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Non-linear relationship in financial inclusion research: Thematic review, evidence, mechanisms, and methods

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Abstract: Emerging studies document a nonlinear relationship between financial inclusion and economic outcomes, but offer little or no explanation for why such a relationship exists. This study reviews 26 research articles reporting nonlinear relationships between financial inclusion and economic outcomes from 2020 to 2025, using a thematic literature review methodology. The findings show that the documented non-linear relationship in the literature is predominantly U-shaped or inverted-U-shaped. I offer explanations for why such non-linear relationships exist and provide insights into theory and methodological approaches that help unravel them in financial inclusion research. The study concludes by suggesting areas for future research. The insights offered in this article can assist policymakers and practitioners in understanding the role of inflection points in financial inclusion and the implications for financial inclusion practice and policymaking.

Keywords: non-linear, threshold, research, financial inclusion, digital financial inclusion, economic growth, poverty, financial stability, inflection point

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1. Introduction

Financial inclusion is crucial for sustainable economic development (Rastogi & Ragabiruntha, 2018). By definition, financial inclusion means that people have access to formal financial accounts (e.g., bank or mobile money accounts) that they can use to make payments and access pensions, mortgages, utilities, savings, deposits, and internet connectivity (Demirgüç-Kunt & Klapper, 2013). As more people become financially included, they will be able to access and use essential financial services to meet their needs and improve their well-being (Demirgüç-Kunt & Klapper, 2013). This has led policymakers to prioritize financial inclusion as a development priority, especially in developing countries (Arora, 2018).

In the literature, many studies document a linear, positive relationship between financial inclusion and economic outcomes (Ozili, 2025a; Van et al., 2021; Ozili et al., 2023). However, there is growing concern that financial inclusion may have a nonlinear relationship with economic outcomes, as some countries with high levels of financial inclusion still face poverty, hunger, poor health, economic recessions, financial crises, and environmental pollution, among other challenges. This suggests that a persistent increase in financial inclusion may not always be beneficial if it does not translate into improved economic outcomes or address existing economic and social development challenges. One reason might be the too-much-of-a-good-thing effect, which occurs when the benefits of financial inclusion have been fully realized and have reached an inflection point beyond which further increases in the level of financial inclusion lead to negative or undesirable outcomes. This inflection point may explain why financial inclusion indicators exhibit a nonlinear relationship with certain economic indicators.

Although the emerging literature has begun to present evidence that financial inclusion may have a non-linear effect on economic outcomes (see, for example, Tissaoui et al, 2024; Ahmat-Tidjani, 2025; Demir et al, 2020; Nsiah et al, 2021; Nsiah & Tweneboah,

2025), the literature hardly provide economic explanations for why a non-linear relationship between financial inclusion and economic outcomes may exist, therefore, the purpose of this study is to cross-examine the emerging evidence on the non-linear relationship between financial inclusion and economic outcomes and explain why such non-linear relationship exists, these explanations can guide policymakers in making sound decisions about the optimal level of financial inclusion for economic development in developing countries, it can also assist scholars in providing meaningful explanations for the nonlinear relationships observed in empirical research on financial inclusion.

The study employed a thematic literature review method to categorize the literature by key themes. After reviewing 26 studies reporting nonlinear relationships between financial inclusion and economic outcomes from 2020 to 2025, the thematic review finds that these relationships are predominantly U-shaped or inverted-U-shaped. The study also offers plausible explanations for why such a non-linear relationship may exist and suggests useful directions for future research.

This study contributes to the existing literature in several ways. It contributes to the literature on the linear relationship between financial inclusion and economic outcomes, but it has not examined the nonlinear relationship. It contributes to this literature by showing that a nonlinear relationship may arise due to inflexion points. Second, the study contributes to the scant literature examining the non-linear relationship between financial inclusion and economic outcomes, but it does not explain why such a relationship may exist. This study contributes to the literature by providing credible explanations for the existence of a nonlinear relationship. Finally, the study contributes to the discourse on the 'too-much-of-a-good-thing' effect. It shows that the 'too-much-of-a-good-thing' phenomenon may be present in financial inclusion practice and policymaking, as financial inclusion efforts may yield benefits up to a threshold beyond which they become detrimental, indicating a non-linear rather than linear effect.

