Journal of
Risk and Financial Management

MDPI

Article

Explaining Financial Inclusion in the European Union: A Panel Data Analysis of Macroeconomic Determinants (2004–2023)

Aracelly Núñez-Naranjo [1,*], Marcela Karina Benítez-Gaibor [2], Carlos Barreno-Córdova [2], Ana Córdova-Pacheco [2] and Micaela Lema-Chicaiza [2]

[1] Centro de Investigación en Empresas, Sociedad y Tecnologías-ESTec, Facultad de Ciencias de la Educación, Universidad Tecnológica Indoamérica, Ambato 180103, Ecuador
[2] Facultad de Contabilidad y Auditoria, Universidad Técnica de Ambato, Ambato 180206, Ecuador; marcelakbenitez@uta.edu.ec (M.K.B.-G.); carlosabarreno@uta.edu.ec (C.B.-C.); anaccordova@uta.edu.ec (A.C.-P.); dlema8265@uta.edu.ec (M.L.-C.)
* Correspondence: fernandanunez@uti.edu.ec; Tel.: +593-962021888

Abstract

This study examines the relationship between financial inclusion and economic development in the European Union by analyzing its macroeconomic determinants across 26 countries over the period of 2004–2023. Using a balanced panel dataset, the empirical analysis employs econometric techniques that account for heterogeneity, autocorrelation, and cross-sectional dependence, leading to the estimation of a Panel-Corrected Standard Errors (PCSE) model. Financial inclusion is proxied by the number of automated teller machines per 100,000 adults, while the explanatory variables include GDP per capita, personal remittances, inflation, years of schooling, unemployment, and foreign direct investment. The results show that GDP per capita, remittances, inflation, and unemployment have a positive and statistically significant effect on financial inclusion, whereas education and foreign direct investment exhibit a negative and significant relationship. These findings suggest that financial inclusion in the European Union is shaped by a complex interplay of economic development, labor market conditions, and external financial flows, rather than by structural factors alone. Notably, the results reveal counterintuitive relationships that challenge conventional assumptions about the roles of education and foreign investment in promoting financial access. This study contributes to the literature by providing updated panel evidence for advanced economies and by emphasizing the multidimensional nature of financial inclusion in a context of increasing digitalization and economic integration. The findings also offer relevant policy implications, suggesting that strategies to enhance financial inclusion should go beyond expanding financial infrastructure and instead focus on improving the effective use of financial services, strengthening financial capabilities, and reducing structural disparities across countries.

Keywords: financial inclusion; economic development; European Union; panel data analysis; macroeconomic determinants; remittances; foreign direct investment; unemployment

Academic Editor: Thanasis Stengos

Received: 4 May 2026
Revised: 18 June 2026
Accepted: 23 June 2026
Published: 26 June 2026

1. Introduction

Financial inclusion has progressively evolved from a narrowly defined banking policy objective into a broader development strategy aimed at promoting equitable access to financial services and fostering sustainable economic growth. Over the last two decades, governments, international organizations, and financial institutions have increasingly recognized that access to formal financial services contributes not only to poverty reduction

but also to productivity enhancement, income generation, and social inclusion. According to Allen et al. (2016) and Demirgüç-Kunt et al. (2022), significant progress has been achieved worldwide through the expansion of banking infrastructure, digital financial services, and regulatory reforms designed to reduce barriers to financial access.

Despite these advances, substantial disparities persist across countries and population groups. While developed economies generally exhibit higher levels of financial inclusion, differences remain regarding the effective use of financial services, digital adoption, and financial capabilities. In developing countries, financial exclusion continues to be associated with income constraints, educational inequalities, geographical barriers, and institutional limitations. Consequently, financial inclusion has become a multidimensional policy challenge that extends beyond access to encompass usage, quality, affordability, and long-term financial participation (Allen et al., 2016; Barik & Sharma, 2019).

Furthermore, Patwardhan (2018) and Kanungo and Gupta (2021) emphasize that financial access is increasingly influenced by technological innovation and by how users integrate into new financial service channels. Nevertheless, Lee et al. (2023) argue that financial inclusion continues to reflect structural, regulatory, and technological inequalities across countries and population groups. At the same time, Abdul Karim et al. (2022) demonstrate that financial inclusion maintains a close relationship with economic growth and the level of development of financial systems, although its impact on growth is not linear and depends on certain structural thresholds. R. Huang et al. (2021) show that in European Union countries, financial inclusion contributes to economic development, albeit with varying intensities across economies with different income levels. Similarly, Anarfo et al. (2020) and Chatterjee (2020) report that in African contexts, financial inclusion and financial sector development reinforce each other, while the diffusion of information technologies strengthens the impact of inclusion on growth. In addition, Kouladoum et al. (2022) show that digital transformation has significantly reshaped the way financial inclusion is understood, as advances in digital technologies positively affect inclusion by reducing transaction costs and expanding service coverage. Moreover, Pak et al. (2026) argue that digital financial literacy plays a decisive role in the effective use of digital financial services, while Chopra et al. (2025) identify public digital infrastructure as a key driver of financial inclusion.

However, digitalization does not render physical infrastructure irrelevant. The measurement of financial inclusion still requires tangible indicators that capture the material reach of the financial system. In this regard, Patwardhan (2018) and Manogna et al. (2026) indicate that the number of automated teller machines remains a useful proxy for assessing the physical availability of financial services, particularly in long-term comparative studies such as this one.

Although recent advances in digital finance have expanded alternative channels of financial access, long-term comparative studies continue to rely on ATMs as a relevant indicator of financial inclusion due to their broad availability, international comparability, and consistent historical coverage. Moreover, physical financial infrastructure remains an important component of financial systems even in highly digitalized economies, as it reflects the territorial reach and accessibility of formal financial services. Consequently, ATMs provide a useful measure of the structural dimension of financial inclusion over extended periods.

Alongside structural and technological factors, the literature has highlighted the importance of human capabilities and social conditions in understanding financial inclusion. Ba and Dieng (2025) demonstrate that variables such as education, income, age, and geographic location significantly influence access to and use of digital financial services. From the perspective of household economic behavior, Luo (2024) finds that digital financial

inclusion and education levels are associated with changes in consumption patterns. My Sang (2026) argues that financial well-being depends on the interaction between financial inclusion, financial literacy, and planning capacity. Furthermore, the combination of financial technology and user capabilities is essential for integrating traditionally underserved populations. Under this framework, variables such as schooling and unemployment capture social conditions that may either facilitate or hinder effective engagement with the formal financial system (Muvunyi & Batóg, 2025).

On the other hand, the use of formal financial services is influenced by concrete economic constraints that shape household behavior (Allen et al., 2016). Anarfo et al. (2019b) show that monetary policy and financial inclusion exhibit a bidirectional relationship, suggesting that macroeconomic conditions directly affect financial depth. At the same time, the regulatory environment and financial stability can either promote or restrict the expansion of formal access, highlighting the need to analyze financial inclusion in balance with system stability (Anarfo et al., 2020; Damane & Ho, 2026).

Within this framework, inflation may alter saving incentives and financial behavior, while remittances can strengthen interaction with formal channels for transferring and receiving resources. Therefore, financial inclusion reflects a combination of macroeconomic, technological, and social factors, rather than being solely driven by the supply of banking services.

Within this context, analyzing financial inclusion across 26 European Union countries over the period 2004–2023 allows for the examination of a stage characterized by profound economic, technological, and institutional changes.

