{jj} / \varepsilon$$

Welfare changes due to trade costs:

$$U_j = \lambda_{jj}^{-1/\varepsilon}$$

Due to costs arise from language barriers increase in trade costs. The welfare significances of large changes $\tau_{ij}$ to $\tau_{ij} \ \theta_{ij}$ can be inferred by integrating

$$\widehat{U}_j = \hat{\lambda}_{jj}^{-1/\varepsilon}$$

This establishes that for any change in trade costs, two statistics—the trade elasticity $\varepsilon$, and the changes in the share of expenditure on domestic goods $\lambda_{jj}$— are sufficient to infer welfare changes.

Possible proposition: A decrease in trade elasticity points to rising trade expenses. The chance of trade conflicts is increased by trade costs.

1. As no extra trade costs

$\varepsilon = 1$, Countries have no possibility to involve in trade disputes

2. As costs arise due to language barriers, increase in trade costs

$\varepsilon < 1$, Countries possibility to involve in trade disputes increase.

Trade elasticity is a measure of how trade flows react to fluctuations in trade costs. The increase in trade costs caused by language barriers reduces trade elasticity, making trade flows less responsive to changes in these costs. This suggests the presence of significant trade barriers. Trade distortions can

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potentially result in the initiation of complaints and trade disputes. There is a strong correlation between trade costs, trade elasticity, and trade disputes (Hübler & Herdecke, 2020; Kim, 2021). Trade disputes between countries can often arise due to the presence of high trade costs. The costs of trade have a direct impact on trade disputes, often resulting in the implementation of tariffs or other trade barriers (Zheng et al., 2023). Trade flows become less responsive to changes in costs due to the increase in expenses, which in turn reduces trade elasticity. The importance of the reduced-form trade elasticity in calculating aggregate gains from trade has been emphasized in recent research on trade gains (Arkolakis et al., 2012). By using observable changes in trade policy, it is possible to accurately estimate the relationship between changes in trade flows and changes in trade costs (Afiyati, 2022; Garfinkel et al., 2015). This provides a straightforward method to determine trade elasticity. To summarize, the interconnectedness of trade costs, trade elasticity, and trade disputes significantly influences the international trade landscape. The interconnectedness of global trade dynamics becomes evident when changes in one aspect have a ripple effect on others, showcasing their complexity.

### 3.2 Hypothesis

The term "language barrier" in international trade refers to communication issues that develop as a result of language disparities between individuals or organizations from various nations (Lohmann, 2011). These hurdles can include issues understanding, interpreting, and effectively expressing information, which can lead to misconceptions and misinterpretation, eventually affecting the success of commercial transactions and relationships (Abuarqoub, 2019; Harzing & Feely, 2008). The figurative meaning of the word "language barrier" is the difficulty that individuals or groups may have communicated due to the fact that they speak different languages, or even dialects (Lameli et al., 2015). Misunderstandings caused by a lack of common language can impede the development of meaningful relationships, which in turn can cause hostility, aggression, hurt feelings, and the loss of precious time, energy, resources, and even lives (Fidrmuc & Fidrmuc, 2016; Taylor & Bain, 2008).

Trading countries' ongoing participation in trade disputes with partners having language dissimilarity raise the concern about the importance of languages as member countries' participation in WTO trade disputes settlement affected by their people language skills (Wilkinson, 2009). Countries with dissimilar languages face challenges to understand WTO rules and regulations. A country having language barriers with trade partners often initiate a trade complaint or involve in trade disputes due to improper communication, misunderstanding, information costs, ambiguity, and uncertainty (Casella, 1998; Zhang et al., 2020). Langugae barriers continuously increase trade costs.

Language barriers between trading countries significantly influence their probability to participate in trade disputes. In general, language barriers between countries are a basis of indistinctness that is deteriorating bilateral trade ties. Language barriers intuitively increase trade costs due to communication gaps,

flawed information (Carsten et al., 2005), vagueness (Guiso et al., 2016), doubt, and misunderstanding (Yanxi & Sai, 2020). As, countries with language barrier don't comprehend each other cultural values, beliefs and customs, consider foreign culture to be harmful and create threat for their national culture. The language barrier is the emblem of cultural difference. The studies indicate that countries often raise the issue of trade protectionism to those countries with whom they have language barriers (Canto & Wiese, 2018; Fouda, 2012). Countries with language barriers often involved in trade, as dependencies increase in foreign products, they feel a threat to lose their national culture, these feelings are more acute when they have language barriers. Language barriers are very significant issue during trade disputes as countries face challenges to communicate and to get essential information regarding policies or regulations. Due to language barriers, norms and values create difficulties for trading countries to properly recognize each other's trading views and perceptions (Korneliussen & Jörg, 2008).

Language obstacles exacerbate misunderstandings (Toshitaka et al., 2019) create uncertainty and ambiguity of information, generate uncertainty and ambiguity in comprehending trade norms and regulations (Konara, 2020) escalate trade expenses, and contribute to trade conflicts. Hence, put forth the subsequent hypothesis:

**Hypothesis 1:** Language barriers (LB) increase the likelihood of trade disputes between nations.

### 4. Data and Methodology

#### *4.1 Variables and Data*

From 1995 to 2018, a comprehensive collection of data on the language barriers and trade disputes between WTO members was used, with 8,256 country pairs from 129 WTO members and 565 dispute cases. Data collected from the WTO trade disputes database on each country pairs participation in a trade dispute. The multi-plaintiff cases were divided into several bilateral cases, all involving the same defendant country (WTO, 2019). Thus, define Trade Dispute (TD) as a binary variable that takes the value of one if country $i$ is involved in at least one dispute with country $j$ in the year $t$.

This paper employs the language barrier index as a proxy of language barriers, which uses the main official languages. The language barrier index (LBI) for a country pair is calculated using World Atlas of Languages' language data, which gives 2650 languages data (Lohmann, 2011). The $LBI_{i,j}(i, j = 1,2, \ldots.129)$ takes 1 if country $i$ and country $j$ have no shared language features in terms of official language, otherwise 0. LBI takes one specifies that the two countries have greater language differences. The two languages are identical, and one means two languages have no features in common (e.g., Brazil -Indonesia). Table A in the appendix describes the trade disputes and language barriers data of country pairs from 1995 to 2018.

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In this study, control variables are employed to examine country-level economic and trade features, including GDP, FTA, trade, and the trade freedom index. Therefore, the economic growth of a country may be assessed by utilizing the variable $GDP_{i,t}$ ,while the relative market size can be measured by employing the GDP ratio $GDP_{i,t}/GDP_{j,t}$. The Free Trade Agreement (FTA) is utilized to assess the extent to which FTA contributes to the mitigation of trade disputes. The trade freedom index ($TFI_{i,t}$) is a commonly employed indicator for assessing a country's trade policy. Thus, utilize the GDP data from the World Bank, the FTA data from the WTO database, and the trade freedom index obtained from 'The Index of Economic Freedom by The Heritage Foundation and The Wall Street Journal'. Trade, denoted as ($Trade_{i,j,t}$), represents the aggregate value of both exports and imports. The data for trade is obtained from World Integrated Trade Solution (WITS) database.

The descriptive statistics are presented in Table 1. Given that TD can assume a binary value of either 1 or 0, a mean value of 0.0044 signifies that, on average, 0.44 percent of member nations of the World Trade Organization (WTO) were involved in at least one trade dispute between the years 1995 and 2018. Based on the data presented in Table 1, the mean value of LBI is 0.4145, suggesting that 41.45 percent of WTO members encounter language obstacles while communicating with their trade counterparts.

**Table 1: Summary of descriptive statistics**

| Variable | Obs. | Mean | Median | Std. Dev. | Min | Max |
|---|---|---|---|---|---|---|
| $TD_{i,j,t}$ | 173,960 | 0.0044 | 0 | 0.0578 | 0 | 1 |
| $LBI_{i,j}$ | 173,960 | 0.4145 | 0 | 0.4950 | 0 | 1 |
| $TFI_{i,t}$ | 173,960 | 1.8509 | 1.8943 | 0.2661 | 1.1209 | 4.1427 |
| $Trade_{i,j,t}$ | 173,960 | 4.5975 | 4.7572 | 1.6097 | -0.4948 | 8.8238 |
| $FTA_{i,j,t}$ | 173,960 | 1.3309 | 1.0096 | 7.6141 | -860.6950 | 980.7872 |
| $GDP_{i,t}$ | 173,960 | 3.9946 | 4.1357 | 0.6183 | 2.0525 | 4.9472 |
| $GDP_{i,t}/GDP_{j,t}$ | 173,960 | 1.1381 | 1.1017 | 0.3002 | 0 | 11.0900 |

### *4.2 Research Method*

Due to a binary dependent variable, this study empirically evaluates the impact of language barriers on the occurrence of trade disputes using the panel probit regression model. To be more precise, suppose that the likelihood country $i$ be engaged in a trade dispute with the country $j$ in a year $t$ stated as follows,

$$\text{Prob}(TD_{i,j,t} = 1 | LBI, \text{controls} = \phi(\beta_0 + \beta_1 LBI_{i,j} + \gamma \text{controls}_{i,j,t} + \varepsilon_{i,j,t}) \quad (1)$$

Where LBI is language barrier index, controls are the vector of country-level control variables. $\varepsilon_{i,j,t}$ is an error term capturing unobserved components. $\beta$ s

and $\gamma$ s are the parameters to be measured. Hence, the present study aims to investigate the impact of language barriers on trade disputes by analyzing the average marginal probability effects.

## 5. Empirical Analysis

### 5.1 Base Regression Results

Discuss the empirical findings in this section. The findings of the panel probit model are shown in Table 2, and the results substantially validate the hypothesis. The empirical findings of model (1) and model (2) show that, at the 1% significance level, the likelihood of a trade conflict is substantially positively linked to language barriers. Language obstacles make trading partners more inclined to dispute trade. This finding supports the hypothesis that having language barriers upsurges the likelihood of trade battles.

**Table 2: Panel probit model Regression Results**

| Model | (1) | (2) |
|---|---|---|
| Dependent | TD | TD |
| $LBI_{i,j}$ | 0.4387*** (0.0268) | 0.2303*** (0.0652) |
| $\log(TFI_{i,t})$ | | -0.6476*** (0.1806) |
| $\log(Trade_{i,j,t})$ | | 0.6493*** (0.0395) |
| $\log(GDP_{i,t})$ | | -0.5283*** (0.0665) |
| $GDP_{i,t}/GDP_{j,t}$ | | 0.4588*** (0.1603) |
| $FTA_{i,j,t}$ | | -0.6719*** (0.0126) |
| Constant | -4.9865*** (0.2126) | -4.5273*** (0.3276) |
| Observations Country –Pairs | 173,960 8,097 | 173,960 8,097 |

Notes: Parentheses indicate robust standard errors by country pair. ***/**/* indicate 1%, 5%, and 10% significance.

Table 2 illustrates the impacts of the controls, which are predominantly consistent with the existing body of research. At a significant level of 1%, there exists a negative correlation between the trade freedom index ($TFI_{i,t}$) and trade conflicts. The results align with economic intuition, suggesting that a more liberal trade policy and less trade protectionism serve as deterrents to trade

disputes (Kitson & Michie, 1995). Additionally, these policies appear to decrease the probability of trading partners engaging in trade disputes (Oatley, 2017). There is a positive correlation between trade ($Trade_{i,j,t}$) and trade disputes at a statistically significant level of 1%. This indicates that increased trade leads to a higher occurrence of trade conflicts. Multiple contemporary literature sources indicate that an increase in bilateral commerce is positively correlated with a higher probability of trade disputes (Bown, 2004; H. Horn et al., 1999).

The presence of Free Trade Agreements ($FTA_{i,j,t}$) exhibits a statistically significant negative correlation with trade conflicts, with a significance level of 1%. The Free Trade Agreement (FTA) serves to mitigate trade disputes between trading partners and promote the adoption of trade laws that are less restrictive, as well as the exemption of trade barriers (M. Kitson & Michie, 1995) The likelihood of countries engaging in trade disputes is reduced when they have Free Trade Agreements (FTAs) with their trading partners (T. Li & Qiu, 2021).

$GDP_{i,t}$ measures total production, which represents the scale of a country's international market. Table 2 shows a negative relationship between, $GDP_{i,t}$ and trade conflicts. Trade has inevitably slowed due to trade tensions or disputes, as well as the country's economic development. Slow economic development has been adversely correlated with trade tensions because it dampens the country's business relations and trade flows (Bown & Reynolds, 2015; Karim et al., 2022). Table 2 further illustrate a statistically substantial and positive association between GDP ratio $GDP_{i,t}/GDP_{j,t}$ and trade disputes at a level of 1%. The economic instinct behind this finding comes from the theory of power. Guzman & Simmons (2005) and later, Bown & McCulloch (2009) state that a country with a bigger market seems to hold greater economic strength and can handle trade disputes better.

### 5.2 Probability Effects

Additionally, this study undertakes the estimation and presentation of the average marginal probability effects of language barriers (LBI) in Table 3, intending to investigate its economic implications on trade disputes. In comparison to the typical values of TD (0.44%), the average marginal likelihood effects of LBI on TD are statistically and economically significant, with a value of 0.0017. Countries that experience language barriers (LBI) with their trading partners have an average increase of 0.17 percent in the risk of trade conflicts, as indicated by the probability impact. The results of the probability effect for LBI validate the hypothesis regarding linguistic barriers.

**Table 3: The probability effects of LBI on TD**

| Model | (1) |
|---|---|
| Dependent | TD |
| $LBI_{i,j}$ | 0.0017*** |
| | (0.0005) |

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| | |
|---|---|
| $\log(TFI_{i,t})$ | -0.0046*** |
| | (0.0014) |
| $\log(Trade_{i,j,t})$ | 0.0047*** |
| | (0.0004) |
| $\log(GDP_{i,t})$ | -0.0038*** |
| | (0.0005) |
| $GDP_{i,t}/GDP_{j,t}$ | 0.0033*** |
| | (0.0012) |
| $FTA_{i,j,t}$ | -0.0045*** |
| | (0.0000) |
| Observations | 173,960 |
| Country –Pairs | 8,097 |

Notes: Parentheses indicate robust standard errors by country pair. ***/**/* indicate 1%, 5%, and 10% significance.

### 5.3 Robustness Tests

#### 5.3.1 Different Models

The number of confrontations varies greatly between partner countries. Simultaneously, not all WTO members are engaging in trade disputes. This study estimates the Poisson model to examine the frequency of conflicts and count characteristics of trade dispute data. Given the rarity of the TD instance, estimate the rare event logistic model for the robustness test. Table 4 shows the average likely outcome of LBI based on the Poisson model and the rare event logistic model. The empirical data show that LBI has a significant and favorable impact on trade conflicts at a 1% level. The average probability effects implying that LBI has an influence on TD are 0.0019 and 0.0016, respectively, and are consistent with the base results in Table 3.

In many cases, the dependent variable has the value 0 because a country does not typically have long-term trade disputes with numerous countries. The zero-inflated Poisson model (ZIP) was used to solve the problem of unneeded zeros. The ZIP regression findings are shown in Table 4, and they are consistent with the base results. Use a dummy, Major Trading Partners, as the inflated characteristic, which indicates whether or not the two countries are major trading partners. The assumption is that even if countries are big trading partners, language constraints have a negative impact on their trade connections. The ZIP results show that LBI has a substantial positive influence on trade conflicts at a 1% significance level, and the average probability impacts of LBI on TD is 0.0024. Other explanatory factors produce results that are equivalent to those obtained in the baseline model, indicating that unnecessary zeros are unlikely to be included in the study.

**Table 4: Probability Effects with Different Models**          **JUJBR**

|  | Poisson Model | Rare-Event Logistic Model | Zero-Inflated Poisson Model |
|---|---|---|---|
| Model | (1) | (1) | (1) |
| Dependent | TD | TD | TD |
| $LBI_{i,j}$ | 0.0019*** | 0.0016*** | 0.0024*** |
|  | (0.0003) | (0.0005) | (0.0007) |
| $\log(TFI_{i,t})$ | 0.0045*** | 0.0063*** | 0.0053*** |
|  | (0.0006) | (0.0009) | (0.0010) |
| $\log(Trade_{i,j,t})$ | 0.0043*** | 0.0046*** | 0.0046** |
|  | (0.0002) | (0.0004) | (0.0014) |
| $\log(GDP_{i,t})$ | -0.0023*** | -0.0038*** | -0.0033*** |
|  | (0.0004) | (0.0006) | (0.0013) |
| $GDP_{i,t}/GDP_{j,t}$ | 0.0013*** | 0.0028** | 0.0046** |
|  | (0.0004) | (0.0006) | (0.0023) |
| $FTA_{i,j,t}$ | -0.0052*** | -0.0052*** | -0.0069*** |
|  | (0.0014) | (0.0014) | (0.0025) |
| Observations | 173,960 | 173,960 | 173,960 |
| Country –Pairs | 8,097 | 8,097 | 8,097 |

Notes: Parentheses indicate robust standard errors by country pair. ***/**/* indicate 1%, 5%, and 10% significance.

### 5.3.2 Different Subsamples

The United States and the European Union exert significant influence on international trade due to their status as the world's largest economies and their substantial trade volume with other nations. The United States and the European Union are the primary actors in the World Trade Organization's trade dispute settlement body (Cai, 2020; Goulard, 2020; Pencea, 2019). To mitigate the potential impact of outliers, it is recommended to rerun the panel probit regression models for the two sub-samples listed below. Conduct a sample that excludes the United States and the European Union. The consequences of average marginal likelihood are presented in Table 5. According to the findings shown in Table 5, the absence of the United States and European Union (EU) results in average probability effects of LBI on TD of 0.0010 and 0.0011, respectively. These effects are statistically significant at the 1% level. The empirical findings demonstrate a high level of robustness, as evidenced by the data presented in Table 3.

**Table 5: Probability Effects with different subsamples**

|  | Without US | Without EU |
|---|---|---|
| Model | (1) | (1) |
| Dependent | TD | TD |
| $LBI_{i,j}$ | 0.0010*** | 0.0011*** |
|  | (0.0005) | (0.0004) |
| $\log(TFI_{i,t})$ | -0.0039*** | -0.0037*** |
|  | (0.0002) | (0.0010) |
| $\log(Trade_{i,j,t})$ | 0.0041*** | 0.0039*** |
|  | (0.0004) | (0.0005) |
| $\log(GDP_{i,t})$ | -0.0039*** | -0.0038*** |
|  | (0.0005) | (0.0007) |
| $GDP_{i,t}/GDP_{j,t}$ | 0.0038*** | 0.0032*** |
|  | (0.0011) | (0.0010) |
| $FTA_{i,j,t}$ | -0.0044*** | -0.0043*** |
|  | (0.0010) | (0.0020) |
| Observations | 170,969 | 169,004 |
| Country –Pairs | 7,880 | 7,230 |

Notes: Parentheses indicate robust standard errors by country pair. \*\*\*/\*\*/\* indicate 1%, 5%, and 10% significance.

### 5.3.3 Proxy Measure of Language barrier

Furthermore, as a proxy for language barrier measurements, this paper employed linguistic distance, which was calculated using the algorithm available at http://www.elinguistics.net/,to ensure robustness. Many scholars have questioned the adequacy of an official language binary measure (Egger & Toubal, 2016; Melitz & Toubal, 2014). In recent years, some measurements of linguistic distance have been added to the gravity model (Visser, 2019; Vlasenko, 2020). Linguistic distance is a measure of the differences between two languages or language variations. It is a linguistic term that quantifies the degree of similarity between languages using numerous linguistic variables such as vocabulary, grammar, phonetics, and syntax (Isphording & Otten, 2013). Table 6 displays the average likely outcome of linguistic distance (LD). The empirical results reveal that LD has a considerable and positive impact on trade conflicts at the 1% level. The average probability effects imply that LD increases TD likelihood by an average of 0.15%, which is consistent with the base values in Table 3. This finding further demonstrates that language barriers, whether measured by the language barrier index or linguistic distance, have a considerable favorable impact on trade conflicts.

**Table 6: Probability Effects with Proxy measure**          **JUJBR**

| Model | (1) |
|---|---|
| Dependent | TD |
| $LD_{i,j}$ | 0.0015*** |
|  | (0.0002) |
| $\log(TFI_{i,t})$ | -0.0024*** |
|  | (0.0002) |
| $\log(Trade_{i,j,t})$ | 0.0052*** |
|  | (0.0001) |
| $\log(GDP_{i,t})$ | -0.0037*** |
|  | (0.0005) |
| $GDP_{i,t}/GDP_{j,t}$ | 0.0032*** |
|  | (0.0002) |
| $FTA_{i,j,t}$ | -0.0043*** |
|  | (0.0001) |
| Observations | 173,960 |
| Country –Pairs | 8,097 |

Notes: Parentheses indicate robust standard errors by country pair.
***/**/* indicate 1%, 5%, and 10% significance.

## 6. Discussion

Using a panel probit model, this paper finds that language barriers have a significant and positive impact on the trade dispute participation of WTO members, with a significance level of 1%. The empirical findings show that language barriers increase the likelihood of a trade dispute. Specifically, a one-unit increase in language barriers increases the likelihood of trade disputes by 0.17%. A plausible explanation for this could be that language barriers contribute to misinterpretations of legal texts, oral proceedings, and difficulties in accessing relevant case law and precedents (Kruse & Willumsen, 2020; Oh et al., 2011). Consequently, this results in a higher likelihood of initiating disputes and poorer outcomes when disputes are pursued. These findings align with Smith (2004), Whitaker et al., (2008), and L. Zhou & Wei (2016) who identified similar barriers in regional trade agreements. However, this study expands on these insights by applying them to the global context of the WTO. The findings indicate that member states with limited English proficiency encounter significant challenges in comprehending complex legal documentation and effectively participating in dispute resolution processes (Chiswick & Miller, 2005; Taylor & Bain, 2008). Furthermore, these findings suggest that language barriers not only affect individual member states but also undermine the overall effectiveness and fairness of the WTO dispute settlement system (Simões, 2017). Addressing these barriers is crucial for enhancing global trade justice.

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### 6.1 Policy implications:

The key findings of this study have important policy implications for the WTO dispute settlement body and member states. Firstly, it is crucial for the organization to implement more robust multilingual support systems to address the impacts of language barriers on participation in WTO trade disputes (Miwa, 2021; Simões, 2017). The WTO should provide comprehensive translation services for all official documents and during dispute settlement proceedings to ensure linguistic accessibility for all member states (Chua, 2019). Essential steps include establishing a multilingual help desk to assist member states in navigating the dispute settlement process and introducing language training programs for representatives of member states to improve their proficiency in the WTO's working languages (Sauter, 2012). The WTO could also partner with international language service providers to develop a pool of certified translators and interpreters specialized in trade law (Mavroidis, 2021). Additionally, allocating funding for language training programs and providing incentives for participation would be beneficial. Implementing these measures would likely result in more equitable participation in trade disputes, higher quality dispute resolutions, and a more inclusive and effective WTO dispute settlement system.

The findings of this study suggest several policy implications for WTO member states. Member states facing language barriers can focus on high-quality translation and interpretation services to overcome language barriers (Balogh & Jámbor, 2018). Developing comprehensive training programs to improve proficiency in WTO languages among trade officials and legal practitioners is essential (Islam, 2017). These programs should focus on legal and technical English relevant to international trade. Creating and distributing multilingual legal resources and guides on WTO dispute processes can aid non-native speakers and empower businesses and legal professionals with the necessary knowledge and tools to participate effectively in trade disputes (Zitawi & Abdel Wahab, 2014) Furthermore, utilizing Artificial Intelligence-based translation and interpretation tools can provide real-time language support during negotiations and hearings (Kitenge & Lahiri, 2022). Investing in technological solutions can bridge language gaps more efficiently and cost-effectively.

### 6.2 Contribution

This paper makes a unique contribution to the literature by focusing on the often-overlooked impact of language barriers on participation in trade disputes within the WTO. It is the first study to systematically investigate this impact, providing a new perspective on the challenges faced by member states that do not speak English. The findings contribute to theories of international trade law by highlighting the critical role of language in legal participation and dispute resolution. In practical terms, this research offers actionable insights for the

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WTO and member states on how to enhance participation and fairness in dispute settlements. Additionally, this study lays the groundwork for future research on language barriers in other international organizations and suggests further exploration of digital translation tools to facilitate trade dispute participation.

### *6.3 Limitations and Future Research Area*

This study has limitations due to its exclusive focus on WTO disputes where English is the primary language. As a result, it may not fully reflect the linguistic diversity and challenges experienced by member states that use other languages. These limitations could impact the applicability of our findings to non-English contexts and other international trade organizations. For future research, it would be valuable to investigate language barriers in other international trade organizations and assess the efficacy of digital translation tools and multilingual support systems. Additionally, conducting longitudinal studies would enable us to gain a deeper understanding of the long-term effects of language training programs on dispute participation.

## 7. Conclusion

This study examines the effect of language barriers in trade disputes. Using a comprehensive data set consists of 8,256 country pairs of 129 countries and 565 WTO trade dispute cases from 1995 to 2018, evidenced that the language barrier had a substantial and positive effect on trade conflicts. When trading partners face linguistic hurdles, it is more likely that confusion, distrust, misinterpretation, ambiguity, facts, and communication expenses will occur, increasing overall trade costs. The Armington model is used to explore the relationship between trade expenses associated with linguistic barriers, trade elasticity, and trade disputes. The empirical findings imply that linguistic barriers considerably enhance the likelihood of international trade conflicts. Furthermore, the findings show that trading nations with linguistic distance suffer greater challenges comprehending international trade laws and practices, as well as communication and negotiation issues, and are more likely to engage in trade disputes with trading partners.

This study further provides key policy ramifications for the WTO dispute settlement body and member states, emphasizing the need to address language barrier issues through multilingual support systems, language training programs, and high-quality translation services. The fundamental contribution of this study is to empirically highlight the impact of linguistic barriers on trade disputes. Given the importance of language in international trade, more study is required to investigate the impact of language proficiency on trade disputes.

## Disclosure Statement

There is no potential conflict of interest.

