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Digital financial inclusion and poverty reduction in Kazakhstan

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Abstract
Digital financial inclusion serves as a key mechanism for enhancing accessibility of financial services and fostering inclusive and sustainable economic growth. The accelerated expansion of financial technologies including digital banking, electronic payments and online platforms has opened new prospects for improved financial availability, especially for disadvantaged and underserved populations. Simultaneously, the degree of contribution the digital financial inclusion exerts on poverty mitigation remains a critical challenge for both scholars and policymakers. The present study aims to evaluate the poverty-reducing impacts of digital financial inclusion in Kazakhstan. To do that, the research focuses on examining both short-run dynamics and long-term relationships between poverty level and digital financial inclusion. To proxy digital financial inclusion, a composite index was designed combining internet users with automated teller machines based on principal component analysis. The empirical study utilizes Autoregressive Distributed Lag approach to examine both short-run dynamics and long-term associations between variables. The results of cointegration testing validate the presence of stable equilibrium relationships among variables in the long run. Estimated parameters reveal that digital financial inclusion exerts a strong long-term negative impact on poverty level. The findings of empirical analysis underscore the importance of digital financial inclusion in alleviating poverty, suggesting that enhanced digital financial infrastructure substantially contributes to inclusive economic progress. By assessing the association between digital financial technologies and poverty indicators, the study contributes to the current literature in the context of developing countries. Research results generate several policy implications for expanding financial inclusion and developing digital financial ecosystems to support long-term poverty reduction.

Keywords: digital financial inclusion, poverty reduction, internet users, automated teller machines, ARDL approach, short-run dynamics, long-term relationships.

Introduction

Poverty reduction continues to be one of the principal objectives of long-term economic development in developing economies. Despite considerable improvements in alleviating poverty levels in many countries, comparative poverty and income differences remain a key challenge for policymakers. In this regard, enhanced access to basic financial services has been acknowledged as a core mechanism for fostering all-inclusive development and mitigating poverty (Ozili, 2018; Khan,2024). Financial inclusion allows households and businesses to afford fundamental financial services including loans, payments, investments and insurance, enabling them to cope with financial risks, balance consumption and participate in profit-making activities. Consequently, expansion of available financial services is increasingly recognized as a significant tool for achieving Sustainable Development Goals, connected to poverty alleviation and inclusive development (Sahay et al.,2015).

Over the past decades, rapid technological progress has revolutionized traditional financial service channels and gave rise to digital financial inclusion. It refers to the provision of financial services through advanced technologies including digital banking, online payment systems, digital platforms and wallets. Thus, digital financial inclusion enables individuals and entrepreneurs to get facilitated access to core financial services, particularly those who are economically disadvantaged and formerly excluded from formal financial services (Sun, 2018). By decreasing operational costs, mitigating spatial barriers, and strengthening accessibility, digital financial services integrate vulnerable groups into the institutional financial system (Al Khub et al.,2024).

Increasing body of literature underscores the importance of digital financial inclusion in reducing poverty and income disparities. Improved financial access allows households to save money, get secure loans, engage in efficient economic activities, reinforcing earning opportunities and reducing susceptibility to economic risks (Fouejieu et al., 2020). Moreover, financial inclusion strengthens financial resilience and social support by incorporating earlier excluded groups into regulated financial markets (Khan, 2024). Many

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empirical studies have revealed that enhanced financial access plays a substantial role in poverty mitigation and fosters economic well-being in developing countries.

Digital technologies further enhance finance-growth relationships by enlarging financial affordability to underserved and marginalized groups. Through digital banking and electronic payments households in isolated and provincial areas can get formal financial services without attending physical banking branches. This decreases financial exclusion, generates new business and investment opportunities (Aracil et al.,2022; Wang&Luo, 2022). Accordingly, digital financial inclusion has been widely approved as a strategic government tool for alleviating poverty and supporting inclusiveness of economic growth.

