"Nexus between financial innovations, remittances and credit performance: Evidence from augmented ARDL and nonlinear ARDL"

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NEXUS BETWEEN FINANCIAL INNOVATIONS, REMITTANCES AND CREDIT PERFORMANCE: EVIDENCE FROM AUGMENTED ARDL AND NONLINEAR ARDL

Abstract

The motivation for this study is to assess the impact of financial innovation and remittances on bank-based financial institutions' credit performance in Bangladesh for the period 1981–2019. The study applies augmented ARDL (AARDL) and nonlinear ARDL (NARDL) to identify both long-run and short-run effects and directional causality by performing non-granger casualty tests. AARDL confirms the presence of a long-run association between financial innovation, remittance, trade openness, FDI, and credit performance, which is measured by non-performing loans. In the long run, financial innovation and FDI volatility expose a positive link with NPLs, but remittance inflows and trade openness establish a negative association. Asymmetry shocks in financial innovation reveal a positive relationship with credit performance.

In contrast, the asymmetric shock of remittance and trade openness unveil a negative tie to credit performance, especially in the long run. Furthermore, directional causality provides evidence to support a feedback hypothesis explaining causality between financial innovation and credit performance, as well as remittance inflows and credit performance. These findings suggest that credit performance is guided by future development in remittances and financial innovation; thus, closer attention from policymakers and financial experts is persistent to capitalize or mitigate the impact of the financial system.

Keywords	financial innovation, remittances, non-performing loans, augmented ARDL, nonlinear ARDL, TY causality test
JEL Classification	O32, F24, H81, C22

INTRODUCTION

The effect of non-performing loans on financial systems is widely used at an international forum. Financial institutions' performance and financial sustainability are adversely affected by the increase of NPLs in the financial system. Therefore, financial institutions repetitively tried to minimize the conversation rate of NPLs arising from the creation of their assets. Furthermore, over the past decades, several reforms and projects have been carried out aimed at reforming banking and financial structures in numerous countries. The enhanced quality of banks' reserves is due to faster growth in nominal income and credit, expanded financial inclusion, as well as the attempts of supervisory authorities to enhance the control of banks' credit risk and underwriting activities. In recent years, the non-performing loan – fundamental macro nexus have attracted immense interest among scholars (Dimitrios et al., 2016; Anjom & Karim, 2016; Turan & Koskija, 2014; Ghosh, 2015; Grigoli et al., 2018; Makri et al., 2014).

Credit mobilization is one way to create assets for financial institutions in the financial system, especially bank-based institutions.

Credit provision acts as a double-edged sword due to efficient allocation. Credit management allows financial institutions to maximize earnings and credit defaulter, which creates unintended pressure that detrimentally causes operational performances. Thus, credit creation and efficient management for financial institutions emerged as one of the discussant issues among researchers, policymakers, and academicians. Credit defaults, only non-performing loans hereafter NPLS, established the significant fact responsible for financial volatility and mostly hindered the normal financial development process (Amin et al., 2019).

Financial efficiency is the critical determinant for inclusive and sustainable economic growth (Schumpeter, 1911), since financial inefficiency deteriorates capital accumulation and underpins economic growth. The prime effect observed due to financial inefficiency is the continuous increase of non-performing loans (NPLs) in the financial system. Hence, NPLs induce financial pollution and diminish social benefits (Minsky, 1964; Stiglitz & Weiss, 1981). An efficient financial system's role is critically addressed in achieving sustainable economic growth by accumulating capital and increasing society's saving propensity. However, the efficiency of the banking sector will be hindered if banks are exposed to speculative loans and financial investments, which, if not adequately controlled, can lead to creating non-performing loans, which can lead to a destabilized financial system (Fofack, 2005) and severe banking crises (Reinhart & Rogoff, 2011).

This study's prime motivation is to unsheathe the new insight by investigating the effects of financial innovation, remittance inflows, the volatility of FDI, and trade openness on non-performing loans in Bangladesh. To investigate the impact from selected independent variables, namely, trade openness, FDI volatility, remittance, and financial innovation to non-performing loans, this study applies several econometric tools such as ARDL bound test proposed by Pesaran et al. (2001), ARDL t-test proposed by McNown et al. (2018), and augmented ARDL with F-test proposed by Sam et al. (2019). Furthermore, asymmetric relationships were investigated by following nonlinear ARDL proposed by Shin et al. (2014). The directional causality was established by performing the non-granger causality test proposed by Toda and Yamamoto (1995).

The paper is structured as follows: Section 1 contains the survey of related literature and hypotheses development. Section 2 defined variables and explains research methodology. The empirical model estimation and the interpretation are exhibited in Section 3. Finally, the last section provides conclusion.

1. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

For the last decades, NPLs have become troublesome and one of the most critical issues globally because of banks' profitability and liquidity hamper. Overall economic growth is negatively affected by the increased amount of non-performing loans (Klein, 2013). NPLs respond to macroeconomic, bank-specific, and other global factors. Moreover, wrong customer selection, intense competition, poor management, lack of supporting facilities, poor cash flow, delayed disbursement of funds, and absence of proper monitoring are the gener-

al reasons behind the NPLs. Besides, fundamental macro factors such as lower GDP, unemployment rate (Jiménez & Saurina, 2005), inflation rate, interest rate, and the exchange rate (D. Louzis et al., 2010) can be considered as the root causes of NPLs. Furthermore, bank-specific factors (credit growth, bank size, risk-taking, return on asset, return on equity, solvency, inefficiency, liquidity) and global factors, NPLs arise (Boudriga et al., 2009). In addition, macroeconomic and bank-specific variables affect non-performing loans (Anjom & Karim, 2016; Md Qamruzzaman et al., 2020). As external economic factors are uncontrollable and affect the overall performance of financial institutions, compared to the bank-specific factors, NPLs react most by the macroeconomic factors (Kjosevski

& Petkovski, 2017; Klein, 2013; D. P. Louzis, et al., 2012; Polodoo et al., 2015), while opposite conclusions were made by Amuakwa-Mensah and Boakye-Adjei (2015), Dimitrios et al. (2016), Haniifah (2015), and Rifat (2016).

In European countries, NPLs are found to increase when unemployment rises, the exchange rate depreciates, and inflation is high (Klein, 2013; D. P. Louzis et al., 2012; Škarica, 2014; Turan & Koskija, 2014). However, opposite findings are found in Shingjergji (2013). An insignificant relationship has been found between GDP, interest rate, inflation, exchange rate, and NPLs (Haniifah, 2015). In a general sense, GDP and NPLs should be strongly related because higher GDP mostly expresses a country's robust economic condition. Non-performing loans cannot exist too much in countries with healthy economic conditions (Ghosh, 2015; Rajha, 2016). On the other hand, a positive relationship has been found between GDP and NPLs (Anjom & Karim, 2016; Poudel, 2013; Shingjergji, 2013). Moreover, banks' profitability also influences NPLs to some extent. Banks that are profitable and have lower exposure to the household sectors tend to have lower NPLs (Beaton & Myrvoda, 2016; Isik & Bolat, 2016).