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**APPENDIX**

## Table A. Country-pairs with Trade Disputes and Language Barrier Index (1995-2018)

| Country-Pairs | No. of Trade Disputes Cases | LBI | Country-Pairs | No. of Trade Disputes Cases | LBI |
|---|---|---|---|---|---|
| US-China | 38 | 1 | Colombia-US | 1 | 1 |
| US-Korea | 20 | 1 | Greece-China | 1 | 1 |
| US-Brazil | 15 | 1 | Bangladesh-India | 1 | 1 |
| EU-China | 15 | 1 | Costa Rica-US | 1 | 1 |
| US-Japan | 11 | 1 | Croatia-Hungary | 1 | 1 |
| Mexico-US | 10 | 1 | Cuba-Australia | 1 | 1 |
| EU-Russia | 8 | 1 | Czech Republic-Poland | 1 | 1 |
| Japan-Korea | 7 | 1 | Dominican Republic-Australia | 1 | 1 |
| EU-Korea | 7 | 1 | Egypt-Thailand | 1 | 1 |
| EU-Japan | 7 | 1 | Egypt-US | 1 | 1 |
| Argentina-Brazil | 6 | 1 | Egypt-Pakistan | 1 | 1 |
| Japan-Canada | 6 | 1 | Honduras-Australia | 1 | 1 |
| EU-Indonesia | 6 | 1 | Hong Kong-Turkey | 1 | 1 |
| Brazil-Canada | 5 | 1 | Hungary-Slovak Republic | 1 | 1 |
| Mexico-China | 5 | 1 | Hungary-Czech Republic | 1 | 1 |
| EU-Thailand | 5 | 1 | Hungary-Romania | 1 | 1 |
| Australia-India | 4 | 1 | Hungary-Turkey | 1 | 1 |
| Australia-Indonesia | 4 | 1 | Hungary-Argentina | 1 | 1 |
| Canada-China | 4 | 1 | Hungary-Australia | 1 | 1 |
| China-Japan | 4 | 1 | Hungary-Canada | 1 | 1 |
| France-US | 4 | 1 | Hungary-New Zealand | 1 | 1 |
| Germany-US | 4 | 1 | Hungary-Thailand | 1 | 1 |
| Greece-US | 4 | 1 | Hungary-US | 1 | 1 |
| Indonesia-Korea | 4 | 1 | Indonesia-Vietnam | 1 | 1 |
| New Zealand-Indonesia | 4 | 1 | Indonesia-Brazil | 1 | 1 |
| Norway-US | 4 | 1 | Indonesia-Chinese Taipei | 1 | 1 |
| Pakistan-Indonesia | 4 | 1 | Indonesia-Japan | 1 | 1 |
| Pakistan-US | 4 | 1 | Indonesia-South Africa | 1 | 1 |
| Russia-US | 4 | 1 | Indonesia-Argentina | 1 | 1 |
| Spain-US | 4 | 1 | China-Italy | 1 | 1 |

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| Country-Pairs | No. of Trade Disputes Cases | LBI | Country-Pairs | No. of Trade Disputes Cases | LBI |
|---|---|---|---|---|---|
| Thailand-Turkey | 4 | 1 | Ukraine-Australia | 1 | 1 |
| Ukraine-Armenia | 4 | 1 | Chinese Taipei-US | 1 | 1 |
| Vietnam-US | 4 | 1 | Chinese Taipei-India | 1 | 1 |
| Mexico-China | 4 | 1 | Chinese Taipei-EU | 1 | 1 |
| Chile-US | 3 | 1 | Chinese Taipei-Canada | 1 | 1 |
| Peru-Brazil | 3 | 1 | Switzerland-India | 1 | 1 |
| EU-Norway | 3 | 1 | Srilanka-Brazil | 1 | 1 |
| Belgium-US | 3 | 1 | Slovak Republic-Switzerland | 1 | 1 |
| Turkey-US | 3 | 1 | Romania-US | 1 | 1 |
| South Korea-Canada | 3 | 1 | Portugal-US | 1 | 1 |
| EU-Turkey | 2 | 1 | Philippines-Brazil | 1 | 1 |
| EU-Pakistan | 2 | 1 | Philippines-Thailand | 1 | 1 |
| Costa Rica-Trinidad & Tobago | 2 | 1 | Philippines-Korea | 1 | 1 |
| Spain-US | 2 | 1 | Poland-Thailand | 1 | 1 |
| Russia-Japan | 2 | 1 | Poland-Slovak Republic | 1 | 1 |
| Pakistan-EU | 2 | 1 | Poland-India | 1 | 1 |
| Japan-Brazil | 2 | 1 | Moldova-Ukraine | 1 | 1 |
| Japan-China | 2 | 1 | Morocco-Turkey | 1 | 1 |
| Colombia-Thailand | 1 | 1 | Netherlands-India | 1 | 1 |
| Malaysia-US | 1 | 1 | Netherlands-Brazil | 1 | 1 |
| Mexico-Venezuela | 1 | 1 | New Zealand-India | 1 | 1 |
| Mexico-Brazil | 1 | 1 | Pakistan-South Africa | 1 | 1 |
| Japan-India | 1 | 1 | Japan-Thailand | 1 | 1 |
| Japan-Argentina | 1 | 1 | | | |

Source: Author's own accumulation from WTO Trade Disputes Data and World Atlas Language Data.

# Significance of Subsidiaries for Improving Financial Performance in the Sugar Industry: A Quantitative Analysis on Carew & Co. (Bangladesh) Limited

**Dhanonjoy Kumar**[*]
**Sutap Kumar Ghosh**[**]
**Zeennat Ara Begum**[***]

*Abstract: Sugar cane stands out as a plant that is very effective at converting solar energy into biomass and sugary substances. It is a plentiful supply of fuel, chemicals, fodder (green cane plant leaves and tops, bagasse, molasses, and to some extent press mud), food (sucrose, jaggery, and syrup), fibre (cellulose), and other nutrients. Bagasse, molasses, and press mud are the principal byproducts. Gud, sukker, or khandeswari, made from sugarcane, has been a traditional sweet in Bangladesh since ancient times. These sweeteners can also be made from palm and date juice. The study's objectives are to investigate the significance of subsidiaries in improving the sugar industry's financial performance. Multiple regression analyses has been used to evaluate the sugar industry's economic success based on secondary data. After accounting for the losses of other units, such as sugar and agro-firms, the analysis has found that the distillery unit dramatically increases net profit every financial year. The sugar division and the agro-farm units have positive impact on the net profit because losses from the sugar division and the agro-farm unit reduce day by day. The fertilizer unit also generates an adequate profit, which helps to prevent other units, such as sugar and agro-firms, from going bankrupt. The government and policymakers use this example as a benchmark for developing policies that address the government's losses in other sectors and transform them into profitable ones.*

*Keywords: Byproduct, sugar mills, distillery unit, cost minimization and sugarcane.*

## 1. Introduction

Sugarcane cultivation in the ancient region of Bangladesh has a long history. The Persian traders first introduced it in India in the 6th century AD (Reza, Riazi, and Khan 2016). Commercial sugar production in Bangladesh began during the colonial period, with Portuguese traders establishing sugar factories in the 16th century. The industry is vital to the country's economy, employing millions and

[*] Professor, Department of Management, Islamic University, Kushtia, Bangladesh-7003, E-mail:djoysk@mgt.iu.ac.bd

[**] Associate Professor, Department of Finance and Banking, Islamic University, Kushtia, Bangladesh-7003

[***] Professor, Institute of Business Administration, Rajshahi University, Rajshahi-6205.

contributing to the agricultural GDP (Rahman, Khatun, and Rahman, 2016; Kumar, 2019; Kumar, Adhikari, and Kumar, 2020). However, the industry has faced challenges, including low sugar production and poor recovery rates (Rahman & Kumar, 2018). The Indian sugar industry, which is a significant contributor to the country's socio-economic development, provides a potential model for the development of the Bangladeshi industry (Solomon, 2016). In the 16th century, Portuguese traders founded sugar factories in Chittagong. The sugar industry has been nationalized since Bangladesh gained independence, and the responsibilities to administer all the sugar mills in Bangladesh have been given to the Bangladesh Sugar and Food Industries Corporation (BSFIC).

Sugar occupies an important place in the industrial sector of Bangladesh, employing over 5 million people and contributing 0.74% of agricultural GDP in 2010, though, the industry has been running at a loss since the mid-1980s. Consequently, the government has shut down the Setabganj Sugar Mill in Dinajpur, the Panchagarh Sugar Mill, the Shyampur Sugar Mill in Rangpur's Badarganj upazila, the Pabna Sugar Mill, the Kushtia Sugar Mill, and the Rangpur Sugar Mill in 2020 due to ongoing losses. Nine state-run mills currently use sugarcane crushing to create sugar, and have produced 24,509.75 metric tonnes where the expectation was to produce 50,000 metric tonnes (Shakil, 2022). Production levels, owing to inefficiencies, mismatched raw material demand, antiquated technology, and low cane extraction rates, production levels fall well short of installed capacity. The average extraction rate is 8–9%, varying depending on factors like sugarcane quality, milling technology, and operational efficiency (Sabur, et al., 2023).

## 2. Overview of Carew & Co. (Bangladesh) Ltd

Carew & Co. (Bangladesh) Ltd., established in 1938, is a notable factory among Bangladesh's 15 sugar mills. Founded by Rozer Carew, the mill began crushing sugar cane in 1938 and later expanded to 150 million tons. The mill became a public corporation in 1968, after the government's privatization of the industrial sector. Following the liberation struggle, the government nationalized it in 1972, handing management to Bangladesh Sugar Mills Corporation, later known as BSFIC.

From 1990 to 1991, the Bangladesh Sugar and Food Industry Corporation (BSFIC) planned to enhance sugar cane crushing capacity from 10,000 to 11,500 metric tons. Launching an extension programme in 1951 led to the establishment of a pharmaceutical plant capable of producing 90,000 liters. The mill continues to progress with the help of sugarcane cultivators and the management committee's efforts.

The mill consists of six equipment units: a sugar-producing unit, a distillery, a pharmacy, a commercial farm, an akundabaria farm, and a composite fertilizer factory. The distillery and compound fertilizer facilities are the only lucrative ones. Molasses, bagasse, and press mud are used to make alcohol and liquor. The distillery unit produces 8,00,000 litres of denatured spirit, 26,00,000 litres of

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country spirit, and 10,80,000 proof litres of alcohol. The mills make the most money from alcohol, manufacturing brands such as Yellow Level Malted Whisky, Gold Ribbon Gin, Fine Brandy, Cherry Brandy, Imperial Whisky, Orange Curacao, Tsarina Vodka, Rosa Rum, and Old Rum. At the time of COVID, the Carew and Co. (Bangladesh) Ltd., a state-run sugar mill, has developed vinegar to prevent COVID-19 (Bangladesh Post, 2022).

In a joint manufacturing process, the main product is an output that significantly contributes to the net realizable value (NRV), whereas by-products are goods recovered from materials wasted in the main process or from the creation of certain key products. A variety of industries, including soft drinks, convenience foods, fast food, candy and sweets, confectionery, and baking products, use sugar as their major product. By-products, such as molasses and bagasse, are secondary or subsidiary products that arise from the manufacture of the primary product. Biotechnology can transform sugarcane byproducts into valuable goods for the production of sugar cane and other crops. Interest in biocontrol has increased due to its potential to combat insects and epidemics by focusing on harmful bacteria and germs.

Sugar mills use bagasse, the fibrous substance left over from extracting juice from sugarcane stalks, as a captive fuel, a raw material for paper mills, and a biofuel. Various mills in countries like Australia, Brazil, and Mauritius burn bagasse to produce steam, which powers sugar refineries (Deepchand, 2005). Compostable and biodegradable food service goods, clay-based green construction bricks, sugarcane bagasse ash, long-lasting acoustic absorbers, effective bio sorbents, and wastewater management products can also make use of bagasse (Kumar, Hasan, and Pathak, 2016). For example, bagasse is an effective absorber of common pollutants found in synthetic wastewater, including chromium, cadmium, copper-nickel, and pigments (Meena et al., 2020). Particleboard (Chakraborty & Priya, 2020) and fiber board (Almazan, 1994) both use bagasse as a building material. Recently, Muttil et al. (2014) used bagasse to make panels, both for the resin and the fibers in the board.

Press mud, a solid byproduct of sugar cane processing, is an excellent source of potassium, salt, phosphorus, and organic material. Bio-earth, which serves as a foundation material. In Bangladesh, press mud is an important fertilizers and organic carbon source for maintaining soil fertility and promoting crop cultivation. In India, bio composting has become popular (MDiaz, 2016; Partha & Sivasubramanian, 2006). Press mud can serve as plant fertilizer and animal feed due to storage concerns (Dotaniya & Datta, 2014).

Manufacturers use molasses, a byproduct of sugar manufacture, to produce alcohol, yeast, cow feed, citric acid, glutamine, and bovine feed. India has traditionally used it to make rectified spirits and alcohol, as it comprises around 50% sugar. Technological advancements have made it possible to utilize it for the production of bio-ethanol, which when combined with gasoline, can create fuel. Molasses production is cyclical, occurring every three to five years

(Inamdar, 1994), affecting dependent industries and necessitating precise forecasting and planning.

Absolute alcohol is the chemical ingredient in alcoholic beverages, while foreign liquor refers to domestically made hard liquor. Historically, people have used acetic acid, a byproduct of sugarcane production, in pickling, cuisine, industry, medicine, and the home. Ethanol, a byproduct of sugarcane processing, is a biofuel that can replace gasoline. One acre of sugarcane produces 4000 liters of ethanol per year, with a 5% mix resulting in higher liter-mileage, fewer environmental pollutants, and a longer engine life. Ethanol's ability to knock quickly enhances engine life, making it a valuable resource in many industries.

### 3. Literature Review

This study has explored the various aspects of the sugar industry and its byproducts, including bagasse, molasses, ethanol, spent wash, press mud, and trash from secondary sources. Alcohol production and the preparation of food and animal feed use molasses, a commercially significant byproduct. Yeast dilutes the fermentable sugars in molasses with water and ferments them. After fermentation, the spent wash contains lower-order sugars, water-soluble amino acids, lignin, and other organic fractions that remain unfermented. Processing sugarcane entails cleaning and sugar extraction, followed by treatment, concentration, and sterilization (Chen & Chou, 1993). Mills extract sugar from juice, treat, clarify, and dewater it before crystallizing and centrifuging it.

Reza, Riazi, and Khan (2016) found that producing sugarcane benefits farmers, and intercropping boosts profit margins. However, high input costs, low output prices, payment delays, and a lack of scientific knowledge consider as major problems in sugarcane production (Nazir, Jariko, and Junejo, 2013). Haider, Ahmed, and Mallick (2011) found that farming experience and credit availability positively affect profitability and productivity of sugar industries. Redefining and redesigning credit instruments are necessary for long-term sustainability. The use of fertilizer, insecticides, and seed significantly affects sugarcane production, with seed having a negative impact. Tilling and insecticides have a positive impact on sugarcane output with intercrop, whereas human labor is somewhat unfavorable.

Dotaniya and Datta (2014) found that using sugarcane industry byproducts reduces fertilizer doses and improves soil organic matter during crop production. These byproducts alongside commercial fertilizers, or use them in combination with inorganic chemical fertilizers, molasses, and press mud are the three principal byproducts of sugarcane production. Sugarcane businesses use bagasse, a fibrous residue, as fuel and burn it to produce ash. In Ethiopia 2.7 million tons of leftover bagasse produces annually, which serves as biomass for ethanol production (Berhanu, Jabasingh, and Kifile, 2017). Further fermentation processes include distillation and dehydration. However, Ethiopia has not significantly utilized this waste, prompting an essay on how sugarcane byproducts can help reduce climate change (Habte, Mulatu, and Ahn, 2018).

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Akhtar et al. (2017) suggests that developing nations can reap benefits from the sustainable utilization of sugarcane industry byproducts, particularly press mud and bagasse fly ash. In the sugar industry, the combination of inorganic fertilizers and compost can reduce solid waste and air pollution problems.

Bangladesh's agriculture industry, particularly sugarcane, can boost revenue and employment by providing long-lasting cash crops. Sugarcane byproducts can be used for wood, fuel, cement replacement, soil mitigation, water and wastewater treatment, and soil treatment (Sarker, Rahman, and Rupa, 2018). Hossain (2021) found that Bangladesh's sugar mills faced uncompetitive production costs due to high production costs. The removal of import restrictions on inexpensive sugar has worsened their situation, leading to increased losses for state-owned sugar enterprises. Raza et al. (2021) suggested that proper, organized disposal of sugar industry byproducts in agriculture is crucial for raising awareness and fostering goodwill between farmers and industrialists. Ungureanu, Vlăduț, & Biriş (2022) discussed a sustainable sugarcane processing process and analyzed waste and byproducts. They emphasized the potential for valorizing each waste and by-product to produce biofuels and other products, thereby contributing to global environmental, agricultural, and human health sustainability.

Many academics and professionals in Bangladesh have explored the various uses and possible advantages of byproducts, in addition to the intricacies and difficulties related to the sugar industry only. Therefore, it is crucial to explore the ability of sugarcane industry to transform and improve the sector's overall operations. This study provides an in-depth understanding of the various ways that Carew & Company Bangladesh Limited's business units contribute to the company's overall profitability and financial stability. In order to enable management and stakeholders to make more informed decisions that will improve profitability and sustainability across all business divisions, the study intends to give them a better understanding of the company's financial dynamics.

## 4. Objectives of the Study

The objectives of the study are to:

✔ Evaluate the correlation between the net profit and loss of Carew & Company Bangladesh Limited's distillery unit and the company's overall net profit and loss, and determine if they move together.

✔ Observe the relationship between Carew & Company Bangladesh Limited's net profit and loss and that of its sugar unit to see if they are positively correlated.

✔ Examine the connection between Carew & Company Bangladesh Limited's net profit and loss and the net profit and loss of its fertilizer unit, and determine whether there is a positive link.

✔ Study the correlation between the net profit and loss of Carew & Company Bangladesh Limited's Agro-Firm unit and the company's total net profit and loss, and determine whether they are definitely correlated.

## 5. Hypothesis of the Study

$H_1$: Carew & Company Bangladesh Limited's distillery unit's net profit and loss and the company's overall net profit and loss are positively correlated.

$H_2$: Carew & Company Bangladesh Limited's net profit and loss and the net profit and loss of its sugar unit are positively correlated.

$H_3$: Carew & Company Bangladesh Limited's net profit and loss and the net profit and loss of its fertilizer unit are positively correlated.

$H_4$: The net profit and loss of Carew & Company Bangladesh Limited's Agro-Firm unit and its net profit and loss are positively correlated.

## 6. Methodology of the Study

### 6.1 Research Design

In Bangladesh, fifteen sugar mills are now operational. Carew & Company (Bangladesh) Limited is one of the top sugar mills out of these fifteen due to its significant size and the presence of Bangladesh's sole distillery unit. This study uses a quantitative research design to examine the performance and financial health of Carew & Company (Bangladesh) Limited. Multiple regression analysis has been utilized to assess secondary data gathered from diverse sources, aiming to uncover significant predictors of the business's financial performance.

### 6. 2 Data Collection

### 6.2.1 Period of study and sources of data

The study has been conducted between 2001 and 2021. The secondary data was collected from a variety of sources, including Carew & Company (Bangladesh) Limited's published annual reports, books, journals, and articles pertinent to the sugar industry and financial analysis; seminar papers; publications from national and international research institutions; reports from financial institutions; public records and statistics; and more.

### 6.2.2 Data Variables

The net profit of Carew & Company (Bangladesh) Limited is dependent variable to assess the company's financial health. Net profits for several business divisions or product lines, on the other hand, are considered independent variables.

### 6.3 Data Analysis

### 6.3.1 Data Preprocessing with R Software

The researcher preprocessed the acquired data using R software before performing multiple regression analysis. This includes using descriptive statistics to comprehend the distribution and summary of the data, as well as data cleansing to deal with outliers and missing numbers.

### 6.3.2 Multiple Regression Analysis

To investigate the link between the dependent and independent variables, multiple regression analysis has been done. The model can be shown as follows:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_n X_n + \epsilon$$

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Where:

Y = Net profit of Carew & Company

$X_1, X_2, ... X_n$ = Independent Variables

$\beta_0, \beta_1, \beta_2, ... \beta_n$ = Regression coefficients

$\epsilon$ = Error term

### 6.3.3 Diagnostic Tests of Regression

After the multiple regression analysis, the researcher has run the following diagnostic tests to confirm the assumptions of the regression model:

Normality: Used Q-Q plots and the Jarque Bera test to determine whether the error terms have a normal distribution.

Homoscedasticity: Used the Breusch-Pagan test and the residual vs. fitted values plot to ascertain the error terms' constant variance.

Independence: Used the Durbin-Watson test to determine whether the error terms are independent.

Non-collinearity test: Used Multicollinearity Diagnostics (VIF) to determine the autocorrelation between the independent variables.

Model fitness: Used residual value to determine the perfect fit of the model. The mean value of residuals is zero, suggesting that the regression line goes precisely throughout all of the data points, implying that the model fits the data perfectly.

## 7. Data Analysis and Interpretation of the Data

### 7.1 Descriptive Analysis of the Carew & Company Bangladesh Limited

The distillery sector of *Carew & Company* has the highest average net profit of $4375.91, while the bio fertilizer sector has a somewhat disappointing average net profit of -$31.79. The sugar industry and agri. units both had negative average net profits of -$3117.42 and -$207.87, respectively. The average net profit for all sectors is around $1160.68.

The distillery sector of *Carew & Company* has a median net profit of $4360.36, and the general net profit is $1109.36, the bio fertilizer sector has a median of -$50.61, the sugar sector has a median of -$2685.00, and the agri. unit has a median of -$155.95. These median net profit values closely mirror the mean values.

The standard deviation represents the variability or dispersion of net profit figures. The distillery sector has the most variation, with a standard deviation of $3236.45, followed by general net profit, which has a standard deviation of $999.95. The standard deviations for the bio fertilizer, sugar, and agri-units are $51.91, $2495.80, and $149.93, respectively.

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**Table 1: Represent the descriptive analysis**

|  | Net profit | Net profit distillery | Net profit bio fertilizer | Net profit sugar | Net profit agri-unit |
|---|---|---|---|---|---|
| Mean | 1160.68 | 4375.91 | -31.79 | -3117.42 | -207.87 |
| Std. dev | 999.95 | 3236.45 | 51.91 | 2495.80 | 149.93 |
| Min | -259.87 | 574.40 | -98.56 | -7086.25 | -489.28 |
| Q1 | 427.97 | 1262.08 | -71.61 | -4908.22 | -326.64 |
| Median | 1109.36 | 4360.36 | -50.61 | -2685.00 | -155.95 |
| Q3 | 1894.89 | 5971.91 | 18.60 | -777.97 | -74.09 |
| Max | 4044.79 | 10397.62 | 32.88 | -291.61 | -12.08 |
| MAD | 1030.33 | 4455.52 | 71.09 | 2828.19 | 136.78 |
| IQR | 1466.92 | 4709.83 | 83.82 | 4130.25 | 252.55 |
| CV | 0.86 | 0.74 | -1.63 | -0.80 | -0.72 |
| Skewness | 0.93 | 0.36 | 0.08 | -0.34 | -0.53 |
| SE.Skewness | 0.50 | .50 | 0.79 | 0.50 | 0.50 |
| Kurtosis | 0.90 | -1.32 | -1.99 | -1.55 | -1.30 |

The standard deviation represents the variability or dispersion of net profit figures. The distillery sector has the most variation, with a standard deviation of $3236.45, followed by general net profit, which has a standard deviation of $999.95. The standard deviations for the bio fertilizer, sugar, and agri-units are $51.91, $2495.80, and $149.93, respectively.

The range of net earnings varies greatly between sectors. The distillery industry has the highest maximum net profit of $10397.62 and the highest minimum net profit of $574.40. On the other hand, the sugar industry has the poorest net profit of -$291.61 and a maximum net profit of -$7086.25.

The interquartile range (IQR) measures the dispersion of the middle 50% of data. The distillery industry had the highest IQR ($4709.83), showing a broad range of net earnings within the sector. The overall net profit has an IQR of $1466.92, the bio fertilizer sector has an IQR of $83.82, the sugar sector has an IQR of $4130.25, and the agricultural unit has an IQR of $252.55.

The coefficient of variation (CV) is a normalized measure of dispersion around the mean. A greater CV suggests more relative variability. The general net profit has the greatest CV (0.86), followed by the distillery industry (0.74). The bio fertilizer sector has a negative CV of -1.63, suggesting that the standard deviation exceeds the mean, as do the sugar sector and the agricultural unit, which have CVs of -0.80 and -0.72, respectively.

Skewness assesses the asymmetry of a data distribution. A positive skewness implies that the data is biased to the right, whereas a negative skewness suggests

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that the data is biased to the left. The general net profit, distillery industry, and bio fertilizer sector all show positive skewness, indicating a right-skewed distribution. The sugar industry and the general agricultural unit have negative skewness, indicating a left-skewed distribution.

Kurtosis calculates the "tailedness" of a data distribution. A positive kurtosis suggests a distribution with large tails and a sharp peak, whereas a negative kurtosis indicates a distribution with small tails and a flat peak. The net profit has a kurtosis of 0.90, indicating a mesokurtic distribution. The distillery sector, bio fertilizer sector, sugar sector, and general agriculture unit all have negative kurtosis values, implying platykurtic distributions.

In conclusion, the distillery industry has the highest average and fluctuation in net profit, whereas the bio fertilizer sector has the lowest variability but also the lowest average net profit. The sugar industry and the overall agriculture unit both have negative average net earnings and left-skewed distributions with platykurtic shapes.

***7.2 Graphical presentation of the profit scenario of the Carew & Company Bangladesh Limited.***

**Net Profit Over Financial Years**
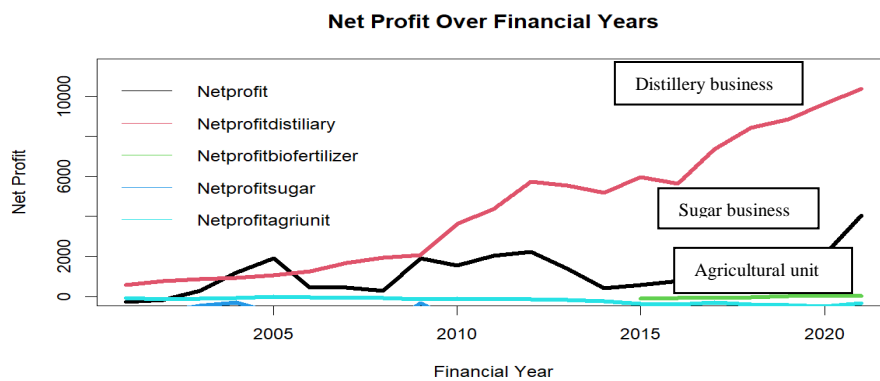


**Figure 1: Represent the sequence plot of net profit of the Carew & Company Bangladesh Limited.**

The graph displays the net earnings for multiple divisions of company or product lines from 2005 until the end of 2020. The black line illustrates Carew & Company Bangladesh Limited's total net profit. The graph illustrates that the company had an adverse value in 2001 and 2002 before transforming positive in 2003. It has been gradually rising over the years, with significant highs in 2005 and 2009, as well as substantial growth after 2014. By 2021, the net profit had risen substantially and achieved a high. The distillery business (pink line) began with a negative net profit in 2001 and 2002, but soon turned positive after 2003.

The distillery business (pink line) started with a negative net profit in 2001 and 2002 but quickly turned positive from 2003. There is a substantial increase in profits from 2004 to 2007, followed by fluctuations. The business demonstrates a significant rise from 2014 onwards, with a sharp increase in 2021. The bio

fertilizer sector started with a negative net profit and remained negative until 2004. From 2005 onwards, there has been steady growth, with fluctuations in between. By 2021, the business shows a positive net profit, although not as high as the other units. The sugar business (Blue line) starts with a negative net profit and remains negative until 2009. There's substantial growth from 2010 to 2014, followed by fluctuations. The business demonstrates a significant rise from 2018 onwards, with a considerable increase in 2021.The agricultural unit (cyan line) starts with a negative net profit and remains negative until 2008. From 2009 onwards, there's a consistent growth, with minor fluctuations. By 2021, the business shows a positive net profit but remains the lowest among the categories.

Overall, the graph suggests that the distillery business has been the most profitable over the years, with a significant increase in net profit, while the agricultural unit has been the least profitable with little to no growth. The overall net profit trend seems to be influenced heavily by the distillery's performance, given its dominant rise compared to the other categories.

***7.3 Regression analysis to demonstrate how Carew & Company Bangladesh Limited's net profit is affected by its distillery, bio fertilizer, sugar, and agricultural divisions.***

### Table 2: Represent the result of multiple regression

lm (formula = Net profit ~ Net profit distillery + Net profit bio fertilizer + Net profit sugar + Net profit agri-unit)

Residuals:

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| -5.7118 | 3.8518 | 2.7287 | 0.6831 | -2.4945 | 1.5062 | -0.5635 |

| | Estimate | Std. Error | t value | Pr (>|t|) |
|---|---|---|---|---|
| (Intercept) | 38.072236 | 36.171373 | 1.053 | 0.40295 |
| Net profit distillery | 0.997361 | 0.003630 | 274.751 | 0.0000132 *** |
| Net profit bio-fertilizer | 1.057472 | 0.106789 | 9.902 | 0.01004 * |
| Net profit sugar | 1.000957 | 0.003939 | 254.123 | 0.0000155 *** |
| Net profit agri-unit | 1.016370 | 0.045938 | 22.125 | 0.00204 ** |

Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 5.665 on 2 degrees of freedom (14 observations deleted due to missingness). Multiple R-squared:1, Adjusted R-squared:1

F-statistic: 6.847e+04 on 4 and 2 df, p-value: 0.0000146

Table 2 depicts the analysis findings, which reveal a substantial association between Carew & Company Bangladesh Ltd.'s net profit and the net profits of its subsidiaries, which include the Distillery Unit, Bio-Fertilizer, Sugar Unit, and Agricultural Firm Unit.