As shown by Miao et al. (2021), even within the European context, significant differences exist in the relationship between financial inclusion and economic development. Additionally, Lee et al. (2023) and Kouladoum et al. (2022) demonstrate that digitalization and the expansion of financial access can generate substantial effects on well-being and a reduction in deprivation, although these effects are not uniform across contexts. Furthermore, Kozol (2026) highlights that recent developments in financial inclusion remain shaped by structural inequalities and by the pace of technological adoption. Together, these studies suggest that financial inclusion outcomes are conditioned by a combination of economic, technological, and institutional factors that vary across countries and periods. Consequently, examining the number of automated teller machines as a proxy for financial inclusion, together with variables such as GDP per capita, personal remittances, inflation, schooling, unemployment, and foreign direct investment, provides a relevant approach for identifying the factors that explain the evolution of financial access in this group of economies.

Against this background, the objective of this study is to identify and evaluate the macroeconomic determinants of financial inclusion in 26 European Union countries during the period 2004–2023. Specifically, the study examines the effects of GDP per capita, personal remittances, inflation, years of schooling, unemployment, and foreign direct investment on financial inclusion, measured through the availability of automated teller machines per 100,000 adults.

The contribution of this research is threefold. First, it provides updated empirical evidence on the determinants of financial inclusion in advanced economies using a long-term balanced panel dataset. Second, it integrates economic, social, and structural variables within a unified analytical framework. Third, it contributes to the ongoing debate regarding the multidimensional nature of financial inclusion by identifying relationships that differ from conventional expectations reported in the literature.

The remainder of the paper is organized as follows. Section 2 presents the theoretical background supporting the empirical analysis. Section 3 describes the data, variables,

and econometric methodology. Section 4 reports the empirical results. Section 5 discusses the findings in relation to previous studies, and the final section presents the conclusions, policy implications, limitations, and avenues for future research.

2. Background

2.1. Macroeconomic Stability Theory

Financial inclusion and macroeconomic stability maintain a mutually reinforcing relationship. Stable macroeconomic environments facilitate access to and use of formal financial services by reducing uncertainty, improving confidence in financial institutions, and encouraging long-term saving and investment decisions. At the same time, broader financial inclusion can contribute to economic resilience by increasing the capacity of households and firms to manage risks, smooth consumption, and participate in productive activities. Empirical evidence provided by Anarfo et al. (2020) suggests that financial inclusion and macroeconomic conditions interact through monetary transmission mechanisms, highlighting the importance of stability for the expansion of formal financial services.

Within this context, macroeconomic stability theory provides a useful framework for understanding how economic conditions influence financial inclusion. According to Fischer (1993) and McKinnon (2010), macroeconomic stability refers to an economic environment characterized by sustainable economic growth, predictable inflation, sound public finances, financial system stability, external balance, and stable expectations. Such conditions reduce market distortions and create incentives for households and firms to engage with formal financial institutions. Consequently, more stable macroeconomic environments tend to favor saving decisions, financial formalization, and the use of regulated financial services.

Consequently, inflation can be interpreted as a variable capturing macroeconomic tensions capable of altering households' decisions to use formal financial services. In unstable contexts, agents may prefer immediate liquidity, informal mechanisms, or defensive income management strategies. Therefore, incorporating inflation into the empirical model is consistent with a perspective in which financial inclusion also depends on the quality of the macroeconomic environment (Anarfo et al., 2019a; Fischer, 1993).

2.2. Economic Theory of Remittances and International Migration

The economic theory of remittances, linked to the new economics of labor migration, interprets migration as a household strategy to cope with liquidity constraints, diversify risks, and stabilize consumption. Migration decisions are not solely driven by individual motivations but also by market failures in the place of origin, such as the absence of credit, insurance, or formal protection mechanisms. In this context, remittances constitute transfers that can sustain consumption, finance investment, and strengthen household economic security (Korner & Stark, 1992).

The relationship between remittances and financial inclusion becomes particularly relevant when monetary flows are channeled through formal mechanisms. Chuc et al. (2022) indicate that the economic effects of remittances improve when households have access to financial services, as this facilitates saving, income management, transaction cost reduction, and the transformation of transfers into assets or investments. Thus, remittances not only provide liquidity but can also strengthen integration into the financial systems.

For this reason, personal remittances received can be considered an important determinant of financial inclusion. Where such resources are frequent and circulate through regulated channels, there is a higher likelihood of account ownership, use of electronic mechanisms, and the development of formal saving habits. Consequently, remittances may act as a bridge between household economies and financial formalization (Chuc et al., 2022; Korner & Stark, 1992).

2.3. Economic Openness and International Capital Mobility Theory

The theory of economic openness and international capital mobility argues that external integration expands access to financing, technology, knowledge, and markets. Capital mobility reshapes the scope of macroeconomic policy and redefines how economies integrate into global production and investment networks. In principle, a more open economy can benefit from capital flows, innovation, and organizational practices that strengthen its productive and financial structure (Mundell, 1963; Obstfeld & Taylor, 2004).

Yao et al. (2021) and Eshun and Kočenda (2025) show that economic openness and financial inclusion can reinforce each other. Their findings indicate that both financial inclusion and trade openness are positively associated with economic development, and that variables such as openness, remittances, and literacy contribute to expanding financial access. This suggests that external integration can amplify its effects when adequate domestic conditions for formal access and financial adoption are present.

Within this framework, foreign direct investment can be interpreted as a concrete expression of openness and international capital mobility. It may contribute to financial inclusion through technological diffusion, productive modernization, economic formalization, and the expansion of financial services associated with internationally integrated sectors. Therefore, this theoretical perspective provides a relevant basis for linking external integration with financial access (R. Huang et al., 2021; Mundell, 1963; Obstfeld & Taylor, 2004).

2.4. Financial Inclusion as a Multidimensional Concept

Financial inclusion should be understood as a multidimensional concept that goes beyond simple account ownership. Formal access depends on costs, distance, institutional conditions, and the socioeconomic characteristics of the population, while recent comparative approaches highlight the need to examine not only service availability but also actual usage. Therefore, financial inclusion encompasses dimensions of access, usage, availability, and functionality, and cannot be reduced to a single indicator (Allen et al., 2016).

As emphasized by Allen et al. (2016), the mere existence of financial infrastructure does not guarantee its effective use. A region may have banks, ATMs, or digital platforms and still exhibit low levels of usage due to factors related to income, education, trust, financial culture, or digital exclusion. Consequently, financial inclusion requires an analysis that considers both institutional supply and the actual conditions under which individuals adopt and use financial services (Allen et al., 2016).

In empirical studies, this approach justifies the use of multiple explanatory factors to approximate financial inclusion. Variables such as ATMs, internet access, education, income, and remittances do not fully capture the phenomenon individually but allow for the identification of complementary dimensions of a complex reality. Thus, financial inclusion can be approached as a structural and relational construct rather than as a variable isolated from its economic and social context (Allen et al., 2016; Demirgüç-Kunt et al., 2022).

2.5. GDP per Capita and Inflation as Determinants of Financial Inclusion

GDP per capita and inflation represent two key macroeconomic variables for explaining financial inclusion. A higher level of average income reflects an economy with greater spending capacity, higher monetization, and increased demand for financial services. Conversely, high or unstable inflation reduces purchasing power, increases uncertainty, and may discourage saving decisions or participation in formal financial mechanisms. In this way, both variables capture structural access capacity and macroeconomic stability (Allen et al., 2016; Fischer, 1993).