Money supply (broad money) is also a strong influencer of NPL, but its impact is ambiguous as it can create both positive and negative impacts on NPL. Thus, though money supply is used in a few papers as independent variables, different results are found in Morakinyo and Sibanda (2016) and Poudel (2013). Because of rising domestic credit to the private sector (loans, purchases of securities, trade credits, account receivables), there is a probability of increasing NPL. So, there must be a positive impact of credit to the private sector on NPL (Akinlo & Emmanuel, 2014; Beaton & Myrvoda, 2016; Dorina & Colesnicova, 2014; Kjosevski & Petkovski, 2017). On the other hand, NPL are used to respond negatively with remittances, as the remittance inflow keeps the general people from taking excessive loans from banks, and a decrease in loans tends to decrease NPLs. Thus, NPL is negatively related to remittances (Dorina & Colesnicova, 2014; Turan & Koskija, 2014).

Kumar et al. (2018) investigated the NPLs' determents of the banking industry in Fiji for the period 2000–2013. They found that macro fundaments, such as economic growth, exchange rate, inflation, and unemployment, attribute to the buildup of NPLs. On the other hand, remittance inflows create downward pressure on NPLs pileup during the research period. Furthermore, Adebola et al. (2011) investigated the key factors responsible for expanding NPLs in Malaysia's Islamic banking sector for 2007M1–2009M12. They concluded that interest rate and industrial production index exhibited a positive association for an increase of NPLs of Islamic banking in Malaysia in the long run. However, the producer price index appears with an antagonistic relationship both in the long and short run.

Rahman and Jahan focused on NPLs determinants for Islamic banking with firms' specifics factors. Study findings revealed that firms' profitability attributes to increasing non-performing loans. They argued that asset creation through sectioning excess credit offered higher interest earnings and created the possibility of augmenting NPLs. Panel data from 16 banks for the period 1990–2005 were used.

This study is not aimed at a comprehensive investigation to identify the critical determinants for the increase in NPLs in Bangladesh. Instead, it explores the nexus between Financial Innovation, Remittance Inflows, Trade Openness, FDI Volatility and NPLs for the first time by applying both linear frameworks that are bound testing proposed by Pesaran et al. (2001), t-test proposed by McNown et al. (2018), augmented ARDL proposed by Sam et al. (2019), and nonlinear framework, that is nonlinear ARDL, proposed by Shin et al. (2014). The study tests six hypotheses pertinent to the conceptual model of the study. Figure 1 represents the possible causality between financial inclusion, stock market development, and foreign capital from a theoretical perspective.

2. METHODS

The study utilizes annualized time series data for the period 1981–2019. As a dependent variable, non-performing loans are measured by the ratio of NPLs to gross domestic product (Chen et al., 2018). Because of broad regional economic growth
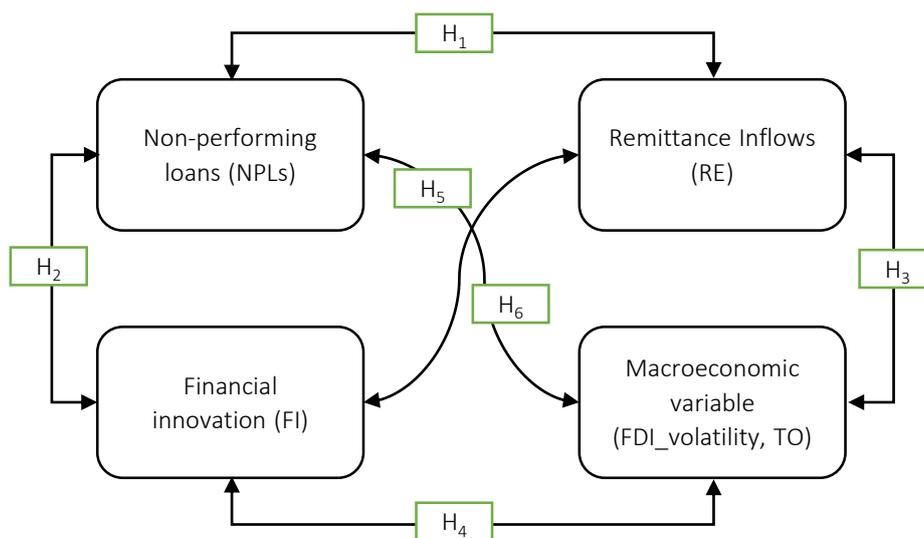
Note: $H_{1A, B}$: Remittance inflows cause non-performing loans, and vice versa; $H_{2A, B}$: Financial innovation causes non-performing loans, and vice versa; $H_{3A, B}$: Remittance inflows cause a macroeconomic variable, and vice versa; $H_{4A, B}$: Financial innovation causes a macroeconomic variable, and vice versa; $H_{5A, B}$: Stock market development causes financial inclusion, and vice versa; and $H_{6A, B}$: Non-performing loans cause a macroeconomic variable, and vice versa.

Figure 1. Conceptual model for hypotheses testing

disparities, non-performing loans of commercial banks can be affected by regional economic efficiency. Therefore, the non-performing credit ratio is preferred to calculate non-performing commercial bank loans to avoid economic growth. Remittances are measured by the per capita remittance received: Personal remittances comprise personal transfers and compensation of employees. Personal transfers consist of all current transfers in cash or in-kind made or received by residents. It is expected that continuous inflows of remittances in the economy can reduce the trend of increasing non-performing loans in the economy. The expected sign of remittance (R) is negative. As a proxy for financial innovation, empirical literature suggests three indicators widely used such as the ratio of M2 to M1 (Md Qamruzzaman & Karim, 2020a), the ratio of M3/M2 (Md. Qamruzzaman & Wei Jianguo, 2018; Md Qamruzzaman & Wei, 2019), and the growth of domestic credits to the private sector (Md. Qamruzzaman & Jianguo, 2017; Md Qamruzzaman & Wei, 2018). Addressing the effects on NPLs from a different proxy of financial innovation, this study selects all three for enhancing the robustness of empirical model estimation. Trade openness (TO) is measured by the sum of import and export as a percentage of GDP. And finally, the FDI volatility is measured by performing ARCH effects of annualized data.

