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Exploring the Nexus between Financial Literacy, Electronic Payment, Formal Account Ownership, Savings and Credit to Private Sector Nexus in MINT: Accounting for the Role of Political and Climate Risks

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Abstract

This study delves into the intricate nexus between financial literacy, electronic payment, formal account ownership, savings, and credit to the private sector in MINT (Mexico, Indonesia, Nigeria, and Turkey) countries from 2000 to 2021. This study seeks to assess the influence and interactive impact of credit accessibility enhanced by financial literacy, electronic payments, and formal account ownership and credit to the private sector, with a particular emphasis on the influential roles of political and climate risks. Utilizing a robust methodology, the panel Autoregressive Distributed Lag (ARDL) baseline model was adopted to estimate the long and short run. Additionally, panel dynamic Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS) models are employed as robustness checks to ensure the reliability and validity of the study findings. Our findings reveal noteworthy insights that show that financial literacy, electronic payments, and formal account ownership exhibit significant negative impacts on credit to the private sector. The role of savings is nuanced, with both negative and positive influences on credit across diverse models. The short-run error correction model (ECM) results indicate the pace of adjustment from short-run shocks to the long-run equilibrium annually. To enhance the understanding of this nexus, the pivotal influence of political and climate risks on credit to the private sector was captured. The FMOLS and DOLS robustness check results underscore the complexity of these nexus, revealing mixed effects in the context of MINT countries. Based on these findings, this study proposes practical recommendations that include the improvement of internet broadband networks to facilitate electronic transactions, the integration of financial education into educational curricula to enhance financial literacy, and addressing political and climate-related crises to foster business and economically friendly environments to enhance credit to the private sector in MINT economies. This study contributes valuable information to the discourse on the intricate dynamics of financial systems in emerging economies, particularly in the context of MINT countries.

1. Introduction

The growth, development, and stability of the MINT countries (Mexico, Indonesia, Nigeria, and Turkey) in the 21st century is considered an emerging economic bloc of the world anchor, among other things, on her youthful and favourable demographic dividend, economic potential, infrastructure development, political stability, and increasing integration into the global economy. Although challenges exist, MINT countries are key players in shaping the economic landscape of the 21st century. The influence of finance, particularly credit to the private sector, in fostering stability and economic development over the decades has garnered attention from diverse scholars. Over the decades, the findings of Schumpeter (1911), Idun and Aboagye (2014), Laeven, Levine, and Michalopoulos (2015), and Assefa Assef (2014) have significantly contributed to this discourse, emphasizing the significance of private sector credit in stimulating economic growth. The focus on MINT countries is particularly relevant given their shared aspirations for rapid economic development since the establishment of this economic bloc.

At the heart of this unending discourse lies the intricate nexus between financial literacy, electronic payment systems, formal account ownership, savings, and accessibility of credit to the private sector. Credit, encompassing loans, advances, securities, and trade credits, is key to providing financial resources for human, economic, and business development to engage in the production of goods and services (World Bank 2022). The resourceful utilization of credit is contingent upon individuals' financial literacy to channel funds into productive economic and business activities (Lusardi, 2009; Pierre-Carl, 2017; Abeysuriya, 2018; Edirisinghi et al., 2017; Nahar et al., 2022; Beal & Delpachitra, 2003). Thakur and Mago (2021) argue that the stability and significant positive nexus between financial attitude, investment, and human capital development anchors the efficiency of financial institutions to inculcate savings habits through efficient financial intermediation for business improvement (Gbenga et al., 2019; Obeng-Amponsah et al., 2019; Mukuka, 2019).

The efficiency of electronic payment systems and the prevalence of formal account ownership within the MINT countries' economic space anchors on the advent of technological innovation in financial services to streamline credit movement from financial institutions to the private sector, making transactions secure, easy, and cost-effective (Idun and Aboagye, 2014; Nasir et al., 2020) and also bridging income inequality, and expanding access to affordable, flexible, and convenient

financial services globally (Van et al., 2021; Ifediora et al., 2022; Wang et al., 2022; Dahiya and Kumar, 2020; Nazir et al., 2020).

Empirically, the findings of Udo et al. (2023) and Ifediora et al. (2022) reveal that the extension of credit to the private sector is influenced by various factors, such as political and climate risks stemming from diverse institutional and human environments. In MINT countries, the influence and contribution of political and climate risks in shaping the credit landscape add another layer of complexity to this dynamic nexus. Political instability and climate-related uncertainties facilitate and impede the flow of credit to the private sector through credit market disruption, affecting the disposition of financial institutions to spread credit facilities to economic agents operating in the base of MINT countries (Udo, et, al 2023; Udoh, et, al 2016). Similarly, climate risks influence the operational functionalities of businesses, savings, and investments, subsequently influencing financial institutions' prowess in providing affordable and flexible credit facilities to the private sector. Previous studies assessing this nexus have focused on financial literacy, electronic payment, formal account ownership, savings, and credit to the private sector in major economic bloc like the European Economic Area (EEA), The ASEAN Economic Community (AEC), The Southern African Development Community (SADC) among others, these studies ignore the contributive impact of political and climate risks and the influence in MINT economic bloc. This study contributes to the extant literature by incorporating political and climate risks within the MINT context.