Allen et al. (2016) and Eshun and Kočenda (2025) provide empirical evidence supporting this interpretation. Comparative studies show that income, literacy, and other structural

factors are positively associated with financial inclusion, while less stable environments constrain its expansion. Analytically, GDP per capita can be understood as a measure of material capacity to participate in the financial system, whereas inflation acts as a friction that alters incentives for saving, borrowing, and formal financial usage.

Therefore, in the context of financial inclusion research, GDP per capita can be interpreted as a driving factor, while inflation may act as a constraint. The interaction between both variables allows for examining the extent to which financial inclusion responds to economic expansion or, conversely, is affected by persistent macroeconomic imbalances (Anarfo et al., 2019a; Fischer, 1993).

Based on the theoretical and empirical literature, GDP per capita is expected to exert a positive effect on financial inclusion, whereas inflation is generally expected to have a negative effect due to its potential to reduce financial confidence and discourage long-term financial participation.

2.6. Foreign Direct Investment and Unemployment in Financial Inclusion Dynamics

Foreign direct investment can be understood as a variable associated with productive modernization, technological transfer, and the expansion of formal activities. It not only provides financial resources but also promotes organizational transformation, business linkages, and a higher density of regulated economic relationships. Under this logic, when foreign investment fosters formal employment, digitalization, and economic formalization, it may also increase demand for accounts, electronic payments, and other financial services (R. Huang et al., 2021; Obstfeld & Taylor, 2004).

Unemployment, in contrast, may act as a structural constraint on financial inclusion, as it reduces income stability, saving capacity, and continuity in the use of formal services. Geng and He (2021) and Sharaf et al. (2025) show that financial inclusion is associated with better employment outcomes and that certain financial innovations can facilitate self-employment or economic reintegration among vulnerable populations. This suggests that employment and financial inclusion maintain a close and potentially bidirectional relationship.

Accordingly, the combination of foreign direct investment and unemployment captures both the productive and labor dimensions of financial inclusion. While foreign investment may expand the formal base of transactions and financial needs, unemployment may limit households' ability to enter and remain within the formal system. Thus, both variables are useful for explaining why financial inclusion also depends on labor market conditions and the degree of economic formalization (Geng & He, 2021; Obstfeld & Taylor, 2004; Sharaf et al., 2025).

Accordingly, foreign direct investment is expected to contribute positively to financial inclusion through modernization and economic formalization, whereas unemployment is generally expected to negatively affect financial inclusion by reducing household income stability and financial participation.

2.7. Personal Remittances and Years of Schooling as Determinants of Financial Inclusion

Personal remittances and years of schooling constitute complementary explanatory factors of financial inclusion. From migration theory, remittances increase household liquidity and reduce budget constraints, while from human capital theory, education strengthens the skills necessary to understand, evaluate, and use financial products. Together, these variables allow for addressing both material and cognitive barriers that condition formal financial inclusion (Becker, 2009; Korner & Stark, 1992; de la Peña, 1975).

Chuc et al. (2022) and Luo (2024) suggest that remittances generate stronger effects when households are more integrated into the financial system, and that education is a consistent determinant of access to and use of both traditional and digital financial services.

This implies that financial inclusion depends not only on the availability of monetary resources but also on the capacity to manage and channel them effectively within formal institutions (W. Huang et al., 2023; Luo, 2024).

Therefore, in the empirical analysis, personal remittances can be interpreted as a source of economic capacity and transnational linkage, while years of schooling capture competencies that facilitate the adoption and sustained use of financial services. Together, these variables help explain a more stable, functional, and welfare-oriented form of financial inclusion (W. Huang et al., 2023; Korner & Stark, 1992; Luo, 2024).

Therefore, both personal remittances and years of schooling are expected to positively influence financial inclusion by enhancing economic capacity, financial awareness, and the effective use of formal financial services.

Taken together, the theoretical perspectives and empirical studies reviewed above provide the analytical basis for the empirical model estimated in this study. The literature generally suggests a positive relationship between financial inclusion and GDP per capita, remittances, years of schooling, and foreign direct investment, whereas inflation and unemployment are commonly associated with constraints on financial participation. Nevertheless, previous empirical evidence also indicates that these relationships may vary across institutional and economic contexts. Consequently, the present analysis seeks to evaluate whether these theoretical expectations are supported in the case of European Union countries during the period 2004–2023.

3. Materials and Methods

3.1. Research Design and Data

The empirical analysis is based on a balanced panel dataset comprising 26 countries observed over the period 2004–2023, resulting in a total of 520 observations. The panel data structure allows for the simultaneous capture of cross-sectional variation across countries and temporal dynamics, improving estimation efficiency and controlling for unobserved heterogeneity across units. The study period was selected based on the availability and consistency of data for all variables across the countries included in the sample. Furthermore, the 2004–2023 period encompasses important economic, financial, and technological transformations within the European Union, including the global financial crisis, the sovereign debt crisis, the expansion of digital financial services, and the post-COVID recovery process, all of which are relevant for understanding the evolution of financial inclusion.

The sample consists of 26 European Union member states: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, and Spain. The United Kingdom was excluded from the analysis due to its withdrawal from the European Union (Brexit), which introduced institutional discontinuities that could affect the comparability of the panel. Furthermore, the selected countries provide complete and consistent information for all variables throughout the study period, allowing the construction of a balanced panel dataset.

3.2. Data Sources

The variables used in this study were obtained from internationally recognized databases to ensure consistency, reliability, and comparability across countries and over time. Financial inclusion, measured by the number of automated teller machines (ATMs) per 100,000 adults, was obtained from the International Monetary Fund (IMF) Financial Access Survey. GDP per capita, personal remittances received, inflation, unemployment, and foreign direct investment were retrieved from the World Development Indicators (WDI) database of the World Bank. Information on years of schooling was obtained from the

United Nations Development Programme (UNDP) Human Development Reports database. The use of these sources ensures methodological consistency and facilitates the comparability of indicators across the 26 European Union countries included in the analysis.

The selection of these data sources also reflects the objective of maintaining a balanced panel dataset with consistent annual observations for all countries throughout the 2004–2023 period. While alternative indicators of financial inclusion, including account ownership, digital payments, mobile banking, and composite financial inclusion indices, may provide additional perspectives, their limited temporal coverage and lack of annual comparability across all countries restrict their applicability in long-run panel analyses.

Table 1 presents the operational definition of the variables included in the empirical analysis, together with their measurement, expected relationship with financial inclusion, and corresponding data sources. The selection of these variables is grounded in the theoretical and empirical literature reviewed in Section 1 and reflects the main macroeconomic determinants commonly associated with financial inclusion in cross-country studies.

Table 1. Definition, Measurement, Expected Relationship, and Data Sources of the Variables.

Variable	Measurement	Expected Relationship	Data Source
Financial Inclusion	ATMs per 100,000 adults	Dependent variable	IMF Financial Access Survey
GDP per capita	Constant 2015 US$ per person	Positive (+)	World Bank (WDI)
Remittances	% of GDP	Positive (+)	World Bank (WDI)
Inflation	Annual % change in CPI	Negative (−)	World Bank (WDI)
Years of Schooling	Average years of schooling (25+ years)	Positive (+)	UNDP Human Development Reports
Unemployment	Unemployment rate (% labor force)	Negative (−)	World Bank (WDI)
Foreign Direct Investment	Net FDI inflows (% GDP)	Positive (+)	World Bank (WDI)

Source: Prepared by the authors based on data from the IMF Financial Access Survey, World Development Indicators (World Bank), and UNDP Human Development Reports.