Table 1. Variable definition and sources

Variables	Notation	Definition	Data sources
Non-performing loans	$NPLs$	NPLs as a percentage of GDP	Bangladesh Bank Annual reports
Financial innovation			
M2/M1	FI_1	The ratio of M2/M	Author calculation
M3/M2	FI_2	The ratio of Broad money to Narrow	
DCP	FI_3	Domestic credit private section as a percentage of GDP	WDI
Trade openness	TO	As a ratio of total trade to GDP	WDI
Remittance	R	Per capital remittance received	WDI
FDI volatility	FDI_{vol}	ARCH effects of FDI inflows in the economy	Authors calculation

The generalized conceptual empirical model can be established as follows:

$$NPL = \int Remitane, \; Financial \; innovation, \quad (1)$$
$$Trade \; Opennes, \; FDI_{volatility}.$$

Transforming equation (1) into a linear form can be represented as follows:

$$\ln NPL_t = \alpha_0 + \beta_1 \ln RE_t + \beta_2 \ln FI_t + \\ + \beta_3 \ln TO_t + \beta_3 \ln FDI\_vol_t + \varepsilon_t, \quad (2)$$

where RE is the exchange rate, FI stands for financial innovation, $FDI\_volatility$ represents variability in foreign direct investment, TO represents trade openness, and G is the real government expenditure. Model coefficients of β_1 to β_3 in equation (2) represent long-run elasticities, and ε_t stands for error correction term the equations.

2.1. Autoregressive distributed lag (ARDL)

In recent times, when investigating the long-run association, empirical studies extensively use a framework proposed by Pesaran, known as ARDL (Md Qamruzzaman & Wei Jianguo, 2018; Md Qamruzzaman et al., 2020; Md Qamruzzaman & Karim, 2020a, 2020b). ARDL estimation possesses certain benefits over traditional cointegration tests, including (1) efficient estimation regardless of the study's sample size (Ghatak & Siddiki, 2001), (2) ability of handling mixed-order variable integration, and model stability and efficiency can be obtained by selecting appropriate lagged specification (Pesaran et al., 2001), (3) unbiased estimation for both long-run and short-run elasticity (Banerjee et al., 1993).

Following Pesaran et al. (2001), the generalized ADRL model for the study with different proxies for $NPLs$ is as follows:

$$\Delta \ln NPL_t = \alpha_0 + \sum_{i=1}^{n} \mu_1 \Delta \ln NPL_{t-i} +$$

$$+ \sum_{i=0}^{n} \mu_2 \Delta \ln RE_{t-i} + \sum_{i=0}^{n} \mu_3 \Delta \ln FI_{t-i}^* +$$

$$+ \sum_{i=0}^{n} \mu_6 \Delta \ln TO_t +$$

$$+ \sum_{i=0}^{n} \mu_7 \Delta \ln FDI\_volatility_{t-i} +$$

$$+ \gamma_1 \ln NPL_{t-1} + \gamma_2 \ln RE_{t-1} +$$

$$+ \gamma_3 \ln FI_{t-1}^1 + \gamma_6 \ln TO_{t-1} +$$

$$+ \gamma_6 \ln FDI\_volatility_{t-1} + \omega_{1t}.$$

(3)

where Δ indicates differencing of variables, while is the error term (white noise), and $(t-1)$ is for the lagged period, is the long-run coefficient. Based on linear ARDL equations 3-5, long-run coefficient should be available from γ_1 to γ_5 and short-

run coefficients should be obtained from μ_1 to μ_5 from each empirical model estimation. Long-run association between variables should be tested following the F-test (Pesaran et al., 2001) and the t-test on the lagged level of the dependent variable as suggested by Pesaran et al. (2001), as well as another additional F-test on the lagged levels of the independent variable(s) as suggested by McNown et al. (2018).

Table 2. Null hypotheses for all three tests

Cointegration test	Null hypothesis	Alternative hypothesis
F-bound test	$\gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = \gamma_5 = \gamma_6 = \gamma_7 = 0$	Any, $\gamma_1, \gamma_2, \gamma_3, \gamma_4, \gamma_5, \gamma_6, \gamma_7 \neq 0$
t-test on a lagged dependent variable	$\gamma_1 = 0$	$\gamma_1 \neq 0$
F-test on a lagged independent variable	$\gamma_2 = \gamma_3 = \gamma_4 = \gamma_5 = \gamma_6 = \gamma_7 = 0$	Any, $\gamma_2, \gamma_3, \gamma_4, \gamma_5, \gamma_6, \gamma_7 \neq 0$

Recently, investigating the asymmetry association between dependent and independent variables, non-linear ARDL emerged as a pioneering framework in empirical studies (Md Qamruzzaman et al., 2020; Md Qamruzzaman et al., 2019), which is proposed by Shin et al. (2014). Investigation of non-linear effects from independent variables to dependent variables requires integrating variables decomposition into positive and negative shocks. The decomposition of positive and negative shocks of explanatory variables can be computed by using the following equations:

$$\begin{cases} POS(FDI_{vol})_t = \sum_{k=1}^{t} \ln FDI_{vol_k^+} = \\ = \sum_{k=1}^{T} MAX(\Delta \ln FDI_{vol_k}, 0) \\ NEG(FDI_{vol})_t = \sum_{k=1}^{t} \ln FDI_{vol_k^-} = \\ = \sum_{k=1}^{T} MIN(\Delta \ln FDI_{vol_k}, 0) \end{cases}$$

(4)

$$\begin{cases} POS\left(TO\right)_t = \sum_{k=1}^{t} \ln TO_k^+ = \sum_{k=1}^{T} MAX\left(\Delta \ln TO_k, 0\right) \\ NEG\left(TO\right)_t = \sum_{k=1}^{t} \ln TO_k^- = \sum_{k=1}^{T} MIN\left(\Delta \ln TO_k, 0\right) \end{cases}, \quad (5)$$

$$\begin{cases} POS\left(R\right)_t = \sum_{k=1}^{t} \ln R_k^+ = \sum_{k=1}^{T} MAX\left(\Delta \ln R_k, 0\right) \\ NEG\left(R\right)_t = \sum_{k=1}^{t} \ln R_k^- = \sum_{k=1}^{T} MIN\left(\Delta \ln R_k, 0\right) \end{cases}, \quad (6)$$

$$\begin{cases} POS\left(FI^*\right)_t = \sum_{k=1}^{t} \ln FI^{*+}_k = \sum_{k=1}^{T} MAX\left(\Delta \ln FI^1_k, 0\right) \\ NEG\left(FI^*\right)_t = \sum_{k=1}^{t} \ln FI^{*-}_k = \sum_{k=1}^{T} MIN\left(\Delta \ln FI^1_k, 0\right) \end{cases}. \quad (7)$$