However, the association between digital financial inclusion and poverty remains exposed to continuing discussion in the existing literature. Some researchers argue that financial technologies mitigate poverty by facilitating credit accessibility and enhancing resource distribution, while others imply that benefits of digital technologies may be unequally shared across different income levels (Fouejieu et al., 2020). To be precise, recent findings indicate that financial technological progress may worsen income gap if digital technologies are predominantly accessible to upper-income groups with better technological framework and financial education (Wong et al.,2023). Thus, the influence of digital financial inclusion on poverty reduction may differ among countries due to institutional quality, digital infrastructure, and country-specific characteristics.

Despite an increasing amount of research examines the relationship between poverty and financial inclusion, evidence-based findings on digital financial inclusion stay relatively limited, especially in developing economies. Most previous research primarily focus on large emerging regions such as Africa and Asia, while insufficient attention has been paid to Central Asian region. Interpreting the role of digital financial inclusion in developing economies is significantly important, considering their persistent financial transformation and expanding digital diffusion. Against this context, this study evaluates the influence of digital financial inclusion on poverty alleviation in Kazakhstan. To do that, this research aims to examine both short-run dynamics and long-term relationships between poverty level and digital financial inclusion controlling for economic factors such as exports of goods and services, inflation and gross capital formation. Having considered theoretical frameworks and empirical findings, it is hypothesized that digital financial inclusion exerts significant negative impact on poverty level and its effect may vary across short-run and long-term dynamics. To investigate the DFI-poverty nexus, a composite DFI index is constructed applying principal component analysis integrating indicators such as internet users and ATMs. The quantitative analysis estimates both short-run trends and persistent long-term relationships based on Autoregressive Distributed Lag (ARDL) approach. By assessing the association between digital financial technologies and poverty indicators, the study adds to the current literature on financial inclusion and inclusive economic growth in developing countries. Research findings are assumed to provide critical insights for policymakers intending to enhance digital financial inclusion and long-term poverty alleviation.

Literature review

Poverty reduction continues to be a primary goal of development strategies, and extensive research highlights that expanding access to basic financial services improves household living standards and alleviates poverty. Access to deposits, transactions, and loans are enhanced by financial inclusion, thereby facilitating consumption balancing, uncertainty management and earning opportunities. Cross-national evidence supports the poverty mitigation effect of financial inclusion. For instance, Tran and Le (2021) design a composite financial inclusion index based on principal component analysis (PCA) using a panel of European countries and found that improved financial inclusion is connected to reduced poverty across different poverty thresholds. In a similar manner, Nsiah et al. (2021) indicate that financial inclusion in Sub-Saharan Africa alleviates poverty only after attaining the cutoff point, reflecting non-linear nexus between finance and poverty. This suggests that inefficient financial systems may not inherently generate poverty mitigation benefits.

With accelerated adoption of ICT, the emphasis has been placed on digital financial inclusion (DFI) rather than traditional financial inclusion. The DFI refers to the use of digital pathways and technological advancements to broaden financial access, reduce intermediation costs, and resolve geographic barriers. Emerging empirical literature reveals that digital financial inclusion can enhance poverty mitigation by strengthening service delivery, decreasing operational transaction costs and enabling new channels for financial engagement. Kumari and Giri (2025) generated DFI index through PCA across Asian economies and found positive relationship between DFI and poverty reduction in the long run, recoding reverse causality

between the two. These results imply that digital pathways can reinforce the spillover effect via enhanced availability of financial services and involvement in market activities.

Empirical results from China offer most comprehensive findings on the connection between DFI and poverty applying both large scale and micro-level household data. Xie (2023) provides regional evidence concluding that DFI substantially mitigates poverty rates even after considering the effects of income inequality, sectoral structure and financial investment in agricultural, educational and open-economy policies. At the micro level, Dong et al. (2024) argue that digital financial inclusion advances noticeably alleviate household poverty by functioning through local enterprise activities. The authors also found that these effects are more pronounced within rural households. Consistent with these results, Tao et al. (2023) clearly concentrate on relative poverty, revealing that digital financial inclusion reduces the likelihood of entering comparative poverty by diminishing formal loan constraints, supporting engagement in high-risk financial investments and promoting small-scale rural entrepreneurship. Within a similar research lines, Wang and Fu (2021) state that DFI alleviates exposure to poverty within rural communities and both the extent and intensity of DFI usage are important. Importantly, their indirect effect analysis underscores agricultural outputs, non-farm employment and entrepreneurship as core mechanisms.