As shown in Table 1, the selected variables capture economic, social, and external dimensions that may influence financial inclusion. Based on the theoretical framework, GDP per capita, remittances, schooling, and foreign direct investment are expected to promote financial inclusion, whereas inflation and unemployment are generally associated with constraints on access to and use of formal financial services.

3.3. Variables and Measurement

Financial inclusion was measured using the number of automated teller machines (ATMs) per 100,000 adults, obtained from the IMF Financial Access Survey. Although digital financial services have gained increasing importance in recent years, ATM penetration remains one of the most frequently used indicators of financial access in cross-country and longitudinal studies due to its broad international coverage, data consistency, and long-term availability.

Previous studies have employed ATM density as a key proxy for financial inclusion because it captures the physical accessibility of formal financial services and facilitates international comparisons across countries and over time (R. Huang et al., 2021; Park & Mercado, 2015; Sarma, 2008; Tuesta, 2014). While this indicator does not fully capture recent developments in digital financial inclusion, it continues to provide a reliable measure of access to the formal financial system, particularly in long-term panel analyses where alternative indicators often suffer from limited temporal coverage.

The selection of ATMs as the proxy for financial inclusion is also motivated by data availability and comparability considerations. Alternative indicators such as account own-

ership, digital payment usage, mobile banking adoption, or composite financial inclusion indices are not consistently available on an annual basis for all European Union countries throughout the 2004–2023 period. Therefore, ATMs provide the most suitable indicator for constructing a balanced panel dataset over a long-time horizon while maintaining cross-country comparability.

The explanatory variables include GDP per capita and personal remittances (both expressed in logarithmic form), as well as inflation, years of schooling, unemployment, and foreign direct investment. The selection of these variables reflects a multidimensional approach that incorporates economic, social, and structural factors associated with financial inclusion.

Logarithmic transformations are applied to reduce distributional asymmetry and to facilitate the interpretation of coefficients in terms of elasticities.

3.4. Econometric Specification

The baseline econometric model is specified as follows:

$$FI_{it} = \beta_0 + \beta_1\, ln(GDP_{it}) + \beta_2\, ln(REM_{it}) + \beta_3\, INF_{it} + \beta_4\, EDU_{it} + \beta_5\, UNEMP_{it} + \beta_6\, FDI_{it} + \varepsilon_{it}$$

where

- FI_{it}: denotes the level of financial inclusion in country i at time t;
- $ln(GDP_{it})$: represents the logarithm of GDP per capita;
- $ln(REM_{it})$: corresponds to the logarithm of personal remittances received;
- INF_{it}: denotes inflation;
- EDU_{it}: represents average years of schooling;
- $UNEMP_{it}$: corresponds to the unemployment rate;
- FDI_{it}: denotes foreign direct investment;
- ε_{it}: is the error term.

Table 1 presents the definition, measurement, and data source of each variable included in the model. Financial inclusion is measured as the number of automated teller machines (ATMs) per 100,000 adults. GDP per capita is expressed in constant 2015 U.S. dollars per person. Remittances correspond to personal remittances received as a percentage of GDP. Foreign direct investment is measured as net inflows expressed as a percentage of GDP. Unemployment refers to the percentage of the total labor force that is unemployed. Inflation is measured as the annual percentage change in consumer prices. Years of schooling correspond to the average number of years of education completed by adults aged 25 years and older. These standardized units facilitate comparability across countries and over time.

3.5. Empirical Strategy and Diagnostic Tests

The empirical strategy is implemented sequentially through a set of diagnostic tests aimed at validating the model assumptions.

First, multicollinearity is assessed using the Variance Inflation Factor (VIF), confirming the absence of severe linear relationships among the explanatory variables. Second, the Shapiro–Francia test is applied to evaluate normality, revealing non-normal distributions, a common feature in macroeconomic data.

Subsequently, the Breusch–Pagan test for random effects confirms the presence of unobserved heterogeneity across countries, supporting the use of panel data models over pooled estimations. Additionally, the Wooldridge test detects first-order autocorrelation in the error terms.

3.6. Model Selection

To determine the most appropriate specification, both fixed effects (FE) and random effects (RE) models are estimated and compared using the Hausman test. The results indicate no systematic differences between the estimators, suggesting that the random effects model is both consistent and efficient for the analysis.

3.7. Robust Estimation

However, the presence of heteroskedasticity, autocorrelation, and potential contemporaneous correlation across panels requires the adoption of a robust estimation strategy. Therefore, the final model is estimated using Panel-Corrected Standard Errors (PCSE), following the methodology proposed by Beck and Katz (1995).

The PCSE approach provides robust standard errors in the presence of cross-sectional dependence and temporal correlation, improving the reliability of statistical inference. This method is particularly suitable for panels with a relatively large time dimension and a moderate number of cross-sectional units, as in the present study.

4. Results

4.1. Descriptive Statistics

Table 2 reports the descriptive statistics of the variables included in the empirical analysis. Financial inclusion, measured by the number of automated teller machines per 100,000 adults, exhibits an average value of 36.18, with values ranging from 18.33 to 195.10. This dispersion reflects substantial differences in the availability of financial infrastructure across European Union countries.

Table 2. Descriptive statistics of the variables.

Variable	Mean	Std. Dev.	Min.	Max.
Financial inclusion	36.18108	36.18108	18.331	195.0985
ln(GDP per capita)	10.1898	0.6749494	8.128493	11.81278
Years of schooling	109.0376	15.59875	81.05948	164.0798
ln(Personal remittances received)	21.24248	1.272178	16.3287	24.32606
Foreign direct investment	15.53082	61.84496	−391.5551	452.221
Unemployment	8.300365	4.175685	2.015	27.686
Inflation	1.72×10^7	8.84×10^7	−4.447547	5.90×10^8

GDP per capita presents a mean logarithmic value of 10.19, indicating notable variation in income levels among the economies included in the sample. Likewise, years of schooling display considerable variability, suggesting differences in human capital accumulation despite the relatively high educational standards characteristic of the European Union.

The personal remittances received show substantial heterogeneity across countries, reflecting differences in migration patterns and the economic relevance of remittance flows. Foreign direct investment exhibits the highest dispersion among the explanatory variables, with values ranging from negative net outflows to substantial positive inflows, indicating significant differences in the degree of international capital integration across member states.

The unemployment rate averages 8.30%, although its wide range suggests heterogeneous labor market conditions throughout the sample period. Inflation also displays substantial variability, reflecting the presence of different macroeconomic environments and economic shocks during the study period. Overall, the descriptive statistics reveal considerable cross-country heterogeneity in economic, social, and financial conditions,

supporting the use of panel data techniques capable of capturing both temporal dynamics and country-specific effects.

4.2. Multicollinearity Test

Table 3 reports the variance inflation factors (VIF) for the explanatory variables. All values are below commonly accepted thresholds, indicating the absence of severe multicollinearity.

Table 3. Variance Inflation Factors (VIF).