Now the asymmetric shocks derived from equations 4-7 are incorporated in equation (3) and reproduced in a nonlinear framework, which is as follows:

$$\Delta \ln NPL_{t,i} = \alpha_0 + \sum_{i=1}^{n} \mu_1 \Delta NPL_{t-i} +$$

$$+ \sum_{i=0}^{m} \left(\mu_2^+ \Delta FDI_{vol_{t-i}} + \mu_2^- \Delta FDI_{vol_{t-i}} \right) +$$

$$+ \sum_{i=0}^{r} \left(\mu_3^+ \Delta TO_{t-i} + \mu_3^- \Delta TO_{t-i} \right) +$$

$$+ \sum_{i=0}^{r} \left(\mu_4^+ \Delta FI_{t-i} + \mu_4^- \Delta FI_{t-i} \right) + \quad (8)$$

$$+ \sum_{i=0}^{r} \left(\mu_4^+ \Delta R_{t-i} + \mu_4^- \Delta R_{t-i} \right) +$$

$$+ \gamma_0 NPL_{t-1} + \left(\gamma_1^+ FDI_{vol_{t-1}} + \gamma_1^- FDI_{vol_{t-1}} \right) +$$

$$+ \left(\gamma_2^+ TO_{t-1} + \gamma_2^- TO_{t-1} \right) +$$

$$+ \left(\gamma_3^+ FI_{t-1} + \gamma_3^- FI_{t-1} \right) + \left(\gamma_4^+ R_{t-1} + \gamma_4^- R_{t-1} \right) + \omega_t.$$

To investigate the existence of the long-run asymmetric relationship, Shin et al. (2014) proposed a bound test, which is a joint test of all lagged levels of regressors. Wald F-test is utilized to test the null hypothesis that there is no asymmetric relationship H_0: $\gamma_0 = \gamma_1^+ = \gamma_1^- = \gamma_2^+ = \gamma_2^- = \gamma_3^+ = \gamma_3^- = \gamma_4^+ = \gamma_4^- = 0,$ against the alternative hypothesis H_1: $\gamma_0 \neq \gamma_1^+ \neq \gamma_1^- \neq \gamma_2^+ \neq \gamma_2^- \neq \gamma_3^+ \neq \gamma_3^- \neq \gamma_4^+ \neq \gamma_4^- \neq 0.$ The rejection of the null hypothesis establishes an asymmetric relationship available in the empirical equation.

Non-linear ARDL model is evaluated under three assessments. First, the short-run asymmetry, that is $\mu_1^+ \neq \mu_1^-$ for FDI volatility, $\mu_2^+ \neq \mu_2^-$ for trade openness; $\mu_3^+ \neq \mu_3^-$ for financial innovation, and $\mu_4^+ \neq \mu_4^-$ for remittance inflows in the equation. Second, short-run asymmetry impact confirmed, if $\sum \mu_1^+ \neq \sum \mu_1^-$ for FDI volatility; $\sum \mu_3^+ \neq \sum \mu_3^-$ for trade openness; $\sum \mu_4^+ \neq \sum \mu_4^-$ for financial innovation; and $\sum \mu_5^+ \neq \sum \mu_5^-$ for remittance inflows, respectively. Third, long-run asymmetry is ascertained if $\gamma_1^+ \neq \gamma_1^-$ for the FDI volatility, $\gamma_2^+ \neq \gamma_2^-$ for the trade openness, $\gamma_3^+ \neq \gamma_3^-$ for financial innovation, and $\gamma_4^+ \neq \gamma_4^-$ for remittance inflows.

To establish directional causality between financial innovation, money supply, interest rate, remittances, and stock price, the non-causality test proposed by Toda and Yamamoto (1995) was applied. The Toda and Yamamoto (1995) causality test is based on the idea of Vector autoregression at level $\left(P = K + D_{max} \right)$ with correct VAR order K and d extra lag, where d represents the maximum order of integration of time series. The following causal equation is used to detect possible directional association between variables:

$$NPL_{t(pcb)} = \alpha_0 + \sum_{i=1}^{k} \beta_{1i} NPL_{t-i} +$$

$$+ \sum_{j=k+1}^{d_{max}} \beta_{2j} NPL_{t-j} + \sum_{i=1}^{k} \gamma_{1i} R_{t-i} +$$

$$+ \sum_{j=k+1}^{d_{max}} \gamma_{1j} R_{t-j} + \sum_{i=1}^{k} \pi_{1i} FI^1_{t-i} +$$

$$+ \sum_{j=k+1}^{d_{max}} \pi_{1j} FI^1_{t-j} + \sum_{i=1}^{k} \tau_{1i} FI^2_{t-i} + \quad (9)$$

$$+ \sum_{j=k+1}^{d_{max}} \tau_{1j} FI^2_{t-j} + \sum_{i=1}^{k} \varphi_{1i} FI^3_{t-i} +$$

$$+ \sum_{j=k+1}^{d_{max}} \varphi_{1j} FI^3_{t-j} + \sum_{i=1}^{k} \delta_{1i} FDI_{vol_{t-i}} +$$

$$+ \sum_{j=k+1}^{d_{max}} \delta_{2j} FDI_{vol_{t-j}} + \sum_{i=1}^{k} \theta_{1i} TO_{t-i} +$$

$$+ \sum_{j=k+1}^{d_{max}} \theta_{2j} TO_{t-j} + \varepsilon_{1t}.$$

3. RESULTS

According to the existing literature, empirical estimation using time series data has helped to determine the order of variable integration. In line with literature, the study performs a stationary test by applying the ADF test proposed by Dickey and Fuller (1979), P-P test proposed by Phillips and Perron (1988), KPSS test proposed by Kwiatkowski et al. (1992). The results of unit root tests are displayed in Table 3. The study findings establish a mixed order of integration, indicating that variables are either stationary at a level I(0) or after the first difference I(1); no variables expose stationarity after the second difference I(2).

Furthermore, the study applies the Ng and Perron (2001) test, and the right size and power properties are employed. Unit root test under Ng produces four test statistics, namely MZa, MZt, MSB, and MPT, for investigating the existence or unit roots.

The coefficients MZ_a and MZ_t were obtained by modifying Phillips (1987) and Phillips and Perron (1988) Z_a and Z_t test. The MSB is extracted from the Bhargava (1986) R test, and lastly, the value of MPT is adopted from Elliott, Rothenberg, and Stock's (1996) point optimal test. Results of the stationary test are exhibited in Table 4.