This study aims to bridge this gap by comprehensively investigating the long-run and short-run effects of these variables on private sector credit from 2000 to 2021, exploring the nexus between financial literacy, electronic payment, formal account ownership, savings, and credit to the private sector in MINT countries employing the panel ARDL model and panel dynamic Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS) models as robustness checks to ensure the reliability and validity of the study findings to address the endogeneity problem and country-specific variations inherent in panel studies and ignored by prior studies. The intricate interplay between financial literacy, electronic payment systems, formal account ownership, savings, and the influence of political and climate risks on credit accessibility in MINT countries presents a multifaceted research frontier.

The uniqueness of this study anchors to its focus on political and climate risks within the MINT context and provides valuable insights into the broader discourse on economic development in emerging economies. Addressing this complexity contributes significantly to the understanding of the economic dynamics within MINT countries and offers valuable insights for policymakers, financial institutions, and scholars on the nexus.

2. REVIEW OF LITERATURE

The growth and stability of the financial sector in the 21st century has undergone a substantial transformation, specifically after the 2007-2008 global financial crisis, which exposed regulatory framework weakness. In response, several countries, particularly the MINT countries, implemented substantial regulatory reforms to enhance financial stability. This is evident in the Dodd-Frank Wall Street Reform and Consumer Protection Act in the United States, which addresses systemic risk, transparency, and consumer protection. The Findings of Udo et al. (2019), Udo et al. (2023), Gbenga et al. (2019), Nazir et al. (2020), and Ifediora et al. (2022) attribute the 2015 economic recession in Nigeria to financial instability and regulatory framework weakness. This is evident in recent regulatory adjustments to strengthen banking supervision, enhance risk management, and promote financial inclusion through financial technology to increase access to affordable, flexible, and convenient financial services in Nigeria (Udo, et, al 2023). Rapid technological changes, advancements in information and communication technology, and digital transformation in the financial sector have effectively disrupted traditional banking models with a profound impact on the operational activities of the financial markets and intermediation sectors, thereby offering a new and efficient conduit for delivering financial services (Gbenga et al., 2019). The introduction of mobile banking, digital payments, and blockchain technology into the operational and business activities of traditional banking has significantly promoted financial inclusion and innovation, and contributed to the growth of the Fintech sector in MINT countries (Udo, et, al 2023; Eze & Egoro, 2016).

Theoretically, King and Levine (1993) revealed that the nexus between financial development and economic growth in a cross-section of 80 nations from 1960 to 1989 is positive and statistically significant. Proxying the financial industry with private sector credit and private credit as a percentage of GDP. Gurley and Shaw's (1967) findings in their financial intermediation theory corroborate the findings of (King & Levine 1993). Schumpeter (1911), the pioneer discussant, and Gurley and Shaw (1967), McKinnon (1973), and Fry (1988), on the causal nexus between financial development and economic growth under the supply leading hypothesis, revealed that economic growth through financial intermediation to the real sectors is

Granger caused by financial sector growth (Udo, et, al 2019).

On the contrary, Robinson (1952), the pioneer discussant McKinnon (1973) and Lucas (1988), among others, argues that economic growth spurs financial sector advancement through the GDP per capita growth rate, suggesting a causal nexus between finance and growth under the demand-following hypothesis posits that economic growth stimulates the advancement of the financial sector, suggesting a causal relationship between finance and growth.

Alternatively, Patrick (1966) under the "*stages of development model*" Patrick (1966) argued that the financial sector stimulate economic growth at the initial stage of economic expansion and degenerates as the economy expands for the demand-led finance model to triumph. Patrick proposed causality according to the stages of development of countries and the economic bloc (Udo, et,al 2019a: 2019b).

Empirical Review

The findings of Udo et al. (2019) in Nigeria from 1999 to 2018 revealed that the causal nexus between financial development and economic growth is influenced by the stages and levels of economic and financial sector growth through the appropriate policy mixes of regulators and monetary authorities in Nigeria. Gbenga et al. (2019) proxying financial sector development with total credit to the private sector and money supply in Nigeria observed a positive and significant nexus of financial development, economic growth, and economic growth in Nigeria. In Bangladesh, Begum and Aziz (2019) observed that the proxy for financial sector development by domestic credit to the private sector has a significant impact on GDP. In Ghana, Obeng-Amponsah et al. (2019) proxied financial sector development by money supply and gross capital formation, and observed a positive nexus.