Moreover, empirical evidence from South Asia and Africa also validates that DFI can strengthen social welfare effects, even though the outcome may vary across different fintech tools. Onyejiaku et al. (2024) examining African developing economies based on ARDL approach, found that automated cash machines, digital wallet transactions and broader financial development lead to poverty reduction measured by consumer consumption. While digital payments exhibit negative association with poverty alleviation reflecting that cost, service charge and usage behavior may generate differential welfare outcomes. Similarly, Kelikume (2021) indicates that mobile coverage and internet adoption are correlated with poverty mitigation in Africa highlighting the connection between digital diffusion, financial inclusion and shadow economy. Islam et al. (2025) analyzed disadvantaged populations in Bangladesh using logistic statistical model and variable reduction method and found that enhanced access to digital financial services results in reduced poverty, especially through income generation and non-food spending pathways. Consistent with these results, Hussain and Dikko (2024) provide empirical evidence from north-western Nigeria implying that both traditional and digital financial inclusion promote alleviation of poverty through job opportunities, increased consumer capacity, and enhanced wellbeing, emphasizing entrepreneurial activities as the main transitional outcome.

Large bodies of literature also highlight that socio-economic and institutional conditions influence the magnitude and direction of DFI's poverty-related outcomes. Joseph (2025) offers panel evidence based on IV method, implying that financial inclusion eradicates extreme poverty and the impact is much more significant when combined with digital network systems and financial awareness programs. This corresponds with wider perspectives that ICT infrastructure and capability barriers can restrict poverty reducing potential of digital financial inclusion. Based on systematic literature review, Amarasooriya (2025) argues that digital instruments including digital banking, wallets and platforms support economic stability, enterprise development behavior and living standards among vulnerable groups. The research also emphasized research limitations regarding cross-border cash inflows, ecological consequences, digital technology risks and cyber protection. Moreover, Tay et al. (2022) suggest that even though digital financial inclusion is predominantly enhanced to achieve SDGs, especially poverty reduction goals, differences by gender, economic status and geographic location persist, implying that uneven access to digital tools, internet availability and digital skills may exacerbate inclusive effects of digital finance.

Another line of research connects poverty to financial inclusion with overall macroeconomic stability and income distribution frameworks. Khan (2024) states that financial inclusion alleviates poverty and income gap, thereby strengthening financial resilience. The author also highlights that inflation increases poverty and income disparities. In a related manner, Kumari et al. (2025) demonstrate that gender-specific digital financial inclusion and female empowerment substantially facilitate poverty mitigation in Asian countries, implying that allocation effects of digital finance may rely on gender divide in access and enabling mechanisms. Overall, prior literature indicates that digital financial inclusion contributes to poverty reduction through several important pathways such as improved access to credit, promotion of entrepreneurship, output growth and strengthened household stability. The effects vary in scale and direction across different settings, tools and communities (Tao et al.,2023; Tay et al., 2022; Onyejiaku et al.,2024). Importantly, many empirical studies focus on China, Africa and other multi-country samples, while Central Asia remains insufficiently investigated. This research gap is especially meaningful for Kazakhstan, which is

characterized by rapid expansion of digital transaction systems and fintech startups, but questions related to poverty-reducing impacts of digital financial inclusion in Kazakhstan remain underexamined. Following earlier research, the current study aims to investigate the relationship between DFI and poverty in Kazakhstan as a noteworthy case from developing economy context.

Methodology

Estimation approach

The study uses the Autoregressive Distributed Lag (ARDL) estimation to investigate the connection between digital financial inclusion and poverty. This framework, designed by Pesaran, Shin and Smith (2001), is broadly utilized in evidence-based macroeconomic analyses to evaluate both short-term and long-term interactions.