The results of the long-run cointegration test are reported in Table 5. The study performs nine cointegration equations to ascertain possible long-run association based on NPL measures in the equation and proxy of financial innovation. Because the test statistics of $F_{overall}$, t_{DV}, and F_{IDV} are statistically significant at a 1% level of significance, these findings suggest the presence of long-run cointegration between financial innovation, remittance, trade openness, FDI volatility, and non-performing loans.

Since the cointegration test of AARDL confirms long-run cointegration in the empiri-

Table 3. Unit root test results

	At level			At first difference		
	ADF	**PP**	**KPSS**	**ADF**	**PP**	**KPSS**
NPL_{pcbs}	−1.481	0.530	0.329***	−6.105***	−6.109***	0.095
NPL_{scbs}	−1.705	−1.805	0.447***	−5.263***	−5.272***	0.099
NPL_{fcbs}	−1.518	−1.959	0.412***	−4.399***	−8.392***	0.108
FI^1	−9.560***	−1.560	0.563***	−5.978***	−8.074***	0.081
FI^2	−3.980**	−3.303	0.445***	−11.817***	−3.577***	0.136
FI^3	−18.392***	−8.249	0.430***	−5.942***	−7.184***	0.500***
$FDI_{volatility}$	−1.260	−2.159	0.497***	−7.997***	−3.638**	0.220
RE	−2.293	−1.325	0.647***	−3.240**	−6.461***	0.111
TO	−0.888	−0.839	0.631***	−3.794**	−7.856***	0.243**

Table 4. Ng-Parron unit root test

	At level				At first difference			
	MZa	**MZt**	**MSB**	**MPT**	**MZa**	**MZt**	**MSB**	**MPT**
NPL_{pcbs}	−4.895	−1.537	0.314	18.45	−16.355**	−2.857	0.174	5.585
NPL_{scbs}	−18.069**	−2.800	0.155**	6.234	−18.505**	−0.790	0.427	37.822
NPL_{fcbs}	−3.244	−1.219	0.375	26.926	−16.431*	−2.863	0.174	5.563
FI^1	−8.739	−2.038	0.233	10.60	−16.398*	−2.853	0.174	5.613
FI^2	−5.639	−1.628	0.288	16.035	−16.356*	−2.858	0.174	5.579
FI^3	−13.389	−2.586	0.193	6.810	−14.605*	−2.667	0.182	6.441
$FDI_{volatility}$	−4.207	−1.264	0.300	19.845	−70.773*	−5.905	0.083	1.474
RE	−7.272	−1.860	0.255	12.604	−16.434	−2.860	0.174	5.581
TO	−9.94	−2.092	0.21051	9.75269	−16.115	−2.799	0.173	5.886
Asymptotic critical values: Ng and Perron (2001), Table 1				1%	−23.80	−3.420	0.143	4.030
				5%	−17.300	−2.910	0.168	5.480
				10%	−14.200	−2.620	0.185	6.670

Table 5. Augmented ARDL cointegration test

		F-bound	*t*-DV	*F*-IDV	Remark
Panel A: For private commercial banks					
$F\left(NPL_{PCBS}\right)=\left(NPL_{PCBS}/FI_1,RO,TO,FDI_{volatility}\right)$		7.211	−5.646	4.988	Presence
$F\left(NPL_{PCBS}\right)=\left(NPL_{PCBS}/FI_2,RO,TO,FDI_{volatility}\right)$		11.972	−8.441	10.671	Presence
$F\left(NPL_{PCBS}\right)=\left(NPL_{PCBS}/FI_3,RO,TO,FDI_{volatility}\right)$		10.723	−3.969	16.284	Presence
Panel B: For state-owned commercial banks					
$F\left(NPL_{SCBS}\right)=\left(NPL_{SCBS}/FI_1,RO,TO,FDI_{vol}\right)$		5.501	−3.501	3.833	Presence
$F\left(NPL_{SCBS}\right)=\left(NPL_{SCBS}/FI_2,RO,TO,FDI_{vol}\right)$		7.722	−3.468	4.643	Presence
$F\left(NPL_{SCBS}\right)=\left(NPL_{SCBS}/FI_3,RO,TO,FDI_{vol}\right)$		9.552	−2.921	9.808	Presence
Panel C: For foreign commercial banks					
$F\left(NPL_{FCBS}\right)=\left(NPL_{FCBS}/FI_1,RO,TO,FDI_{vol}\right)$		6.975	−4.251	13.285	Presence
$F\left(NPL_{FCBS}\right)=\left(NPL_{FCBS}/FI_2,RO,TO,FDI_{vol}\right)$		13.574	−11.125	9.848	Presence
$F\left(NPL_{FCBS}\right)=\left(NPL_{FCBS}/FI_3,RO,TO,FDI_{vol}\right)$		12.162	−5.214	12.094	Presence

Critical value : *K* = 4	1%		5%		10%	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Pesaran et al. (2001)	4.59	6.368	3.276	4.63	2.696	3.898
Narayan t test	−3.43	−4.6	−2.86	−3.99	−2.57	−3.66
Sam et al. (2019)	3.58	5.91	2.46	4.18	2.00	3.47

cal equation, the next step is to investigate the magnitude of long-run and short-run coefficients running from financial innovation, FDI volatility, remittance, trade openness and NPLs in Bangladesh. The empirical model results are reported in Table 6.

The following section investigates asymmetric effects of financial innovation, remittance, trade openness, and FDI volatility on NPLs by performing a nonlinear ARDL equation. Table 7 exhibits the results of nonlinear models consisting of a six-panel representation.

Table 6. Long-run and short-run model coefficients

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Panel A: Long-run coefficients									
FI^1	0.063***	−	−	0.085***	−	−	0.060***	−	−
FI^2	−	0.070***	−	−	0.077***	−	−	0.035***	−
FI^3	−	−	0.041***	−	−	0.078***	−	−	0.022***
FDI_{vol}	0.096**	0.084**	0.035**	0.030**	0.109**	0.034***	0.072***	0.047***	0.087***
RE	−0.283***	−0.257***	−0.161**	−0.137***	−0.108**	−0.136***	−0.036***	−0.099***	−0.069***
TO	−0.086***	−0.090**	−0.066***	−0.194**	−0.112***	−0.069***	−0.105***	−0.080***	−0.102***
C	−10.506***	−0.533**	−9.522***	−0.782***	−0.441***	−0.362***	0.744***	−1.102***	−1.445***
Panel B: Short-run coefficients									
φ	−0.389***	−0.655***	−0.587***	−0.530***	−0.752 ***	−0.461***	−0.181***	−0.174***	−0.183***
β^1	0.081***			0.082**			0.045**		
β^2		0.085**			−0.040*			0.063	
β^3			0.012*			0.021			0.087**
Υ	0.096	−0.062**	−0.012***	−0.067**	−0.098**	−0.016*	−0.076*	−0.017**	−0.094**
μ	−0.081***	−0.019***	−0.012 **	−0.026***	−0.006***	−0.049***	−0.068**	−0.053**	−0.025**