The model's overall p-value is 0.0000146, and its F-statistic is 6.847e+04. This suggests that the model is statistically significant as a whole.

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At the 0.00 significance level, distillery net profit is statistically significant. Specifically, the model output coefficient indicates that, when all other factors are held constant, a rise of one unit in distillery net profit is linked to an average increase of 0.997361 units in net profit.

At the 0.01 significance level, net profit bio fertilizer is statistically significant. Specifically, the coefficient derived from the model output indicates that, if all other factors remain same, an increase of one unit in net profit bio-fertilizer corresponds to an average gain of 1.057472 units in net profit.

Net profit sugar has statistical significance at the 0.00 significance level. In particular, the coefficient produced from the model output shows that an average gain of 1.000957 units in net profit corresponds to a one-unit rise in net profit sugar, assuming all other factors stay the same.

At the 0.001 significance level, net profit as an agricultural unit has statistical significance. Specifically, the coefficient derived from the model output indicates that, under the assumption that all other variables remain constant, an average increase in net profit of 1.016370 units equates to a one-unit rise in net profit agri- unit.

It demonstrates that the alternative hypothesis $H_1$, $H_2$, $H_3$, and $H_4$ are acceptable. As a result, Carew & Company Limited's net profit and loss in Bangladesh are significantly related to the net profits and losses of the distillery, sugar, bio-fertilizer, and agro-firm units.

The regression analysis summary includes information about the regression model's goodness-of-fit. The correlation coefficient (R) represents a perfect correlation between the independent and dependent variables. An $R^2$ score of 1.000 implies that the independent factors fully explain the dependent variable's variance. A modified $R^2$ value of 1.000 ensures a flawless fit, and the predictors explain all of the variability. The regression model is highly significant ($p < 0.05$), suggesting that at least one predictor has a non-zero effect on Carew & Company Bangladesh Ltd.'s net profit.

The residual standard error measures the average distance that the observed values fall from the regression line. The observed values fall an average of 5.665 units from the regression line.

The following multiple linear regression equation infer from the model is output:

Net profit of Carew & Company Bangladesh Ltd. = 38.072 + 0.997 * (Net profit of Distillery Unit) + 1.057 * (Bio-Fertilizer) + 1.001 * (Sugar Unit) + 1.016 * (Agricultural Firm Unit).

### 7.4 Diagnostic tests of Regression analysis

#### 7.4.1 Jarque Bera test for identifying the normality of residuals

The results of the Jarque Bera Test show that the X-squared is 0.57357, the df is

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2, and the p-value is 0.7507. Given that the p value in the current study is more than 0.05, the null hypothesis—that is, that the residuals are normally disturbed—is not successfully rejected.
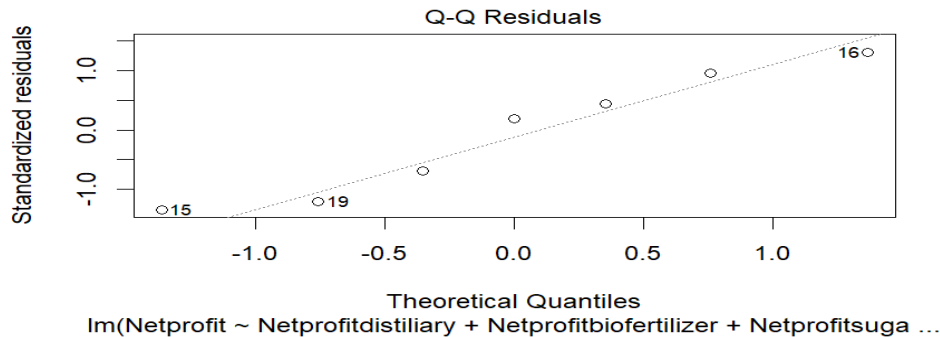


**Figure 2: represent the standard residuals and theoretical quantiles**

*7.4.2 Breusch-Pagan test for determining the heteroscedasticity*

At every level of the predictor variable, the residuals are assumed to be distributed with equal variance, which is one of the fundamental premises of linear regression. Homoscedasticity is the name given to this presumption.

Using R software, the Studentized Breusch-Pagan test result shows that the p-value is 0.3278, the df is 4, and the value of BP is 4.6265. Thus, the null hypothesis cannot be rejected. In other words, there is homoscedasticity among the residuals.
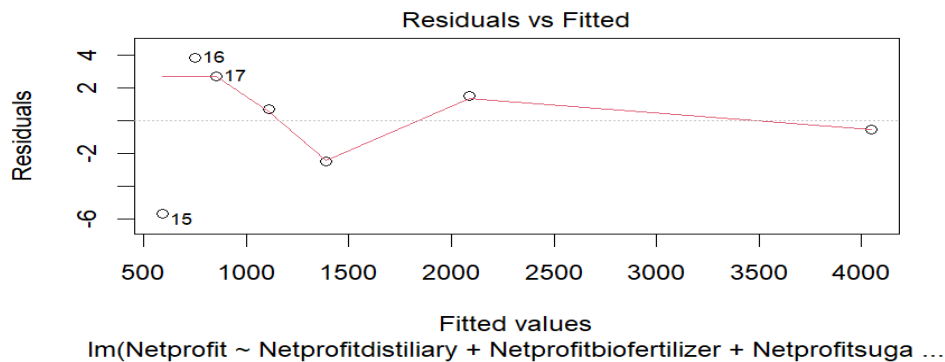


**Figure 3: represent the residuals and fitted values**

*7.4.3 Durbin-Watson test for detecting the autocorrelation*

The Durbin-Watson test result indicates DW = 1.9833 and p-value = 0.05186, which indicates that the null hypothesis—that is, that there is no correlation among the residuals. Thus, null hypothesis cannot be rejected.

*7.4.4 Model fitness*

According to the R software, the mean value of the residuals is 0.0000000000000004440892. That is, it validates a key assumption of linear regression. The regression line runs precisely across all of the data points, indicating that the model fits the data properly.

***7.4.5 Non-collinearity test***

Given that multiple regressions are being used in this study, it is imperative to understand that if the independent variables have a high degree of correlation with one another; it will be challenging to determine the genuine correlations between the independent and dependent variables.

**Table 2: Represent the Individual Multicollinearity Diagnostics Result**

|  | VIF |
|---|---|
| Net profit distillery | 8.019444 |
| Net profit bio-fertilizer | 5.746103 |
| Net profit sugar | 3.284591 |
| Net profit agri-unit | 1.621015 |

It can be observed from the R software that the independent variable's VIF value is less than the threshold of 10 (Hair et al., 1998; Pallant, 2010). It follows that there isn't a significant multicollinearity issue.

In summary, all of the regression analysis's diagnostic tests were satisfied by multiple regression analysis. Therefore, the model created for this study is appropriate.

**Major Findings**

The diagrams indicate that Carew & Company Bangladesh Limited's net profit increased despite its lack of revenues from FY 2001–2002 and FY 2002–2003. The distillery unit significantly increases net profit each fiscal year to compensate for the losses experienced by other units, including the sugar and agro-firm units. Annual losses in profitability are observed in both the sugar business and the agro-farm unit. The fertilizer unit's considerable profit has a positive impact on other units, including sugar and agro-firms, which experience less loss. The bio-fertilizer unit was ultimately operational in 2015 and 2016.

The regression study reveals a strong relationship between Carew & Company Bangladesh Ltd.'s net profit and its subsidiaries, which include the Distillery Unit, Bio-Fertilizer, Sugar Unit, and Agricultural Firm Unit. It shows that at the 0.00 significance level, distillery net profit increases by 0.997361 units. At the 0.01 significance level, net profit of the bio fertilizer increased by 1.057472 units. Net profit sugar also has statistical significance at the 0.00 significance level. At the 0.001 significance level, net profit as an agricultural unit increases by 1.016370 units. The model demonstrates that Carew & Company Limited's net profit and loss in Bangladesh are significantly related to these units.

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## Conclusion

The financial status of Carew & Company Limited is significantly affected by its several divisions; the sugar, bio-fertilizer, agri-unit, and distillery units have the most impact. The whole financial performance of the company depends on its subsidiary's profitability. The general net profit is favorably connected with the net profit of the sugar, bio-fertilizer, agri-unit, and distillery units. Improving the financial status of the company depends on efficient management at every level. The financial performance of the sugar company is much improved by the founding and running of affiliates. They assist in recovery from losses, avoidance of bankruptcy, restoration of profitability, and presentation of investment prospects in yet unexplored sectors. They also enable sugar companies to reach economies of scale and reorganize their procurement systems. Effective methods of corporate governance among associates help to improve financial sustainability even further. Therefore, careful use of subsidiaries will greatly increase sugar industry profitability and lifespan. On the other hand, the Government could address these issues to improve productivity by reducing input costs and by improving management practices.

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**APENDIX**

### Table 1: Summary of Sugar, Molasses, Distillery, Fertilizer and Agro-firm production, Profit & Loss in Carew & Company (Bangladesh) Limited.

| Threshing Season/Fiscal Year | Molasses (Metric Ton) | Profit/Loss Distillery Factory (Medicine Factory) | Bio-Fertilizer | Profit/Loss Sugar Factory (Taka in Lakh) | Profit/loss Agro-farm (Including Experimental farms) (Taka in Lakh) |
|---|---|---|---|---|---|
| 2001-2002 | 8500.76 | 574.40 | | -760.18 | -74.09 |
| 2002-2003 | 7859.00 | 767.75 | | -777.41 | -158.30 |
| 2003-2004 | 5695.42 | 856.17 | | -483.76 | -109.41 |
| 2004-2005 | 5726.64 | 917.88 | | -291.61 | -70.34 |
| 2005-2006 | 7110.35 | 1062.59 | | -820.22 | -12.08 |
| 2006-2007 | 8083.75 | 1262.08 | | -777.97 | -56.19 |
| 2007-2008 | 6171.82 | 1670.91 | | -1291.27 | -63.69 |
| 2008-2009 | 3623.25 | 1928.08 | | -1575.60 | -67.35 |
| 2009-2010 | 3880.00 | 2059.00 | | -351.81 | -155.95 |
| 2010-2011 | 4586.00 | 3629.89 | | -1241.77 | -123.03 |
| 2011-2012 | 2534.03 | 4360.36 | | -2685.00 | -137.69 |
| 2012-2013 | 3131.73 | 5749.62 | | -3384.70 | -142.27 |
| 2013-2014 | 4677.00 | 5539.97 | | -3976.36 | -163.43 |
| 2014-2015 | 3818.00 | 5186.44 | | -4522.98 | -250.15 |
| 2015-2016 | 2870.10 | 5971.91 | -98.56 | -4908.22 | -380.25 |
| 2016-2017 | 3134.30 | 5634.00 | -71.61 | -4405.75 | -416.01 |
| 2017-2018 | 3141.00 | 7365.57 | -65.33 | -6144.93 | -308.04 |
| 2018-2019 | 3208.00 | 8434.22 | -50.61 | -6857.84 | -416.61 |
| 2019-2020 | 4139.00 | 8872.15 | 32.88 | -7077.44 | -444.38 |
| 2020-2021 | 4486.76 | 9653.52 | 12.09 | -7086.25 | -489.28 |
| 2021-2022 | 2152.86 | 10397.62 (Provisional) | 18.60 (Provisional) | -6044.79 (Provisional) | -326.64 (Provisional) |

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**Table 2: Summary of Net profit & losses in Carew & Company Bangladesh Limited of Last 21 years (Taka in Lakh).**

| Year | Net profit (without interest) | Amount of interest | Net profit (with interest) |
|---|---|---|---|
| 2001-2002 | 105.22 | 365.09 | -259.87 |
| 2002-2003 | 205.06 | 372.94 | -167.88 |
| 2003-2004 | 614.53 | 351.53 | 263.00 |
| 2004-2005 | 1325.07 | 149.43 | 1175.64 |
| 2005-2006 | 2187.40 | 292.58 | 1894.89 |
| 2006-2007 | 642.31 | 214.39 | 427.97 |
| 2007-2008 | 667.03 | 237.24 | 429.79 |
| 2008-2009 | 666.70 | 382.45 | 284.25 |
| 2009-2010 | 2410.96 | 511.42 | 1899.54 |
| 2010-2011 | 2359.92 | 826.59 | 1533.33 |
| 2011-2012 | 3370.28 | 1338.62 | 2031.66 |
| 2012-2013 | 4545.04 | 2312.59 | 2232.45 |
| 2013-2014 | 2364.61 | 968.43 | 1396.18 |
| 2014-2015 | 1731.92 | 1317.58 | 414.41 |
| 2015-2016 | 2164.79 | 1579.9 | 584.89 |
| 2016-2017 | 2576.57 | 1824.03 | 752.54 |
| 2017-2018 | 2778.36 | 1924.41 | 853.95 |
| 2018-2019 | 3046.14 | 1936.78 | 1109.36 |
| 2019-2020 | 3403.89 | 2020.68 | 1383.21 |
| 2020-2021 (Actual) | 4296.79 | 2206.71 | 2090.08 |
| 2021-2022 (Budgeted) | 6194.79 | 2150.00 | 4044.79 |

# Does Islamic Mutual Fund Bear Higher Risk than Conventional Mutual Fund? An Empirical Analysis from Bangladesh

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## Shaikh Masrick Hasan[*]

*Abstract: This study aims to identify whether Islamic mutual funds bear higher risk exposure than conventional mutual funds due to implementing their shariah screening criteria to select assets on the portfolio. For this purpose, monthly closing price data of Islamic and conventional funds operated in Bangladesh are collected from January 2016 to August 2023. A total of 2320 observations of each risk measure (e.g., standard deviation, beta, semi-standard deviation, and lower partial moment) are computed using a 12-month rolling window method to compare risk exposure between Islamic and conventional funds using univariate and multivariate analysis. The univariate analysis is conducted by performing an independent samples t-test, which confirms that overall, Islamic funds bear lower risk exposure than conventional funds. In multivariate analysis, the Feasible Generalized Least Square (FGLS) method, a dynamic panel data analysis model, is applied where the effects of macroeconomic variables such as GDP growth rate, exports, imports, broad money, deposit rate, and remittances are controlled. The results of the multivariate analysis also confirm that Islamic mutual fund risk exposure is lower than that of conventional mutual funds. This finding indicates that asset screening criteria of Islamic funds do not have any negative impact on the risk exposure of Islamic funds compared to unrestricted conventional funds. The findings of the study will be helpful for practitioners and institutional investors as well as risk-averse investors in making their investment decisions as screened Islamic mutual fund investment is safer than conventional mutual funds.*

***Keywords:*** *Risk, downside risk, Islamic Funds, Shariah, Bangladesh, Mutual Fund, conventional funds.*

## Introduction

Mutual funds have become an increasingly popular investment over the past twenty years, including in Bangladesh. While investors see mutual funds as a safe option due to professional management and pooling of resources, it is vital to note that they carry risks. (Rahman, & Mamun, 2022). Policymakers become concerned with the level of investors' knowledge regarding the risk and return of the mutual funds (Hasan, 2016). Investors generally choose mutual funds, which create relatively high-risk investment portfolios because professionally managed funds aim to generate potentially high returns through strategic investments in

[*]  Associate Professor, Department of Finance, Faculty of Business Studies, Jagannath University, Dhaka, Bangladesh, E-mail: masrick@fin.jnu.ac.bd

risky assets (Noor, et al., 2023; Elton, et al., 2007). Ali, et al., (2023) stated that attitude towards risk preferences of investors are related to the investment types, risk-taking tendencies of individuals, and retirement plans. In the strategic and planned investment decision-making process, risk is considered an important factor thus risk exposure of mutual funds is crucial (Ali et al., 2023).

Islamic Shariah law is the basis for selecting assets in Islamic funds which prohibits investors from investing their money in Haram businesses, such as businesses related to Gharar, Maysir, and Riba (Hayat & Kraeussl, 2011). Securities of conventional financial institutions, treasury bonds, treasury bills, and highly leveraged firms are excluded from the investment of Islamic funds (Rahman, et al., 2022). Thus, Islamic funds may not be able to create a well-diversified optimal portfolio due to their shariah screening criteria when selecting assets, a challenge highlighted by the modern portfolio theory (MPT) proposed by Markowitz in 1952 (Dimmock, et al., 2024).

Islamic finance is growing in importance within the global financial system such as United States, United Kingdom, China, European Union, and Japan (IFSB, 2023; Climent, et al., 2020; Renneboog, et al., 2008). Increased demand for Islamic mutual funds, followed by improved returns, can contribute to ongoing progress in Islamic finance in the current financial. An analysis of investment and financial performance from 20 different nations shows that in the developed Islamic financial markets, Islamic funds exhibit greater returns than the underdeveloped or developing nations (Hoepner, et al., 2011). This indicates that the performance of Islamic funds varies in different nations due to fund managers' analytical skills, and overall market conditions.

Previously many authors (Climent et al., 2020; Mansor & Bhatti, 2011; Rodriguez, 2015; Hayat & Kraeussl, 2011) conducted their research on the risk exposure of Islamic mutual funds and conventional mutual funds separately, where no comparison of risk exposure is shown between these two distinct groups of funds. Rodriguez (2015) investigates only conventional mutual funds and explores the systematic and total risk of mutual funds. Vidal at al. (2016) also focus on conventional mutual funds and try to identify the idiosyncratic risk exposure. Moreover, Hayat & Kraeussl (2011) show the downside and systematic risk exposure of Islamic mutual funds. Whereas, Reddy, et al. (2017) compare the risks of Islamic mutual funds with Conventional and Socially responsible funds using systematic risk measures. Naveed, et al. (2020) compared the risk exposure (e.g. systematic risk, idiosyncratic risk, and downside risk) between Islamic and conventional mutual funds, and found that Islamic funds bear lower risk than conventional funds in Pakistan.

Thus, this study asks the following research questions: 1) Do Islamic funds bear higher risk than conventional funds in Bangladesh? And 2) Do macroeconomic variables influence the risk? To answer these questions, this study collects monthly closing price data from January 2016 to August 2023, and all risk measures are calculated using the 12-month rolling window method. Based on 2320 observations, the risk measures of Islamic mutual funds are compared with

the conventional mutual funds where both univariate and multivariate data analyses are applied. Independent samples t-test is performed for the univariate data analysis, and the Feasible Generalized Least Square (FGLS) method of panel data analysis is applied for the multivariate analysis. In multivariate analysis, macroeconomic variables, such as GDP growth rate, broad money, remittance, deposit rate, exports, and import payments, are used as control variables.

This study contributes to the existence knowledge in several ways. Firstly, most of the researchers (Hoepner et al., 2011; Abdelsalam, et al, 2014; Kreander, et al., 2005; Climent, & Soriano, 2011; Capelle & Monjon, 2014) focus on the performance comparison of ethical or socially responsible funds with conventional funds. This indicates that there is a lack of research on risk comparison between Islamic and conventional mutual funds, so, this study helps to extend knowledge in the existing literature of Islamic and conventional funds.

Secondly, this study utilized both traditional risk measures (standard deviation and beta) (following Humphrey & Lee, 2011; Bodnaruk, et al., 2019) and downside risk measures (semi-standard deviation and lower partial moment) (following Hoepner & Schopohl, 2016). Thus, the findings of the study are robust for considering various types of risk measures, risk-averse investors can utilize these findings of downside risk measures to make investment decisions according to their low-risk-taking aptitude.

Thirdly, there is a methodological contribution in this research which is the utilization of a 12-month rolling window method to compute risk measures, and the application of both univariate (t-test) and multivariate data (FGLS method) analysis to compare risk exposure between Islamic and conventional funds. The fund managers and investors can use this rolling window method to compute the risk exposure of mutual funds. Moreover, this research includes the macroeconomic factors in the multivariate analysis as control variables, which also helps fund managers or investors evaluate their investment decisions considering the effect of macroeconomic factors.

**Literature Review**

Since the creation of Islamic mutual funds, researchers have been enquiring to find out whether their performance differs from that of conventional funds. Reddy et al. (2017) show that the performance of Islamic equity mutual funds differs from that of conventional equity mutual funds due to their differences in risk exposure. Islamic mutual funds are fundamentally different from traditional investment funds since Islamic funds are strictly prohibited from investing in human cloning, wine production, pornography, gambling, and interest-bearing businesses (Hayat & Kraeussl, 2011). The comprehensive market risk analysis in Saudi Arabia reveals that Islamic mutual funds are significantly less vulnerable than conventional mutual funds (BinMahfouz & Hassan, 2012).

A study conducted on Pakistani Islamic Funds using beta (systematic risk) and standard deviation (total risk) reveals that a greater proportion of funds have lower risk exposure and positive returns (Shah, 2020). Another research conducted in Pakistan finds that Islamic mutual funds' risk exposures are lower than conventional mutual funds (Nafees, et al., 2018). These results, however, conflict with a Malaysian study that explores that Islamic portfolios offer marginally lower returns as well as carry a higher level of risk than their conventional funds (Mansor & Bhatti, 2011).

Moreover, a study conducted by Deb (2019) on Islamic mutual funds found that Indian mutual funds bear the downside risk. Chowdhury, Habibullah & Nahar (2018) performed a study in Bangladesh and found that mutual funds bear higher risks than conventional counterparts. Bodnaruk et al. (2019) identify that mutual funds are affected by downside risk. Yang & Hou (2016) explore that the performance of mutual funds is positively correlated with risk. Marco, et al. (2011) performed a comparative analysis and found that risks vary from conventional fund to Islamic fund. Consequently, in an investigation conducted in Malaysia, the economic situation affected the funds' efficiency and found that Islamic funds perform better than conventional funds in a downturn economic situation (Abdullah, et al., 2002).

Islamic mutual funds perform better than conventional mutual funds, and their risk-adjusted return is superior to conventional funds (Nafees et al., 2018). Climent et al. (2020) find that the performance of Islamic mutual funds is higher than that of conventional funds. Another investigation in Malaysia identifies that Islamic mutual funds' performance is not superior to that of conventional funds (Mansor & Bhatti, 2016). Anwar, et al. (2017) show that Islamic mutual funds do not perform better than conventional funds because Islamic funds have less diversification and get stable returns, whereas conventional funds have more volatility and get higher returns. Elmanizar & Aveliasari (2023) find that systematic risk has no significant difference between Islamic and conventional mutual funds.

In addition, Ahmed & Siddiqui (2019) explore that conventional mutual funds perform better than Islamic funds during the financial and non-financial crisis period. Agussalim, Limakrisna & Ali (2017) show that Islamic mutual funds' performance is higher than conventional funds. Naveed, et al. (2021) revealed that better governance lowers the risk exposures of mutual funds. A study in Indonesia shows that Islamic mutual funds perform better than conventional funds (Pratama, et al., 2021).

### *Impact of Macroeconomic Variables on the Risk Exposure of Mutual Fund*

Like the risk exposure of other business sectors, the risk and return of mutual funds are also influenced by macroeconomic factors (Dash & Kumar, 2008; Ahmed & Siddiqui, 2019; Hussain, 2017; Singh, et al., 2011). For example, Dash & Kumar (2008) identify those macroeconomic factors such as interest rate, exchange rate, inflation and crude oil price have a significant influence on the

risk and return of mutual funds. Also, Ahmed & Siddiqui (2019) identify that macroeconomic variables have a significant influence on the performance of mutual funds. Moreover, Hussain (2017) shows that interest rate has a negative relation with the return of mutual funds but the inflation rate has a positive relation with mutual funds' return. Philpot, et al. (1998) find the inverse relation between interest rate and performance of mutual funds.

Similarly, researchers like Rizwan, et al. (2020), Shankar, et al. (2021), and Duan et al. (2021) show that macroeconomic variables have a significant impact on the risk or the performance of mutual funds. Based on the discussion, this research also considers that macroeconomic variables have an impact on the risk of mutual funds and aims to control the effects of macroeconomic variables while comparing risk exposure between Islamic and conventional funds.

### *Are Islamic Mutual Funds Exposed to Higher Risk than Conventional Funds?*

The proposition of modern portfolio theory (MPT) suggests that Islamic funds have fewer diversification opportunities because they have a smaller asset universe than conventional funds (Hakim & Rashidian, 2004). Islamic Shariah considerations reduce the number of securities from the investable asset universe of Islamic funds; therefore, investors may be forced to choose risky assets from limited options (Reddy et al., 2017). BinMahfouz & Hassan (2012) state that when screening criteria are applied to Shariah-compliant investments, securities of specific companies and sectors are removed from the asset universe regardless of the risk-return profile. As a result, Islamic funds have a lower risk-sharing capacity than conventional funds and are exposed to a higher level of risk than funds with no screening criteria (conventional funds) according to MPT (Nainggolan, et al., 2016).

Moreover, conventional funds do not miss out on any opportunities in the financial market as they have no regulatory restrictions. Lack of diversification of Islamic funds also increases the risk exposure compared to conventional funds (Nainggolan et al., 2016). Islamic funds may also have higher costs for screening and monitoring than conventional funds because of the emphasis on non-financial performance, which increases the volatility of returns (Hong & Kacperczyk, 2009). Furthermore, if investors want to reduce risk with limited investment options, it might come at the cost of low returns (Reddy et al., 2017). Thus, the intensity of the screening and monitoring process of Islamic funds is associated with additional risks compared to conventional funds. Based on the above discussion, the following hypotheses are posited in connection with the research question 1:

> $H_1$: *Islamic funds bear higher risk than conventional mutual funds.*

### Materials and Methods

This section provides a concise explanation of the procedures, materials, and methods of research, indicates how research is conducted, data is collected, and what statistical tools are used.

*Sample Development and Data Collection*

The study period is from January 2016 to August 2023 as before 2016 the number of Islamic funds was very low. Here, 29 mutual funds are selected for this study, of which 27 are conventional mutual funds and 2 are Islamic mutual funds. To create a balanced dataset none of the funds included that were established after January 2016 because balanced data has fewer biases than unbalanced data (Hido, et al., 2009). Thus, the number of Islamic mutual funds is low in the sample.

The monthly closing price data of funds and DSEX index data is collected from January 2016 to August 2023 from investing.com[1] and the Dhaka Stock Exchange[2]. Additionally, macroeconomic variables data, i.e., exports, imports, remittances, broad money supply, deposit rate, and GDP growth rate, are collected from the Bangladesh Bank. Monthly mutual fund return is calculated using the formula below (Miskolczi, 2017)-

$$\bar{R_i} = ln\left(\frac{P_{i,t}}{P_{i,t-1}}\right) \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (i)$$

Here, *ln* is the natural logarithm; *i* is unit of the fund, *t* is time, and $P_{i,t-1}$ stands for the previous period close price, $P_{i,t}$ is the current period close price.

### Risk Measures

Following the previous researchers (Bodnaruk et al., 2019; Hoepner & Schopohl, 2016; Naveed, 2021), this study utilized traditional risk measures like standard deviation and beta along with downside risk measures like semi-standard deviation, and lower partial moment. Each risk measure is computed following a 12-month rolling window method in agreement with Brown & Goetzmann (1997). Thus, risks are calculated from January 2017 to August 2023. A brief discussion of risk measures is given below-

### Standard Deviation (SD)

Standard deviation or total risk measures the maximum and minimum volatility of funds return from the average return. The formula for calculating standard deviation is given below (Hasan, 2017)

$$SD_{i,t} = \sqrt{\frac{1}{t-1}\sum_{t=1}^{T}(r_{i,t}-\bar{r}_{i,t})^2} \ldots \ldots \ldots \ldots \ldots \ldots \ldots (ii)$$

Here, *SD* stands for standard deviation of return, *r* is monthly return, $\bar{r}$ is mean return, *i* is the fund and *t* is the time.

### Beta

Beta or systematic risk measures the sensitivity of an investment return which is a change relative to the market return. Formula for calculating beta is given below (Bodnaruk et al., 2019).