The findings of Pierre-Carl (2017), Abeysuriya (2018), and Edirisinghe et al. (2017) reveal that financial literacy is a crucial factor that influences how individuals utilize credit, save, and invest. Financial literacy spurs improved debt management and reduces wealth inequality. The findings of Wale and Makina (2017) reveal that account ownership and usage are higher among males, middle-aged individuals, higher income earns, and financial literacy in selected sub-Saharan African economies.

Savings accumulation and income diversification contribute to improved credit access in the private sector. Studies by Arslan et al. (2018) and Nguyen et al. (2022a) revealed that financial literacy enhances savings culture and facilitates the financial decision-making of economic agents.

Technological innovation through electronic banking reshaped its financial landscape. The findings of Ugwueze and Nwezeaku (2018) reveal the nexus between electronic banking and the performance of Nigerian commercial banks. These findings emphasize the need for comprehensive awareness campaigns

regarding the benefits of e-banking. The findings of Eze and Egoro (2016) collaborate with those of Ugwueze and Nwezeaku (2018) on the positive impact of electronic banking on the profitability of commercial banks in Nigeria.

The impact of climate risk on financial performance is an emerging area of research. Sun et al. (2020) reveal that the impact of climate-related risks on the financial performance of the mining industry in China has an effect on economic growth. Bolton and Kacperczyk (2021) reveal that the stocks of firms with higher CO2 emissions earn higher returns, indicating that investors demand compensation for exposure to carbon-intensive companies.

The evaluation of the financial sector in the 21st century in MINT countries is marked by technological advancements, the changing dynamics in financial development theories, the growing recognition of the interplay between financial literacy, account ownership, savings, electronic banking, and climate risks on economic growth and development. Empirical studies provide valuable insights into these complex relationships, contributing to a more comprehensive understanding of the modern financial landscape in MINT countries.

2. Methodology

This study employed the *ex-post facto* research design using the panel Autoregressive Distributed Lag (ARDL) approach of Pesaran et al. (1999, 2001) to examine the long- and short-run nexus between exploring the nexus between financial literacy, electronic payment, formal account ownership, and savings on credit to the private sector in MINT countries: the role of political and climate risks. The ARDL model is considered more technically robust than alternatives, such as Johansen and Juselius (1990), Gregory and Hassan (1996), Engle and Granger (1987), and Johansen (1988). The distinctive capability of the ARDL approach lies in its simultaneous estimation of both long- and short-run parameters, facilitating the assessment of the impacts of financial literacy, electronic payment, formal account ownership, and savings on credit to the private sector in MINT countries. Time series data spanning 22 years (2000 – 2021) were collated from the World Bank Development Indicators (WDI, 2021) and the Financial Index Database (Global Findex, 2021). Additionally, data on political and climate risks were obtained from the Global Economic Uncertainty Index Database for various years.

3.1. Model Specification

The fulcrum of this study is to determine the cause-effect nexus among the variables. To achieve this, we estimate the baseline long-run model equation. The model decision rules are the lower critical bound values, where all the variables are 1(0), signifying no integration. The upper bound values denote that all variables are 1(1), signifying integration. To address endogeneity problems associated with the ARDL, cross-sectional dependence, and country-specific effects, fully modified ordinary least squares (FMOLS) and dynamic ordinary least squares (DOLS) were adopted as robustness checks (Manasseh et al., 2017). The generalized ARDL (p, q, q, q) baseline model is expressed as follows:

$$InX_{i,t} = \sum_{j=1}^{p} \alpha_{i,j} InX_{i,t-j} + \sum_{j=0}^{q} \beta_{i,j} Z_{i,t-j} + \sum_{j=0}^{q} \delta_{i,j} Cont_{i,t-j} + \vartheta_i + \varepsilon_{i,t} - - - - - (1)$$

Where $X_{i,t}$ is private sector credit, $Z_{i,t}$ is the vector of the independent variables, $\alpha_{i,j}$ is the coefficient of the lagged dependent variable, $\beta_{i,j}$ = coefficient of the independent variables or coefficient vector. $Cont_{i,t}$ = vector of the control variables, and $\delta_{i,j}$ is the related coefficient of the control variables. ϑ_i = unit-specific fixed effect. $i = 1, \ldots\ldots, N; t = 1,2, \ldots\ldots, T; q\ and\ p$ = optimal lag order. $\varepsilon_{i,t}$ = error term. This study further accounts for the influence of political risks (POR) and climate risks (CLR) on private sector credit in MINT countries. Thus, to assess the financial literacy, electronic payment, formal account ownership, and savings nexus with private sector credit, equation 1 was modified, as shown below:

$$\Delta X_{i,t} = \emptyset_i \left[X_{i,t-1} - \gamma_i Z_{i,t}\right] + \sum_{j=1}^{p-1} \rho_{i,j} \Delta X_{i,t-j} + \sum_{j=0}^{q-1} \sigma_{i,j} \Delta Z_{i,t-j} + \vartheta_i + \varepsilon_{i,t} - - - - - (3)$$