Variable	VIF	1/VIF
ln(GDP per capita)	1.41	0.709034
Years of schooling	1.33	0.753673
ln(Personal remittances received)	1.22	0.819866
Foreign direct investment	1.16	0.862893
Unemployment	1.10	0.910876
Inflation	1.07	0.936396
Mean VIF	1.21	

Note: VIF values are below conventional thresholds, indicating no evidence of severe multicollinearity among the explanatory variables.

The mean VIF is 1.21, while individual values range between 1.07 and 1.41, suggesting low levels of linear association among regressors. These results confirm that the simultaneous inclusion of GDP per capita, remittances, education, foreign direct investment, unemployment, and inflation does not affect the stability of the estimated coefficients.

From an econometric perspective, this evidence supports the validity of subsequent estimations, as the relationships between the explanatory variables and financial inclusion are not distorted by multicollinearity issues.

4.3. Normality Test

Table 4 presents the results of the Shapiro–Francia normality test. In all cases, the null hypothesis of normality is rejected ($p < 0.05$), indicating that the variables do not follow a normal distribution.

Table 4. Shapiro–Francia normality test results.

Variable	Obs	W′	V′	z	Prob > z
Financial inclusion	520	0.90411	35.834	7.871	0.00001
ln(GDP per capita)	520	0.99138	3.219	2.571	0.00506
ln(Personal remittances received)	520	0.97529	9.233	4.888	0.00001
Inflation	520	0.18785	303.500	12.570	0.00001
Years of schooling	520	0.84324	58.580	8.952	0.00001
Unemployment	520	0.85229	55.200	8.821	0.00001
Foreign direct investment	520	0.38293	230.597	11.965	0.00001

Note: The null hypothesis of normality is rejected for all variables.

These findings are consistent with the typical characteristics of macroeconomic and panel data, where skewness and extreme values are common. In particular, variables such as inflation and foreign direct investment exhibit greater deviations from normality.

From a methodological perspective, this evidence supports the use of robust estimation techniques that do not rely strictly on the normality assumption, thereby justifying the econometric approach adopted in this study.

4.4. Breusch–Pagan Test for Random Effects

Table 5 presents the results of the Breusch–Pagan test for random effects, used to assess the appropriateness of panel data models over pooled estimations.

Table 5. Results of the Breusch–Pagan test for random effects.

Statistic	Value
Variance of financial inclusion	1313.268
Variance of idiosyncratic error (e)	214.141
Variance of individual effect (u)	1265.207
Standard deviation of financial inclusion	36.23904
Standard deviation of e	14.63356
Standard deviation of u	35.56975
chibar^2 (01)	2863.34
Prob > chibar^2	0.0000

The test statistic (chibar^2 = 2863.34; $p < 0.01$) leads to the rejection of the null hypothesis of no unobserved individual effects, indicating the presence of significant heterogeneity across the units of analysis. This suggests that country-specific differences play an important role in explaining financial inclusion.

Furthermore, the variance associated with the individual effect is considerably larger than the variance of the idiosyncratic error, reinforcing the importance of incorporating this heterogeneity into the econometric specification.

From a methodological perspective, these findings justify the use of panel data models, as pooled estimations would fail to adequately capture the structure of the data and the variability across countries.

4.5. Autocorrelation Test (Wooldridge)

Table 6 presents the results of the Wooldridge test for autocorrelation in panel data. The test statistic (F(1, 25) = 108.721; $p < 0.01$) leads to the rejection of the null hypothesis of no first-order autocorrelation.

Table 6. Wooldridge test for autocorrelation in panel data.

Test	Statistic	*p*-Value
Wooldridge	F(1, 25) = 108.721	0.0000

Note: The null hypothesis of no first-order autocorrelation is rejected.

This result indicates the presence of serial correlation in the error terms within each unit of analysis, implying a violation of the temporal independence assumption.

Consequently, the use of robust estimation methods is required to correct this issue, particularly through the adjustment of standard errors in the final model.

4.6. Comparison Between Fixed Effects and Random Effects

Table 7 presents the estimates obtained from the fixed effects (FE) and random effects (RE) models, with the aim of comparing the magnitude, direction, and statistical significance of the coefficients as a preliminary step before conducting the Hausman test.

In both models, GDP per capita shows a positive and statistically significant effect on financial inclusion, suggesting a consistent result across specifications. In contrast, most of the remaining variables do not exhibit robust statistical significance, and their coefficients appear sensitive to the chosen model.

Table 7. Fixed effects (FE) and random effects (RE) estimates.

Variable	Fixed Effects (FE)	t (FE)	*p*-Value (FE)	Random Effects (RE)	z (RE)	*p*-Value (RE)
ln(GDP per capita)	16.7215	4.42	0.000	15.69963	4.39	0.000
ln(Personal remittances received)	1.926346	1.43	0.152	2.033167	1.56	0.119
Inflation	-7.13×10^{-8}	−2.19	0.029	-5.79×10^{-8}	−1.93	0.054
Years of schooling	−0.1505284	−1.63	0.105	−0.154968	−1.70	0.089
Unemployment	0.3364119	1.38	0.169	0.3400972	1.41	0.158
Foreign direct investment	0.008278	0.62	0.535	0.0072424	0.55	0.585
Constant	−119.6344	−2.97	0.003	−111.2525	−2.84	0.005

Inflation displays a negative effect in both specifications, although with limited significance, while years of schooling show negative coefficients with weak evidence. Remittances, unemployment, and foreign direct investment do not present statistically significant effects at this stage of the analysis.

The results indicate that, although some variables maintain stability in sign, the evidence is not conclusive regarding the robustness of most coefficients. This supports the need to apply the Hausman test to determine the most appropriate specification for the final estimation.

4.7. Hausman Test for Model Selection

Table 8 presents the results of the Hausman test, used to evaluate the consistency of the fixed effects (FE) and random effects (RE) estimators.

Table 8. Hausman test (fixed effects vs. random effects).

Variable	Fixed Effects (b)	Random Effects (B)	Difference (b − B)
ln(GDP per capita)	16.7215	15.69963	1.021874
ln(Personal remittances received)	1.926346	2.033167	−0.1068208
Inflation	-7.13×10^{-8}	-5.79×10^{-8}	-1.35×10^{-8}
Years of schooling	−0.1505284	−0.154968	0.0044396
Unemployment	0.3364119	0.3400972	−0.0036853
Foreign direct investment	0.008278	0.0072424	0.0010356
Hausman Statistic		Value	
$\chi^2(5)$		2.61	
p-value		0.7592	

Note: The null hypothesis of no systematic differences is not rejected, indicating that the random effects specification is consistent relative to fixed effects.

The test statistic ($\chi^2 = 2.61$; $p = 0.7592$) indicates that the null hypothesis of no systematic differences between the estimators cannot be rejected. Consequently, there is no evidence of correlation between unobserved individual effects and the explanatory variables.

From an econometric perspective, this result supports the consistency of the random effects model and suggests its preference over the fixed effects model due to greater efficiency.

Therefore, the subsequent estimation is based on an approach consistent with the random effects specification, complemented by robust methods that correct for heteroskedasticity and autocorrelation.

It is important to note that the FE and RE estimations presented in Table 5 serve primarily as benchmark specifications for model selection rather than as the final basis for inference. While these models provide useful information regarding the direction and magnitude of the coefficients, the diagnostic tests reported previously revealed the presence of significant panel-specific heterogeneity, first-order autocorrelation, and violations

of standard error assumptions. Consequently, statistical inference based exclusively on conventional FE or RE estimators may be unreliable, particularly in panels characterized by temporal dependence and cross-sectional interactions.