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[1] https://www.investing.com/
[2] https://www.dsebd.org/

$$\left(r_{i,t} - r_{f,t}\right) = \propto_{i,t} + \beta_{i,t}\left(r_{m,t} - r_{f,t}\right) + \varepsilon_{i,t} \dots\dots\dots\dots\dots\dots\dots (iii)$$

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Here, $i$ stands for fund, $t$ stands for time, $m$ stands for market, $f$ is the risk-free rate, $r$ is monthly return, $\beta$ is the beta which measures the systematic risk, $\propto$ is the model constant and $\varepsilon$ is the error of the model.

### *Semi-Standard Deviation (SSD)*

SSD considers the variances that are less than zero (Hoepner & Schopohl, 2016). Formula for calculating SSD is given below:

$$SSD_p = \sqrt{\frac{1}{T-1}\sum_{t=1}^{T} \max\left[(\overline{r_p} - r_{p,t}), 0\right]^2} \quad \dots\dots\dots\dots\dots\dots (iv)$$

Here, $SSD_p$ indicates a semi-standard deviation of a portfolio, $\overline{r_p} - r_{p,t}$ indicates the maximum functions which ensure that only returns below $\overline{r_p}$ are considered.

### *Lower Partial Moment (LPM)*

LPM considers the negative returns and cubes them instead of squaring those (Hoepner & Schopohl, 2016). The formula for calculating LPM is given below:

$$LPM_p^3(R_f) = \frac{1}{T-1}\sum_{t-1}^{1} \max\left[(R_f - r_{p,t}), 0\right]^3 \quad \dots\dots\dots\dots\dots\dots\dots (v)$$

Here, $LPM_p^3(R_f)$ indicates the lower partial moment of the portfolio, $R_f$ indicates the risk-free return is considered the minimum accepted return for investors.

### *Macroeconomic Variables*

Macroeconomic variables are used as control variables in the multivariate *analysis*. This study aims to control the effects of macroeconomic variables such as deposit rate, GDP growth rate, broad money, exports, imports, and remittances while comparing the risks of Islamic and conventional funds. The yearly data, such as GDP, is converted to monthly data by applying the proportional Denton method "*dentonmq'* using the EViews software (Baum 12-month rolling window method, 2006). A brief discussion of these variables is given below:

### *Deposit Rate*

The deposit rate is the rate banks or financial institutions provide depositors or investors for depositing their money.

### *GDP growth rate*

Gross domestic product is the amount of goods and services produced by a nation over a certain period and sold to the consumers.

### *Exports*

The quantity of exports is the money made from exporting goods or services made in one country to customers in another country.

*Imports*

The price paid for the purchase of products and services that are transported from one nation to another for first use is called an import payment.

### Broad Money

"Broad money" is defined as money in circulation, demand deposits, savings and time deposits held by individuals and businesses, and other monetary aggregates.

### Remittances

A remittance is a financial transaction made by someone working abroad to their family members back home.

### Methods of Data Analysis

Both the univariate and multivariate data analysis methods are applied in this study for the robustness of the findings. Independent sample t-test is used for univariate data analysis where each risk measures a comparison between Islamic and conventional funds. This study also uses multivariate analysis to identify which funds bear higher risk between the Islamic and conventional mutual funds while controlling the effects of macroeconomic variables on the risk exposure of mutual funds. The two-step data normalization method is used to normalize the data following (Templeton, 2011). In the first step, the rank percentile of data is computed and in the second step, normal inverse documented frequency is applied to the results of step 1 along with mean and standard deviation of data.

Following the previous researchers (Dhiab, 2021; Malkawi & Pillai, 2018), the FGLS method of panel data analysis is applied in this research. Additionally, the random effect model of panel data analysis is also utilized for the robustness of the results of FGLS methods. The equation for panel data analysis is given below:

$$risk_{i,t} = \beta_0 + \beta_1 Islamic.dummy_{1_{i,t}} + \beta_2 Controls_{1_{i,t}} + \varepsilon_i \dots\dots\dots\dots..(vi)$$

Where *i* indicates the unit of funds, *t* indicates time, risk is dependent variables i.e. standard deviation, beta, semi-standard deviation and lower partial moment, $\beta$ indicates coefficients, *Islamic.dummy* indicates dummy variables for Islamic mutual funds where if the fund type is Islamic then 1 otherwise 0, Controls indicate the macroeconomic variables i.e. Deposit rate, GDP growth rate, broad money, remittance, exports and import payments and $\varepsilon$ is the error term.

### Results and Discussion

This section is designed to show data analysis results and discussion. This section shows the descriptive statistics, univariate data analysis to compare risk exposure between Islamic and conventional funds, correlation matrix, and multivariate panel data analysis where the influence of macroeconomic variables are controlled while comparing risk between Islamic and conventional funds.

*Descriptive Statistics*                                                          **JUJBR**

All the risk measures and macroeconomic variables data are transformed to improve their normality following a two-step data normalization approach (Templeton, 2011). The mean of raw data and transformed data is not statistically significantly different. Therefore, transformed data is used for conducting data analysis in this study. Table 1 shows the descriptive statistics for risk measures and macroeconomic variables. Panel *A* shows the risk measures for Islamic mutual funds, panel *B* shows conventional mutual funds, and Panel *C* shows the description of macroeconomic variables.

Panel *A* and *B* of Table 1 show that Islamic mutual funds are exposed to lower risk for all the risk measures than conventional funds. This indicates that the screening criteria don't negatively influence the risk exposure of Islamic funds. In panel *C*, descriptive statistics of macroeconomic variables are shown where the monthly mean deposit rate is 4.82%. The monthly mean value of exports and imports shows that there is a monthly trade deficit of 1,420.01 million dollars in Bangladesh. Additionally, the monthly mean of remittance is 13916.27 million dollars, which may help in managing trade imbalance of Bangladesh. Lastly, the GDP growth rate has a monthly mean value of 6.390%.

### Table 1: Descriptive Statistics

| Variables | Obs. | Mean | Std. Dev | Minimum | Maximum |
|---|---|---|---|---|---|
| **Panel A: Islamic Mutual Funds** | | | | | |
| Standard Deviation | 160 | 0.058 | 0.018 | 0.020 | 0.100 |
| Beta | 160 | 0.494 | 0.454 | -0.650 | 1.281 |
| Semi-Standard Deviation | 160 | 0.037 | 0.020 | 0.000 | 0.082 |
| Lower Partial Moment | 160 | -0.076 | 0.018 | -0.110 | -0.041 |
| **Panel B: Conventional Mutual Funds** | | | | | |
| Standard Deviation | 2160 | 0.072 | 0.035 | 0.000 | 0.171 |
| Beta | 2160 | 0.672 | 0.614 | -2.635 | 3.061 |
| Semi-Standard Deviation | 2160 | 0.043 | 0.027 | 0.000 | 0.194 |
| Lower Partial Moment | 2160 | -0.083 | 0.03 | -0.180 | -0.030 |
| **Panel C: Control Variables** | | | | | |
| Deposit Rate | 2320 | 4.820 | 0.543 | 3.461 | 6.191 |
| Exports | 2320 | 3545.933 | 801.324 | 1537.620 | 5571.952 |
| Imports | 2320 | 4965.941 | 1118.312 | 2163.140 | 7793.471 |
| Remittances | 2320 | 13916.27 | 3516.872 | 5102.130 | 22808.1091 |

| Variables | Obs. | Mean | Std. Dev | Minimum | Maximum |
|---|---|---|---|---|---|
| Broad Money | 2320 | 1648706 | 280765.330 | 942958.190 | 2286988 |
| GDP Growth Rate | 2320 | 6.390 | 1.050 | 3.762 | 9.042 |

*Notes: This table is descriptive statistics that show the observation, mean value, standard deviation, maximum, and minimum value of data. Panels A and B show the risk measures for Islamic and conventional mutual funds, Panel C shows macroeconomic variables.*

*Closing price data is collected from January 2016 to August 2023 for 27 funds conventional funds and 2 funds Islamic funds. And then, calculate fund returns from February 2016 to August 2023, and lastly, calculate risk measures from January 2017 to August 2023 using the 12-month rolling window method. The two-step data normalization method is followed to normalize the data. Here, standard deviation and beta are traditional risk measures, and semi-standard deviation and lower partial moment are downside risk measures.*

### Univariate Risk Comparison Between Islamic and Conventional Funds

Mean difference analysis of different risk measures is performed using independent samples t-test to identify whether there is a statistically significant difference in risk between Islamic and conventional mutual funds. Before performing the t-test, the normality of data is tested using the Kolmogorov-Smirnov test (Berger & Zhou, 2014), and it is found that data is normally distributed. Consequently, the equality of data is tested using Levene's test (Schultz, 1985), and found that data is equally distributed. The results of the mean difference analysis using a t-test are shown in Table 2:

**Table 2: Mean risk exposure comparison between Islamic and conventional funds**

| Risk Measures | Mean | | Diff. of Mean |
|---|---|---|---|
| | Islamic Fund | Conventional Fund | |
| Standard Deviation | 0.05693 | 0.07231 | -0.01537*** |
| | | | (-5.5344) |
| Beta | 0.48889 | 0.67178 | -0.18289*** |
| | | | (-3.6926) |
| Semi-Standard Deviation | 0.03605 | 0.04302 | -0.00696*** |
| | | | (-3.2038) |
| Lower Partial Moment | -0.07419 | -0.08347 | 0.00927*** |
| | | | (3.8845) |
| No. of Observation | 160 | 2,160 | - |

*Note: *, **, and *** indicate 10%, 5%, and 1% significance levels, respectively.*

*Notes: The above table shows the results of the independent t-test for comparing the risks of Islamic and conventional mutual funds from January 2017 to August 2023. Standard deviation and beta are used as traditional risk measures, and semi-standard deviation and lower partial moments are used as downside risk measures.*

Table 2 shows that traditional risk measures like standard deviation and beta exhibit statistically significantly lower risk for Islamic mutual funds than

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conventional mutual funds. Consequently, downside risk measures like semi-standard deviation and lower partial moment also exhibit similar results that Islamic funds bear lower risk than conventional funds. Because Islamic funds select assets for their portfolios following the Sharia screening criteria, that is why risk of Islamic funds is lower than that of conventional mutual funds, which is aligned with the result of Naveed et al. (2020).

### Correlation Matrix

The correlation matrix confirms that all risk measures have a statistically significant relationship with all macroeconomic variables that are used in this research. These findings primarily justify the reasons for choosing these specific macroeconomic variables in the multivariate analysis.  Moreover, there is little chance of multicollinearity problems among the independent variables because the correlation coefficient for all variables is less than 0.80 (Hasan, 12-month rolling window method, 2023; and Hasan & Islam, 2023). The results of the correlation matrix are shown in Table 3

**Table 3: Correlations Matrix**

| Variables | SD | BETA | SSD | LPM | DR | EXP | IMP | REMI | BM | GDP |
|---|---|---|---|---|---|---|---|---|---|---|
| SD | 1.000 | | | | | | | | | |
| BETA | 0.53*** | 1.00 | | | | | | | | |
| SSD | 0.71*** | 0.42*** | 1.00 | | | | | | | |
| LPM | -0.69*** | -0.38*** | -0.84*** | 1.00 | | | | | | |
| ISL.DUMMY | -0.10*** | -0.08*** | -0.06*** | 0.06*** | | | | | | |
| DR | -0.008 | 0.24*** | 0.05** | -0.11*** | 1.00 | | | | | |
| EXP | -0.27*** | -0.31*** | -0.12*** | 0.09*** | -0.54*** | 1.00 | | | | |
| IMP | -0.10*** | -0.29*** | -0.011 | -0.09*** | -0.57*** | 0.73*** | 1.00 | | | |
| REMI | -0.16*** | -0.29*** | -0.11*** | 0.11*** | -0.39*** | 0.56*** | 0.39*** | 1.00 | | |
| BM | -0.05** | -0.28*** | -0.018 | -0.08*** | -0.58*** | 0.59*** | 0.63*** | 0.72*** | 1.00 | |
| GDP | 0.09*** | 0.04** | 0.16*** | -0.15*** | -0.19*** | 0.05** | 0.21*** | -0.33*** | -0.26*** | 1.00 |

*Note:*, **, *** indicate 10%, 5%, and 1% level of significance respectively.*

*Notes*: This table is a Pearson correlation matrix that shows the correlation coefficient for 27 conventional funds and 2 Islamic funds. The monthly panel data is used from January 2017 to August 2023. In this table, risk measures are standard deviation (SD), beta, semi-standard deviation (SSD), and lower partial moment (LPM), and macroeconomic variables are deposit rate (DR), exports (EXP), imports (IMP), remittances (REMI), broad money (BR) and gross domestic product growth rate (GDP).

### Multivariate Analysis of Risk Exposure of Islamic Funds

Panel data analysis is undertaken to compare risk exposure of Islamic funds with conventional funds in a multivariate setting where the effects of macroeconomic variables are controlled.  As a prerequisite of panel data analysis, normality of data is tested using the Kolmogorov-Smirnov (following Berger & Zhou, 2014), multicollinearity of data is tested using Variance Inflation Factor (VIF) (following Schroeder, et al., 1990), heteroscedasticity in data is tested using Breusch-Pagan test (following Glejser, 1969) and finally, autocorrelation problem is checked using

Wooldridge test (in agreement with Born & Breitung, 2016). The test results indicate that the data is normally distributed, and there is no issue of multicollinearity, heteroscedasticity, and autocorrelation in the dataset.

In this research, a dynamic panel data analysis method, e.g., FGLS, is applied for multivariate analysis following Dhiab (2021) and Malkawi & Pillai (2018) for plausible results. Overall results of the multivariate analysis show that Islamic mutual funds bear lower risk than conventional mutual funds in terms of traditional risk measures and downside risk measures. Details results of the panel data analysis are shown in Table 4.

**Table 4: Regression results of different risk measures for Islamic funds using FGLS method**

|  | Model-01 | Model-02 | Model-03 | Model-04 |
|---|---|---|---|---|
|  | **Std. Deviation (T- Value)** | **Beta (T- Value)** | **Semi-Std. Deviation (T- Value)** | **Lower Partial Moment (T- Value)** |
| Islamic Dummy | -0.013838*** | -0.1788287*** | -0.0061505*** | 0.0070255*** |
|  | (-5.33) | (-3.88) | (-2.94) | (3.25) |
| Deposit Rate | -0.0072975*** | 0.0781889*** | 0.0067715*** | -0.0200592*** |
|  | (-4.29) | (2.59) | (4.94) | (-14.16) |
| Export | -0.0000178*** | -0.0000657*** | -0.00006*** | 0.000078*** |
|  | (-13.24) | (-2.75) | (-5.92) | (7.02) |
| Import | 0.00002 | -0.0000871*** | 0.00008 | -0.000036*** |
|  | (0.24) | (-4.75) | (0.10) | (-4.24) |
| Remittance | -0.00001*** | -0.0000333*** | -0.00067*** | 0.000016*** |
|  | (-3.40) | (-6.29) | (-2.72) | (6.50) |
| Broad Money | 0.00002*** | 0.00007* | 0.00002*** | -0.000056*** |
|  | (6.10) | (1.83) | (7.77) | (-14.93) |
| GDP Growth Rate | 0.0036081*** | 0.0279508* | 0.0062019*** | -0.0077306*** |
|  | (4.48) | (1.95) | (9.55) | (-11.51) |
| Constant | 0.1146963*** | 1.001611*** | -0.0443823*** | 0.1239102*** |
|  | (7.47) | (3.67) | (-3.59) | (9.68) |
| $Chi^2$ | 370.782*** | 364.829*** | 195.609*** | 511.705*** |
| Obs. | 2320 | 2320 | 2320 | 2320 |

*Note: *, **, *** indicate 10%, 5%, and 1% level of significance respectively.*

*Notes:* This table shows the result of FGLS model of panel data analysis where 2320 observations of each variable are utilized from January 2017 to August 2023. The following equation $risk_{i,t} + \beta_0 + \beta_1 Islamic.dummy_{1_{i,t}} + \beta_2 Controls_{1_{i,t}} + \varepsilon_i \dots\dots\dots (vi)$ is used for the regression analysis. Here, the columns show the risk measures such as standard deviation, beta, semi-standard deviation, and lower partial moment, which are used as dependent variables in the regression equation. In the row, the Islamic fund dummy variable indicates that if the fund type is Islamic mutual funds, then 1; otherwise, 0 indicates that the fund type is conventional mutual funds. Besides, rows present macroeconomic factors which are used as control variables of the regression equations.

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Model 01 of Table 4 shows that the total risk (standard deviation) of Islamic mutual funds is statistically significantly lower than conventional mutual funds while controlling the effect of macroeconomic variables. Besides, the macroeconomic variables like deposit rate, exports, and remittances have a significantly negative relation with the total risk of mutual funds, which indicates that when deposit rate, exports, and remittances are increased, the risk of mutual funds decreases and vice-versa. On the other hand, broad money and GDP growth rates have a significant and positive relationship with risk. That is, when the GDP growth rate and broad money circulation in the economy increased, the risk of mutual funds also increased.

The results of Beta (Model 02, Table 4) show that Islamic mutual funds have a statistically significant negative relationship with beta, confirming that Islamic mutual funds bear lower systematic risk than conventional mutual funds. This result is aligned with Reddy et al. (2017) who report that UK Islamic funds have a lower beta (0.9992) than ethical funds (1.000). Macroeconomic variables deposit rate, broad money supply and GDP growth rate have a significant positive relationship with the systematic risk of mutual funds, indicating that when these variables perform better in the economy, the systematic risk of mutual funds increases. On the other hand, exports, imports and remittances have significant negative relations with the systematic risk which confirms that when these variables increase, the systematic risk of mutual funds decreases and vice-versa.

Islamic mutual funds are exposed to a statistically significant negative relationship with the Semi-standard deviation (Model 03, Table 4). This indicates that Islamic mutual funds bear lower semi-standard deviation risk than conventional mutual funds. Subsequently, the deposit rate, broad money supply, and GDP growth rate have a significant positive relationship with semi-standard deviation risk, indicating that when these macroeconomic variables increase, the risk of mutual funds also increases. Besides, exports and remittances have a significant negative relationship with the semi-standard deviation risk of mutual funds, indicating that when these variables increase, the risk of mutual funds decreases and vice-versa.

In the case of lower partial moments ((Model 04, Table 4)), Islamic mutual funds are exposed to statistically significantly higher downside risk than conventional mutual funds. Besides, deposit rate, imports, broad money, and GDP growth rate have a significant negative relationship with the lower partial moment risk of mutual funds, which indicates that when they increase, the lower partial moment risk of mutual funds decreases and vice-versa. However, exports and remittances have a significant and positive relation with the risk of mutual funds, indicating that when they increase, the risk of mutual funds also increases.

Overall findings of multivariate analysis show that Islamic funds exhibit lower risk exposure than conventional funds, which is consistent with previous authors such as Hayat & Kraeussl (2011), Nainggolan et al. (2016), and Mahfouz & Hassan (2012). This finding indicates that due to implementing Shariah screening criteria, Islamic funds do not invest in securities of traditional financial institutions, interest-bearing securities such as bonds, highly leveraged firms and

highly volatile assets. Thus, Islamic funds are less affected during financial downturns like the worldwide economic crisis and COVID-19, which brings lower risk for Islamic funds compared to conventional funds (Reddy et al., 2017; Derigs & Marzban 2008; Renneboog et al., 2008).

### *Robustness Analysis*

The risk exposure of Islamic funds was also compared with conventional funds using the random effects model of panel data analysis (Table 5). The random effects model is applied further to justify the results of the feasible generalized least square (FGLS) method. In general, the results are consistent in both FGLS and random effect models. Both models confirm that Islamic fund bears lower risk than conventional funds. Moreover, the impact of macroeconomic variables on the risk exposure of mutual funds is also similar to the FGLS model.

**Table 5: Regression results of different risk measures for Islamic funds using the Random Effect Model**

|  | Model-01 | Model-02 | Model-03 | Model-04 |
|---|---|---|---|---|
|  | Std. Deviation (T- Value) | Beta (T- Value) | Semi-Std. Deviation (T- Value) | Lower Partial Moment (T- Value) |
| Islamic Dummy | -0.013838*** | -0.1788287 | -0.0061505** | 0.0070255*** |
|  | (-4.87) | (-1.12) | (-2.25) | (2.69) |
| Deposit Rate | -0.0072975*** | 0.0781889*** | 0.0067715** | -0.0200592*** |
|  | (-2.93) | (2.72) | (2.41) | (-7.46) |
| Export | -0.0000178*** | -0.0000657*** | -0.00066*** | 0.000078*** |
|  | (-15.04) | (-2.89) | (-4.37) | (6.31) |
| Import | 0.00020 | -0.0000871*** | 0.00088 | -0.000036*** |
|  | (0.27) | (-4.99) | (0.08) | (-4.21) |
| Remittance | -0.00001*** | -0.0000333*** | -0.00067*** | 0.000016*** |
|  | (-3.03) | (-6.62) | (-2.67) | (6.54) |
| Broad Money | 0.00027*** | 0.00007* | 0.00028*** | -0.000056*** |
|  | (5.41) | (1.92) | (5.96) | (-11.20) |
| GDP Growth Rate | 0.0036081** | 0.0279508** | 0.0062019*** | -0.0077306*** |
|  | (2.45) | (2.05) | (4.72) | (-5.75) |
| Constant | 0.1146963*** | 1.001611*** | -0.0443823* | 0.1239102*** |
|  | (4.95) | (3.83) | (-1.90) | (4.72) |
| $R^2$ | 0.149*** | 0.145*** | 0.082*** | 0.201*** |
| $Chi^2$ | 382.406*** | 167.286*** | 79.563*** | 316.803*** |
| Obs. | 2320 | 2320 | 2320 | 2320 |

*Note: *, **, *** indicate 10%, 5%, and 1% level of significance respectively.*

*Notes:* This table shows the result of the random effect model of panel data using 2320 observations from January 2017 to August 2023. Here, the columns show the risk measures such as standard deviation, beta, semi-standard deviation, and lower partial moment, which are used as dependent variables in the regression equation. In the row, the Islamic fund dummy variable indicates that if the fund type is Islamic mutual funds, then 1; otherwise, 0 indicates that the fund type is conventional mutual funds. Besides, rows present macroeconomic factors which are used as control variables of the regression equations. ``The following equation $risk_{i,t} = \beta_0 + \beta_1 Islamic.dummy_{1_{i,t}} + \beta_2 Controls_{1_{i,t}} + \varepsilon_i \dots \dots \dots (vi)$ is used for the regression analysis.

**Conclusion**

This study is conducted on mutual funds in Bangladesh to quantify the risk exposure of Islamic mutual funds relative to conventional mutual funds. For this purpose, the monthly closing price data is collected from January 2016 to August 2023 for 29 mutual funds in Bangladesh. Then monthly return is calculated using the close price data and subsequently, by applying 12-month rolling window method all the risk measures i.e. standard deviation, beta, semi-standard deviation, and lower partial moment are calculated from January 2017 to August 2023. At first, the univariate analysis is performed using an independent $t$-test known as mean difference analysis which confirms that the mean differences in risk exposure of Islamic mutual funds are lower than the conventional mutual funds. After that, the multivariate analysis FGLS method is applied and finds that Islamic mutual funds bear lower risk than conventional mutual funds. These findings indicate that due to implementing Shariah screening criteria, Islamic funds do not invest in securities of traditional financial institutions and highly leveraged firms, bonds or treasury bills which bring lower risk for Islamic funds compared to conational funds (Reddy et al., 2017). Additionally, this analysis finds that all macroeconomic variables have a statistically significant impact on the risk exposures of mutual funds. The findings of the study will be beneficial for mutual funds investors when they choose mutual funds whether invest in Islamic mutual funds or conventional mutual funds. Moreover, the fund managers and investors can use the rolling window method to compute the risk exposure of mutual funds.

This research considers monthly data and uses a 12-month rolling window method to calculate each risk measure. The sample size for Islamic funds is low in this research. This research only focuses on measuring the different types of risk using market data, where investor sentiment and expectations about risk are yet to be studied. The future researcher can perform their research on mutual funds using the weekly or daily data and can also increase the sample size and data period. Moreover, other risk factors such as idiosyncratic risk and extreme event risk measures can be utilized in such research. Apart from these, future research can consider other macroeconomic factor such as inflation rate, exchange rate, and unemployment rate to identify their effect on the risk of mutual funds. Also, they can show the effect of COVID-19 on the risk exposure of Islamic mutual funds compared to conventional mutual funds. One of the most important research opportunities is that future researchers can collect primary data to identify the investors' perceptions and expectations about mutual fund risk.

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# The Association between Credit Risk Management and Banks' Performance in Bangladesh: A Panel Autoregressive Distributed Lag Approach

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**Md Badrul Alam**[*]

*Abstract: This paper aims to empirically investigate both the long-run and short-run association between credit risk management and commercial banks' performance of Bangladesh by employing a panel data collected from 23 Dhaka Stock Exchange (DSE) listed conventional commercial banks over a period of 13 years spanning from 2008 to 2020. The study incorporates capital adequacy ratio (CAR), non-performing loan ratio (NPLR), and geographical loan concentration ratio (GLCR) as the indicators of credit risk management, while considering return on asset (ROA) as the performance measure. The results indicate that there is a significant positive long run as well as short-run relationship between CAR and ROA. In addition, the study reveals a short-run negative relationship between NPLR and ROA. The study suggests that commercial banks may maintain sufficient capital to absorb any substantial loan loss without collecting any emergency funds.*

*JEL Classification: C33, C52, G21*

*Keywords: Credit risk management; Capital adequacy ratio; Geographical loan concentration ratio; Non-performing loan ratio; Return on Asset; Bangladesh*

## 1. Introduction

Commercial banks should demonstrate a good performance not only for ensuring their sustainable operations but also for maintaining a stable banking industry in the economy (Sain and Kashiramka, 2023). Hence, a well performing banking sector can strengthen financial stability, thereby facilitating the economic growth of the country by absorbing the external shocks. Due to the nature of business, commercial banks' performances could be substantially affected by the credit risks, the risks associated with the failure of the borrowers to fulfil their obligations in repaying interest and principal (Islam et al., 2019). Excessive level of credit risk arising from the American real estate sector jeopardized the banking sector's performance of the country, leading to the world financial crisis in 2008 (Saif-Alyousfi, 2022).

Inefficient credit risk management creates regulatory pressure to banks owing to their failure to maintain the minimum risk-based capital requirement specified by BASEL III (Radovanov et al., 2023). More importantly, banks are required to

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[*] Assistant Professor, Institute of Business Administration (IBA-JU), Jahangirnagar University, Savar, Dhaka-1342, Bangladesh, E-mail: badrul.ibaju@juniv.edu

maintain loan loss provision from their operating income to absorb the bad loans, reducing the overall performance of commercial banks. The excessive accumulation of classified loans may downgrade the performance of low-capitalized banks as they cannot absorb the loss from bad loans.