Where $\emptyset_i = -(1 - \gamma_i)$, = group-specific speed of adjustment coefficient (expected that $\emptyset_i > 0$); γ_i = vector of long-run relationships. $ECT = \left[X_{i,t-1} - \gamma_i Z_{i,t}\right]$ = error correction term. $\rho_{i,j}$ and $\sigma_{i,j}$ are the short-run dynamic coefficients. Choosing between fixed effects and random effects models relied heavily on likelihood tests such as the Hausman test. The summarized panel unit root models of Levin, Lin, and Chu (LLC), Im, Pesaran, and Shin (IPS), Fisher-ADF, and Fisher-PP were used to test the stationarity properties of the series.

Robustness Check Model – FMOLS AND DOLS

The FMOLS and DOLS models were adopted to address endogeneity, cross-sectional dependency, and country-specific effects in the model, which have been ignored by previous studies in estimating long-run coefficients. The FMOLS considers a non-parametric approach and cross-sectional heterogeneity. The. The DOLS model is a parametric approach. FMOLS and DOLS are specified as follows:

$$\beta FMOLS = \left[N^{-1} \sum_{i=1}^{N} \left(\sum_{t=1}^{T} (P_{i,t} - P_{i,t})^2\right)\right] X \left[\left(\sum_{t=1}^{T} (P_{i,t} - P_{i,t})\right)\right] S_{i,t} - T\Delta_{\varepsilon u} - - - - - - - - - (13)$$

$$\beta DOLS = \left[N^{-1}\sum_{i=1}^{N}\left(\sum_{t=1}^{T}(W_{i,t}+P_{i,t})^{-1}\right)\left(\sum_{t=1}^{T}(P_{i,t}-P_{i,t})\right)\right]S_{i,t} - T\Delta_{\varepsilon u} - - - - - - - - (14)$$

where p is the explanatory variable, S the dependent variable, and Z the repressor vector (W = P – P).

4. DATA PRESENTATION AND ANALYSES

4.1. Data Description

Basic descriptive statistics of the study variables are presented in Table 1.

Table 1: Descriptive Statistics

Variable	Mean	Median	Max	Min	St. D	Skewness	Kurtosis	JB	Prob.	Obs.
CPS	2.550	2.622	3.743	1.179	0.708	-0.041	1.935	34.18	0.000	88
FIL	-0.219	-0.089	3.092	-4.313	1.988	0.251	1.963	14.86	0.001	88
EBANKING	0.867	0.811	3.037	-0.681	0.694	0.811	4.145	14.12	0.001	86
FAO	4.323	4.636	6.448	0.001	1.733	-0.884	2.775	11.66	0.003	88
SAV	21.03	21.17	25.40	13.59	2.995	-0.579	2.647	45.961	0.000	80
POR	1.165	1.396	3.817	-1.648	1.797	-0.296	1.658	7.889	0.019	88
CLR	4.319	4.324	4.929	3.571	0.273	-0.316	3.131	13.57	0.004	88
M2/GDP	2.338	2.856	4.393	-0.501	1.907	-0.390	1.516	10.30	0.005	88
EXR	3.750	3.847	7.285	0.336	1.517	-0.256	2.134	39.63	0.000	86

Source: Computed by the Author. Note: CPS=credit to the private sector; FIL=financial literacy; EBANKING=electronic banking; FAO=formal account ownership; SAV=savings; POR=political risks; CLR=climate risks; M2/GDP=financial deepening; EXR=exchange rate. The MINT countries include (Mexico, Indonesia, Nigeria, and Turkey).

Table 1 shows the results of the descriptive statistics that describe the variables in the model using basic statistical tools such as mean, median, standard deviation, Skewness, and Kurtosis. The total mean values of the observations move from -4.313 to 25.40. The values of the measures of central tendency did not drift too much from each other, signifying that the variables were normally distributed. The probability values of the Jaque-Bera statistics are less than 0.05, signifying a normally distributed and stable series for the test of study hypotheses. Spearman's correlation was used to test for correlations among the variables. Spearman's correlation results are presented in table 2.