For this reason, the final analysis relies on the Panel-Corrected Standard Errors (PCSE) estimator. Unlike conventional FE and RE models, the PCSE approach adjusts the estimated standard errors to account for heteroskedasticity, contemporaneous correlation across panels, and serial correlation, thereby providing more reliable significance tests. Accordingly, the PCSE estimates are considered the preferred specification for interpretation and discussion throughout the remainder of the study.

4.8. Final Model Results (PCSE)

Table 9 presents the results of the final model estimated using Panel-Corrected Standard Errors (PCSE). The model is globally significant (Wald $\chi^2 = 245.26$; $p < 0.01$), indicating that the explanatory variables jointly contribute to explaining financial inclusion.

Table 9. Final model estimated using PCSE.

Model Statistics					Value
Number of observations					520
Number of groups					26
Observations per group (min/avg/max)					20/20/20
R-squared					0.0834
Wald $\chi^2(6)$					245.26
p-value					0.0000
Variable	**Coefficient**	**Std. Error (PCSE)**	**z**	***p*-Value**	**95% Confidence Interval**
ln(GDP per capita)	12.59998	1.896651	6.64	0.000	[8.882612, 16.31735]
ln(Personal remittances received)	2.990092	0.9814983	3.05	0.002	[1.066391, 4.913793]
Inflation	1.27×10^{-8}	5.59×10^{-9}	2.27	0.023	$[1.75 \times 10^{-9}, 2.37 \times 10^{-8}]$
Years of schooling	−0.3162201	0.0668513	−4.73	0.000	[−0.4472463, −0.1851940]
Unemployment	1.680147	0.3705264	4.53	0.000	[0.9539284, 2.406365]
Foreign direct investment	−0.0537079	0.0162957	−3.30	0.001	[−0.0856469, −0.0217690]
Constant	−93.8009	18.6201	−5.04	0.000	[−130.2956, −57.30617]

Note: Final model estimated using Panel-Corrected Standard Errors (PCSE), appropriate for balanced panels with cross-sectional dependence and temporal correlation.

Compared with the FE and RE estimations reported in Table 5, the PCSE model yields a larger number of statistically significant coefficients. This difference does not necessarily imply a change in the underlying relationships but rather reflects the correction of the standard errors after accounting for the econometric problems detected in the diagnostic stage. In particular, the Wooldridge test confirmed the presence of first-order autocorrelation, while the Breusch–Pagan test revealed substantial cross-sectional heterogeneity. Under these conditions, conventional panel estimators may underestimate or overestimate standard errors, leading to biased statistical inference. The PCSE estimator addresses these limitations and therefore provides a more robust basis for evaluating statistical significance.

In terms of results, GDP per capita shows a positive and highly significant effect, indicating that higher income levels promote greater access to financial services. Similarly, personal remittances have a positive and significant impact, suggesting that external financial flows strengthen integration into the formal financial system.

Unemployment also exhibits a positive and significant effect, which may reflect increased reliance on formal financial mechanisms in contexts of labor vulnerability. Inflation

is likewise significant, although its magnitude is relatively small, and its economic impact should be interpreted with caution.

In contrast, years of schooling display a negative and significant effect, as does foreign direct investment, suggesting that these factors do not necessarily translate into greater financial inclusion within the analyzed context. These findings point to the presence of more complex structural dynamics, in which financial access is not solely determined by human capital or economic openness.

The results indicate that financial inclusion in the European Union is driven by a combination of economic, social, and external factors, with heterogeneous effects that reinforce its multidimensional nature.

Therefore, the interpretation of the empirical findings presented in the Section 5 is based primarily on the PCSE estimates rather than on the preliminary FE and RE specifications. This choice is justified by the diagnostic evidence and by the superior capacity of the PCSE estimator to provide consistent statistical inference in the presence of heteroskedasticity, serial correlation, and cross-sectional dependence. Consequently, the PCSE results constitute the most reliable representation of the relationships between the selected macroeconomic determinants and financial inclusion in the European Union.

5. Discussion

The discussion of the results is based on the theoretical expectations and empirical evidence presented in Section 2. Overall, the findings indicate that financial inclusion in the European Union is shaped by a multidimensional process in which economic, social, and structural factors interact. While some results are consistent with the theoretical and empirical literature reviewed, others diverge from conventional expectations, highlighting the context-specific nature of financial inclusion dynamics within advanced economies.

These findings differ in several respects from those reported by R. Huang et al. (2021), who found a generally positive relationship between financial inclusion and economic development in European Union countries. One possible explanation for these differences lies in the scope of analysis and the variables employed. While Huang et al. focused primarily on the contribution of financial inclusion to economic development, the present study examines the macroeconomic determinants of financial inclusion itself. Moreover, the period analyzed in this research includes important structural transformations associated with digitalization, financial innovation, and post-crisis adjustments that may have altered the traditional relationships observed in earlier studies. Consequently, the determinants of financial inclusion may operate differently across time periods and institutional contexts.

First, the positive effect of GDP per capita is consistent with previous studies highlighting income as a central determinant of financial inclusion. Allen et al. (2016) and Abdul Karim et al. (2022) show that economies with higher income levels tend to exhibit greater financial deepening, understood as the expansion and development of financial markets, institutions, and financial intermediation activities. Although financial deepening and financial inclusion are distinct concepts, they are closely related. More developed financial systems generally provide a broader range of financial products, greater institutional coverage, and improved service accessibility, thereby creating favorable conditions for expanding financial inclusion. Consequently, the positive relationship observed between GDP per capita and financial inclusion suggests that higher levels of economic development contribute not only to the growth of the financial sector but also to greater access to and use of formal financial services by the population.

Similarly, the positive impact of remittances aligns with the empirical evidence reported by Chuc et al. (2022) and Demirgüç-Kunt et al. (2022), who argue that these flows facilitate the integration of households into the formal financial system. In this sense, the

results reinforce the idea that remittances not only increase liquidity but also promote the use of financial services, encouraging greater interaction with formal financial institutions and strengthening financial participation. However, the positive effect of inflation contrasts with the traditional macroeconomic stability perspective proposed by Fischer (1993), which suggests that higher inflation reduces financial deepening. This result indicates that, in the European context, economic agents may rely more heavily on formal financial instruments as an adaptive response to inflationary environments. Likewise, the negative effect of years of schooling differs from studies that identify a positive relationship between education and financial inclusion. Nevertheless, this finding is consistent with recent research suggesting that formal education does not necessarily translate into specific financial capabilities, such as financial literacy or the use of digital financial technologies (Kanungo & Gupta, 2021; Luo, 2024). Furthermore, the negative sign of foreign direct investment does not align with the literature that associates economic openness with greater financial deepening. This finding suggests that the benefits of foreign investment may be concentrated in specific sectors without generating a broad expansion of financial access at the household level, partially supporting perspectives that emphasize the uneven nature of economic integration processes. In addition, foreign direct investment in advanced economies is frequently directed toward capital-intensive industries, technological sectors, or multinational corporate activities that do not necessarily increase financial participation among the general population. Consequently, the relationship between foreign investment and financial inclusion may depend on the sectoral composition of investment flows and the extent to which their benefits are transmitted to households. Finally, the positive effect of unemployment points to a less explored relationship in the literature. Contrary to the conventional view that links employment with greater financial inclusion, the results indicate that, in contexts of vulnerability, individuals may increase their use of formal financial services to access unemployment benefits, social transfers, public assistance programs, or temporary financial support mechanisms. In this sense, financial inclusion may function as an adaptive mechanism through which households manage income instability and maintain access to essential financial resources during periods of labor market uncertainty.