During the last decade, there has been an overriding concern among the regulators, and banking practitioners of the financial system of Bangladesh about reduction of the large amount of classified loans from the system (Bangladesh Bank, 2022, p.24). However, Bangladeshi banking sector has been experiencing higher proportion of non-performing loans than that of several South Asian countries over the past few years. The average non-performing loan ratio of Bangladesh banking sector was 7.55% over the period 2011-2020, whereas it was, during the same period, 6.61%, and 1.75% in case of India and Malaysia respectively (World Development Indicator). This excessively high proportion of non-performing loans are detrimental to the steady profit generation of the commercial banks of Bangladesh.
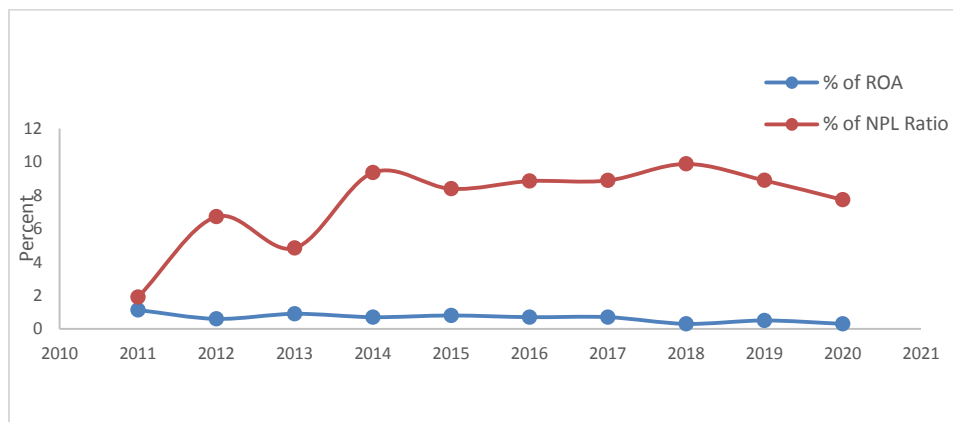


**Fig. 1: % of Non-performing Loan Ratio and % of ROA (Source: World Development Indicators and Bangladesh Bank)**

From Fig. 1, non-performing loan ratio demonstrates an increasing trend over the period of ten years (2011-2020) with a little fluctuation in the year 2013. However, we get a declining trend in case of ROA over the same years with a little fluctuation in the years 2013 and 2015. Therefore, the accelerating non-performing loans and decreasing profitability of banking industry of Bangladesh can be arguably attributable to the inefficient management of credit risk. So far, a good number of research has been conducted on the financial system of Bangladesh, focusing on the factors relevant to profitability determinants of commercial banks (Sufian and Kamaruddin, 2012; Samad, 2015; Mahmud et al., 2016; Chowdhury et al., 2022; Akther et al., 2023; Lalon et al., 2023; Biswas, 2023). However, to the best knowledge of the researcher, there has been very few previous studies conducted on the impact of credit risk management on the banking system of Bangladesh. A few of the studies considered asset quality (the

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proportion of the classified loans to total loans) as the measure of credit risk without including any other indicators arising from loan concentration (see Islam and Rana, 2019; Chowdhury et al., 2022). This inspires the researcher to devise a credit risk model by including a credit risk measure indicating loan concentration into a certain geographic area.

The present study will have threefold contributions on the existing literature of credit risk management. Firstly, it enriches the current literature of credit risk management by adding the context of a developing country, Bangladesh. Secondly, it includes a loan concentration measure, geographical loan concentration ratio, in the model of credit risk management which is unaddressed in the similar types of research around the world. Thirdly, it estimates the parameters by using three different estimators of panel ARDL framework to avoid estimation bias and endogeneity problem.

The rest of the paper is organized as follows: Section 2 demonstrates a literature review of relevant studies while section 3 discusses methodology. Results and discussions of the study have been presented in section 4. Finally, section 5 describes the conclusion and policy implications of the study.

## 2. Literature Review

### 2.1 Studies Conducted in Other Regions except South Asia

Researchers throughout the world have contemplated the importance of credit risk management and conducted their studies on this issue. Salas and Saurina (2002) investigated the determinants of problem loans of Spanish commercial and saving banks over the periods 1985-1997 by considering some macroeconomic and bank level variables, and the study revealed that capital ratio has a significant negative association with problem loans in case of commercial banks, meaning that solvent banks are less likely to suffer from the accumulation of problem loans. With an aim to examine the determinants of banks' performance in Greece, Kosmidou (2008) conducted research on an unbalanced panel data collected from 23 commercial banks over the period 1990 to 2002, incorporating some bank specific and macro level variables. The major findings of the study suggested that higher equity to total assets exerted a significant positive impact on bank performance measured by Return on Average Assets (ROAA).

Boahene et al. (2012) investigated the connection between credit risk and profitability of selected banks in Ghana and the findings claimed that non-performing loan rate had a positive relationship with bank profitability measured by ROA. Kolapo et al. (2012) carried out research to estimate the detrimental effect of credit risk on Nigerian commercial banks, analyzing a panel data collected from 5 commercial banks over a period of 11 years starting from 2000 to 2010. The study employed some credit risk measures as the regressors and ROA as the performance indicator. The results of the study indicated that both the ratios non-performing loan to total loan and advances (NPL/LA), and Loan loss provision to classified loans (LLP/CL) impacted ROA negatively. Gizaw et

al. (2015) worked on eight commercial banks in Ethiopia to quantify the effect of credit risk on two different indicators of profitability: ROA and ROE. The study claimed that the ratio of non-performing loans to total loans and advances exerted a negative effect on profitability irrespective of any measure. In similar research done on thirty-seven commercial banks in Kenya, Kurba and Garba (2014) posited that capital adequacy ratio (CAR) had a positive association with ROA.

In a contemporary study, Qehaja-Keka et al. (2023) contented that some bank specific factors namely loan interest rate, non-performing loans and total loan disbursements had a significant impact on the profitability of commercial banks of Kosovo and Albania. The results of the econometric models suggested that non-performing loans deteriorated the banking system's profitability. In a very recent study, Belcaid and Al-Faryan (2024) investigated the importance of BASEL III requirements on the banking sector's profitability in the context of Morocco. The study incorporated appropriate measures for ownership structure, solvency, and liquidity as the profitability determinants. The findings suggested that foreign ownership is negatively associated with the profitability measured by ROA. However, higher level of equity capital and adequate liquid assets affected the profitability positively.

In case of BRICS countries, Sain and Kashiramka (2023) argued that bank profitability could have a significant impact on bank stability. The outcomes of the study highlighted the negative impact of non-performing assets on the bank profitability while suggesting a positive effect of the institutional quality on profitability.

### 2.2 Studies Conducted in South Asian Countries including Bangladesh

In the context of Indian economy, Almaqtari et al. (2018) carried out a study to explore the profitability determinants of the commercial banks. Among the internal factors, bank size and liquidity ratio were found to be positively associated with profitability, whereas high leverage was identified to be negatively associated with profitability. To provide evidence from Pakistani economy, Ali and Puah (2019) examined the panel data collected from twenty-four commercial banks over a nine-year period. The researchers argued that bank size had a significant positive impact on profitability, meaning that larger banks were found to exercise economies of scales in terms of their operations. In addition, the study revealed that well managed credit risk was also favorable with profitability.

Among the studies conducted on the commercial banks in Bangladesh, Mahmud et al. (2016) claimed that CAR had a positive association with the profitability of commercial banks in Bangladesh. Conversely, the study demonstrated a negative relationship between non-performing loan ratio and ROA. Samad (2015) investigated the factors affecting profitability of commercial banks in Bangladesh. According to the findings of the study, loan to deposit ratio and equity capital to total assets (EQTA) had positive association with the performance of commercial banks in Bangladesh. In case of 23 listed commercial

banks of Bangladesh, Islam et al. (2019) suggested that CAR had a positive association with all the three profitability measures namely ROA, ROE, and market-to-book value ratio, whereas NPLR affected the profitability measures negatively. In another study, Noor and Das (2020) confirmed a significant negative association between NPLR and ROA, while a positive but insignificant association between CAR and ROA. Chowdhury et al. (2022) conducted a study on many commercial banks to reveal the impact of bank size, capital ratio, and loan risks measured by non-performing loan ratio. The findings of the GMM estimation suggest that bank size is negatively associated with ROA, while capital ratio is found to be positive with ROA. On the other hand, the study revealed a negative association between loan risks and ROA. In a recent study, Akther et al. (2023) highlighted the importance of capital adequacy, asset quality, and inflation in determining the profitability of commercial banks in Bangladesh. The findings suggested an insignificant impact of capital adequacy on bank performance, while indicating a positive association between inflation and ROA. The existing literature of both developing and developed countries has indicated a significant association between credit risk management and banks' performance. However, the measure of credit risk is not uniform throughout the existing literature. At this backdrop, it will be interesting to see how a novel measure of credit risk namely geographical loan concentration ratio (GLCR) behaves towards profitability of commercial banks in the context of Bangladesh.

## 3. Methodology

### 3.1 Data collection

At present, the banking industry of Bangladesh comprises of 61 commercial banks. However, only 36 commercial banks have been listed in DSE (Dhaka Stock Exchange). Based on the differences in their core business policies, the DSE listed commercial banks fall under two broad categories: Conventional commercial banks and Islami shariah banks. Therefore, the present study merely considers 23 conventional commercial banks due to their similar nature of business, excluding seven Islamic banks and six fourth generation conventional banks. Secondary data has been collected from the audited annual reports of the selected banks over a period of 13 years starting from 2008 to 2020 for the study.

### 3.2 Variables' definition

The underlying variables which represent credit risk measures are CAR, NPLR, and GLCR. The performance of the commercial banks has been measured through ROA. This ratio is commonly used as an indicator of competence and operational efficiency of banks since it addresses the profit earned from the assets employed by the bank (Jahan, 2012). ROA is an important performance measure as it is directly related to the profitability of banks and it is not affected by high equity multipliers (Rivard and Thomas, 1997; Kosmidou, 2008; Chowdhury et al., 2022). Capital adequacy ratio refers to the amount of equity and other reserves which a bank holds against its risky assets. The purpose of this reserve is to protect the depositors from any adverse and unpredicted loss (Basel

Committee on Banking Supervision, 1988). Considering the importance of regulatory capital in managing credit risk, many researchers use CAR as an indicator of credit risk management (Kurwa and Garba, 2014; Gizaw et al., 2015; Alshatti, 2015; Ahmad and Ariff, 2008; Mahmud et al., 2016, Akther et al., 2023). Previous literature demonstrates a mixed relationship between regulatory capital requirements measured by CAR and bank performance measured through ROA. Therefore, the relationship between CAR and bank performance cannot be predicted precisely.

NPLR measures the proportion of classified loans against the total loans and advances for a period. The ratio is considered as the best measure of credit risk for a bank according to many studies (Salas and Saurina, 2002; Samad, 2015; Mahmud et al., 2016; Chowdhury et al., 2022; Lalon et al., 2023). Previous studies suggest differing opinions regarding the nature of the association between NPLR and ROA. Therefore, the researcher cannot expect a specific sign of the coefficient of NPLR. GLCR refers to the ratio between the loans extended to the counterparties in a particular region and total loans and advances of a bank for a given year. The Basel Committee on Banking Supervision (1999) reinforced the source of credit risk which might arise from geographical concentration. Therefore, it is reasonable to include a variable representing the geographical concentration of loan portfolios of commercial banks in Bangladesh. It is expected that the relationship between geographical loan concentration ratio and bank performance may be inverse. Measures of all the variables included in the study along with their individual expected effect on bank performance are presented in Table 1.

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

| Variable | Notation | Measurement | Expected Impact |
|---|---|---|---|
| Return on Asset | ROA | Net income/ Average Total Assets | |
| Capital Adequacy Ratio | CAR | Tier I Capital + Tier II Capital/ Risk Weighted Assets | + |
| Non-performing Loan Ratio | NPLR | Non-performing Loans/ Total Loans and Advances | +/- |
| Geographical Loan Concentration Ratio | GLCR | Loans Concentrated in Dhaka Division/Total Loans and Advances | - |

### 3.3 The empirical model selection

Two recent versions of panel ARDL such as Pooled Mean Group (PMG) and Mean Group (MG) estimators can provide efficient estimates of regression parameters when number of cross-sections ($N$) and number of time periods ($T$) are sufficiently large and thereby avoiding the restrictive assumptions of uniform

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slope coefficients across the cross-sections of interest (Pesaran et al., 1999). MG estimator allows all the parameters such as intercepts, short run and long run coefficients, and error variances to vary across the groups (Pesaran and Smith, 1995). Conversely, DFE estimator assumes all the parameters to be equal both in the long run and in the short run across the individual units (Blackburne and Frank, 2007). Considering the homogeneity of the estimated coefficients, PMG estimator takes an intermediate position between MG and DFE estimators. In PMG method, short run coefficients are allowed to take different estimated values, while long run coefficients are restricted to be equal across all the groups (Pesaran et al., 1999). To estimate the regression parameters according to PMG, MG, and DFE methods, the common form of panel ARDL ($p, q, q, ..., q$) model is as follows:

$$y_{it} = \sum_{j=1}^{p} \lambda_{ij} y_{i,t-j} + \sum_{j=0}^{q} \delta_{ij} x_{i,t-j} + \gamma_i d_t + \varepsilon_{it}, \text{ where } t = 1,2,3,..,T \text{ (time periods);}$$

$i = 1,2,3,...,N$ (number of groups); $x_{it}$ ($k \times 1$) is the vector of independent variables, $d_t$ ($s \times 1$) is the vector of dummy variables representing observable time effects, $y_{i,t-j}$ is the lagged dependent variable, $\lambda_{ij}$ is scalar, $\delta_{ij}$ and $d_t$ are ($k \times 1$) and ($s \times 1$) vectors of unknown parameters to be estimated, and $\varepsilon_{it}$ is the error term which varies across groups and time spans. This model requires time periods (*t*) must be sufficiently large enough to estimate the parameters for each group separately. To produce consistent estimates, panel ARDL model assumes that error terms ($\varepsilon_{it}$) are independently distributed across individual groups ($i$) and time periods ($t$). Moreover, disturbances ($\varepsilon_{it}$) will not be correlated with regressors: $x_{it}$ and $d_t$. The inclusion of time dummy variables ($d_t$) (in ARDL model eliminates any time shock affecting all the groups in a specific year and thereby assuming of independent distribution of error terms across individual entities quite reasonable. If the time specific effect ($d_t$) is not observable, then year mean is subtracted, to eliminate cross-sectional dependence, from each observation for all variables as suggested by Pesaran et al. (1999). Another assumption of the model stipulates that error terms ($\varepsilon_{it}$) of different time periods will be independent of each other. This assumption is also not too restrictive as panel ARDL model keeps a provision for the regressors to be included in the model with proper lags (Pesaran et al., 1999). The selection of appropriate lag structures of the regressors essentially reduces the possibility of the interdependence between disturbances ($\varepsilon_{it}$) and time periods ($t$). Therefore, panel ARDL model can arguably be said to be the consistent estimator

controlling for the problems arising from the specific nature of panel data. The overall procedure for estimating the regression parameters by employing panel ARDL involves four steps. The first step requires the series to get free from cross-sectional dependence. In the present study, the researchers did not get any observable time effect during the period of interest (2008-2020) in the banking sector of Bangladesh. Therefore, the researchers find the cross-sectionally demeaned data by subtracting yearly mean value from each observation of all variables. To further verify that the data set no longer suffers from cross-sectional dependence, Pesaran CD test has been conducted. The second step involves running different unit root tests relevant to panel data to know the maximum order of integration of the non-stationary series. Unlike the traditional panel error correction model, ARDL based error correction model does not necessarily require all the non-stationary series to be first difference stationary or purely $I(1)$ (Pesaran and Shin, 1997). The ARDL model appears to be equally consistent estimator irrespective of the order of integration of the series: $I(0)$, $I(1)$, or mixed form of $I(0)$ and $I(1)$ (Pesaran and Shin, 1997). Through conducting unit root tests, the researchers must be assured that no non-stationary series exhibits order of integration greater than one, $I(1)$. The third step deals with selecting proper lags of the regressors by applying different lag structure criteria such as Akaike Information Criterion (AIC), Schwarz Bayesian Criterion (SBC), and Hannan-Quinn (HQ) Information Criterion. The lag structure which estimates the regression parameters by keeping the value of Schwarz Bayesian Information Criterion the most parsimonious will be considered as the optimal lags. The fourth step helps the researchers to estimate three different versions of panel ARDL from the error correction model. Moreover, the Hausman test is conducted to select the most efficient model out of MG, PMG, and DFE estimators.

## 4. Results and Discussions

The descriptive statistics of the variables included in the present study has been demonstrated in Table 2. The overall average ROA of the 23 DSE listed conventional commercial banks over the period 2008-2020 is 1.36% with a minimum of -13.97% and up to a maximum of 7.40%. Like ROA, similar types of information have been presented for other variables such as CAR, NPLR, and GLCR in the following table. Both ROA and CAR have a negative value in their minimum range, indicating that some banks were not capable of generating positive return to their shareholders in some years and did not maintain the minimum capital requirements imposed by the central bank.

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### Table 2: Descriptive Statistics

| Variables | Mean | Std. Deviation | Minimum | Maximum |
|---|---|---|---|---|
| ROA | 0.0136 | 0.0124 | -0.1397 | 0.0740 |
| CAR | 0.1113 | 0.0372 | -0.2967 | 0.1878 |
| NPLR | 0.0573 | 0.0875 | 0.0003 | 0.9817 |
| GLCR | 0.6916 | 0.0848 | 0.0681 | 0.9824 |

Out of the four variables, ROA exhibits the least volatility of 1.24% followed by 3.72% volatility of CAR. However, the other two variables such as NPLR and GLCR illustrate greater volatility. The lower standard deviations of ROA and CAR suggest their relatively small variability across the banks and time periods, while the higher standard deviations of NPLR and GLCR indicate greater deviations across groups and time spans.

Panel data of banking sector is highly likely to suffer from cross-sectional dependence arising from common shocks like political instability, and declining credit growth due to lower demand of loanable funds sweeping over a specific banking industry in a certain time. To avoid this problem, the current study uses cross-sectional demeaned data by taking individual deviations from yearly mean values of all variables. In this regard, the researchers conducted Pesaran CD test proposed by Pesaran (2004) to be sure that the residuals do not have any cross-sectional dependence. The results of the corresponding Pesaran CD test[1] suggest that the residuals do not suffer from cross-sectional dependence. The current study examines the presence of non-stationarity of the variables by applying four widely used panel unit root tests: Levin, Lin and Chu test, Im, Pesaran and Shin test, ADF-Fisher test, and PP-Fisher test. Upon conducting these unit root tests, the researchers can detect any non-stationary variable and its maximum order of integration, which is very critical to the validity of panel ARDL model. In Table 3, the results of the four-unit root tests individually confirm that all the variables used in the study are stationary at their levels, being integrated of order zero, $I(0)$.

### Table 3: Results of the unit root tests.

| Variables | Levin, Lin and Chu Test | | Im, Pesaran and Shin Test | | ADF-Fisher Test | | PP-Fisher Test | |
|---|---|---|---|---|---|---|---|---|
| | Individual Intercept | | Individual Intercept | | Individual Intercept | | Individual Intercept | |
| | Level | 1st difference | Level | 1st difference | Level | 1st difference | Level | 1st difference |
| ROA | -8.827*** | -16.54*** | -5.84*** | -11.99*** | 111.45*** | 202.27*** | 121.5*** | 288.77*** |
| CAR | -8.79*** | -14.46*** | -6.63*** | -12.01*** | 123.38*** | 205.79*** | 141.20*** | 315.72*** |
| NPLR | -8.04*** | -14.12*** | -4.60*** | -8.56*** | 94.08*** | 150.77*** | 99.07*** | 159.34*** |
| GLCR | -6.89*** | -17.08*** | -3.26*** | -11.50*** | 83.17*** | 191.82*** | 85.42*** | 227.31*** |

Note: *** denotes the rejection of null hypothesis at 1% level of significance

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[1] Pesaran CD test provides Pesaran's CD statistics result – 0.103 with a probability of 0.9183, supporting the null hypothesis of no cross-sectional dependence.

**JUJBR**    Therefore, there is not any non-stationarity present in the variables of interest, meaning that all the regressors are stationary. The researchers select the optimal lag lengths of the regressors for the ARDL model, thereby controlling the serial correlations of the residuals across the time periods. In this regard, several ARDL models with different lag structures of the independent variables have been evaluated based on Schwarz-Bayesian Information Criterion (SBC). However, the values of other two information criteria such as Akaike Information Criterion (AIC), and Hannan-Quinn Information (HQ) Criterion have also been presented with that of Schwarz-Bayesian Information Criterion (SBC). Table 4 demonstrates different ARDL models with the corresponding values of three information criteria. In Table 4, we see that ARDL (1, 1, 1, 1) model estimates regression parameters keeping the most parsimonious value of SBC and the same model has the most parsimonious value under HQ as well.

**Table 4: ARDL model selection based on Schwarz
Bayesian Information Criterion**

| Model | LogL | AIC | SBC* | HQ | Specification |
|-------|------|-----|------|-----|---------------|
| 1 | 1073.21 | -7.55 | -5.90 | -6.89 | ARDL(1,1,1,1) |
| 2 | 1100.75 | -7.59 | -5.62 | -6.79 | ARDL(2,1,1,1) |

After determining the appropriate lag structures of the regressors, the following ARDL (1,1,1,1) model was estimated through PMG, MG, and DFE estimators.

$$ROA_{it} = \alpha_i + \delta_{10i}CAR_{it} + \delta_{11i}CAR_{i,t-1} + \delta_{20i}NPLR_{it} + \delta_{21i}NPLR_{i,t-1} + \delta_{30i}GLCR_{it} + \delta_{31i}GLCR_{i,t-1} + \lambda_i ROA_{i,t-1} + \varepsilon_{it} \quad \text{...........(1)}$$

The error correction equation corresponding to the above ARDL (1,1,1,1) model is as follows:

$$\Delta ROA_{it} = \phi_i(ROA_{i,t-1} - \theta_{0i} - \theta_{1i}CAR_{it} - \theta_{2i}NPLR_{it} - \theta_{3i}GLCR_{it}) - \delta_{10i}\Delta CAR_{it} - \delta_{20i}\Delta NPLR_{it} - \delta_{30i}\Delta GLCR_{it} + \varepsilon_{it} \quad \text{............(2)}$$

Here,

$$\theta_{0i} = \frac{\alpha_i}{1-\lambda_i}, \theta_{1i} = \frac{\delta_{10i} + \delta_{11i}}{1-\lambda_i}, \theta_{2i} = \frac{\delta_{20i} + \delta_{21i}}{1-\lambda_i}, \theta_{3i} = \frac{\delta_{30i} + \delta_{31i}}{1-\lambda_i}, \phi_i = \lambda_i - 1.$$

### 4.1 The model estimate

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The results of the three estimators, MG, PMG, and DFE have been presented in table 5.

**Table 5: ARDL (1,1,1,1) estimation through MG, PMG, and DFE**
**(Dependent Variable: ROA)**

|  | MG | PMG | DFE |
|---|---|---|---|
| Adjustment coefficient ($\phi$) | -1.0003*** | -0.8254*** | -1.005*** |
|  | (0.1041) | (0.073) | (0.1282) |
| Long-run coefficients ($\theta_i$) |  |  |  |
| CAR | 0.2529 | 0.0723*** | 0.1110*** |
|  | (0.2299) | (0.0141) | (0.0209) |
| NPLR | 0.1529 | 0.0050** | 0.0010 |
|  | (0.2059) | (0.0021) | (0.0053) |
| GLCR | -0.0433 | -0.0251*** | -0.0157 |
|  | (0.0461) | (0.0063) | (0.0169) |
| Short-run coefficients ($\delta_{ij}$) |  |  |  |
| $\Delta$ CAR | 0.0110 | 0.0760 | 0.1221*** |
|  | (0.0503) | (0.0472) | (0.0268) |
| $\Delta$ NPLR | -0.0040 | 0.0033 | -0.011*** |
|  | (0.0348) | (0.0385) | (0.0039) |
| $\Delta$ GLCR | -0.0502 | -0.0400 | 0.0103 |
|  | (0.0708) | (0.0360) | (0.0090) |
| Intercept ($\alpha_i$) | 0.0026 | -0.00004 | 0.00007 |
|  | (0.0018) | (0.0010) | (0.00004) |
| Hausman Test |  | 0.09 | 0.00 |
|  |  | (0.9932) | (1.00) |

Note: **, and *** denote significance at 5% and 1% respectively

Table 5 demonstrates the significant negative values of error-correction speed of adjustment term under the three estimators, although the magnitudes of the coefficient are not same across the three methods. These negative significant values of the convergence coefficient ($\phi$) essentially indicates the existence of long-run relationship between credit risk management and bank performance in each of the estimated model MG, PMG, and DFE. In the MG estimator, no other parameters except the error-correction coefficient are statistically significant, and the standard errors corresponding to the estimates are larger compared to that of the other two estimators. Furthermore, the result of the Hausman test fails to reject the null hypothesis (PMG is more efficient than MG), confirming the

superiority of PMG over MG. In another Hausman test conducted between DFE and PMG, the test result also fails to reject the null hypothesis (DFE is more efficient than PMG) and thereby suggesting that DFE is the most efficient estimator among the three. In Table 5, long-run coefficients of the three regressors (CAR, NPLR, and GLCR) exhibit uniform signs across the three estimators, whereas short-run coefficients demonstrate different signs across the estimators. Out of the three regressors, CAR exerts long-run positive impact on ROA across all the three estimators, and this association between ROA and CAR is statistically significant in case of DFE and PMG estimators. Moreover, according to DFE estimator, there is a short-run positive association between CAR and ROA, while the association is negative between NPLR and ROA. Previous studies also documented a positive association between CAR and ROA (Kurba and Garba 2014; Mahmud et al., 2016; Samad 2015; Akther et al., 2023; Biswas 2023). One of the plausible reasons behind the positive relationship between CAR and ROA might be the lower cost of funds incurred by the well capitalized banks. The banks maintaining the minimum CAR do not need to raise funds on an emergency basis to avoid regulatory pressure, and thus reducing the cost of funds. Similar findings have been documented by a study conducted by Kosmidou et al. (2008) where they claimed that well capitalized banks can manage external financing at a lower cost than capital deficit banks, and this results in generating higher ROA.

The present study has revealed an interesting finding regarding the impact of NPLR on ROA. All the three estimators uniformly claim a positive long-run association between NPLR and ROA, although the association is statistically significant only for PMG estimators. The finding is opposite to that of the studies conducted by Chowdhury et al. (2022) and Lalon et al. (2023), which revealed a negative association between non-performing loan ratio and profitability. This positive association might be an outcome of the insufficient loan-loss provisioning of the commercial banks. Commercial banks are directed by the regulatory authority to deduct a certain percentage of their outstanding problem loans from yearly operating profits. The improper loan-loss provisioning helps the commercial banks to report higher ROA than they would be, and thereby preventing the detrimental effect of non-performing loan on ROA. Boahane et al. (2012) also reported a positive relationship between NPLR and ROA, having a conformity with the finding of our study.

The results of the three estimators uniformly claim a long-term negative association of GLCR with ROA. However, out of the three estimators, PMG estimator alone exhibits a significant long-term negative association between GLCR and ROA. Bangladeshi commercial banks have already concentrated their loan books by extending a significant portion of their total outstanding loans to different business entities and individual borrowers of Dhaka division. That is why performance of the banking industry of Bangladesh is highly sensitive to the shocks affecting the business organizations operating in Dhaka city. Moreover, the loanable fund market of Dhaka division is highly saturated due to the

aggressive lending of all the commercial banks in that specific geographic region. Commercial banks are in fierce competition to attract the same group of customers and business organizations for extending loans, and thus reducing the prospects of getting new customers locating in different geographical areas. This mismanagement of loan portfolios arising from geographical loan concentration may significantly reduce the profitability of commercial banks. The finding of our study is in line with that of other studies such as Grippa and Gornica (2016) which indicated the negative consequences of concentration risk.

## 5. Conclusion and Policy Implications

This paper analyzes the long-run association between ROA and three credit risk measures namely CAR, NPLR, and GLCR by employing three estimators such as MG, PMG, and DFE estimators under panel ARDL framework. Out of the three estimators, DFE appears to be the best estimator supported by Hausman test. The key outcomes of the three estimators suggest that CAR and NPLR exert a positive long-run impact on bank performance measured through ROA, while GLCR has a negative long-run influence on ROA. Out of the short-run coefficients, CAR has a significant positive association with ROA, whereas NPLR has a significant negative association with ROA. The findings of the study provide some valuable insights into banking professionals and the banking regulator as well. Top management of commercial banks should reduce the accumulation of risky assets by originating good quality loans. These may shrink the portion of risky assets in the loan portfolios of commercial banks, contributing to the higher CAR. In addition, Bangladesh Bank which is the regulatory authority of commercial banks in Bangladesh might increase its monitoring to prohibit commercial banks in extending loans to lower creditworthy borrowers. The management of commercial banks should also be conscious of sufficient loan-loss provisioning each year to prevent the overestimation of ROA and the real scenario of classified loans. Otherwise, the detrimental effect of non-performing loans on ROA would not be well perceived among the different stakeholders of commercial banks. Commercial banks of Bangladesh are excessively extending credits in Dhaka division, impacting ROA negatively. In this regard, banks should focus on other potential geographical locations by introducing new loan policies compatible with the requirements of the borrowers of those regions. The central bank might impose a maximum limit for extending credit in Dhaka division to reduce the concentration risk arising from loan concentration in that area.