The ARDL approach has numerous strengths, that make it appropriate for this study. First, it can be employed when variables follow an order of integration (I (0) and I (1)), given that none is integrated of order I (2). This feature enables the ARDL to be more adaptable compared to other conventional cointegration methods. Second, the ARDL technique works effectively in small datasets, which is relevant for research based on annual economic data with restricted sample observations. Third, this approach allows the assessment of both short-term fluctuations and long-run stable equilibriums in an integrated approach via the Error correction model (ECM). Moreover, the ARDL is characterized by procedures that test bounds and presence of long-run connections between variables without the necessity of identical order of integration. Considering these methodological advantages, ARDL is recognized as a suitable framework for examining the effect of digital financial inclusion on poverty alleviation.

DFI index design

In order to quantify the level of digital financial inclusion, a composite index was built based on Principal component analysis (PCA). This method is used in empirical studies to aggregate several related indicators into a single unified index while simplifying dimensions and keeping maximum information content of the initial variables.

The DFI index was constructed based on two essential indicators related to availability of digital financial services:

– -the number of individuals using the internet (% of population), indicating the extent of digital connection and potential availability of digital financial services.

– -the number of ATMs per 100,000 adults, reflecting the maturity of financial structures and banking facilities

These variables cover reinforcing dimensions of digital financial access. While internet diffusion represents the technological settings that enhance digital financial inclusion, ATM reflects the availability of fundamental financial services.

Model specification

To examine the factors influencing poverty, the long-run model formulated as follows:

$$\boldsymbol{lnpoverty_t=\beta_0+\beta_1 DFI_t+\beta_2 gfcf_t+\beta_3 lnexports_t+\beta_4 inflation_t+\varepsilon_t}$$

where:

- $lnpoverty_t$ — the log of poverty;
-DFI_t — digital financial inclusion index;
-$gfcf_t$ — gross fixed capital formation;
-$lnexports_t$ — the log of exports of goods and services;
-$inflation_t$ — inflation rate;
-ε_t — error term.

To consider temporal adjustments, the ARDL error correction model specification is constructed in the following manner:

$$\Delta ln(poverty_t) = \alpha_0 + \sum_{\{i=1\}_i} \alpha_i \Delta ln\left(poverty_{\{t-i\}}\right) + \sum_{\{j=0\}_j} \beta j X_{\{t-j\}} + \lambda ECT_{\{t-1\}} + u_t$$

where λECT_{t-1} indicates error correction term, representing the adjustment coefficient towards the steady state after short-term shocks. The error correction term exhibited a negative and statistically significant coefficient, validating the existence of long-term relationship between variables.

Diagnostic tests

To check for credibility of empirical results, numerous assessment tests are conducted. The Breusch-Godfrey is used to detect serial autocorrelation in the residuals of the model, while Breusch-Pagan test is performed to evaluate heteroskedasticity. The Ramsey RESET test is carried out to verify model correctness. Moreover, variance inflation factors (VIFs) are utilized to assess multicollinearity among independent variables. These validation tests enable the confirmation of the model and verify that the fitted connections between digital financial inclusion and poverty are statistically reliable and consistent.

Data and variables

The empirical evaluation relies on annual national accounts data across the period between 2004 and 2024. Observational dataset involves core economic indicators that represent both financial inclusion and macroeconomic settings affecting poverty trends. The data were extracted from World Development Indicators database which offers standardized international metrics for macroeconomic and financial parameters.

The poverty rate is the main predicted variable, indicating the share of population below the societal poverty threshold. To normalize variance and decrease heteroskedasticity the poverty was converted to natural log form.

Digital financial inclusion index, designed by principal component analysis, is the main independent variable. The index integrates two metrics reflecting availability of both digital and traditional financial instruments: internet coverage and the number of automated teller machines (ATMs). This combined indicator enables us to generate a more comprehensive assessment of digital financial inclusion covering both digital penetration and financial infrastructure.

Multiple control variables are incorporated into the model to adjust for macro-financial factors that may affect poverty. Investment activities are proxied by gross fixed capital formation, implying that greater the investment levels higher the employment opportunities. As a result, expansion of entrepreneurship and overall economic activities may lead to poverty reduction.