Table 2: Results of Correlation Test

	CPS	FIL	EBANKING	FAO	SAV	POR	CLR	M2_GDP	EXR
CPS	1.000								
FIL	0.908	1.000							
EBANKING	0.702	0.559	1.000						
FAO	-0.630	0.787	0.350	1.000					
SAV	0.820	-0.310	-0.182	-0.432	1.000				
POR	-0.492	0.003	0.005	0.076	-0.355	1.000			
CLR	0.764	0.014	0.019	0.022	0.141	-0.383	1.000		
M2_GDP	-0.802	0.466	0.203	0.628	-0.546	0.702	-0.309	1.000	
EXR	0.831	-0.011	-0.013	-0.143	0.275	-0.314	0.162	-0.268	1.000

Source: Computed by the Author. Note: CPS=credit to the private sector; FIL=financial literacy; EBANKING=electronic banking; FAO=formal account ownership; SAV=savings; POR=political risks; CLR=climate risks; M2/GDP=financial deepening; EXR=exchange rate.

The results in table 2 show that financial literacy and electronic banking have strong positive correlations with private sector credit, and formal account ownership has strong negative correlations with private sector credit. Savings positively correlate with private sector credit and climate risks, whereas political risks have

strong negative correlations with private sector credit in MINT economies.

4. Unit Root

The test results of the unit root demonstrate that the study variables attained stationarity in Order I (1) and level I(0) order of integration. A combination of I (1) and I (0) order of integration gives the Panel ARDL model creditability to test for co-integration and satisfy the Gauss-Markov conditions for unbiased estimation.

Table 2 Unit Root Results

Variable	LLC	IPS	Fisher-ADF	Fisher-PP	Integration Order	
					Level	First-Diff.
CPS	-3.882*** (0.000)	-4.325*** (0.000)	32.39*** (0.000)	32.67*** (0.000)	_	I(1)
FIL	-7.416*** (0.000)	-6.046*** (0.000)	45.57*** (0.000)	52.94*** (0.000)	_	I(1)
EBANKING	-6.431*** (0.000)	-5.487*** (0.000)	41.46*** (0.000)	44.1901*** (0.000)	I(0)	_
FAO	-3.199*** (0.001)	-4.312*** (0.000)	33.86*** (0.000)	85.64*** (0.000)	_	I(1)
SAV	-4.404*** (0.000)	-4.722*** (0.000)	36.66*** (0.000)	82.35*** (0.000)	_	I(1)
POR	-3.822*** (0.000)	-2.634*** (0.004)	22.45*** (0.004)	22.96*** (0.003)	I(0)	_
CLR	-5.836*** (0.000)	-5.765*** (0.000)	43.79*** (0.000)	45.20*** (0.000)	I(0)	_
M2/GDP	-4.057*** (0.000)	-3.290*** (0.001)	26.27*** (0.001)	27.23*** (0.001)	_	I(1)
EXR	-10.56*** (0.000)	-9.545*** (0.000)	74.10*** (0.000)	308.4*** (0.000)	_	I(1)

Source: Computed. ***, ** & * represents the 1%, 5% and 10% respectively (.) is the probability value, while *In* indicates that the variables are expressed in natural logarithms.

Table 4: Pedroni Co-Integration Test Results

	Model 1	Model 2	Model 3	Model 4	Model 5
	Within Dimension	Within Dimension	Within Dimension	Within Dimension	Within Dimension
Panel v-Statistic	-8.553*** (0.000)	-11.99*** (0.000)	-8.005*** (0.000)	-32.18*** (0.000)	-18.69*** (0.000)
Panel rho-Statistic	6.426*** (0.000)	7.466*** (0.000)	2.105*** (0.032)	6.371*** (0.000)	21.64*** (0.000)
Panel PP-Statistic	-3.455*** (0.000)	-5.128*** (0.000)	8.765*** (0.000)	0.588 (0.721)	-8.142*** (0.000)
Panel PP-Statistic	2.827*** (0.008)	0.038 (0.515)	4.103*** (0.000)	9.743*** (0.000)	-5.908*** (0.000)
	Between Dimension	Between Dimension	Between Dimension	Between Dimension	Between Dimension
Group rho-Statistic	9.943*** (0.000)	2.768*** (0.007)	2.863*** (0.007)	2.945*** (0.008)	8.004*** (0.000)
Group PP-Statistic	-5.913*** (0.000)	8.727*** (0.000)	7.129*** (0.000)	9.656*** (0.000)	96.70*** (0.000)

Group ADF-Statistic	2.722*** (0.006)	6.821*** (0.000)	9.449*** (0.000)	19.91*** (0.000)	10.06*** (0.000)

Source: Computed. NB: ***, **, and * represent the 1%, 5%, and 10% levels of significance, respectively, while (.) where denotes the probability value.