It is possible to undertake future studies on the same issue by overcoming the limitations of the present study. One of the major limitations of the study includes that it did not consider all the DSE listed commercial banks due to some differences in their lending policies. Future research can focus on some interesting research work by applying different econometric models on a long and wide panel data and by including more variables associated with credit risk measures, such as loan-loss provision ratio, and the ratio of off-balance sheet assets to total assets etc.

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# Factors influencing Customer Purchasing Attitudes towards F-commerce in Bangladesh: Youth Group Perspective

**Md. Al Amin**[*]
**Md. Mahathy Hasan Jewel**[**]
**Md. Abul Bashar Offi**[***]

***Abstract:*** *The study aims to identify the key factors influencing customers' attitudes towards purchasing on Facebook and establish the relationship between these variables and consumers' buying behavior on f-commerce. A quantitative research design was utilized to accomplish the goal of the study, where convenience sampling method was used for collecting data from 219 young individuals engaged in online purchasing. Furthermore, the data was analyzed by the confirmatory factor analysis (CFA) technique of the Structural Equation Model (SEM) using the PLS 4.0 software. Finally, the results demonstrate the intricate interaction between multiple factors and young client preferences toward f-commerce purchasing. The study's findings indicate that trust-related concerns, such as protecting sensitive information and online safety, significantly shape the buying decisions of young customer groups in the case of f-commerce purchasing. Furthermore, sales services, including prompt delivery, cash on delivery, warranty and promotional activities like Facebook blogs, affect young customers' opinions of f-commerce. The study's results may assist f-commerce firms and policymakers in increasing their f-commerce operations. Further research might be undertaken to examine the impact of macro-environmental elements on the purchase attitudes of young clients concerning f-commerce.*

***Keywords:*** *Customers' Perception, Factors, Facebook, F-commerce, Young Group*

## 1. Introduction

Facebook commerce, or f-commerce, grew in prominence simultaneously with the internet connection (Ha & Chuah, 2023). Knowing the background of customer opinions regarding purchasing in this sector helps to highlight the rise of essential influencing elements, including commitment, behavior after the sale, and trustworthiness. When direct purchasing was first proposed on Facebook, it

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[*]   Assistant Professor, Department of Marketing, Jagannath University, Dhaka-1100, Email: alamin@mkt.jnu.ac.bd

[**]  Associate Professor, Department of Marketing, Jagannath University, Dhaka-1100, Email: jewelbhola@yahoo.com

[***] Independent Researcher, Department of Marketing, Jagannath University, Dhaka-1100, Email: a.basharoffi@gmail.com

sparked curiosity and concerns about confidence and safety (Nipa et al., 2020). The limited e-commerce infrastructure made it difficult to carry out transactions smoothly, and the importance of price competition heightened as consumers hesitated to make online purchases (Leong et al., 2018). In the long run, integrating smartphones improved usability and accessibility, which sped up f-commerce and adoption (Senjam et al., 2021). Content provided by users, including evaluations and recommendations, has grown in significance as it impacts buying choices (Shahbaznezhad et al., 2021). Moreover, improving payment connectivity and safety measures fosters credibility and ease in the operations of f-commerce (Stampoulaki, 2012).

Finding the correct items to attract young customers today depends on content production and customized marketing strategies. Siregar (2018) mentioned that the variables of amusement, annoyance, trust in Facebook, and trust in e-commerce on Facebook have a substantial influence on young group's attitudes toward F-commerce advertising. To build trust and solve issues, live chat and attentive customer service have become essential (Hollebeek & Macky, 2019). Ethical sourcing, transparency, and helping others are increasingly crucial to f-commerce buyers (Chen et al., 2022).

Due to the potential hazards of conducting business online, young customers often choose systems with strong security measures and reputable vendors. This protects against information theft, deceit, and goods deception (Praveen & Singla, 2019). Essential components include the desire for praise from others and societal pressure. According to Liébana-Cabanillas et al. (2018), peer recommendations and good evaluations reduce perceived risk, boost trust, and function as social cues regarding the quality and enjoyment of the good in question.

Customers seek affordable prices and added benefits such as package savings, reward schemes, and offers to obtain the best deal for what they spend (Dean, 2010). Young buyers are soothed and driven to make additional purchases when they encounter rapid problem-solving, easy return processes, and attentive interactions (Dean, 2010). Liébana-Cabanillas et al. (2018) assert that interactive elements, content created by younger consumers, and an established company image promote confidence and devotion. Brands must comprehend the tastes, habits, and worries of young consumers in e-commerce to customize their plans properly.

Bangladesh is making progress in becoming a digitally linked nation, which ultimately increases the likelihood of its citizens using the internet (Pal & Sarker, 2023). Facebook is Bangladesh's dominant social media platform, surpassing India's monthly active users (MAU) and ranking in the top three nations (Kamruzzaman, 2023). According to a survey, 66.7% of firms in Bangladesh used Facebook as a sales channel, with 81.5% using it as their primary sales channel (Aiman, 2020). According to Riyasad (2021), over 30% of Bangladesh Facebook users have purchased on the platform. Despite the increasing popularity of F-commerce in Bangladesh as an affordable alternative avenue for

small and medium-sized businesses to reach clients and sell products, there is a shortage of empirical data on the factors influencing consumer satisfaction with F-commerce (Gao et al., 2023). Therefore, this paper aims to discover the underlying factors that impact the attitudes of young customers towards f-commerce and subsequently affect their level of contentment.

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## 2.  Literature Review and Hypothesis Development

### 2.1 Customer Purchasing Attitudes

"Customer attitudes" are the feelings, whether favorable or unfavorable, that result from a judgment of an item, including brands, costs, sellers, and products or services offered (Dean, 2010). According to Schiffman & Kanuk (2007), a customer's attitude is their informed propensity to respond favorably or negatively to the ideas and feelings that result from regularly evaluating the object's knowledge. Consumer views have a significant impact on what they intend to buy. According to Chaniotakis et al. (2010), customers' "style of thinking" influences their buying decisions. Buying intention refers to the consumer's desire to acquire the good or service, and it also involves the expectation that the customer will buy a product after doing some research (Younus et al., 2015).

### 2.2 F-Commerce and Online Shopping Behavior

A decision-making process known as buying intent examines the reasons behind the consumer's choice of a specific brand (Shah et al., 2012). F-commerce is also a social platform that supports the on-demand buying and selling of goods and services, allowing customers to offer and participate in interpersonal relationships while working toward a common objective (Chen et al., 2014). The appearance of the social network and Web 2.0 allowed for the emergence of Facebook commerce, or f-commerce, as it is commonly known (Santos et al., 2019). Facebook commerce, or "f-commerce," is a relatively recent internet-based company venture that uses the social media platform to facilitate and advertise business interactions (Bai et al., 2015). The word "F-Commerce" refers to an advertising medium that makes it easier to promote, auction, buy, and offer anything (goods and services) using the online social networking platform Facebook. It is a euphemistic combination of Facebook and trade (Praveen & Singla, 2019).

Customers' uniqueness, contextual factors, item uniqueness, experience with purchasing products online, confidence in the experience, and attitudes toward simplicity of use, web utility, and pleasure are just a few of the variables that shape how they shop online (Praveen & Singla, 2019).

### 2.3 Factors Influencing Online Shopping and F-commerce

Customers' intentions to purchase are significantly impacted by connections (Palmatier et al., 2006), interaction/information communications (Leal et al., 2014), and platform technology products and services (Curty & Zhang, 2013; Huang &Benyoucef, 2013). The level of sales service, which encompasses pre-

sales assistance, product expertise, and post-sales support, significantly influences buyer engagement and repurchase attitudes (Zeithaml & Bitner, 2003). Appropriate promotional tactics may concurrently affect customer beliefs, viewpoints, and purchase actions. These tactics include loyalty programs, rebates, vouchers, and marketing initiatives (Kotler & Armstrong, 2016). These elements have a significant influence on how consumers behave, affecting sales and the development of enduring connections with clients. Frequent dissemination of positive information can help users develop relationships and have confidence in one another, which could improve their motivation to do commerce (Liang & Turban, 2011). Schaefer et al. (1981) described social support as consisting of three components: informational, physical, and emotional assistance because social support influences buyer behaviors.

Wang & Chang (2013) found that bargain judgment had no noticeable impact on fidelity or buying intention, and Bai et al. (2015) identified three types of social support: emotional, tangible, and informational. Five critical components of social commerce were identified by Bai et al. (2015): seller ambiguity, product flutter, social support, third-party, and buying motives. Additionally, Jun et al. (2004) confirmed a favorable correlation between the caliber of amenities online retailers offer and client satisfaction. A strong negative correlation exists between age and internet shopping attitudes (Sultan &Uddin, 2011). Liu et al. (2008) discovered that eight constructs—payment, delivery, customer service, security/privacy, item characteristics, transaction capabilities, and information quality—were significantly more likely to predict online shopping customer satisfaction than response time. However, Praveen and Singla (2019) discovered that those customers' opinions about the marketing approach and image may impact their beliefs about adopting online shopping.

### 2.4 Underpinning Theory for Purchase Intentions and F-commerce

Although an individual may possess all the character qualities, their ratings for each feature might vary, with specific traits rated well while others rated poorly. The Big Five model encompasses five dimensions: neuroticism, extraversion, agreeableness, openness to new experiences, and diligence (Khan et al., 2020). The study conducted by Wang and Chang (2013) investigated the impact of product dangers and internet-based social relationships on purchasing attitudes through Facebook.

Their perspectives on customer decision-making were formulated using the Stimulus-Organization-Response (S-O-R) model and the information processing theory. The idea of information processing utilizes brain mechanisms to elucidate purchasing patterns (Tybout et al., 1981). According to Young (2016), a stimulus is an external factor that influences an individual's psychological state. An organism is the internal structure and processes determining an individual's final response or reaction to external stimuli. The intervention's structure encompasses perceptual, physiological, sensory, and cognitive processes (Zhang et al., 2021). In addition, the consumer behavior theory encompasses all purchasing actions undertaken to fulfil customer requirements and reflects customer psychology (Solomon et al., 2019).

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The study employed exploratory factor analysis (EFA) to investigate many factors related to amusement, knowledge, irritation, trust in Facebook, trust in e-commerce on Facebook, and behavior towards F-commerce advertising (Siregar, 2018). In the current research on f-commerce, only a limited number of notions have been employed, such as the theory of reasoned action (TRA), stimulus-organization-response (SOR), theory of planned behavior (TPB), theory of cognitive emotion theory (CET), and technology acceptance model (TAM) (Lai et al., 2021). Given that youthful client groups constitute the majority of Facebook users in Bangladesh (Kamruzzaman, 2023), people in business must consider their attitudes towards f-commerce to conduct marketing efforts effectively. Moreover, f-commerce is booming in Bangladesh because customers depend on smartphones, social media, etc. (Ghosh, 2019). As a result, the study utilized the SOR (stimuli-organization-response) theory to identify the characteristics that affect young customers' perceptions of f-commerce, as no prior research had been conducted to assess the attitudes of young individuals towards f-commerce.

## 2.5 Hypothesis Development:

### 2.5.1 Relationship between promotion and f-commerce buying

Successful advertising and promotion strategies can concurrently impact consumer attitudes, perspectives, and purchasing behavior. Loyalty programs, vouchers, rebates, and marketing campaigns are some strategies mentioned by Kotler and Armstrong (2016). There is a significant correlation between increasing the quantity and strategic placement of promotional activities on f-commerce networks and boosting audience engagement, increasing overall revenue and customer loyalty. Balakrishnan et al. (2014) investigated e-WOM and virtual communities as two instances of online promotional interaction that are significant in promoting a company, its products, or services. Customers endorse engaged social media promotion as it ultimately satisfies their purchase intentions.

Smith and Doe (2023) presented empirical support for the hypothesis in their study, "The Influence of Social Media Promotions on E-commerce Proficiency." It was discovered that businesses utilizing f-commerce sites and implementing targeted promotional strategies experienced a 25% surge in sales and a 40% increase in customer retention rates throughout the season. However, there is no prior research on the impact of promotion on young customers' perceptions of f-commerce buying. Thus, this underscores the critical significance of efficient promotion when young generations integrate social media into prosperous f-commerce endeavors. Therefore, the hypothesis is as follows:

$H_1$. *The promotion has a positive impact on f-commerce buying by young customer groups.*

### 2.5.2 Relationship between trust and f-commerce buying

Scholars have argued that individuals more inclined to trust others are more likely to heed the recommendations of others (Escobar-Rodríguez et al., 2017;

Pentina et al., 2013). In the context of supply chain, studies by Cheng et al. (2019) and Escobar-Rodríguez et al. (2017) have demonstrated a robust positive correlation between a person's propensity for trust and the tendency of customers to make a purchase. Prior research has indicated that in the face of transactional ambiguity and deceitful practices by online vendors, consumers base their purchasing decisions on the insights and advice of seasoned consumers (Chen et al., 2019; Chen & Shen, 2015; Sohn & Kim, 2020). The quality of the consumer's experience influences the overall user experience and usability, which may affect trust levels. In their seminal work "Trust Dynamics in Social Commerce: An Exploration of Facebook Commerce," Johnson and Kumar (2022) examined over a thousand f-commerce operations. Their findings revealed an exceptionally robust positive correlation between levels of trust and intentions to make purchases. Notably, perceived security and privacy protection acted as substantial moderators in this relationship. This study highlights the criticality of trust in ensuring the success of e-commerce endeavors (Johnson & Kumar, 2022). However, the authors didn't consider the young customer segment and their trust impact on f-commerce. As a result, the study proceeds with the hypothesis as follows:

*H₂. Trust positively impacts f-commerce buying by young customer groups.*

### 2.5.3 Relationship between communication and f-commerce buying

Social media platforms enable users to establish extensive connections with others, enabling substantial dialogue that may have psychological repercussions. Yang et al. (2013) and Cyr et al. (2009) investigated the effect of contact on online retail consumers' satisfaction. According to Voorveld et al. (2013) and Yoo et al. (2010), customer perception and behavior in online purchasing are significantly impacted by website interaction. An additional finding has emerged regarding the effect of strategic communication in f-commerce on customer loyalty and satisfaction, subsequently affecting purchase intention. This finding builds upon the research conducted by Chen and Li (2023), which examined the effects of communication strategies on consumer behavior on social commerce platforms. Their research underscores the criticality of effective communication to enhance consumer relationships and sales performance in the digital realm. From this research, one can deduce that although virtual networks have a minimal effect on brand awareness, authenticity, connection, and information sharing substantially increase brand awareness, as stated by ElAydi (2018). The above papers didn't measure communication and young customers' attitudes toward f-commerce. Therefore, the following hypothesis is developed:

*H₃. Communication has a positive impact on f-commerce buying by young customer groups.*

### 2.5.4 Relationship between after-sales service and f-commerce buying

Huang, J. W. (2019) stated that the after-sales service directly impacts the intention to purchase and the commercial performance. However, the authors did not discuss the influence of after-sales service on f-commerce. Moreover, Smith

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& Johnson (2022) asserted that allocating resources to enhance after-sales service capabilities in f-commerce platforms increases customer satisfaction and loyalty. It, in turn, leads to repeated purchases and positive word-of-mouth recommendations. Their research findings substantiate this hypothesis. Smith & Johnson (2022) further highlight the importance of after-sales service as a competitive advantage in internet buying. Reducing client fears associated with digital transactions is crucial in fostering belief and credibility in f-commerce platforms. The hypothesis posits that many customer activity and attitude elements, including happiness, loyalty, and repeat purchase behavior, are impacted by the degree of customer service care offered on e-commerce platforms. The text highlights the need for personalized support and effective resolution of issues in establishing long-lasting client relationships (Rane et al., 2023). Still, it doesn't include the impact of young group segments. As a result, the study proceeds with the hypothesis as follows:

*H₄. After-sales service has a positive impact on f-commerce buying by young customer groups.*

*2.5.5 Relationship between customer expectation and f-commerce buying*

Satisfaction is the emotional state that an individual experience when their requirements are met (Islam et al., 2011). It measures how well a product or service meets consumers' expectations, as defined by Oliver (1997) and Vavra (1997). A company's success depends significantly on the precise identification of the consumer and a thorough grasp of their expectations and influence on the market (Domingues et al., 2015). Therefore, it is essential to comprehend how f-commerce satisfies purchasers' demands.

In addition, Wang and Li (2021) found that f-commerce platforms that closely match customer expectations in terms of product quality, pricing, and service offers tend to have better levels of customer satisfaction and repeat purchase behavior. Their study highlights the need to understand and meet consumer expectations in order to achieve positive outcomes in the e-commerce sector. Moreover, customer expectations substantially influence buyer behavior and perceptions of e-commerce websites. The statement emphasizes the significance of reaching or surpassing these standards to encourage positive outcomes such as satisfaction, assurance, and customer loyalty (Wijaya et al., 2019). Previous studies have also not discussed young clients and their expectations of the f-commerce sector. As a result, the analysis proceeds with the hypothesis as follows:

*H₅. Customer Expectation has a positive impact on f-commerce buying by young customer groups.*

## 3. Objectives of the Study

This paper aims to investigate the fundamental factors that impact the perceptions of young consumers towards f-commerce in Bangladesh.

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*3.1 Specific Objectives:*

- To determine the impact of promotion on young groups while purchasing via Facebook;

- To find out the impact of trust on young customer groups buying from f-commerce;

- To measure the impact of communication on young groups while purchasing via Facebook;

-  To find out the impact of sales services on young groups while purchasing via Facebook;

- To measure the impact of customers' expectations on young groups while purchasing via Facebook.

## 4.  Conceptual Framework

Various factors can significantly impact customer views towards f-commerce. Researchers performed a pilot survey among 20 graduate-level students to determine and summarize the probable elements that influence young people's attitudes towards buying through f-commerce. The initial pilot poll discovered the following elements that affect the views of young people about buying on f-commerce.
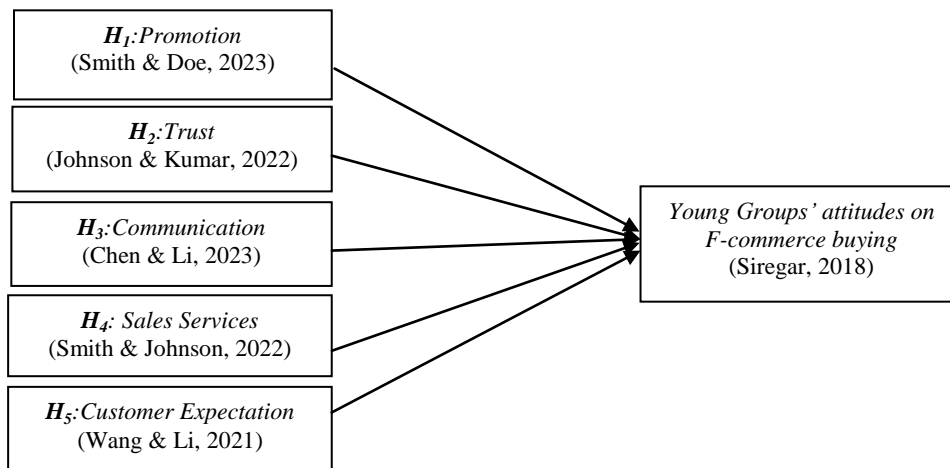


**Figure 1. Factors influencing young customer groups on f-commerce (proposed by authors).**

## 5.  Research Methodology

### 5.1  Research Design

Leong et al. (2018) employ a quantitative methodology to investigate the factors influencing customers' attitudes towards placing orders on f-commerce sites. In order to identify pertinent components at an early stage, the research team conducted a thorough examination of the existing literature. A preliminary

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survey of university students from Bangladesh was undertaken to investigate the stated connections between the variables in the study model (Tu et al., 2005). The study utilized an organized survey as its research methodology to establish the connection between dependent and independent variables.

### 5.2 Population, Sample Frame, Sample Size, and Sampling Techniques

The desired demographic consisted of Facebook users who have completed at least one f-commerce purchase. A sample frame was created by considering the geographic location and demographics (specifically, a youthful group aged 18 to 35) of the participants within the population. Due to Dhaka's dominant position in Bangladesh's f-commerce sales, the sample frame specifically included participants from that city. This study's intended demographic comprises homemakers, employed individuals, students, and individuals without employment. The study uses Facebook to visually represent the relationship between dependent and independent variables for the target population (Khan et al., 2020). The data was examined using a sample size of 219 individuals, focusing on customer satisfaction and purchasing attitudes concerning promotion, communication, sales services and trust in service.

Convenience sampling is a non-probability sampling strategy that allows researchers to easily acquire essential data for their studies by placing them nearby (Sedgwick, 2013). Hence, this research utilized convenience sampling to pick Facebook users who are easily accessible and amenable.

### 5.3 Research Instrument

A structured questionnaire was used to measure factors and their influence on young customers' attitudes toward f-commerce buying. The structured questionnaire has two sections. The first section consists of four inquiries to gather data on the participants' demographic profiles. Twenty-five items, comprising the second half, deal with consumer expectations - 4, sales service - 4, trust -5, promotion- 3, communication - 4, and purchasing attitudes - 5.

### 5.4 Data collection

People who have purchased anything on social media—specifically, Facebook—between September 1, 2023, and February 29, 2024, provided data for this research. Participants must have used at least one well-known social networking site in Bangladesh, such as Facebook. They are not eligible to answer the inquiry in any other way. Data collection was conducted through an online survey using Google Forms. A survey link was distributed to 500 participants, resulting in 347 completed responses. Ultimately, out of the total of 347 completed surveys, only 219 were considered acceptable due to having made at least one purchase through a source on Facebook.

### 5.5 Data Analysis Technique, Measurement of Reliability and Validity

Confirmatory factor analysis (CFA) technique was used to identify the drivers of the variables influencing consumers' attitudes toward purchases in f-commerce. Confirmatory factor analysis (CFA) is a statistical technique used to assess latent

variables, as described by Hoyle (2011), and Byrne (2013). Confirmatory factor analysis aims to assess latent psychological qualities, such as attitude and satisfaction (Pearson and Lee 1903; Spearman 1904).

## 6.   Data Analysis and Interpretation

### 6.1 Demographic profile of respondents

Details of participating respondents are shown below:

**Table 1: Demographic Profile of Respondents (n=219).**

| Characteristics | | Percent |
|---|---|---|
| Gender | Male | 58% |
| | Female | 42% |
| Age | 18-22 | 21.8% |
| | 23-27 | 55.3% |
| | 28-32 | 16.5% |
| | 33-35 | 6.4% |
| Occupation | Students | 65.3% |
| | Job holders | 18.3% |
| | Unemployed | 5.9% |
| | Housewife | 9.1% |
| | Others | 1.4% |

The proportion of male and female responses is 58% and 42%, respectively. The bulk of respondents were young clients, namely in the age range of 23 to 27. Information was additionally gathered from several occupational cohorts of the respondents, 65.3% of who were students, followed by 18.3% were employed.
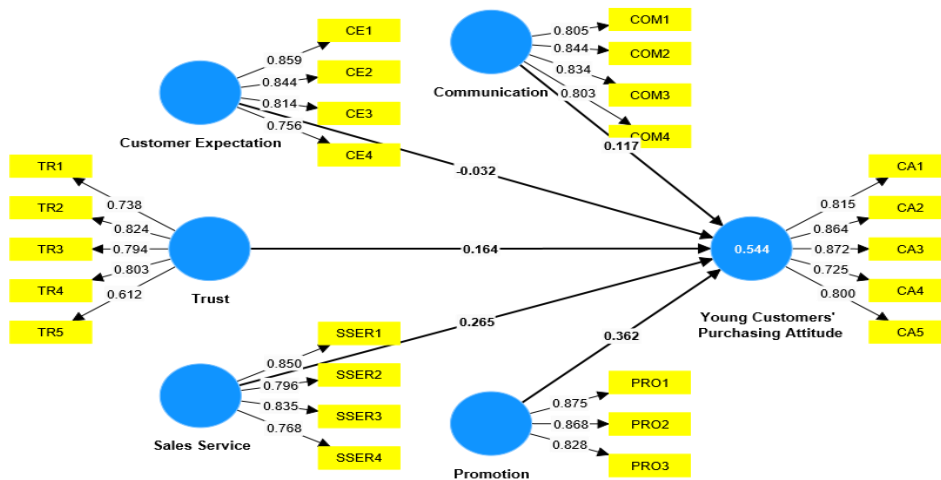
### 6.2 Measurement Model:



**Figure 2: The output of measurement model (Source: PLS-SEM results)**

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The current study deployed measurement model testing to assess the concept's internal consistency reliability and validity (AVE), as shown in Table 2. Vinzi et al. (2010) found that loading indicators with values greater than or equal to 0.60 are considered appropriate for the study concept. In this experiment, the values ranged from 0.612 to 0.875. In addition, Vinzi et al. (2010) said that conducting statistical analysis on composite reliability (CR) and average variance extracted (AVE) yields a significant outcome. The model exhibits convergent validity as all values fall within the designated threshold. The suggested criterion for two reliability metrics, α and rho A, is 0.700 or above, as Hair et al. (2014) stated. The results indicate that the α and rho_A values exceed the threshold. In addition, the convergent validity test evaluates the Average Variance Extracted (AVE), which should exceed 0.500. The AVE is calculated by taking the average of the squared loadings of the items associated with the construct. AVE values are 0.667, 0.671, 0.676, 0.735, and 0.661 for CA, CE, COM, PRO, SSER, and TR.

**Table 2: Summary of descriptive statistics and measurement model**

| Construct | Factor Loading | Mean | Standard deviation | Cronbach's Alpha | CR | AVE |
|---|---|---|---|---|---|---|
| *Young Customers' Attitudes on F-Commerce (CA)* | | | | *0.874* | *0.882* | *0.667* |
| CA1 | 0.815 | 4.215 | 0.658 | | | |
| CA2 | 0.864 | 4.16 | 0.653 | | | |
| CA3 | 0.872 | 4.233 | 0.686 | | | |
| CA4 | 0.725 | 4.055 | 0.744 | | | |
| CA5 | 0.800 | 4.114 | 0.716 | | | |
| *Customers' Expectations (CE)* | | | | *0.837* | *0.847* | *0.671* |
| CE1 | 0.859 | 4.114 | 0.62 | | | |
| CE2 | 0.844 | 4.137 | 0.669 | | | |
| CE3 | 0.814 | 4.1 | 0.714 | | | |
| CE4 | 0.756 | 3.941 | 0.823 | | | |
| *Communication (COM)* | | | | *0.840* | *0.840* | *0.676* |
| COM1 | 0.805 | 3.977 | 0.773 | | | |
| COM2 | 0.844 | 4.073 | 0.796 | | | |
| COM3 | 0.834 | 4.114 | 0.777 | | | |
| COM4 | 0.803 | 4.073 | 0.802 | | | |
| *Promotion (PRO)* | | | | *0.821* | *0.838* | *0.735* |
| PRO1 | 0.875 | 3.858 | 0.948 | | | |
| PRO2 | 0.868 | 3.95 | 0.928 | | | |
| PRO3 | 0.828 | 4.05 | 0.818 | | | |
| *Sales Services (SSER)* | | | | *0.830* | *0.844* | *0.661* |
| SSER1 | 0.85 | 4.018 | 0.844 | | | |
| SSER2 | 0.796 | 4.087 | 0.792 | | | |

| Construct | Factor Loading | Mean | Standard deviation | Cronbach's Alpha | CR | AVE |
|---|---|---|---|---|---|---|
| SSER3 | 0.835 | 4.023 | 0.791 | | | |
| SSER4 | 0.768 | 3.927 | 0.83 | | | |
| *Trust (TR)* | | | | *0.811* | *0.816* | *0.575* |
| TR1 | 0.738 | 4.05 | 0.845 | | | |
| TR2 | 0.824 | 4.055 | 0.694 | | | |
| TR3 | 0.794 | 4.018 | 0.752 | | | |
| TR4 | 0.803 | 4.018 | 0.728 | | | |
| TR5 | 0.612 | 3.959 | 0.851 | | | |

The HTMT and Fornell-Larker Criteria were utilized to assess the discriminant validity, as shown in Tables 3(a) and 3(b). The HTMT ratio results prove strong discriminant validity for the constructs, as all HTMT values are below 0.850 (Hair et al., 2014). The square root of the AVE was compared to the link of latent variables as part of the discriminant validity test. The AVE exhibits a more substantial correlation value than the other constructs, therefore offering support for the threshold (Hair et al., 2014). Therefore, the constructs CA, CE, COM, PRO, SSER, and TR have high levels of discriminant validity.