The exports of goods and services reflecting the effects of trade openness are also expressed in natural log form. Increased exports can foster economic engagement and increase household earnings with the help of workforce expansion and output growth.

Lastly, inflation is included in the model as a control for macroeconomic stability. Increasing inflation may decrease consumer purchasing power, especially for poor households, thereby increasing poverty levels.

Results and discussion

Table 1 demonstrates summary statistics of all variables applied in the baseline model estimation. It reports descriptive data including min, max, mean and standard deviation poverty, digital financial inclusion, gross capital formation, inflation and exports of goods and services across the chosen period.

Table 1. Descriptive statistics

Variable	Mean	Std.dev.	Min	Max
Lnpoverty	2.532	0.362	2.092	3.459
Dfi	0	1.391	-2.6	1.488
Gcf	27.536	3.001	22.998	35.527
Lnexports	3.688	0.204	3.35	4.046
Inflation	8.841	3.487	5.196	17.14
Note –compiled by the authors				

As can be seen from Table 1, the average value of lnpoverty is 2.532 implying moderate variability during the observed sample period. The digital financial inclusion index has a zero-mean suggesting the standardized and scaled form of the index. Exports and gross capital formation also exhibit moderate dispersion, while inflation shows widest distribution within the variables.

To analyze the temporal dynamics of variables, the time series trends were explored. Figure 1 shows visual depiction of all variables over the examined period.

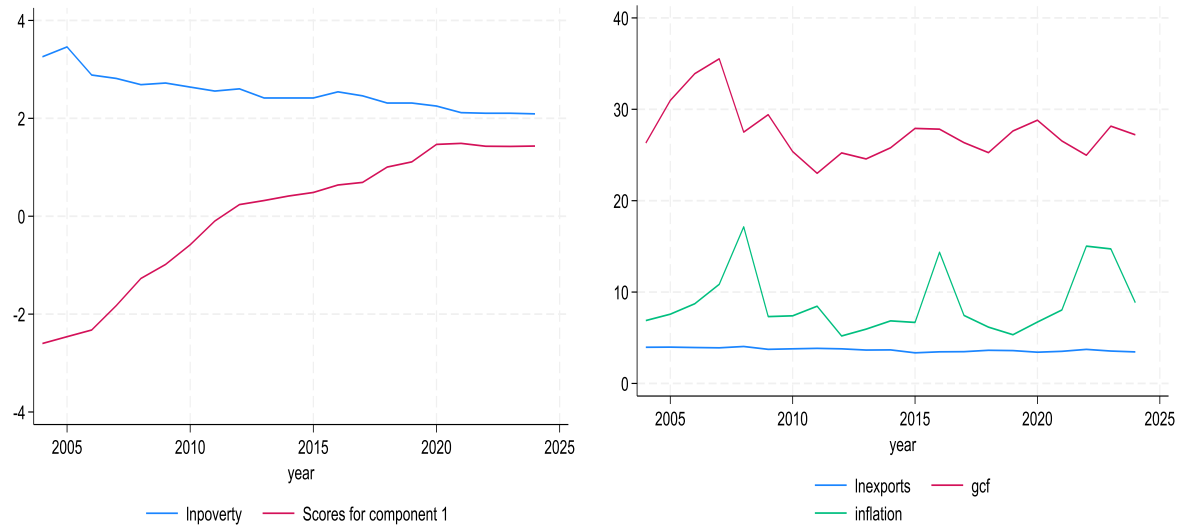

Figure 1. Time series dynamics of variables

Note — compiled by the authors

Figure 1 shows that poverty demonstrates slow downward trend during the observed period, while digital financial inclusion exhibits gradual upward increase, confirming the rapid expansion of digital financial instruments. Gross capital formation varies slightly, while inflation displays greater instability across the study period. Exports demonstrate consistent patterns with small variations. Overall, graphical representation offers initial insights into evolving behavior of variables before model estimation.

Table 2 below demonstrates correlation matrices between variables. The correlation analysis gives initial evidence of the size and direction of the relationships between dependent and independent variables.