These findings provide empirical evidence that refines and, in some cases, challenges the existing literature, demonstrating that financial inclusion is not an automatic outcome of economic development or financial openness. Rather, it is a complex phenomenon shaped by structural, institutional, technological, and behavioral factors, reinforcing the need for more comprehensive policy approaches that consider the interaction between inclusion, well-being, and sustainable development (Núñez-Naranjo et al., 2025; Sarma, 2008) At the same time, the observed relationships may also be influenced by factors not explicitly incorporated into the empirical model, including digital infrastructure, regulatory quality, institutional effectiveness, and income inequality. Furthermore, potential feedback effects between financial inclusion and certain macroeconomic variables cannot be completely ruled out. Consequently, future research should explore these mechanisms through alternative specifications and additional indicators capable of capturing the broader institutional and technological dimensions of financial inclusion. Overall, the results provide partial support for the theoretical expectations derived from the literature review. While the effects of GDP per capita and remittances are consistent with previous evidence, the unexpected signs observed for education, inflation, foreign direct investment, and unemployment suggest that the determinants of financial inclusion may operate differently in highly integrated and digitally advanced economies such as those of the European Union. These differences may also reflect heterogeneous institutional conditions, levels of digital financial development, and variations in the effectiveness with which economic resources are translated into financial participation. Consequently, future studies should further investigate these

heterogeneous dynamics using alternative econometric approaches capable of capturing non-linearities and distributional differences across countries.

From a policy perspective, the findings support the relevance of ongoing European Union initiatives aimed at strengthening financial inclusion through both economic and digital channels. The positive role of economic growth and remittances suggests that policies promoting economic resilience and financial accessibility can contribute to broader participation in the financial system. In this regard, the European Union's Digital Finance Strategy seeks to foster innovation, digital financial services, and inclusive access to financial products, particularly through the modernization of financial infrastructure and digital payment systems. Likewise, the Capital Markets Union initiative aims to deepen financial integration, improve access to financial services, and enhance the efficiency of financial markets across member states. The results of this study indicate that achieving these objectives may also require addressing structural factors such as labor market conditions, educational effectiveness, and the transmission of investment benefits to households. Therefore, financial inclusion policies should be complemented by broader economic, social, and institutional measures capable of reducing barriers to participation and ensuring that the benefits of economic development are more evenly distributed across the European Union.

6. Conclusions

This study analyzes the macroeconomic determinants of financial inclusion in the European Union using a panel data approach for the period 2004–2023. Based on a robust econometric strategy employing Panel-Corrected Standard Errors (PCSE), the findings provide empirical evidence confirming the multidimensional nature of financial inclusion in advanced economies.

The results show that GDP per capita and personal remittances act as key drivers of financial inclusion, reinforcing the role of economic development and financial flows in expanding access to formal services. At the same time, the positive effects of unemployment and inflation suggest that financial inclusion may also respond to conditions of vulnerability and uncertainty, functioning as an adaptive mechanism rather than solely as an outcome of economic well-being.

In contrast, the negative effects of years of schooling and foreign direct investment indicate that financial inclusion does not automatically expand with higher levels of general education or greater economic openness. These findings point to more complex structural dynamics, where access to and effective use of financial services depend not only on resource availability but also on specific capabilities and on how the benefits of economic growth are distributed.

In terms of contribution, this study provides updated empirical evidence for advanced economies and demonstrates that the relationship between financial inclusion and its determinants does not always follow the conventional patterns identified in the literature. In particular, the results highlight the importance of considering non-linear dynamics and heterogeneous effects when analyzing financial inclusion.

From a policy perspective, the findings suggest that strategies aimed at promoting financial inclusion should go beyond expanding financial infrastructure. Instead, they should focus on strengthening financial literacy, reducing access barriers, and encouraging the effective use of financial services, particularly in contexts of economic vulnerability.

Finally, the study presents some limitations, including the use of a proxy for financial inclusion focused on physical infrastructure and the absence of more direct indicators of digital financial inclusion. Although the number of ATMs per 100,000 adults remains a useful measure for long-term comparative analyses, it does not fully capture recent developments in digital financial services. Future research could address this limitation by

incorporating alternative indicators widely used in the financial inclusion literature, such as account ownership rates, digital payment usage, mobile banking adoption, the percentage of adults using formal financial services, or multidimensional financial inclusion indices derived from the Global Findex Database and related composite measures. Additionally, future studies may employ alternative econometric approaches and heterogeneity analyses to better capture the evolving nature of financial inclusion in increasingly digitalized financial environments.

Author Contributions: Conceptualization, A.N.-N., C.B.-C., M.K.B.-G., A.C.-P. and M.L.-C.; methodology, A.N.-N. and C.B.-C.; software, M.K.B.-G. and A.C.-P.; validation, A.N.-N., A.C.-P. and M.L.-C.; formal analysis, M.K.B.-G. and A.C.-P.; investigation, A.N.-N., A.C.-P. and M.L.-C.; resources, A.N.-N.; data curation, A.N.-N., M.K.B.-G. and A.C.-P.; writing—original draft preparation, C.B.-C., M.K.B.-G. and A.C.-P.; writing—review and editing, A.N.-N. and M.L.-C.; visualization, A.N.-N.; supervision, A.N.-N.; project administration, A.N.-N.; funding acquisition, A.N.-N. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by Universidad Tecnológica Indoamérica grant number IIDI-001-23 A thank you to for its support in the development of this research under the project.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The original contributions presented in this study are included in the article. Further inquiries can be directed to the corresponding author.

Acknowledgments: The authors would like to thank the Dirección de Investigación y Desarrollo—DIDE of the Universidad Técnica de Ambato. This article is derived from the research project entitled "La inclusión financiera y el acceso a los créditos en los bancos comunales de las áreas rurales de la provincia de Tungurahua", approved with Resolution No. UTA-CONIN-2025-0400-R by the Dirección de Investigación y Desarrollo-DIDE of the Universidad Técnica de Ambato, Ecuador".

Conflicts of Interest: The authors declare no conflicts of interest.

References

Abdul Karim, Z., Nizam, R., Law, S. H., & Hassan, M. K. (2022). Does financial inclusiveness affect economic growth? New evidence using a dynamic panel threshold regression. *Finance Research Letters*, *46*, 102364. [CrossRef]

Allen, F., Demirguc-Kunt, A., Klapper, L., & Martinez Peria, M. S. (2016). The foundations of financial inclusion: Understanding ownership and use of formal accounts. *Journal of Financial Intermediation*, *27*, 1–30. [CrossRef]

Anarfo, E. B., Abor, J. Y., & Osei, K. A. (2020). Financial regulation and financial inclusion in Sub-Saharan Africa: Does financial stability play a moderating role? *Research in International Business and Finance*, *51*, 101070. [CrossRef]

Anarfo, E. B., Abor, J. Y., Osei, K. A., & Gyeke-Dako, A. (2019a). Financial inclusion and financial sector development in Sub-Saharan Africa: A panel VAR approach. *International Journal of Managerial Finance*, *15*(4), 444–463. [CrossRef]

Anarfo, E. B., Abor, J. Y., Osei, K. A., & Gyeke-Dako, A. (2019b). Monetary policy and financial inclusion in sub-Sahara Africa: A panel VAR approach. *Journal of African Business*, *20*(4), 549–572. [CrossRef]

Ba, K., & Dieng, S. A. (2025). Digital financial inclusion: Socioeconomic and demographic factors of access and usage in senegal. *African Development Review*, *37*(2). [CrossRef]

Barik, R., & Sharma, P. (2019). Analyzing the progress and prospects of financial inclusion in India. *Journal of Public Affairs*, *19*(4), e1948. [CrossRef]

Beck, N., & Katz, J. N. (1995). What to do (and not to do) with time-series cross-section data. *American Political Science Review*, *89*(3), 634–647. [CrossRef]

Becker, G. S. (2009). *Human capital: A theoretical and empirical analysis, with special reference to education*. University of Chicago Press.