**Table 3(a): Output of Discriminant Validity (HTMT)**

| Variables | Heterotrait-monotrait ratio (HTMT) |
|---|---|
| Customer Expectation <-> Communication | 0.584 |
| Promotion <-> Communication | 0.76 |
| Promotion <-> Customer Expectation | 0.711 |
| Sales Service <-> Communication | 0.714 |
| Sales Service <-> Customer Expectation | 0.751 |
| Sales Service <-> Promotion | 0.707 |
| Trust <-> Communication | 0.651 |
| Trust <-> Customer Expectation | 0.753 |
| Trust <-> Promotion | 0.633 |
| Trust <-> Sales Service | 0.7 |
| Young Customers' _Purchasing Attitude <-> Communication | 0.672 |
| Young Customers' _Purchasing Attitude <-> Customer Expectation | 0.588 |
| Young Customers' _Purchasing Attitude <-> Promotion | 0.758 |
| Young Customers' _Purchasing Attitude <-> Sales Service | 0.719 |
| Young Customers' _Purchasing Attitude <-> Trust | 0.648 |

**Table 3(b): Output of Discriminant Validity (Fornell-Larker Criteria)**　　**JUJBR**

|      | COM   | CE    | PRO   | SSER  | TR    | CA    |
|------|-------|-------|-------|-------|-------|-------|
| COM  | 0.822 |       |       |       |       |       |
| CE   | 0.49  | 0.819 |       |       |       |       |
| PRO  | 0.626 | 0.595 | 0.857 |       |       |       |
| SSER | 0.604 | 0.627 | 0.588 | 0.813 |       |       |
| TR   | 0.542 | 0.613 | 0.52  | 0.575 | 0.758 |       |
| CA   | 0.577 | 0.507 | 0.657 | 0.623 | 0.548 | 0.817 |

*Note: COM: Communication, CE: Customers' Expectation, PRO: Promotion, SSER: Sales Services, TR: Trust, CA: Customers' Attitudes*

The cross-loading of the internal item loading is shown in Table 4. The items have a significant level of correlation within the same variable, surpassing 0.70, which suggests a robust internal consistency among the items. In addition, the level of cross-loading between each variable and another factor is limited and below the threshold level.

**Table 4: Cross-loading of items**

|       | Communication | Customer Expectation | Promotion | Sales Service | Trust | Young Customers' Purchasing Attitude |
|-------|---------------|----------------------|-----------|---------------|-------|--------------------------------------|
| CA1   | 0.458 | 0.44  | 0.623 | 0.506 | 0.455 | 0.815 |
| CA2   | 0.481 | 0.451 | 0.574 | 0.527 | 0.501 | 0.864 |
| CA3   | 0.497 | 0.398 | 0.582 | 0.569 | 0.431 | 0.872 |
| CA4   | 0.418 | 0.41  | 0.396 | 0.43  | 0.472 | 0.725 |
| CA5   | 0.5   | 0.374 | 0.479 | 0.5   | 0.386 | 0.800 |
| CE1   | 0.443 | 0.859 | 0.539 | 0.519 | 0.514 | 0.413 |
| CE2   | 0.47  | 0.844 | 0.518 | 0.561 | 0.598 | 0.411 |
| CE3   | 0.347 | 0.814 | 0.462 | 0.557 | 0.449 | 0.478 |
| CE4   | 0.35  | 0.756 | 0.428 | 0.395 | 0.454 | 0.342 |
| COM1  | 0.805 | 0.313 | 0.435 | 0.49  | 0.419 | 0.463 |
| COM2  | 0.844 | 0.42  | 0.565 | 0.507 | 0.485 | 0.476 |
| COM3  | 0.834 | 0.441 | 0.548 | 0.465 | 0.472 | 0.45  |
| COM4  | 0.803 | 0.434 | 0.508 | 0.519 | 0.408 | 0.502 |
| PRO1  | 0.49  | 0.564 | 0.875 | 0.5   | 0.445 | 0.648 |
| PRO2  | 0.559 | 0.473 | 0.868 | 0.517 | 0.431 | 0.534 |
| PRO3  | 0.577 | 0.483 | 0.828 | 0.5   | 0.466 | 0.487 |
| SSER1 | 0.522 | 0.479 | 0.522 | 0.850 | 0.459 | 0.59  |
| SSER2 | 0.468 | 0.463 | 0.468 | 0.796 | 0.425 | 0.471 |
| SSER3 | 0.556 | 0.549 | 0.507 | 0.835 | 0.497 | 0.528 |
| SSER4 | 0.399 | 0.567 | 0.399 | 0.768 | 0.5   | 0.409 |

|      | Communication | Customer Expectation | Promotion | Sales Service | Trust | Young Customers' Purchasing Attitude |
|------|---------------|----------------------|-----------|---------------|-------|--------------------------------------|
| TR1  | 0.3           | 0.544                | 0.311     | 0.386         | 0.738 | 0.328                                |
| TR2  | 0.402         | 0.426                | 0.362     | 0.429         | 0.824 | 0.423                                |
| TR3  | 0.469         | 0.405                | 0.365     | 0.454         | 0.794 | 0.426                                |
| TR4  | 0.401         | 0.475                | 0.43      | 0.501         | 0.803 | 0.458                                |
| TR5  | 0.455         | 0.487                | 0.478     | 0.386         | 0.612 | 0.417                                |

### *6.3 Structural Model*

Structural model analyses rely on the VIF, R2, and path coefficient values. These values are generated from Partial Least Squares (PLS) and are presented in Table 5. VIF values construct relationships between exogenous variables, test for multicollinearity, and determine the lack of significant collinearity. The results suggest that the VIF values are lower than the crucial threshold of 5.00 (Hair et al., 2014). Thus, the proposed structures do not display multicollinearity. The determinant coefficient test, ranging from 0 to 1, evaluates the accuracy of the model's predictive power, which captures the combined impact of exogenous and endogenous variables. The study model's predictive accuracy correlates positively with its value (Hair et al., 2014). In this research, the CA variable is considered endogenous, while the CE, COM, PRO, SSER, and TR variables are exogenous. The R-square value achieved is 0.544, as shown in Figure 3. According to Hair et al. (2014), this value is acceptable for improving the analysis.

**Table 5: Collinearity Test (VIF)**

| Connecting Variables | VIF         |
|----------------------|-------------|
| COM ->CA             | 2.002< 3.000 |
| CE ->CA              | 2.129< 3.000 |
| PRO->CA              | 2.072< 3.000 |
| SSER ->CA            | 2.161< 3.000 |
| TR ->CA              | 1.901< 3.000 |

*Note: COM: Communication, CE: Customers' Expectation, PRO: Promotion, SSER: Sales Services, TR: Trust, CA: Young Customers' Attitudes*

To determine the connection between the variables under investigation, the path coefficient value is utilized to test hypotheses, as summarized in Table 6. The result revealed that Promotion significantly impacts Young Customers' _Purchasing Attitude on f-commerce ($\beta = 0. 362$, t = 3.402, p = 0.001). Hence, H1 was supported. Then, H2 evaluates that Trust significantly impacts Young Customers' _Purchasing Attitude ($\beta = 0.164$, t = 2.199, p = 0.028). Thus, H2 is supported. Next, H3 evaluates that Communication did not significantly impact Young Customers' _Purchasing Attitude ($\beta = 0.117$, t = 1.366, p > 0.000).

Therefore, H3 is not supported. H4 investigates that Sales Service significantly impacts Young Customers' _Purchasing Attitude ($\beta$ = 0.265, t = 2.456, p < 0.000). H2 is supported. Finally, H5 evaluates that Customer Expectation also did not significantly impact Young Customers' _Purchasing Attitudes ($\beta$ = -0.032, t = 0.331, p > 0.000).

**Table 6: Summary of Path Model (Source: PLS-SEM results)**

| Path | Beta | SD | t statistics | p values | Result |
|---|---|---|---|---|---|
| H1: PRO-> CA | 0.362 | 0.106 | 3.402 | 0.001 | Supported |
| H2: TR -> CA | 0.164 | 0.075 | 2.199 | 0.028 | Supported |
| H3: COM -> CA | 0.117 | 0.085 | 1.366 | 0.172 | Not supported |
| H4: SSER -> CA | 0.265 | 0.108 | 2.456 | 0.014 | Supported |
| H5: CE -> CA | -0.032 | 0.097 | 0.331 | 0.741 | Not supported |

Note: COM: Communication, CE: Customers' Expectation, PRO: Promotion, SSER: Sales Services, TR: Trust, CA: Young Customers' Attitudes
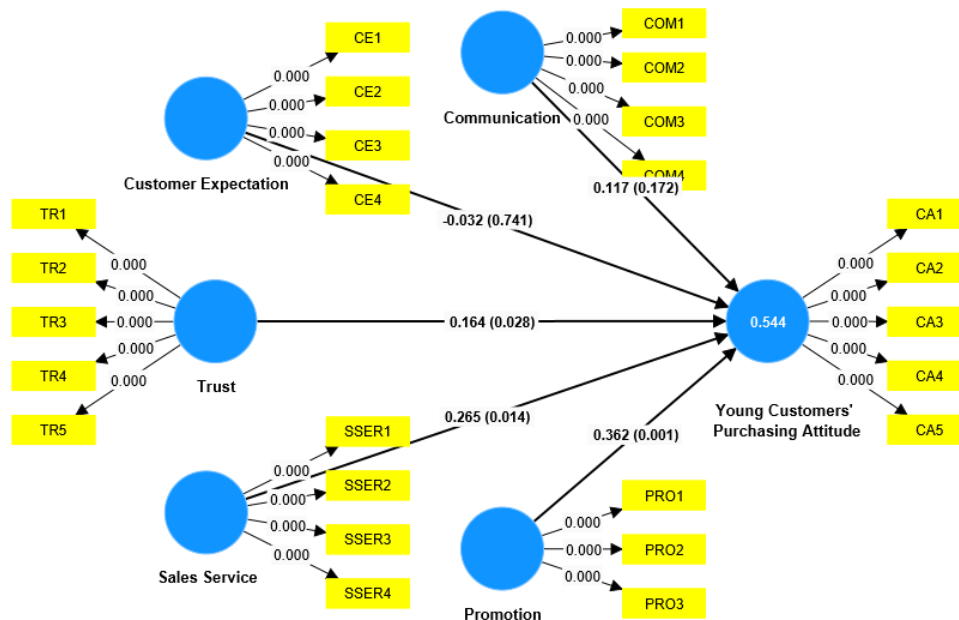


**Figure 3: Structural Model**

## 7. Discussions on Findings

Partial Least Squares Structural Equation Modeling (PLS-SEM) was used in the study to explore the factors affecting young customers' perceptions of F-commerce. Convergent validity and Cronbach's alpha were used to assess the measurement model's accuracy. Table 2 presents a thorough examination of the latent factors that have a substantial impact on consumer views toward f-

commerce. These factors include promotion, sales services, and trust. Discriminant validity analysis in Tables 3(a) and 3(b) proves that promotion, trust, sales services and customer attitudes are related. Examining the route model shows how many factors and client emotions are intricately linked (Table 5). Trust, promotions, and sales services through f-commerce substantially influence young consumers' opinions, indicating the crucial roles these aspects play in influencing customer purchase decisions in the f-commerce market. On the other hand, f-commerce transactions are less affected by customer connections within groups and younger customers' desires. The variance inflation factor (VIF) analysis shows appropriate collinearity, and the obtained $R^2$ value (0.544), which is within a reasonable range, validates the robustness of the study.

Positive path coefficients are determined between exogenous and endogenous variables except COM to CA and CE to CA. The hypothesis ($H_1$) is supported by the results, which suggest that promotional activities carried out by f-commerce enterprises directly impact the attitudes of young customers when making purchases on Facebook. The probable reason for this is that f-commerce businesses engage in several promotional activities, such as blogs, Facebook live streaming, and personalized promotional texts, which significantly impact the attitudes of the younger demographic. Furthermore, the $H_2$ hypothesis is not rejected, suggesting that trust significantly influences the attitudes of young customers towards f-commerce. Fraud poses a prevalent risk to all Internet businesses (Reddy et al., 2024). Hence, young customers purchase products from trustworthy Facebook platforms that necessitate trust between f-commerce entrepreneurs and clients, as Bylok (2022) demonstrated. Furthermore, the rejection of $H_3$ suggests that communication is not significant for young customers when purchasing through Facebook sites. A possible explanation is that young consumers tend to buy inexpensive things from f-commerce sites, which reduces the need for extensive communication with their peers.

Moreover, the inclusion of $H_4$ signifies that sales services substantially influence young customers' purchasing behavior when they buy from Facebook. Hypothesis $H_4$ suggests that young purchasers are particularly concerned about sales activities such as warranty, guarantee, cash on delivery, and after-sales services, significantly influencing their decisions regarding f-commerce. Finally, the null hypothesis $H_5$ is rejected, suggesting that customers' expectations do not substantially impact young purchasers' decision to purchase from Facebook. Inexperienced demographics often fail to meet their expectations due to the influence of emerging trends and fashion, which are the likely factors supporting this assertion.

## 8.   Conclusion and Future Directions

The expansion of f-commerce in South Asian firms is fueled by customer involvement on Facebook. Several crucial aspects contribute to this expansion, including promotional initiatives, trust, and sales services. Establishing trust between f-commerce businesses and younger client segments is vital, as trust

directly influences their purchasing intentions. In addition, promotional strategies such as Facebook live streaming, direct marketing through SMS marketing, blogs, and other methods also influence the purchasing intentions of younger demographics. Lastly, sales services, particularly the sharing of product prototypes, photographs, and discussions between customers and sellers, also influence the intentions of young purchasers toward f-commerce. Further investigation should focus on other emerging countries and analyze the relationship between demographic factors and the probability of participating in f-commerce. Furthermore, the forthcoming research should address additional macro-environmental characteristics and their mediating influence on the buying intentions of the younger demographic.

## 9. Implication of the Research

Collaboration among corporate organizations, technology suppliers, and other stakeholders is essential for enhancing the capabilities of f-commerce. This collaboration aims to improve customer satisfaction, sales services, trust, and cyber security. This study aims to enhance the f-commerce business by promoting confidence among customers and sellers. The research's findings will provide valuable insights for policymakers, business professionals, and industry experts regarding the factors influencing young consumers purchasing decisions on Facebook.

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# Effect of Macroeconomic Factors on Mutual Funds Risk and Return: An Empirical Study from Bangladesh

**JUJBR**

**Dr. Shaikh Masrick Hasan**[*]
**Md. Mahedi Hasan**[**]

***Abstract:*** *This study aims to identify the influence of macroeconomic factors on the risk and return of mutual funds in Bangladesh. The findings of this research can be directly applied by practitioners and institutional investors in their decision-making, particularly in asymmetric market situations. Monthly closing price data of 27 mutual funds from Bangladesh are collected from December 2015 to December 2022. Additionally, monthly data of 6 macroeconomic variables, i.e., deposit rate, export, import payments, remittance, broad money (M2) and GDP growth rate, are gathered for this study. This study utilized standard deviation and beta as risk measures, and the Sharpe and Treynor ratios are applied as risk-adjusted return (RAR) measures. All the risk and risk-adjusted return measures are computed using 12-months rolling window method. The random effect model of panel data analysis is applied to find the influence of macroeconomic variables on the risk and return of mutual funds. Overall findings indicate that macroeconomic factors significantly influence mutual fund risk exposure. On the other hand, risk-adjusted return (RAR) is also significantly influenced by the macroeconomic variables.*

***Keywords:*** *Risk-Adjusted Return, Bangladesh, Mutual Fund, Standard Deviation, Beta, Sharpe Ratio, Treynor Ratio.*

## Introduction

A mutual fund is a pooled investment vehicle in which the money of investors is pooled and invested in a portfolio of assets (Hussain, 2017). Mutual funds are considered one of the most important tools in producing considerable growth in the capital market of Bangladesh. The first mutual fund was issued in Bangladesh in 1980 by the Investment Corporation of Bangladesh (ICB) (Rahman & Mamun, 2022).

According to Dhaka Stock Exchange (DSE, 2022), (9) asset management firms supervised 37 closed-end funds operating on the DSE. Institutional investors make up more than 65% of the total assets under management (AuM) of mutual funds (DSE Shareholding Status Report, 2019). This indicates that ordinary investors in Bangladesh continue to rely mainly on depositing money in banks rather than placing funds in mutual funds (Rahman, 2022).

[*]   Associate Professor, Department of Finance, Faculty of Business Studies, Jagannath University, Dhaka, Bangladesh, E-mail: masrick@fin.jnu.ac.bd

[**]  Lecturer, Department of Business Administration, Dhaka International University, Dhaka, Bangladesh, E-mail: mahedihasan.jnu.fin11@gmail.com

**JUJBR**    There is an ongoing debate regarding the performance of mutual funds compared to the benchmarks. Benchmark is an index that is used to measure the performance of mutual funds (e.g., risk-free rate, average return). Which indicates how much one investment should have earned, that is compare to how much the investment has earned in reality. Mutual fund managers face challenges in identifying investment opportunities because performance of mutual funds depends on managers' abilities and other fund and country-specific factors (Jensen, 1968). The fund-specific factors, i.e., board size, investment strategy, fund size, fund age, management fees, load fees, fund flows, prior performance, management structure, objectives of the fund and country-specific factors, i.e., country governance, rules, regulation and laws, and economic growth have influenced the performance of the mutual funds (Nguyen & Nguyen, 2019).

Again, an investor's mood, as opposed to economic factors, drives mutual fund investing (Harris & Gurel, 1986). However, Oh & Parwada (2007) show that investors often make decisions based on recent market performance. This indicates that investors are more inclined to invest in mutual funds due to the positive performance in the market. On the other hand, in times of market downturns (high volatility), investors tend to be risk-averse for investing in mutual funds due to the perceived higher risk. That means investment decisions in mutual funds are associated with the risk of the investment caused by the financial market volatility and downturns in the economy.

The performance of the mutual fund sector entirely depends on the macro and micro economic factors. The microeconomic factors are unsystematic risks that can be controlled by individual business organizations. However, macroeconomic factors are uncontrollable. Due to the fluctuation in different macroeconomic variables, the financial market is highly volatile. If one variable changes, increases, or decreases, it directly impacts the fluctuation of financial markets. A mutual fund is a part of the financial market, so macroeconomic factors also have an impact on the performance of mutual funds (Garg & Srivastava, 2020). However, the financial market of Bangladesh was established in 1954, and the mutual fund industry started its journey in 1980; since the mutual fund industry has been operating for many years, it has made a significant contribution to the stock market of Bangladesh. However, there is a lack of research to evaluate the impact of macroeconomic variables on the risk exposure and risk-adjusted return of mutual funds. Therefore, this research aimed to understand better the elements that affect the risk and risk-adjusted return of mutual funds in Bangladesh.

The first objective of the study is to measure the risk and risk-adjusted return of mutual funds in Bangladesh using 12-month rolling window methods. The second objective of this study is to evaluate the influence of macroeconomic variables on risk exposure and risk-adjusted return. Macroeconomic variables are important factors in determining whether mutual funds outperform in the market or not (Banegas, Gillen, Timmermann, & Wermers, 2013).

The rest of the article is divided into four sections. The literature review section focuses on various dimensions of risk and risk-adjusted return measures,

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macroeconomic variables, and their effect on risk and risk-adjusted return along with the hypotheses development. The next section is the data and methodology, which includes various methods of the risk and risk-adjusted return computation procedure such as standard deviation, beta, Sharpe ratio, and Treynor ratio, and shows the brief discussion of macroeconomic variables, i.e., deposit rate, GDP growth rate, money supply, export, import, and remittance. It also shows the data analysis methods using the panel data regression for the random effect model. Then the results and discussions section consists of descriptive statistics, correlation matrix, regression analysis of panel data using random effect model, and robustness analysis. Last section discusses the conclusion of the study and indicates the future research opportunity.

## Literature Review

Investment in mutual funds varies depending on purpose, structure, cost, and risk, apart from their size, kind, and other distinguishing characteristics (Hasan, 2017). Mutual funds provide benefits to their shareholders as well as expert management. The mutual fund sector has expanded quickly worldwide over the last two decades and scholars continue to debate about risk exposure and the performance of mutual funds compared to market benchmarks (Hussain, 2017).

The risk associated with an action or occurrence is measured by the magnitude of those negative outcomes. The possible outcomes, probabilities, and mitigating variables associated with each risk category are unique (Burt, 2001). The risk exposure can be computed through traditional risk measures, i.e., standard deviation and beta (Estrada, 2006; Hasan, 2016). According to the modern portfolio theory (MPT), investors can build an optimum holding to get the highest possible rate of return within a certain level of risk (Markowitz, 1991). The focus of this study on risk and performance measurement is to determine whether Bangladeshi mutual funds can optimize efficient portfolios. Although Markowitz considered variance as a measure of risk, this investigation will use standard deviation as one of the risk measures following Bawa (1975) and Fishburn (1977). Risk and return studies of mutual funds are of greater importance to investors than any other investment fund, such as bonds, stocks, and treasury bills, because risk and return are used to determine whether or not to invest in the fund. Although mutual funds have many benefits, they are not risk-free investments. Systematic risk, fund-specific risk, and negative performance are the components. Moreover, the mutual fund's risk varies depending on the features of the national economic condition, such as GDP growth, unemployment rate, inflation, fiscal policy and monetary policy. The growth of a nation's economy will affect the returns on mutual funds (Duch, Palmer & Anderson, 2000).

According to Gjerde & Saettem (1999), stock returns positively correlate with oil prices and show no statistically significant relation between stock returns and inflation. Moreover, macroeconomic factors like trade balance, foreign exchange rate, industrial output, and money supply are co-integrated with stock indexes

(Kwon & Shin, 1999). Subsequently, Bailey & Chung (1996) found that the exchange rate has no relation with the stock market of the Philippines.Canadian, German, Italian, Japanese, and American stock markets were analyzed by Cheung & Ng (1998) to determine the impact of macroeconomic variables, i.e., the real oil price, money supply, and gross national product, on stock prices and found a positive relationship between stock prices and macroeconomic factors. Furthermore, Martínez, Lapeña, & Sotos (2015) find that interest rate influences stock market return.

According to Aggarwal & Saqib (2017), the Indian stock market is affected by both Indian and US macroeconomic factors, i.e., US gross domestic product (GDP), gold prices, and S&P data all have positive relationships with the Indian stock market. It is widely established that stock returns are related to a nation's macroeconomic environment in industrialized countries (Clare & Thomas, 1994). Similarly, Dash & Kumar (2008) find that the return and volatility of mutual funds are strongly influenced by macroeconomic factors such as exchange rate, interest rate, inflation, and crude oil price. Furthermore, macroeconomic variables also affect the performance of traditional mutual funds (Ahmed & Siddiqui, 2019). Moreover, a positive and statistically significant relationship between the return of mutual funds and inflation is identified (Gusni, Silviana, & Hamdani, 2018). However, other authors (Hussain, 2017) provided evidence that interest rates are inversely related to the returns on mutual funds.

According to Kariuki (2014) finds that shifts in GDP had a significant effect on the performance of mutual funds. Furthermore, the money supply has a positive and statistically significant effect on the performance of mutual funds (Kariuki, 2014), and it is inverse to the results of Singh, Mehta, & Varsha (2011). In addition, a negative relationship between interest rates and US mutual funds' performance is identified using fixed effect model data (Philpot, Hearth, Rimbey, & Schulman, 1998).

However, the risk and return of mutual funds are influenced by macroeconomic factors. Previous researchers (Reddy, Mirza, Naqvi, & Fu, 2017) utilized beta to measure the systematic risk of mutual funds. In contrast, others (Vidal-Garcia, Vidal, & Nguyen, 2014) applied unsystematic risk measures to estimate the risk exposure of mutual funds. Yang & Hou (2016) identify a positive correlation between fund risk and performance. Moreover, returns on mutual funds are heavily influenced by unsystematic risk (Vidal-Garcia et al., 2014).

This study has at least three major contributions in mutual fund research. First, this study identifies the impact of macroeconomic variables on both risk and risk-adjusted return, whereas most authors (Nafees, Shah & Khan, 2011; Rahman & Mamun, 2022) focus on only mutual funds' performance. In addition, Chowdhury, Habibullah, & Nahar (2018) investigated the risk-adjusted performance of Bangladeshi mutual funds, but they did not explore the effects of macroeconomic factors on both risk and risk-adjusted return of mutual funds. Therefore, identifying the effects of macroeconomic factors on risk and return of

mutual funds is a novel contribution in the context of Bangladesh which will help to extend the existing literature by fulfilling the research gap.

Secondly, this study contributes to risk and risk-adjusted return computation procedures. This study applied 12-month rolling windows methods to compute risk and risk-adjusted return; however, most authors (e.g., Dash & Kumar, 2008; Qureshi, Khan, Rehman, Ghafoor, & Qureshi, 2019) applied single-period methods to estimate the risk and risk-adjusted return. Moreover, to the best of our knowledge, none of the studies in Bangladesh has applied 12-month rolling window methods to compute risk and risk-adjusted return of mutual funds.

The third contribution of this research is methodological. Previous authors like Estrada (2006) and Hussain (2017) applied time series analysis, cross-sectional analysis, or vector autoregressive model. However, the random effects model of panel data analysis is applied in this research following Gusni et al. (2018) to consider the effects of both time and unit effects. Thus, the result of this analysis is more robust and reliable. w

### *Hypotheses Development*

### *Impact of Macroeconomic Factors on Risk Exposure*

There is a debate about the influence of macroeconomic variables on risk exposure in the literature. Some studies find that macroeconomic factors influence the risk exposure of mutual funds; however, others oppose this argument. Kisoi & Onyango (2017) find that the influence of exchange rate and GDP on portfolio risk is insignificant. Shahabadi, Naziri, & Havaj (2013) explore that exchange rates and risk premiums have an insignificant effect on systematic risk. Subsequently, Valahzaghard, Kashefi, Alikhani, & Hosseini (2012) do not find a significant relationship between the macroeconomic variables of the inflation rate, employment rate, unemployment rate, and currency exchange rate with credit risk. Therefore, the following hypothesis is made.

> $H1_0 =$ *There is no significant influence of macroeconomic factors on the risk of the mutual fund.*

On the other hand, some other authors find the influence of macroeconomic factors on the portfolio risk of different countries. For example, Mendonça & Silva (2018) evidenced that interest rate significantly affects systematic risk. Kisoi & Onyango (2017) find the opposite of interest rate on portfolio risk and a positive effect of GDP on portfolio risk. Furthermore, Shahabadi et al. (2013) find that the inflation rate significantly affects systematic risk. Noroozi (2014) identifies that interest rate, inflation, and public debt positively correlate with credit risk, and the GDP growth rate negatively correlates with credit risk. Finally, Purwono & Dimayanti (2020) identify that interest and exchange rates influence systemic risk. Based on the above discussion, the hypothesis is made:

> $H1_a =$ *There is a significant influence of macroeconomic factors on the risk of the mutual fund.*

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*Impact of Macroeconomic Factors on Risk-Adjusted Return*

Similar to the impact of macroeconomic factors on risk, there is a debate about the influence of macroeconomic variables on risk-adjusted return in the literature. Gjerde & Saettem (1999) find no evidence of a correlation between stock market performance and inflation. In addition, Humpe & Macmillan (2009) explore that the broad money supply is an insignificant determinant of the value of stock market.