Table 2. Pairwise correlations

Variables	lnpoverty	dfi	gcf	Lnexports	inflation
lnpoverty	1				
dfi	-0.940 (0.000)	1			
gcf	0.403 (0.070)	-0.509 (0.018)	1		
lnexports	0.731 (0.000)	-0.8 (0.000)	0.233 (0.310)	1	
inflation	-0.134 (0.562)	0.019 (0.934)	0.142 (0.539)	0.164 (0.479)	1
Note –complied by the author based on correlation analysis results					

The correlation results from Table 2 reflect statistically significant and negative association between poverty and digital financial inclusion, implying that high levels of DFI lead to reduced levels of poverty. Exports of goods and services positively correlate with poverty, while gross capital formation displays moderate positive connection. Even though inflation negatively correlates with poverty levels, it exhibits weak associations with both dependent and independent variables. Generally, the correlation coefficients do not reveal sever multicollinearity within independent variables.

To visualize the association between digital financial inclusion and poverty level the scatter plot was generated. The figure below depicts the relationship between lnpoverty, and digital financial inclusion index obtained using PCA.

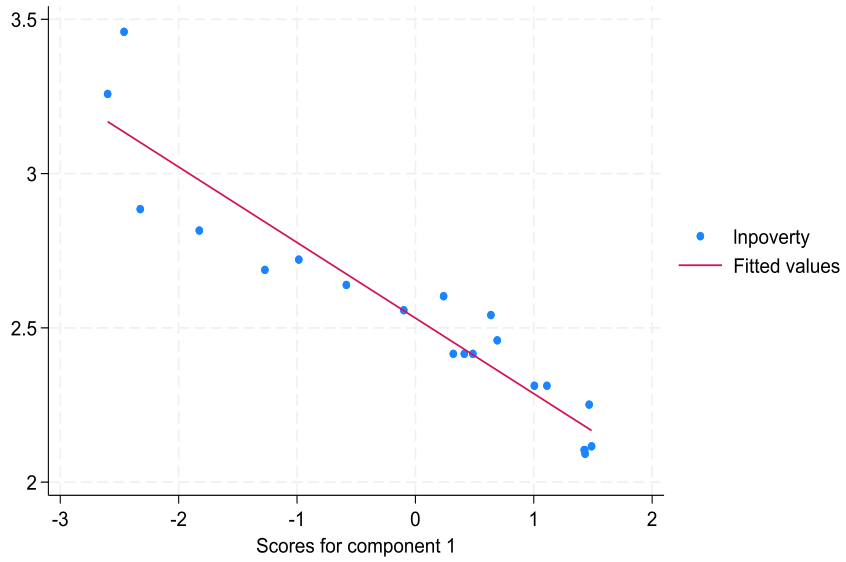

Figure 2. The relationship between poverty and digital financial inclusion
Note — compiled by the authors

Figure 2 illustrates pronounced negative correlation between DFI and poverty indicators. Greater digital financial inclusion is tied to reduced poverty levels, revealing that enhanced digital financial services substantially contribute to poverty alleviation. This graphical trend aligns with the results of correlation analysis reported above.

Prior to model estimation, variables were tested for stationarity relying on Augmented Dickey-Fuller unit root examination. This assessment test was utilized to identify the degree of variables' integration and verify the absence of second-order integration among variables. The ADF unit root test results are reported in Table 3.

Table 3. Augmented Dickey-Fuller unit root test results

Variable	Level ADF statistic	p-value	First Difference ADF	p-value	Integration order
Lnpoverty	-1.76	0.4	-6.5***	0.0000	I(1)
Dfi	-2.944**	0.04	-	-	I(0)
Gfcf	-2.324	0.1644	-4.951***	0.0000	I(1)
Lnexports	-1.728	0.4166	-5.743***	0.0000	I(1)
inflation	-3.251***	0.01	-	-	I(0)
*Note–compiled by the authors based on ADF results, ***p<0.01,**p<0.05,*p<0.1*					

As is noticed from Table 3, digital financial inclusion and inflation display level stationarity, while poverty, gross capital formation and exports achieve stationarity at first difference. Thus, variables exhibit integration orders of I (0) and I (1). Since variables demonstrate different orders of integration, the ARDL is the proper approach to investigate both short term and long-term associations between variables.