The remainder of the paper is organized as follows. Section two presents the methodology and article selection strategy for the thematic literature review. Section three presents a theory of financial inclusion that may explain the nonlinear effects of financial inclusion. Section four discusses the methodologies used in existing studies that report a non-linear relationship between financial inclusion and economic outcomes. Section five presents a review of the literature on the non-linear relationship between financial inclusion and economic outcomes. Section 6 presents explanations for the non-linear relationship between financial inclusion and economic outcomes. Section seven presents some areas for future research. Section eight presents the study's conclusion.

2. Methodology

This study employed a thematic literature review methodology. A thematic literature review synthesizes the literature around major themes, domains, or arguments. The article selection criteria/strategy for the thematic literature review are the following. First, the inclusion criteria are based on the article title and abstract. Only studies that display the precise expression 'financial inclusion', 'threshold', and 'non-linear' in the article title and/or abstract were included. These selection criteria enable us to identify studies that explore the nonlinear relationship in financial inclusion research. The next criterion is based on the study type. The studies included in the thematic literature review are peer-reviewed journal articles, books, book chapters, or institutional working papers. Third, the sample period is 2020-2025. The selected sample period is recent and was chosen because significant published research on the nonlinear relationship and threshold effect began to emerge in 2020. Fourth, only articles written and published in English were selected. All articles published in a non-English language were not included in the article selection process. Fifth, Google Scholar was the main search platform used to produce the article search results. Google Scholar was used because it has a broader scope and yields more search results than Scopus and Web of Science, which are somewhat restrictive (Falagas et al., 2008). In the Google Scholar database, the keywords 'financial inclusion',

'non-linear', and 'threshold' were inserted into the Google Scholar search engine with a search period from 2020 to 2025. Articles retrieved via a Google search were used to conduct the thematic literature review. In the first stage, 44 articles were identified in the Google Scholar search results without applying the article inclusion criteria. The search results on Google Scholar were reduced to 26 articles after applying all article inclusion criteria. The article screening and filtering process was done in two stages. First, 12 studies were excluded as duplicates. Second, six studies were excluded because they were dissertations or non-peer-reviewed articles.

3. Theory

The systems theory of financial inclusion proposed in Ozili (2020) describes the non-linear relationship in financial inclusion research. The systems theory of financial inclusion views the economic system as consisting of interacting sub-systems. The sub-systems could be a bank, a grocery store, a gym, a corner shop, a business, or any entity that offers goods and services in exchange for payment. Each subsystem determines the means of payment it will accept from consumers and communicates this to consumers. The means of payment include debit cards, credit cards, or digital payments. Consumers who want to interact with any of the subsystems will have incentives to obtain the required means of payment that is acceptable to the subsystem before the goods and services offered by the subsystem can be exchanged following payment. Once this is achieved, financial inclusion has occurred, and goods and services can be exchanged at the sub-system level for the benefit of consumers, the sub-system, and the economic system (Ozili, 2020).

Regarding the nonlinear or threshold effects of financial inclusion, systems theory suggests that financial inclusion may increase in a U- or inverted-U-shaped manner when the payment condition imposed at the subsystem level varies over time (Ozili, 2020). For instance, the level of financial inclusion may increase in a U-shaped manner if all subsystems require only cash as their preferred payment method. The cash-only payment option will not motivate prospective unbanked adults to obtain a bank account, a digital account, or a mobile money account. As a result, the level of financial inclusion will not increase; rather, it may remain unchanged or decrease. However, certain events, such as the COVID-19 pandemic, may prompt existing subsystems to adopt digital payment methods, including bank transfers, debit cards, credit cards, or fintech app payments. This will motivate prospective unbanked customers to open a bank account or a mobile money account, enabling them to make digital payments when interacting with a subsystem, and could lead to a high level of financial inclusion.