Furthermore, Pan, Fok, & Liu (2007) discover no relation between currency exchange rates and stock market performance. Subsequently, Bailey & Chung (1996) identified the same results. Additionally, Dash & Kumar (2008) find that the deposit rate has an insignificant relationship with the performance of mutual funds. Based on the above discussion, the following hypothesis is made:

$H2_0$ = *There is no significant influence of macroeconomic factors on the risk-adjusted return of the mutual fund.*

On the other hand, some other authors find the influence of macroeconomic factors on the risk-adjusted return of mutual funds. For example, Ahmed & Siddiqui (2019) explored that performance of conventional mutual funds is affected by macroeconomic factors such as interest rates, inflation rates, and GDP. Hussain (2017) shows that mutual fund performances are negatively connected to interest rates. Consequently, Qureshi et al. (2019) find an inverse relationship between inflation rate and fund performance.

Consequently, Singh et al., (2011) find a negative correlation between money supply and portfolio performance. Kwon & Shin (1999) discovered that the stock market performance has a relationship with the trade balance, the foreign exchange rate, industrial production, and the money supply. Overall findings of Cheung & Ng (1998) show that stock prices move positively with the oil price, money supply, and gross national product (GNP). Based on the above discussion, the following hypothesis is made:

$H2_a$ = *There is a significant influence of macroeconomic factors on the risk-adjusted return of the mutual fund.*

These four hypotheses are developed to identify whether macroeconomic variables impact either risk exposure or the risk-adjusted return of Bangladeshi mutual funds.

## Data and Methodology

### Sample Development and Data Collection

This study focuses on standard deviation (total risk) and beta (systematic risk) as risk measures as well as Sharpe ratio and Treynor ratio as risk-adjusted return (RAR) measures following previous authors like Estrada (2006), Rahman & Mamun (2022) and Hasan (2016). Monthly closing price data of 27 mutual funds out of 37 from Bangladesh and DSEX index points are collected from December 2015 to December 2022 from DSE. The remaining 10 mutual funds were

established after 2017, which is not aligned with the data collection period of this study because the data collection period started in December 2015; for this reason, the remaining 10 mutual funds are excluded from this research. Risk and risk-adjusted return measures are computed using the 12-month rolling windows method (Lin, Yen & Hsieh, 2023; Olasehinde-Williams & Özkan, 2022). Additionally, six (6) macroeconomic factors, i.e., deposit rate, GDP growth rate, broad money, remittances, exports, and imports, are utilized to identify their effects on risk and risk-adjusted return of Bangladeshi mutual funds. Macroeconomic factors data such as deposit rate, export, import payments, GDP growth rate, broad money (M2), and remittance are collected from January 2017 to December 2022 from Bangladesh Bank[1]. Monthly return is computed from January 2016 to December 2022 using the below formula (Miskolczi, 2017) -

$$\overline{R}_i = ln\left(\frac{P_{i,t}}{P_{i,t-1}}\right) \ldots \ldots \ldots \ldots \ldots \ldots (i)$$

Here, *ln* is the natural logarithm, *i* is the unit of funds, *t* is the time, $P_{i,t-1}$ stands for the previous period price, $P_{i,t}$ is the current price.

### Risk Measurement Techniques

This study aims to identify the risks and returns of Bangladeshi mutual funds. To identify the risk exposures, standard deviation (total risk measure) and beta (systematic risk measure) are selected, which are considered as most important risk measures for mutual fund risk (Estrada, 2006; Chowdhury et al., 2018; Rahman & Mamun, 2022). A brief description of these risk measures is given below-

### Standard Deviation

Standard deviation measures a mutual fund's total risk, indicating the maximum return volatility from the mean return. The computation of standard deviation formula is given below (Hasan, 2016).

$$SD_{i,t} = \sqrt{\frac{1}{t-1}\sum_{t=1}^{T}(r_{i,t} - \bar{r}_{i,t})^2} \ldots \ldots \ldots \ldots \ldots \ldots \ldots (ii)$$

Here, *SD* stands for the standard deviation of return, *r* is monthly return, $\bar{r}$ is mean return, *i* is the fund and *t* is the time.

### Beta

The prominent technique to measure systematic risk is beta *(β),* which is derived from the capital asset pricing model (CAPM), as it measures the sensitivity of the asset return relative to the change of the market return. Therefore, beta can be measured using the CAPM formula (Hoepner & Schopohl, 2018).

$$\left(r_{i,t} - r_{f,t}\right) = \propto_{i,t} + \beta_{i,t}\left(r_{m,t} - r_{f,t}\right) + \varepsilon_{i,t} - - - - - - - - - - - - -(iii)$$

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[1] Macroeconomic data are collected from Bangladesh Bank data archive using following URL https://www.bb.org.bd/en/index.php/econdata/index

Here, $i$ stands for fund, $t$ stands for time, $m$ stands for market, $f$ is the risk-free rate, $r$ is monthly return, $\beta$ is the beta which measures the systematic risk, $\propto$ is the model constant, and $\varepsilon$ is the error of the model.

### *Risk-Adjusted Return Measurement Techniques*

In addition to risk, risk-adjusted return is also identified in this study. Here, the Sharpe ratio and Treynor ratio are used as risk-adjusted return measures of mutual funds following Nafees et al. (2011) and Ahmed & Siddiqui (2019). They argued that risk-adjusted return is crucial to measure the performance of mutual funds. A brief description of these risk-adjusted return measures is given below.

### *Sharpe Ratio*

The Sharpe ratio is often used to rate mutual funds based on their level of risk (Sharpe, 1964). Sharpe ratio quantifies the fund's excess return per unit of its total risk. The formula to compute the ratio is below (Hasan, 2017).

$$Sharpe\ Ratio\ (SR) = \frac{r_{i,t} - r_{f_{i,t}}}{\sigma_{i,t}} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots . (iv)$$

Here, $i$ stands for fund, $t$ stands for time, $f$ is the risk-free rate, $r$ is monthly return, $\sigma$ is the standard deviation, which measures the total risk.

### *Treynor Ratio*

The Treynor ratio employs beta as a measure of risk. Treynor ratio quantifies the fund's excess return per unit of its systematic risk. The formula to compute the ratio is below (Elton & Gruber, 1997).

$$Treynor\ Ratio\ (TR) = \frac{r_{i,t} - R_{f_{i,t}}}{\beta_{i,t}} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots . (v)$$

Here, $i$ stands for fund, $t$ stands for time, $f$ is the risk-free rate, $r$ is monthly return, $\beta$ is the standard deviation which measures the systematic risk.

### *Macroeconomic Factors*

Previous authors (e.g., Dash & Kumar, 2008; Qureshi et al., 2019) identified that macroeconomic factors influence the risk and return of mutual funds. Therefore, this study selected 6 (six) macroeconomic variables, i.e., deposit rate, amount of exports, import payments, GDP growth rate, remittance, and broad money (M2), to find their impacts on the risk and return. A brief description of these macroeconomic factors is given below:

### *Deposit Rate*

The rate at which a bank or other financial institution rewards depositors against the money deposited in bank accounts is known as the deposit rate. Osamwonyi & Osagie (2012) find a significant influence of deposit rates on mutual funds.

### *GDP growth rate*

Gross domestic product (GDP) quantifies the monetary worth of all final products and services produced in a nation over a certain time frame and sold to

consumers (Kariuki, 2014). Previous authors (e.g., Hussain, 2017) find a significant relationship of GDP with the performance of mutual funds. However, others (e.g., Osamwonyi & Osagie, 2012) evidenced that GDP has an insignificant influence on the mutual funds' performance.

### Money Supply

Currency in circulation, demand deposits, savings and time deposits held by people and corporations, and other monetary aggregates comprise broad money. Osamwonyi & Osagie (2012) and Singh et al. (2011) discover the significant relationship of broad money supply with the performance of mutual funds.

### Amount of Export

The proceeds of selling products or services produced in one nation to the consumers of another nation are referred to as the amount of exports. Imsar, Tambunan, Silviani, & Harahap (2022) find that exports significantly influence the Islamic Mutual fund.

### Import Payment

The amount paid to buy goods and services from one country to another where it is initially consumed is called import payment.

### Remittance

When someone working overseas sends money back to their near and dear ones in their home country, this transaction is known as a remittance.

From the above discussion, it is said that the selected macroeconomic factors are considered the most influential factors that could influence the risk and risk-adjusted return of Bangladeshi mutual funds. However, previous studies do not explicitly examine the effect of macroeconomic factors on mutual fund risk and risk-adjusted return. Thus, this area demands in-depth investigation.

### Data Analysis Methods

At first, the 'Two-step data normalization method' is followed to normalize the data where in the first step, fractional rank is computed then data is normalized using the Inverse Document Frequency (IDF) formula. By using Kolmogorov-Smirnova test, it is found that data is normally distributed and data set does not suffer from multicollinearity problem which is confirmed by performing Variance Inflation Factor (VIF) test, Breusch-Pagan Test for Heteroscedasticity identify that there is no error term in data, and finally, Durbin- Watson test confirmed that there is no autocorrelation problems in the data set. After that, the Breusch-Pagan Lagrange Multiplier test results and the Husman test confirmed that the random effect model is more plausible for conducting the panel data analysis (Kothari, 2015; Dougherty, 2011).

This study also applied panel data analysis because it has a time dimension and a cross-sectional dimension (Hsiao, 2007). Based on the data, panel data regression follows this basic formula (Kothari, 2015; Dougherty, 2011).

$$Y_{i,t} = \beta_0 + \beta_1 X_{1_{i,t}} + \beta_2 X_{2_{i,t}} + \ldots\ldots\ldots\ldots\ldots\ldots + \beta_k X_{k_{i,t}}$$
$$+ \varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots. (vi)$$

Here, $i$ stands for fund units, $t$ is time; Y stands for dependent variable; $\beta$ is coefficients; $X_1, X_2,$ and $X_k$ are the independent variables 1, 2, and k, respectively; and $\varepsilon$ is the error term.

In this study, four (4) sets of panel regression equations have been developed to examine the effects of macroeconomic factors on risk and risk-adjusted return, which are given below-

$$SD_{it} = \beta_0 + \beta_1 DR_{it} + \beta_2 EXP_{it} + \beta_3 IMP_{it} + \beta_4 GDPGR_{it} + \beta_5 BM_{it}$$
$$+ \beta_6 REM_{it} + \varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots (vii)$$

Where *SD* stands for standard deviation, which is the dependent variable. Moreover, *DR* is the deposit rate, *EXP* stands for exports, *IMP* is import payments, *GDPGR* is the gross domestic product growth rate, *BM* is broad money, and *REM* is remittance, treated as independent variables. Also, $i$ stand for unit of fund (mutual fund), $t$ is time, $\beta$ is coefficient and $\varepsilon$ is the error terms.

$$BE_{it} = \beta_0 + \beta_1 DR_{it} + \beta_2 EXP_{it} + \beta_3 IMP_{it} + \beta_4 GDPGR_{it} + \beta_5 BM_{it}$$
$$+ \beta_6 REM_{it} + \varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots (viii)$$

Here, *BE* is the beta and the rest of the components are the same as equation *vii*.

$$SR_{it} = \beta_0 + \beta_1 DR_{it} + \beta_2 EXP_{it} + \beta_3 IMP_{it} + \beta_4 GDPGR_{it} + \beta_5 BM_{it}$$
$$+ \beta_6 REM_{it} + \varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots (ix)$$

Here, *SR* is the Sharpe ratio and the rest of the components are the same as equation *vii*.

$$TR_{it} = \beta_0 + \beta_1 DR_{it} + \beta_2 EXP_{it} + \beta_3 IMP_{it} + \beta_4 GDPGR_{it} + \beta_5 BM_{it}$$
$$+ \beta_6 REM_{it} + \varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots\ldots (x)$$

Here, *TR* is the Treynor Ratio and the rest of the components are the same as equation *vii*.

**Results and Discussions**

This section discusses the descriptive statistics, correlation matrix and regression analysis of panel data using the random effect model. After that, additional regression analysis is performed as a robustness test to justify the results of the random effect model.

*Descriptive Statistics*

Table 1 shows that the standard deviation (SD), total risk measure, has a mean value of 0.0782. The upside and lower side deviation is 0.0312, and the maximum and minimum values are 0.0245 and 0.1808. Beta has a mean value of 0.7324, and the standard deviation is 0.6004. The maximum and minimum values of beta are 2.7055 and -1.2423. the risk-adjusted return Sharpe ratio with a mean value of -0.6036 and a standard deviation of 0.9837. The maximum and minimum values are 2.6343 and -3.8428. The Treynor ratio has a mean value of -0.1064, and the upside and lower side deviation is 2.2426. The maximum and minimum values are 7.2791 and -7.4930.

**Table 1: Descriptive Statistics**                    **JUJBR**

|  | No. Obs. | Mean | Std. Dev | Minimum | Maximum |
|---|---|---|---|---|---|
| Standard Dev. | 1944 | 0.0782 | 0.0312 | 0.1808 | 0.0245 |
| Beta | 1944 | 0.7324 | 0.6004 | -1.2423 | 2.7055 |
| Sharpe Ratio | 1944 | -0.6036 | 0.9837 | -3.8428 | 2.6343 |
| Treynor Ratio | 1944 | -0.1064 | 2.2426 | -7.4930 | 7.2791 |
| Deposit Rate | 1944 | 4.85 | 0.5714 | 3.4412 | 6.2820 |
| Export | 1944 | 3431.23 | 778.54 | 1508.54 | 5372.46 |
| Import Payment | 1944 | 4930.93 | 1184.60 | 2005.39 | 7884.70 |
| Remittance | 1944 | 13348.60 | 3235.36 | 5358.50 | 21415.72 |
| Broad Money (M2) | 1944 | 1637475.09 | 300289.69 | 893441.73 | 2308679.88 |
| GDP Growth Rate | 1944 | 6.4671 | 1.0933 | 3.7672 | 9.1931 |

*Notes:* This table shows descriptive statistics which includes no. of observation, mean, standard deviation, minimum and maximum value for all variables using monthly data from January 2017 to December 2022 for 27 mutual funds. Here, GDP and broad money are converted to monthly data from yearly data using Denton method (Bikker, Daalmans & Mushkudiani, 2010).

Table 1 also shows the descriptive statistics of macroeconomic factors. Here, monthly mean deposit rate is 4.85%. Moreover, export and import have monthly mean values of 3431.23 and 4930.93 million dollars, respectively. This indicates that there is a trade deficit in Bangladesh. Moreover, the monthly mean of remittance is 13348.60 million dollars which can support balancing the trade deficits. Lastly, the GDP growth rate has a monthly mean value of 6.4771%.

### *Correlation Matrix*

The correlation matrix shows the interrelation between two variables. Table 2 shows that there is a statistically significant relationship exists between each of the risk measures (SD and Beta) with macroeconomic factors. Moreover, a statistically significant relationship exists between risk-adjusted return measures (Sharpe ratio and Treynor ratio) and macroeconomic factors. The correlation matrix primarily indicates that macroeconomic factors are related to risk and risk-adjusted return measures. Additionally, this correlation matrix shows little chance of a multicollinearity problem as none of the pairs shows a correlation coefficient of more than 0.80 (Bohrnstedt & Carter, 1971).

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## Table 2: Correlation Matrix

|  | SD | BETA | SR | TR | DR | EXP | IMP | REM | BM | GDP |
|---|---|---|---|---|---|---|---|---|---|---|
| **SD** | 1.00 | | | | | | | | | |
| **BETA** | 0.46*** | 1.00 | | | | | | | | |
| **SR** | 0.34*** | 0.15*** | 1.00 | | | | | | | |
| **TR** | 0.17*** | 0.08*** | 0.66*** | 1.00 | | | | | | |
| **DR** | -0.11*** | 0.20*** | -0.14*** | -0.06** | 1.00 | | | | | |
| **EXP** | -0.09*** | -0.23*** | 0.02 | 0.02 | -0.50*** | 1.00 | | | | |
| **IMP** | -0.08*** | -0.29*** | 0.02 | 0.05** | -0.53*** | 0.78*** | 1.00 | | | |
| **REM** | 0.10** | -0.22*** | 0.08*** | 0.02 | -0.36*** | 0.47*** | 0.40*** | 1.00 | | |
| **BM** | -0.01 | -0.28*** | -0.02 | -0.06*** | -0.51*** | 0.60*** | 0.60*** | 0.77*** | 1.00 | |
| **GDPGR** | -0.04* | -0.01 | 0.05** | 0.05** | -0.22*** | 0.15*** | 0.23*** | -0.28*** | -0.26*** | 1.00 |

*\*, \*\*, \*\*\* indicate statistical significant at the 5%, 1% and 0.1% level, respectively.*

*Notes:* This table is the Pearson correlation coefficient using monthly data of 27 conventional mutual funds collected from January 2017 to December 2022. Here SD stands for Standard Deviation, Beta is systematic risk, SR is Sharpe Ratio, TR is Treynor Ratio, DR is Deposit Rate, EXP is Exports, IMP is Import Payments, REM is Remittance, BM is Broad Money and GDPGR is Gross Domestic Product Growth Rate.

### *Results of Regression Analysis*

The diagnostic testing of panel data analysis is performed before conducting the research. At first, it is found that data is normally distributed, which is confirmed by performing the Kolmogorov-Smirnova test. Results show that all variables have a p-value of 0.20 or above, which is higher than a 0.05 significance level (Berger & Zhou, 2014). There is no multicollinearity among the independent variables because all variables have a value of less than 10, and the VIF mean value is 2.64, which is also less than 10 (Schroeder, Lander, & Levine-Silverman, 1990). There is no heteroscedasticity problem among the variables, which is performed by using the Breusch-Pagan/Cook-Weisberg test because the p-values are higher than 0.05 significance level (Glejser, 1969). Finally, the result of the Durbin-Watson test explains that there is an autocorrelation problem in data because all variables have a value between 1.50 to 2.50 (Hasan & Islam, 2023).

To determine the appropriate model for panel data analysis, the pooled ordinary least square method (OLS), the fixed effect, and the random effect models are three important techniques. This research applies the Breusch-Pagan Lagrange Multiplier Test and Hausman Test. Breusch-Pagan Lagrange Multiplier Test identifies an appropriate model between pooled OLS and random effects methods. Results show that the p-value of this method for all models is less than 0.05 significance level, which indicates that the pooled OLS method is inappropriate but random effects model is appropriate for this research. Then to choose an appropriate model between random effect model and the fixed effect model, the Hausman test is performed. The results of the Hausman test show that the random effect method is appropriate for this panel data analysis because the p-value for all models is higher than the 0.05 significance level, which indicates to rejection of the fixed effect model (Nguyen & Nguyen, 2019).

The random effect model is utilized following the Breusch-Pagan Lagrange Multiplier and Husman tests (Kothari, 2015; Dougherty, 2011). Overall regression analysis results show that macroeconomic factors influence the risk-adjusted returns of Bangladeshi mutual funds (Table 3). The result for panel data regression using the random effect model is given in the following Table 3:

**Table 3: Results of Regression Analysis Using Random Effect Model**

|  | Model-01 | Model-02 | Model-03 | Model-04 |
|---|---|---|---|---|
|  | **Standard Dev. (T- Value)** | **Beta (T- Value)** | **Sharpe Ratio (T- Value)** | **Treynor Ratio (T- Value)** |
| **Deposit Rate** | -0.014*** (-10.299) | 0.026 (0.948) | -0.383*** (-7.678) | -0.426*** (-3.715) |
| **Export** | -0.00001*** (-4.409) | 0.00001* (1.724) | -0.000 (-0.542) | -0.000 (-0.247) |
| **Import** | -0.00001** (-1.966) | -0.00001*** (-5.989) | 0.000 (0.217) | 0.00001*** (3.507) |
| **Remittance** | 0.00001*** (8.981) | -0.000 (-1.327) | 0.00001*** (6.582) | 0.00001*** (5.138) |
| **Broad Money** | -0.00001*** (-6.176) | -0.00001*** (-3.518) | -0.00001*** (-6.808) | -0.00001*** (-7.642) |
| **GDP Growth Rate** | -0.001* (-1.918) | -0.005 (-0.389) | -0.013 (-0.508) | -0.093 (-1.602) |
| **Constant** | 0.191*** (14.951) | 1.593*** (6.321) | 2.085*** (4.661) | 3.892*** (3.785) |
| **$R^2$** | 0.2820*** | 0.2018*** | 0.1528*** | 0.2347*** |
| **$Chi^2$** | 216.83*** | 249.71*** | 107.88*** | 69.66*** |
| **Obs.** | 1944 | 1944 | 1944 | 1944 |

*\*, \*\*, \*\*\* indicate statistical significant at the 5%, 1% and 0.1% level, respectively.*

*Notes:* This table shows the result of the random effect model for panel data analysis using monthly data of 27 conventional mutual funds prepared from January 2017 to December 2022. Here, columns present risk measures (standard deviation, beta) and risk-adjusted return measures (Sharpe ratio and Treynor ratio) which are used as dependent variables of the regression equations. Moreover, rows present macroeconomic factors which are used as independent variables of the regression equations.

Model 1 of Table 3 shows that all macroeconomic factors have a statistically significant negative relationship with standard deviation, except remittances, which has a significant positive relationship with standard deviation. This indicates that overall, macroeconomic factors influence the total risk of mutual funds.

For beta (Model-02), the coefficients of exports and import payments have a statistically significant positive relationship with beta. However, broad money has a statistically significant negative relation with beta. Furthermore, the deposit rate, remittances, and GDP growth rate have a statistically insignificant relationship with beta. Overall beta results indicate mixed evidence regarding the impact of macroeconomic factors on the systematic risk of mutual funds.

In the case of risk-adjusted return, the coefficients of deposit rate and broad money have a statistically significant negative relationship with the Sharpe ratio (Model 3, Table 3). However, remittances have a statistically significant positive relationship with Sharpe ratio. Moreover, exports, import payments and the GDP growth rate have a statistically insignificant relationship with Sharpe ratio. Therefore, there is mixed evidence about the impact of macroeconomic factors on Sharpe ratio or performance of mutual funds..

Model 04 of Table 3 shows that the coefficients of import payments and remittances have a statistically significant positive relationship with the Treynor ratio; however, deposit rate and broad money supply have a statistically significant negative relationship with the Treynor ratio. Furthermore, exports and GDP growth rates have a statistically insignificant relationship with the Treynor ratio. Overall, the findings suggest that macroeconomic factors impact the Treynor ratio or risk-adjusted performance of mutual funds.

Therefore, it is argued that macroeconomic factors generally impact the risk and risk-adjusted return of Bangladeshi mutual funds. These findings are aligned with the previous studies conducted other than Bangladeshi mutual funds (e.g., Kariuki (2014); Singh et al. (2011); Hussain (2017); Humpe & Macmillan, (2009); Imsar et al. (2022)).

### Robustness Analysis

In this section, robust random effects model of panel data analysis is performed in addition to the random effect model to check the authenticity of the results that are shown in the previous section. The results of robust random effects model (Table 4) are similar to the random effect model (Table 3). The results of robust panel data regression are given in the following Table 4:

### Table 4: Results of Regression Analysis Using Robust Random Effects Model

|  | Model-01 | Model-02 | Model-03 | Model-04 |
|---|---|---|---|---|
|  | Standard Dev. (T- Value) | Beta (T- Value) | Sharpe Ratio (T- Value) | Treynor Ratio (T- Value) |
| Deposit Rate | -0.014*** (-5.68) | 0.026 (0.31) | -0.383*** (-12.25) | -0.426*** (-3.57) |
| Export | -0.00005*** (-7.62) | 0.00004* (1.65) | -0.00003 (-0.88) | -0.00003 (-0.29) |

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| | | | | |
|---|---|---|---|---|
| **Import** | -0.00001* | -0.00011*** | 0.000 | 0.00026*** |
| | (-1.70) | (-5.55) | (0.30) | (4.03) |
| **Remittance** | 0.00002*** | -0.00007 | 0.00007*** | 0.00013*** |
| | (6.32) | (-0.76) | (6.84) | (5.62) |
| **Broad Money** | -0.00001*** | -0.00002** | -0.00009*** | -0.00002*** |
| | (-4.79) | (-2.24) | (-7.83) | (-9.37) |
| **GDP Growth Rate** | -0.001 | -0.005 | -0.013 | -0.093 |
| | (-0.92) | (-0.23) | (-0.75) | (-1.47) |
| **Constant** | 0.191*** | 1.593** | 2.085*** | 3.892*** |
| | (8.11) | (2.26) | (8.20) | (3.59) |
| **$R^2$** | 0.1820*** | 0.1918*** | 0.1728*** | 0.2323*** |
| **$Chi^2$** | 30.01*** | 34.94*** | 21.16*** | 15.63*** |
| **Obs.** | 1944 | 1944 | 1944 | 1944 |

*Note:\*,\*\*,\*\*\* indicate statistical significant at the 5%, 1% & 0.1% level, respectively.*

*Notes:* This table shows the results of robust random effects model using monthly data of 27 conventional mutual funds collected from January 2017 to December 2022. Here, columns present risk measures (standard deviation, beta) and risk-adjusted return measures (Sharpe ratio and Treynor ratio), which are used as dependent variables of the regression equations. Moreover, rows present macroeconomic factors which are used as independent variables of the regression equations.

## Conclusion

The purpose of the study is to identify the risk and risk-adjusted return of mutual funds and show the effect of macroeconomic factors on the risk and risk-adjusted return of mutual funds in Bangladesh. The monthly closing price data for 27 mutual funds out of 37 mutual funds of the Dhaka stock exchange are collected to utilize this study. During the data collection period, 10 mutual funds were excluded because those funds were established after 2017. Though the data collection period started in December 2015, the monthly returns are calculated from January 2016 to December 2022. Using the monthly return, the variables, i.e., standard deviation, beta, Sharpe ratio, and Treynor ratio, are calculated from January 2017 to December 2022 using the 12-month rolling window method. Furthermore, six macroeconomic factors, such as deposit rate, export, import, remittance, broad money, and GDP growth rate, are considered for this study. The GDP growth rate and broad money supply are yearly data, but they are converted to monthly data by applying the proportional Denton method "*dentonmq'* using the EViews software.

The random effect model of panel data analysis is applied to identify the effects of macroeconomic factors on risk and risk-adjusted return. The result shows that the macroeconomic variable deposit rate has a negative effect on standard deviation (total risk) but is insignificant with beta (systematic risk). Export has a significant negative effect on total risk and a positive with systematic risk. Import

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payments have a statistically significant negative effect on total risk and systematic risk. Total risk is statistically significant, but the systematic risk is insignificant with remittance. Broad money has a statistically significant negative relation with total risk and systematic risk. And lastly, the GDP growth rate has a significant effect on total risk but is insignificant with systematic risk.

It also has been found that deposit rate has a significant relationship with risk-adjusted performance Sharpe ratio and Treynor ratio. On the other hand, export has a statistically insignificant effect on risk-adjusted return. Import payment is also statistically insignificant with the Sharpe ratio and significant with the Treynor ratio. On the other hand, remittance has a statistically significant positive relation with risk-adjusted performance. Broad money also has a significant negative effect on the Sharpe ratio and Treynor ratio. At last, the GDP growth rate has a statistically insignificant relation with the Sharpe and Treynor ratios. Therefore, fund managers and investors in Bangladesh can benefit from the results of this study and be able to identify the effects of macroeconomic factors on the risk and risk-adjusted return.

In the future, anyone who wants to study the risk and risk-adjusted return of mutual funds can use other macroeconomic factors like exchange rate, inflation, etc., to identify their effect on the risk and risk-adjusted return. Furthermore, future researchers and practitioners may also apply the 12-month rolling window method to compute the risk and risk-adjusted return to get the best picture. Finally, panel data analysis methods could be applied to capture the effects of both time and units to get the best scenario on the effects of macroeconomic and microeconomic factors on mutual fund risk and return. Future researchers can also include the weekly or daily data to make the study and increase the period from 10 to 20 years. Researchers may also replicate the model of this study in other areas of stock market analysis.

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