Based on unit root test results, the prevalence of long-term linkage between variables was explored applying ARDL bounds testing method. This approach enables us to conduct a cointegration test irrespective of integration orders of variables. Cointegration test outcomes are presented in Table 4 below.

Table 4. ARDL bounds test for cointegration

Test statistic			Value	
F-statistic			6.265	
t-statistic			-4.228	
Significance level	**I(0) lower bound (F)**	**I(1) upper bound (F)**	**I(0) lower bound (t)**	**I(1) upper bound (t)**
10 %	3.050	4.548	-2.542	-3.674
5 %	3.924	5.732	-2.984	-4.219
1 %	6.374	8.998	-3.959	-5.427
Note –complied by the author based on ARDL bounds test results				

As given in Table 4, the obtained F-statistic (6.265) is above the upper critical threshold at 5 % and 10 % levels. This rejects the null hypothesis indicating the absence of cointegration. Thus, these findings validate the presence of steady-state relationship between variables in the long run. Considering the existence of cointegration, the ARDL error correction approach is applied to estimate both short-run and long-run trends of the model.

Having confirmed the cointegration by ARDL bounds test, the long-term and shot run relationships between poverty and digital financial inclusion are examined utilizing the error correction method. Derived coefficients of ARDL estimation for both long-run and short-term dynamics are given in Table 5.

Table 5. ARDL estimation results

Variables	Long-run	Short run
Dfi	-0.348*** (-7.69)	0.254 (1.44)
Gcf	-0.035** (-2.31)	0.043*** (3.22)
Lnexports	-0.681** (-2.38)	0.614** (2.45)
Inflation	0.002 (0.26)	-
ECT	-	-1.089*** (-4.23)
Constant	-	6.488*** (4.20)
Note –compiled by the authors based on ARDL estimation results ****p<0.01, **p<0.05, *p<0.1, t-statistics are given in parentheses*		

The results in Table 5 demonstrate that digital financial inclusion exhibits negative and strongly significant influence on poverty level in the long run, implying that enhanced availability of digital financial services are associated with reduced poverty. The DFI coefficient implies that when DFI increases by one unit poverty decreases by 34.8 %. Similarly, both gross capital formation and exports of goods and services also display negative and statistically significant long-term impact on poverty, indicating that increased levels of investment and exports of goods and services facilitate poverty mitigation. In contrast, inflation does not exert statistically significant effect on poverty in the long term. The coefficient of error correction term has negative sign and is statistically significant at 1 % level, validating stable and steady-state equilibrium linkage between variables in the long run. The magnitude of ECT reveals that variations from equilibrium are adjusted at a rapid pace.

The short-run dynamics of the model indicate that changes in exports and gross capital formation positively and significantly influence poverty, while digital financial inclusion does not have significant effect on poverty in the short run. This implies that poverty-reducing effects of DFI are more prominent in the long run than in the short run.

To confirm the credibility of estimated results several diagnostic tests were performed. These evaluation tests address some econometric issues including autocorrelation, heteroskedasticity, potential model misspecification and multicollinearity between independent variables. Table 6 below presents the results of diagnostic tests.

Table 6. Diagnostic tests of the ARDL model

Test	statistic	p-value	conclusion
Breusch–Godfrey LM test (Autocorrelation)	$\chi^2(1) = 0.822$	0.3646	No serial correlation
Breusch–Pagan test (Heteroskedasticity)	$\chi^2(1) = 0.88$	0.3495	Homoskedasticity
Ramsey RESET test (Model specification)	$F(3,8) = 4.18$	0.05	No model misspecification
Variance Inflation Factor (Multicollinearity)	Mean VIF = 3.28	-	No serious multicollinearity
Note –complied by the author based on correlation analysis results			

The results in Table 6 reveal that designed ARDL model fulfills the main requirements of econometric assumptions. The Breusch-Godfrey test validates that residuals show no serial correlations, while the Breusch-Pagan test validates the absence of residual heteroskedasticity. Moreover, the Ramsey RESET confirms that model form does not demonstrate misspecification, implying that the model is appropriately formulated. The values of variance inflation factors show that multicollinearity is not a critical issue, since the mean VIF is well below the acceptable threshold. Overall, the findings of empirical analysis confirm that the fitted model is robust and reliable.