The results reported in Table 4 show the presence of a cointegrating nexus between financial literacy, electronic payments, formal account ownership, savings, and credit to the private sector in MINT countries. The probability values of the Pedroni tests for all models were less than 5%. This aligns with the findings of (Mukuka 2019, Wale and Makina 2017, Ugwueze and Nwezeaku 2018, and Thalur and Mago 2021) among others.

Baseline ARDL Results

The panel ARDL results and the diagnostic test results of the Breusch-Godfrey Serial Correlation LM Test, Ramsey Reset test of specification, and white heteroscedasticity presented in Table 5 across models (1-5) shows that financial literacy (FIL), electronic payment (E-banking), and formal account ownership (FAO) positively and significantly impact private sector credit. This contrasts with the findings of Panman et al. (2022), Ugwueze and Nwezeaku (2018), and Thalur and Mago (2021). Additionally, savings (SAV) exhibit both positive and negative significant effects on private sector credit, indicating that savings received by financial institutions and their influence on credit disbursement to the private sector is determined by macroeconomic conditions such as inflation rate and unfavorable exchange rates (King et al. 2015, Ndlovu 2013, Mukuka 2019, Wale & Makina 2017, Ugwueze and Nwezeaku 2018, Thalur & Mago 2021) among others.

To deepen the investigation, the interactive effects of financial literacy, electronic payment, formal account ownership, and savings with political risks and climate were assessed on private sector credit. The findings reveal that the interactions between FILPOR, E-banking POR, FAOPOR, and SAVPOR have negative and significant impacts, indicating that political risks disrupt the flow of credit in the economy. These results indicate that government actions, such as monetary policies influenced by political conflicts, hinder credit flow and emphasize the need for political stability (Chi and Li 2017, Mukuka 2019, Panman et al. 2022, Ugwueze & Nwezeaku 2018, Thalur and Mago 2021) among others. In a similar manner, climate risks such as floods and environmental degradation have adverse effects on the activities of manufacturing firms and companies that mainly produce goods and services. This is in accordance with the findings of this study, which show that the interactive effects of FIL*CLR, Ebanking*CLR, FAO*CLR, and SAV*CLR negatively influence private sector credit in MINT countries. To ameliorate this, activities that may lead to

climate-related risks should be avoided in MINT countries.

Table 5: Estimated ARDL Results

Variable	1	2	3	4	5
lnCPS(-1)	0.016*** (0.004)	-0.066 (0.307)	0.105*** (0.000)	0.119*** (0.000)	3.182** (0.011)
lnFIL	0.047*** (0.000)		0.011 (0.290)	0.410*** (0.000)	0.276*** (0.007)
lnEBANKING	0.017** (0.029)	0.755** (0.021)		0.311*** (0.000)	0.812*** (0.000)
lnFAO	0.029*** (0.001)	0.014*** (0.000)	0.001*** (0.000)		0.005** (0.027)
lnSAV	0.002*** (0.001)	-0.001 (0.148)	-8.077*** (0.000)	-3.923*** (0.005)	
lnPOR	-0.470*** (0.001)				
lnCLR	-0.151*** (0.007)				
lnM2/GDP	-0.532*** (0.001)	0.074** (0.021)	0.017*** (0.000)	0.016*** (0.000)	0.037* (0.042)
lnEXR	0.124*** (0.000)	0.090*** (0.000)	-0.004*** (0.000)	-0.006*** (0.000)	0.002 (0.166)
lnFIL*lnPOR		-1.063*** (0.000)			
lnEBANKING*POR			-0.002** (0.034)		
lnFAO*lnPOR				-7.214*** (0.000)	
lnSAV*lnPOR					-0.239** (0.014)
lnFIL*lnCLR		-0.082*** (0.000)			
lnEBANKING*lnCLR			-0.003*** (0.000)		
lnFAO*lnCLR				-3.554*** (0.000)	
lnSAV*lnCLR					-0.088*** (0.000)
No. of Obs.	84	84	80	80	80
Hausman	15.31 (0.083)	24.72 (0.002)	27.93 (0.001)	7.974 (0.435)	12.45 (0.131)
Normality	1769.71 (0.000)	1679.8 (0.000)	1206. (0.000)	1072. (0.000)	1725. (0.000)
Serial Cor.	2.433 (0.095)	2.361 (0.101)	4.519 (0.814)	5.020 (0.569)	2.809 (0.064)
Ramsey	-0.012 (0.003)	-0.009 (0.001)	-0.061 (0.000)	-0.059 (0.000)	-0.013 (0.015)
Het.	2.991 (0.904)	2.266 (0.831)	1.372 (0.222)	3.346 (0.472)	5.055 (0.467-)

Source: Computed. Note: ***, **, and * represent 1%, 5%, and 10% levels of significance, respectively, (.) represents the probability value and in indicates that the variables are expressed in natural logarithms.