Table 6 (cont.). Long-run and short-run model coefficients

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Panel C: Residual diagnostic test									
R^2	0.920	0.893	0.964	0.952	0.808	0.815	0.177	0.851	0.865
$F^2_{statistics}$	9.496	13.691	16.633	10.753	11.487	9.496	13.691	16.633	7.223
x^2_{Auto}	0.113	0.672	0.375	0.270	0.057	0.690	0.716	0.979	0.981
x^2_{Hete}	0.720	0.637	0.926	0.882	0.782	0.331	0.107	0.317	0.112
x^2_{Nor}	0.992	0.437	0.023	0.554	0.476	0.532	0.423	0.466	0.887
x^2_{RESET}	0.116	0.717	0.955	0.085	0.022	0.631	0.912	0.292	0.193

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

Table 7. NARDL model estimation results

	Private commercial bank			State-owned commercial bank			Foreign commercial bank		
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
Panel A: Cointegration test									
$Fpass$	3.479	34.676	12.912	16.923	5.092	3.477*	11.823	12.901	6.091
$Wpss$	12.345	12.457	11.054	7.084	11.041	7.041	10.447	16.754	10.447
$tDBM$	−7.177	−5.712	−14.274	−8.274					
Panel B: Long-run coefficients									
LR^+_{FI1}	0.095$_a$			0.061*			0.018$_a$		
LR^-_{FI1}	0.014$_a$			0.045$_a$			0.069$_b$		
LR^+_{FI2}		0.021$_a$			0.078$_b$			0.091$_b$	
LR^-_{FI2}		0.069$_b$			0.021$_b$	0.084$_a$		0.012$_a$	
LR^+_{FI3}			0.112$_a$			0.071$_b$			0.151$_b$
LR^-_{FI3}			0.090$_b$			0.068$_b$			0.092$_a$
LR^+_{FDIvol}	0.053$_a$	0.023$_b$	0.018$_a$	0.089$_b$	0.057$_a$	0.065$_b$	0.019$_a$	0.011$_b$	0.048$_b$
LR^-_{FDIvol}	0.073$_a$	0.042$_a$	0.096$_a$	0.088$_a$	0.049$_b$	0.022$_a$	0.064$_a$	0.047$_a$	0.064$_a$
LR^+_{R}	−0.092$_b$	−0.0241$_9$	−0.092$_a$	−0.387$_b$	−0.074$_b$	−0.069$_a$	−0.046$_b$	−0.081$_b$	−0.045
LR^-_{R}	0.006$_b$	0.022	0.006$_b$	0.037$_b$	0.033$_b$	0.062$_b$	0.094$_b$	0.078$_b$	−0.061$_b$
LR^+_{TO}	−0.025$_a$	−0.060$_a$	−0.075$_b$	−0.074	−0.061$_b$	−0.039$_b$	−0.087$_b$	−0.042$_b$	−0.175$_b$
LR^-_{TO}	−0.043$_b$	−0.085$_a$	−0.003$_b$	−0.049$_a$	−0.007$_b$	−0.068$_b$	−0.071$_b$	−0.071$_b$	−0.045$_b$
Panel C: Short-run coefficients									
$ECT-1$	−0.389$_a$	−0.271$_a$	−0.260$_a$	−0.401$_a$	−0.389$_a$	−0.207$_a$	−0.263$_a$	−0.175$_a$	−0.220$_a$
FI^+	−0.012b	−	−	−0.012b	−	−	−0.018b	−	−
FI^-	−0.023b	−	−	−0.013b	−	−	−0.005b	−	−
FI^+	−	−0.039a	−	−	−0.024	−	−	0.016	−
FI^-	−	−0.009a	−	−	−0.061	−	−	−0.063	−
FI^+	−	−	−0.009	−	−	−0.002	−	−0.025	−0.085
FI^-	−	−	−0.008	−	−	−0.004	−	−0.017	−0.016
R^+	−0.003$_a$	−0.002$_a$	−0.081$_a$	−0.003$_a$	0.009$_a$	−0.154$_a$	−0.018$_a$	−0.065$_a$	−0.037$_a$
R^-	−0.029	0.004	−0.002	−0.002	−0.377	−0.099	−0.021	−0.040	−0.024
TO^+	−0.007$_a$	−0.024	0.003$_a$	0.011	−0.053$_a$	−0.086	0.011$_b$	−0.014$_b$	−0.003
TO^-	−0.016	−0.015a	−0.002	−0.014	−0.475	−0.048a	−0.035	−0.026	−0.004b
FDI^+	−0.007$_b$	−0.007	0.006$_a$	−0.491	−0.205$_a$	−0.091	0.007$_a$	−0.073	0.013
FDI^-	−0.004	−0.006$_b$	−0.002	−0.502	0.002	0.157	−0.677	−0.518	−0.004$_a$

Table 7 (cont.). NARDL model estimation results

	Private commercial bank			State-owned commercial bank			Foreign commercial bank		
	[1]	**[2]**	**[3]**	**[4]**	**[5]**	**[6]**	**[7]**	**[8]**	**[9]**
Panel D: Symmetry test									
W_{LR_FI1}	21.025$_a$	–	–	14.766$_a$	–	–	13.157$_a$	–	–
W_{SR_FI1}	18.148$_a$	–	–	11.628$_a$	–	–	22.814$_a$	–	–
W_{LR_FI2}	–	14.797$_a$	–	–	6.759$_c$	–	–	11.277$_a$	–
W_{SR_FI2}	–	19.657$_a$	–	–	20.739$_a$	–	–	10.937$_a$	–
W_{LR_FI3}	–	–	15.202$_a$	–		8.317	–	–	12.398$_a$
$W_{SR_{FI3}}$	–	–	9.762$_b$	–	–	9.587$_b$	–	–	13.938$_b$
W_{LR_R}	12.642$_a$	11.628$_a$	13.603$_a$	11.964$_a$	12.384a	12.642$_a$	7.308$_c$	15.266$_a$	13.788$_a$
W_{SR_R}	5.823	7.946$_b$	5.774	1.431	8.908$_b$	1.969	3.201	1.941	1.773
W_{LR_TO}	6.086$_c$	6.051$_c$	7.827$_c$	6.826$_c$	9.253$_b$	14.086$_a$	14.305$_a$	14.655$_a$	10.302a
W_{SR_TO}	4.328	1.867	0.071	2.527	9.034$_b$	6.046	9.252$_b$	5.944	1.78
W_{LR_FDIvoi}	13.556$_b$	8.891$_b$	13.848$_a$	6.742$_c$	16.429$_a$	3.556	5.324	9.472$_b$	14.400$_a$
$W_{SR_{FDIvoi}}$	2.585	1.659	4.139	8.14	2.788	9.384	6.775	3.786	9.31$_b$
Panel E: Residual diagnostic test									
x^2_{Auto}	0.614	0.886	0.387	0.330	0.928	0.219	0.620	0.384	0.681
x^2_{Hete}	0.708	0.295	0.052	0.562	0.235	0.728	0.748	0.420	0.903
$x^2_{Normality}$	0.632	0.187	0.933	0.119	0.017	0.292	0.162	0.480	0.137
x^2_{RESET}	0.924	0.290	0.481	0.619	0.570	0.821	0.794	0.609	0.233