Research results reveal that digital financial inclusion has a major long-term impact in reducing poverty. The statistically significant negative coefficient of DFI reflects that increased accessibility of digital financial services leads to poverty mitigation by enhancing financial inclusion and encouraging economic engagement. These findings validate research hypotheses. First, digital financial inclusion exhibits substantial negative long-term impact on poverty, confirming its poverty-alleviating function. Second, results imply that poverty-reducing effect of digital financial inclusion differs across short-run and long-run dynamics, reflecting that poverty reduction benefits of DFI appear over time in the long-run. These findings are also in line with prior research underscoring the poverty mitigating role of digital financial inclusion (Lee et al., 2022; Kumari&Giri,2025). Gross capital formation and exports also exhibit sustained long-run outcomes in reducing poverty, implying that investment flows and trade operations can strengthen market opportunities and revenue creation. While inflation does not show evidence of significant influence on poverty alleviation in the long run.

The negative and economically meaningful coefficient of error correction term confirms the presence of stable equilibrium in the long-term relationship between variables. The size of ECT coefficient indicates that variations from equilibrium are steadily adjusted over time. However, in the short run, digital financial inclusion does not have significant impact on poverty, suggesting that its poverty-reducing effects emerge over time rather than demonstrating immediate outcomes. Overall, empirical evidence underscores the importance of organizational and regulatory aspects in determining the long-term association between digital financial inclusion and poverty mitigation.

Analytical results provide numerous policy recommendations. First, policymakers should predominantly focus on strengthening digital finance frameworks to broaden the availability of digital financial services, especially among vulnerable and disadvantaged groups. Enhancing online payments, digital banking systems, and fintech evolutions can foster financial inclusion and economic involvement. Second, improved financial education and digital competence increase the effectiveness of digital financial services' use. Instructional initiatives and awareness programs enhance assurance of digital financial landscape and promote digital readiness. Third, enabling regulatory environments is vital to encourage fintech innovations leading to stable financial systems. Well defined rules and cooperation between fintech companies and financial service providers support sustainable progress of digital financial systems. Finally, government strategies aimed at increasing investments and exports can enhance financial inclusion by generating economic prospects and facilitating sustainable poverty alleviation.

Conclusion

This study examined the connection between digital financial inclusion and poverty level based on ARDL estimation framework. The results of ARDL bounds test confirmed the equilibrium relationship between variables in the long run and revealed that digital financial inclusion exhibits statistically significant poverty-reducing impact in the long run. These findings indicate that enhanced digital financial inclusion substantially alleviate poverty levels by expanding access to formal financial services and strengthening economic empowerment.

Moreover, gross capital formation and exports of goods and services were also found to significantly mitigate poverty levels in the long run. This indicates that increasing investment channels and trade operations provide wider economic opportunities and profit-making activities. In contrast, inflation does not demonstrate significant impact on poverty level. In general, research findings highlight the importance of developing digital network systems and encourage financial inclusion to support sustainable long-term economic growth. Advancing digital financial instruments, improving financial awareness, and generating supportive institutional regulations expand financial inclusion and increase economic engagement of marginalized and underserved populations. Overall, digital financial inclusion can be recognized as a key strategic tool for alleviating poverty and achieving inclusive economic growth in the long run.

Despite its contributions this study has several limitations. The empirical analysis examines Kazakhstan as a country-level case and uses macroeconomic indicators, which may not completely describe individual household access to digital financial services. Further investigation could extend the analysis to household-level data or comparisons across countries to reveal deeper understanding of the association between digital financial inclusion and poverty alleviation.

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