The short-run dynamics for the specified models presented in Table 6 show that the error correction term (ECT_{t-1}) is significant and negative, indicating the speed of adjustment to equilibrium in the long run owing to short-run shocks or dynamics. The findings further show that climate risk (CLR) negatively and significantly impacts private sector credit in MINT countries in the short run. These findings are in agreement with those of (Dahiya and Kumar 2020, Edward 2018, Eze and Egoro 2016, Gbenga et al. 2019) among others.

Table 6: Results for Short-Run Dynamic

Variable	1	2	3	4	5
ECT(-1)	-0.208*** (0.009)	-0.220** (0.021)	-0.185*** (0.000)	-0.475*** (0.000)	-0.172*** (0.000)
ΔlnFIL	-1.809 (0.442)		-0.118 (0.446)	0.006 (0.570)	-0.628 (0.240)
ΔlnEBANKING	-0.346 (0.202)	-0.377 (0.256)		-0.151 (0.443)	-0.227 (0.397)
ΔlnFAO	-0.032 (0.287)	-0.055 {0.174)	0.029 (0.884)		-0.019 (0.651)
ΔlnSAV	0.002 (0.345)	0.002 (0.320)	0.056 (0.344)	-0.032 (0.149)	
ΔlnPOR	6.358 (0.316)				
ΔlnCLR	-0.016*** (0.005)				
ΔlnM2/GDP	-6.062 (0.526)	4.619 (0.079)	-1.092 (0.353)	-0.813 (0.344)	-5.498 (0.337)
ΔlnEXR	0.021 (0.748)	-0.007 (0.825)	-0.002 (0.937)	0.005 (0.524)	0.044 (0.430)
ΔlnFIL*lnPOR		-0.080 (0.771)			
ΔlnEBANKING*POR			-0.047 (0.325)		
ΔlnFAO*lnPOR				0.001 (0.365)	
ΔlnSAV*lnPOR					-0.001 (0.587)
ΔlnFIL*lnCLR		-0.009** (0.015)			
ΔlnEBANKING*lnCLR			-0.003 (0.075)		
ΔlnFAO*lnCLR				8.574 (0.865)	
ΔlnSAV*lnCLR					-1.803861 (0.4053)

Source: Computed. Note: ***, **, and * represent 1%, 5%, and 10% levels of significance, respectively, (.) represents the probability value, in indicates that the variables are expressed in natural logarithm, Δ is the first difference operator, and ECT is the error correction term.

Robustness Check Analysis – FMOLS and DOLS

The panel ARDL results reveal that financial literacy, electronic payments, and formal account ownership significantly and negatively influence private sector credit in MINT countries. Savings exhibit both positive and negative significant influence on private-sector credit. Political and climate risks have negative impacts on private-sector credit. Given the policy implications of these results, a robustness check was conducted using the FMOLS and DOLS. The results revealed the existence of both negative and positive significant long-run nexus between financial literacy, electronic payments, formal account ownership, savings, and private sector credit in MINT countries. Political risk (POR) negatively and significantly impacts private sector credit, while climate risk (CLR) positively influences private sector credit.

Moreover, interactive effects, such as FIL-POR and E-banking-POR, exhibit negative and significant long-run effects on private sector credit in MINT countries. Conversely, FOA-POR positively influences private-sector credit. Savings (SAV)-POR portrays both negative and positive effects on FMOLS and DOLS. The examination of climate risk interaction revealed that FIL-CLR and Ebanking-CLR have both negative and positive influences on private sector credit, while FOA-CLR and SAV-CLR exhibit a positive and significant long-run effect. These results align with those of Chi and Li (2017) and Camba and Camba (2020).