Note: The subscripts of a/b/c specify the level of significance at 1%, 5%, and 10%, respectively.

Table 8. Toda-Yamamoto causality test results (dmax=4)

	NPL	*FI*	*FI*	*FI*	*TO*	*R*	*FDI _ vol*
Panel A: For private commercial banks							
NPL	–	11.889$_a$	10.353$_a$	21.439$_a$	12.664$_a$	21.853$_a$	10.088$_a$
FI	1.807	–	4.773	11.725$_a$	5.866	7.673$_b$	0.761
FI	11.580$_a$	12.022$_a$	–	2.893	3.909	2.159	10.670$_a$
FI	3.586	10.533$_a$	7.443$_b$	–	2.972	0.338	0.213
TO	8.438$_b$	10.192$_a$	1.107	0.446	–	0.310	1.393
R	14.299$_a$	3.682	5.348	10.948$_a$	14.669$_a$	–	10.129$_a$
FDI _ vol	2.286	3.468	10.383$_a$	2.569	3.204	13.047$_a$	–
Panel B: For state-owned commercial banks							
NPL	–	10.272a	8.233b	15.149a	13.62a	12.294a	14.078a
FI	12.754a	–	6.74	11.547a	10.972a	9.167b	11.364a
FI	10.75a	8.326c	–	2.316	4.76	2.937	0.067
FI	7.434c	11.553a	1.099	–	5.363	2.978	0.889
TO	9.05b	1.241	0.465	1.475	–	5.54	1.097
R	11.132a	4.427	9.571b	17.839a	27.729	–	1.669
FDI _ vol	8.391c	12.931a	2.621	4.787	6.158	10.309a	–

Table 8 (cont.). Toda-Yamamoto causality test results (dmax=4)

	NPL	FI	FI	FI	TO	R	FDI _vol
Panel C: For foreign commercial banks							
NPL	–	13.675a	17.613a	11.747a	4.039	10.052a	7.135c
FI	0.013	–	4.228	11.337	6.082	5.524	0.791
FI	10.671a	9.933b	–	12.922a	4.627	2.418	0.187
FI	0.354	0.315	0.445	–	0.115	4.193	3.02
TO	5.324	0.161	1.189	0.861	–	1.827	0.267
R	2.974	1.337	4.428	1.19	9.207b	–	2.253
FDI _vol	21.87a	5.224	11.685a	2.183	10.152a	1.21	–

The next section deals with gauging the directional causality by performing equation (8), and the results are displayed in Table 8. Causality results for NPL for private commercial banks are reported in a panel A; results for state-owned bank are displayed in panel B, and for foreign commercial banks – in panel C.

4. DISCUSSION

The results of the impact of financial innovation on NPLs establish a positive link between them. These findings indicate that the excessive financial innovation adaptation and diffusion adversely cause detreating the financial system's loan performance. Referring to the magnitudes of financial innovation, it is apparent that state-owned banks' loan performance in Bangladesh is more intense compared to other segments of bank operation. This finding advocates that bank-based financial institutions must behave rationally by understanding the significance of loan performance and possible consequences of excessive innovativeness in the credit portfolio.

FDI volatility and NPLs nexus reveal a positive association, indicating that the performance of FDI inflow variation in the economy determines the credit performance in the financial system. The evidence is that accumulating long-term capital for investment FDI is positioned on the top because FDI inflows accelerate domestic production activities and promote domestic enterprise expansion. Thus, any innovation in FDI, especially adverse shocks, directly injects a negative wave towards domestic firms, and their performance hinders FDI fluctuation. Eventually, the firm's loan performance to financial institutions hampered at large.

The role of remittances in Bangladesh's economy is well appreciated. In the case of overall loan performance s, remittance inflows enhance credit performance by decreasing the propensity to become a credit defaulter. The impact of remittance inflows on credit performance is positively associated, implying that remittances negatively cause NPLs in all segments of bank-based financial institutions. Moreover, in terms of remittance effects, private commercial banks are getting more assistance for decreasing the number of credit defaulters compared to state-owned and foreign commercial banks' operations in Bangladesh.

Trade openness augments aggregate output by expanding business activities by allowing them to participate in the international arena. Trade openness brings a positive wave into the economy, and financial institutions are not isolated from that wave. Referring to model findings, it is noticeable that trade openness helps financial institutions recover their loan performance, which ingresses that negative relationship between trade openness and NPLs.

The error correction term (ECT) represents the speed of adjustment towards long-run equilibrium, which is negative in sign and statistically significant. Table 6 shows that the error correction term (ECT–1) of each specified model is negative and statistically significant at a 1% significance

level. The impact of financial innovation on NPLs is positive in most cases; however, only a few coefficients are statistically significant. Empirical models pass with several diagnostic tests, and their results are reported in Panel C of Table 6. Study findings reveal that all the empirically tested models are free from serial correlation, residuals of error are normally distributed, the issues of heteroskadacity are missing, and internal consistency and stability test confirms models capacity to produce unbiased estimation.

Asymmetric cointegration is evaluated by performing three tests: Fpss, Wpss, and tBDM, and their test statistics are displayed in Panel A (Table 7). All the test statistics are statistically significant at a 1% level, suggesting the rejection of the null hypothesis: "No asymmetric cointegration". This finding suggests that asymmetric cointegration prevails between financial innovation, remittance, trade openness, FDI volatility and NPLs.