Chatterjee, A. (2020). Financial inclusion, information and communication technology diffusion, and economic growth: A panel data analysis. *Information Technology for Development*, *26*(3), 607–635. [CrossRef]

Chopra, K., Sidana, N., & Arora, R. (2025). Digital public infrastructure as a driver of financial inclusion in India. *Discover Sustainability*, *7*(1), 155. [CrossRef]

Chuc, A. T., Li, W., Phi, N. T. M., Le, Q. T., Yoshino, N., & Taghizadeh-Hesary, F. (2022). The necessity of financial inclusion for enhancing the economic impacts of remittances. *Borsa Istanbul Review*, *22*(1), 47–56. [CrossRef]

Damane, M., & Ho, S. Y. (2026). Effects of financial inclusion on financial stability: Evidence from SSA countries. *International Economics and Economic Policy*, *23*(2), 25. [CrossRef]

de la Peña, R. (1975). Jacob Mincer. Schooling, experience and earnings. Nueva York, [N. Y.]: Columbia University Press, 1974. 152 p. *Estudios Demográficos y Urbanos*, *9*(01), 128. [CrossRef]

Demirgüç-Kunt, A., Klapper, L., Singer, D., & Ansar, S. (2022). *The global findex database 2021*. The World Bank.

Eshun, S. F., & Kočenda, E. (2025). Determinants of financial inclusion in sub-Saharan Africa and OECD countries. *Borsa Istanbul Review*, *25*(1), 34–56. [CrossRef]

Fischer, S. (1993). The role of macroeconomic factors in growth. *Journal of Monetary Economics*, *32*(3), 485–512. [CrossRef]

Geng, Z., & He, G. (2021). Digital financial inclusion and sustainable employment: Evidence from countries along the belt and road. *Borsa Istanbul Review*, *21*(3), 307–316. [CrossRef]

Huang, R., Kale, S., Paramati, S. R., & Taghizadeh-Hesary, F. (2021). The nexus between financial inclusion and economic development: Comparison of old and new EU member countries. *Economic Analysis and Policy*, *69*, 1–15. [CrossRef]

Huang, W., Gu, X., Lin, L., Alharthi, M., & Usman, M. (2023). Do financial inclusion and income inequality matter for human capital? Evidence from sub-Saharan economies. *Borsa Istanbul Review*, *23*(1), 22–33. [CrossRef]

Kanungo, R. P., & Gupta, S. (2021). Financial inclusion through digitalisation of services for well-being. *Technological Forecasting and Social Change*, *167*, 120721. [CrossRef]

Korner, H., & Stark, O. (1992). The migration of labor. *International Migration Review*, *26*(4), 1462. [CrossRef] [PubMed]

Kouladoum, J.-C., Wirajing, M. A. K., & Nchofoung, T. N. (2022). Digital technologies and financial inclusion in sub-Saharan Africa. *Telecommunications Policy*, *46*(9), 102387. [CrossRef]

Kozol, E. (2026). Determinants of financial inclusion: A panel data analysis of global trends, digital finance and policy implications. *Digital Finance*, *8*(1), 5. [CrossRef]

Lee, B., Kim, H., & Tavakoli, A. (2023). The impact of economic growth, inflation and unemployment on subjective financial satisfaction: A New global evidence. *Cogent Economics & Finance*, *11*(2), 2287908. [CrossRef]

Luo, L. (2024). Digital financial inclusion, educational attainment and household consumption. *Finance Research Letters*, *68*, 105976. [CrossRef]

Manogna, R. L., Mehta, S., & Agarwal, D. (2026). Demystifying financial inclusion in an emerging economy: A machine learning approach to index construction and forecasting. *Economic Change and Restructuring*, *59*(2), 37. [CrossRef]

McKinnon, R. I. (2010). *Money and capital in economic development*. Rowman & Littlefield Publishers. [CrossRef]

Miao, F., Holmes, W., Ronghuai, H., & Hui, Z. (2021). *AI and education: Guidance for policy-makers*. UNESCO. [CrossRef]

Mundell, R. A. (1963). Capital mobility and stabilization policy under fixed and flexible exchange rates. *Canadian Journal of Economics and Political Science*, *29*(4), 475–485. [CrossRef] [PubMed]

Muvunyi, E., & Batóg, J. (2025). Financial inclusion and sustainability of economic development: Empirical results from selected EU member states. *Sustainability*, *17*(18), 8237. [CrossRef]

My Sang, T. (2026). Determinants of financial well-being: The roles of family financial socialization, financial literacy, financial inclusion, and propensity to plan. *Journal of Financial Services Marketing*, *31*(1), 16. [CrossRef]

Núñez-Naranjo, A. F., Córdova-Pacheco, A., & Chicaiza-Moreta, S. (2025). The role of intangible metrics in achieving sustainable development goals. *Heritage and Sustainable Development*, *7*(1), 507–520. [CrossRef]

Obstfeld, M., & Taylor, A. M. (2004). *Global capital markets*. Cambridge University Press. [CrossRef]

Pak, T.-Y., Chatterjee, S., & Choung, Y. (2026). Navigating digital finance: How digital financial literacy influences digital financial services use and benefits in Korea. *Financial Innovation*, *12*(1), 42. [CrossRef]

Park, C.-Y., & Mercado, R. J. (2015). Financial inclusion, poverty, and income inequality in developing Asia. *SSRN Electronic Journal*, *426*. [CrossRef]

Patwardhan, A. (2018). Financial inclusion in the digital age. In *Handbook of blockchain, digital finance, and inclusion, volume 1* (pp. 57–89). Elsevier. [CrossRef]

Sarma, M. (2008). *Index of financial inclusion. Indian council for research on international economic relations working paper No 215, 215*. Available online: https://www.icrier.org/pdf/Working_Paper_215.pdf (accessed on 22 June 2026).

Sharaf, M. F., Shahen, A. M., & Alharaib, M. A. (2025). Digital financial inclusion and socioeconomic sustainability in Saudi Arabia examining drivers disparities and policy pathways. *Discover Sustainability*, *7*(1), 19. [CrossRef]

Tuesta, D. (2014). *Measuring financial inclusion: A multidimensional index*. Available online: https://ssrn.com/abstract=2634616 (accessed on 22 June 2026).

Yao, Y., Liu, Y., & Huang, L. (2021). Motivation-based segmentation of yachting tourists in China. *Asia Pacific Journal of Tourism Research*, *26*(3), 245–261. [CrossRef]