Table 8: Estimated Results of FMOLS and DOLS

	FMOLS					DOLS				
Variable	1	2	3	4	5	1	2	3	4	5
lnCPS(-1)	0.844*** (0.000)	-0.171*** (0.000)	0.129*** (0.000)	0.137*** (0.000)	-0.139*** (0.001)	0.828*** (0.000)	-0.179*** (0.000)	0.129*** (0.000)	0.134*** {0.000)	-0.143*** (0.001)
ssInFIL	-0.197** (0.039)		-0.072** (0.011)	-0.084*** (0.002)	-0.181* (0.043)	-0.965*** (0.000)		-0.344*** (0.000)	-0.549*** (0.000)	-0.541*** (0.000)
lnEBANKING	-0.807*** (0.000)	-0.065*** (0.024)		0.098*** (0.006)	-0.108** (0.037)	-0.987*** (0.000)	-0.462*** (0.000)		0.359*** (0.000)	-0.183*** (0.001)
lnFAO	-0.081*** (0.000)	-0.366 (0.645)	0.006*** (0.000)		-0.089*** (0.000)	-0.082*** (0.000)	-0.051*** (0.000)	0.018*** {0.000)		-0.082*** (0.000)
lnSAV	3.828*** (0.000)	4.097** (0.021)	-7.067*** (0.000)	-1.217*** (0.001)		3.788*** (0.007)	3.848*** (0.001)	-8.315*** (0.000)	-9.254*** (0.000)	
lnPOR	-0.835*** (0.000)					-0.099*** (0.000)				
lnCLR	0.091404*** (0.0000)					0.082*** (0.000)				
lnM2/GDP	0.747*** (0.000)	0.048*** (0.001)	0.012** (0.037)	0.084*** (0.000)	0.063** (0.032)	0.187*** (0.000)	0.072*** (0.001)	0.081*** (0.000)	0.076*** (0.000)	0.082*** (0.008)
lnEXR	0.082*** (0.000)	0.001** (0.037)	0.006*** (0.000)	0.009*** (0.000)	0.008 (0.390)	0.021*** (0.000)	0.001 (0.279)	0.008*** (0.000)	0.007 (0.000)	0.019*** (0.000)
lnFIL*lnPOR		-0.011*** (0.000)					-0.009** (0.011)			
lnEBANKING*POR			-0.046*** (0.000)					-0.073*** (0.000)		
lnFAO*lnPOR				1.924*** (0.000)					2.174** (0.021)	
lnSAV*lnPOR					-6.868*** (0.000)					7.154*** (0.000)
lnFIL*lnCLR		-0.786*** (0.747)					2.528*** (0.009)			
lnEBANKING*lnCLR			0.002*** (0.004)					-0.009*** (0.000)		
lnFAO*lnCLR				1.574*** (0.001)					1.164*** (0.000)	
lnSAV*lnCLR					3.724*** (0.000)					3.234*** (0.001)
No. of Obs.	84	84	84	84	84	84	84	84	84	84
R-Squared	0.986	0.805	0.624	0.727	0.771	0.986	0.650	0.695	0.988	0.594

Source: Computed. Note: ***, **, and * represent 1%, 5%, and 10% levels of significance, respectively, (.) represents the probability value and in indicates that the variables are expressed in natural logarithms.

Based on the results reported in Tables 6 and 8, financial literacy, electronic banking, and formal account ownership have significant negative impacts on private sector credit in MINT countries.

Savings negatively and positively influence private-sector credit. To enhance access to affordable, flexible, and available private sectors in MINT economies, this study recommends policies that focus on improving financial literacy for the financially literate population to benefit massively from the various financial services provided by institutions. Consequently, financial institutions should extend private-sector credit to economic agents. The findings of this study have valuable implications for policymakers, financial practitioners, investors, and researchers, especially in MINT countries. Governments in MINT economies must utilize these findings for policy formulation, as the study's models were meticulously scrutinized in accordance with the ARDL assumptions. Robust checking with FMOLS and DOLS further confirmed the existence of both long- and short-run relationships, with no indication of endogeneity, cross-sectional dependence, heterogeneity, or country-specific effects in the models. The R-squared values, indicative of goodness of fit, demonstrate that the models effectively explain a significant portion of the variation in the dependent variable.

5. Conclusion and Policy Implications

This study explored the interconnections between financial literacy, electronic payment, formal account ownership, savings, and private sector credit in the MINT member countries of Mexico, Indonesia, Nigeria, and Turkey from 2000 to 2021 based on available data. This study distinguishes and contributes to the literature through several unique features, including the incorporation of political and climate risks into the analysis of credit to the private sector, the utilization of the panel ARDL estimation technique, and the application of FMOLS and DOLS as robustness check models. The findings reveal that financial literacy, electronic banking, and formal account ownership have significant negative impacts on private sector credit, whereas savings exhibit both negative and positive effects on private sector credit in MINT countries. This study recommends policies that focus on enhancing financial literacy to enhance credit to the private sector in MINT economies. This is vital because a financially literate population benefits from financial services provided by institutions. The findings of this study align with those of Abeysuriva (2018), Beal and Delpachira (2003), Cupak et al. (2019), Edirisinghe et al. (2017), and Huston (2010).

Given that political and climate risks exert adverse effects on private sector credit, and other indicators have mixed effects, it is crucial for governments to implement policies that maintain a peaceful political environment and ensure judicious policymaking to safeguard people's living conditions. Initiatives such as improving internet broadband networks, integrating financial education into school curricula to enhance financial literacy, and addressing political and climate-related crises can significantly contribute to promoting private sector credit in MINT countries, thereby fostering better economic development.

COMPETING INTERESTS

The authors have no competing interests to declare.

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