In the long run, the asymmetric shocks that are positive and negative in financial innovation expose a positive linkage with NPLs. All the coefficients are statistically significant at a 1% or 5% significance levels. These findings suggest that the role of financial innovation is critical for the banks' credit performance. According to estimations, positive growth can intensify the current state of credit performance degradation and control in financial innovation to manage the present state of credit performance. Moreover, the magnitudes of positive innovation produce more intense than negative shocks in the financial system. Thus, the strategy formulation for credit expansion seeks special attention to gauge financial innovation's role, since it plays a meaningful role in financial development. The asymmetric shocks of FDI volatility establish a positive association with NPLs in the long run, and all the coefficients appear statistically significant at a 1% or 5% levels. A positive association suggests that stability in receiving FDI helps capital accumulation and aggregate productivity expansion, allowing growth in domestic firms. According to the coefficients of asymmetric shocks, i.e., positive and negative innovation, it is palpable that reducing the present state of credit situation can be improved by reducing FDI volatility, implying that stability in FDI inflows lessens the effects of volatility, which will

bring positive wave in credit performance in the end. Positive shocks in remittance inflows establish negative associations with NPLs, and negative shocks in remittance inflows expose a positive association with NPLs. These findings suggest that continual inflows of remittances in the economy emerged as an alternative channel for money supply and support for capital formation.

Finally, the asymmetric effects of trade openness on NPLs reveal asymmetric shocks in trade openness and establish negative links with NPLs. Study findings suggest that domestic trade expansion allows firms' earning capacity and increases their credit payment capacity for credit approval from financial institutions. A negative tie between negative shocks and the state of NPLs reveals that decreasing the possibility of domestic trade expansion intensifies the deterioration of credit performance, indicating firms' incapacity for paying credit payment and becoming defaulter eventually.

The results of the short-run model estimation are displayed in Panel C of Table 7. The coefficient of the error term reveals a negative sign and is statistically significant at a 1% level. These findings suggest the speed of long-run convergence due to shocks in the short run, which refers to the short-run asymmetric impact of financial innovation, remittances, trade openness, and FDI volatility on NPLs. Study findings establish a negative linkage between proxies of financial innovation and NPLs, but in terms of magnitudes, financial innovation is not as critical as appeared in the long run; however, all the coefficients are statistically significant. Regarding the remittance asymmetric shock, only positive variations expose a negative tie with NPLs, and all the coefficients are statistically significant at 1%. Furthermore, the asymmetric impact of trade openness and FDI volatility establish statistically insignificant results in most cases.

Symmetry results for the long term are reported in panel D of Table 7 by performing the standard Wald test with the null hypothesis of symmetry. The Wald test statistics revealed the rejection of the null hypothesis and alternatively established asymmetric relations between financial innovation, remittances, trade openness, FDI volatility, and NPLs. Whereas in the short run, all three proxies of financial innovation establish an asym-

metric association with NPLs. Besides, the Wald test results produce conclusive evidence supporting the presence of short-run asymmetry running between remittances, trade openness, FDI volatility and NPLs. The empirical model also undergoes several residual diagnostic tests and unveils estimation unbiasedness, efficiency, and stability when capturing the equation's probable effects.

The results of the study reveal quite a few causal associations between financial innovation, trade openness, remittances, FDI inflows, and NPLs. However, the study predominantly focuses on causality running towards non-performing loans. The study reveals a bidirectional causality between financial innovation and NPLs [FI↔NPLs], trade openness and NPLs [TO↔NPLs], as well as remittances and NPLs[R↔NPLs], which are available in Panel A and Panel B (Table 8). On the other hand, a bidirectional causality between FDI volatility and NPLs is established in Panels B and C. The findings suggest that domestic firm credit performance are largely dependent on macrofundamentals; hence, financial policymakers should emphasize the impact of macroeconomic movements on the implementation of financial policies.

CONCLUSION

The aim of this study is to gauge the effects of financial innovation, remittances, trade openness, and FDI volatility on credit performance in Bangladesh's financial system for the period 1981–2019. An empirical model estimation with AARDL reveals a positive association between financial innovation and NPLs in all banks in Bangladesh. Considering financial innovation elasticities on NPLs, it is evident that state-owned banks show more vulnerability in the process of detreating credit performance, compared to private and foreign banks in the financial system. This finding suggests that state-owned banks must make considerable efforts to understand the ultimate impact of financial innovation while deciding to adopt and disseminate financial innovation in their business models. Furthermore, a positive link reveals FDI volatility to NPLs, indicating that scarcity in capital adversely affects business operations, thus reducing the capacity to perform credit obligations to the financial institutions. This is because FDI inflows are critically significant for supplying capital and smooth business operations.

The results of non-linear ARDL test ascertain the presence of the asymmetric cointegration between financial innovation, remittances, trade openness, FDI volatility and NPLs. Moreover, financial innovation's asymmetric shocks expose a negative linkage with credit performance in all three model estimations. However, in terms of elasticities of asymmetric shocks, the study found that positive shocks in financial innovation are more prominent than negative variations. This fining explains that lessening the present state of credit performance, that is the reduction of credit defaults in the financial system, it is immensely significant to establish control over the speed of financial innovation diffusions in the system. The asymmetric effects of remittance and trade openness reveal a positive link with credit performance in the financial system. The role of remittances and trade openness is critically significant because of money supply management, financial efficiency, and capital accumulation from the expansion of domestic business. Finally, continual inflows of FDI are critical for the financial system, since long-term investment and capital asset mobilization increase aggregate productivity and create domestic enterprises' scope for glut earnings.

In summary, the findings reveal that excessive financial innovations play a detrimental role in bank-based financial institutions' credit performance, both in the long and short run. Thus, financial institutions have to be very cautious when offering innovative credit products, though financial innovation helps enhance financial performance; however, adverse effects can cause credit performance with a negative note. The expansion of domestic output accelerates the credit scope for the financial institutions and, at the same time, boosts credit performance. Therefore, contraction economic policies can adversely cause trade liberalization and, ultimately, contribute to credit de-regularization in the financial system.

LIMITATION AND FUTURE STUDY

This form of research addresses the impact of macrofundamentals on credit performance and, to some extent, can produce one direction findings. An extended future study can be executed by considering key variables related to fiscal and monetary policy, since the credit performance of financial institutions, especially bank-based institutions, is highly dependent on government policy decisions. Furthermore, by taking other countries in the study, a comparative assessment can be made.

AUTHOR CONTRIBUTIONS

Conceptualization: Md. Qamruzzaman.
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Formal analysis: Md. Qamruzzaman.
Funding acquisition: Md. Qamruzzaman.
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Writing – original draft: Md. Qamruzzaman.
Writing – review & editing: Md. Qamruzzaman.

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