In contrast, the systems theory of financial inclusion also suggests that the level of financial inclusion may increase in an inverted-U-shaped manner if all subsystems require bank transfers or other digital payment methods, such as debit cards, credit cards, or fintech apps. This will motivate unbanked adults to open bank or mobile money accounts to make digital payments when interacting with existing subsystems, thereby leading to a high level of financial inclusion. However, certain events, such as internet shutdowns and prolonged downtime of digital payment technologies, may cause one or more subsystems to change their means-of-payment condition to cash-only. When this occurs, it would constitute a setback for financial inclusion, as unbanked adults interacting with the subsystem would have no incentive to open a bank or mobile money account once the payment condition is changed to cash-only.

The systems theory of financial inclusion also explains the relationship between financial inclusion and different economic outcomes in that the payment conditions imposed by existing subsystems not only determines how people obtain the goods and services they need, it also determines how the use of effective payment instruments (e.g., a debit card) contribute to economic outcomes such as economic growth, financial stability, environmental quality, tax revenue, entrepreneurship and sustainable development. The financial transactions of people who own and use non-cash payment

instruments are more likely to have a strong spillover into the economic system, thereby improving financial stability, environmental quality, tax revenue, entrepreneurship, and sustainable development.

4. Methodological issues

Recent studies investigating the non-linear effect of financial inclusion commonly use the threshold regression method to determine how the statistical relationship between financial inclusion indicators (as the independent variable) and economic outcomes (i.e., the dependent variable) changes quickly at a specific threshold value of the threshold variable (see, for example, Ofoeda, 2022; Demir et al, 2020; Sebai & Talbi, 2024; Logogye et al, 2025; Ahmat-Tidjani, 2025). The threshold variable may be a financial inclusion indicator or another independent variable that triggers a change in the relationship when it crosses a threshold. The threshold regression estimator reports values for the relationship below and above the threshold and can accommodate multiple thresholds (Yu, 2013; Yu & Fan, 2021).

While the threshold regression method is commonly used to identify nonlinear relationships in financial inclusion research, it has inherent limitations. For instance, it lacks a simple analytical solution, and determining the appropriate threshold can be challenging. Two, its computation is computationally intensive because it requires multiple initial values before identifying the appropriate threshold. Third, it does not address endogeneity when the independent variables are correlated with the error term, thereby yielding inconsistent threshold estimates. For this reason, the threshold regression is often complemented by generalized method of moments (GMM) or two-stage least squares (2SLS). Fourth, there is a risk of model misspecification when using the threshold regression method, especially if the underlying assumptions about the nature of the threshold effect or the distribution of the error term in the threshold model are incorrect. Five, the interpretation of the estimates obtained from the threshold regression method may not be straightforward, as it describes a relationship that changes at distinct thresholds rather than along a single linear function.

Other studies employ alternative methods to examine the nonlinear effects of financial inclusion. For instance, Nsiah et al. (2021) use Hansen's estimation and a differenced generalized method of moments regression to investigate the non-linear relationship between financial inclusion and poverty. Emara and Kasa (2021), Avom et al. (2022), Umar et al. (2025), and Tissaoui et al. (2024) use the system generalized method of moments panel estimation method when examining the nonlinear effects of financial inclusion on domestic savings, bank concentration, financial stability, and human development. Bayesian regression methods are also common and were used by Nguyen et al. (2025) to investigate the non-linear effects of financial inclusion on tax revenue and the level of sustainable development. A summary of the methods used in the literature is presented in Table 1.

Table 1. Methodological contributions to the literature

Financial inclusion measure	Access	Emara & Kasa (2021). Sebai and Talbi (2024), Bhatter et al. (2025) and Karim et al. (2022)
	Usage	Demir et al (2020)
	Digital	Demir et al. (2020). Dinh (2025), Le and Pham (2024), Huang and Lan (2025), and Basnayake et al (2024)
Identification method	Types	Panel smooth transition regression (Sebai & Talbi, 2024); system generalized method of moments (Emara & Kasa, 2021; Avom et al, 2022; Umar et al, 2025; Tissaoui et al, 2024); Bayesian regression methods (Nguyen et al, 2025); dynamic threshold panel (Tissaoui et al, 2024)
Threshold type	Single	Feng and Zhang (2023), Abdallah et al. (2024), Ndombi Avouba et al. (2023), Umar et al. (2025)
	Multiple	Rapih and Wahyono (2023). Karim et al. (2022). Le and Pham (2024) and Tissaoui et al. (2024)
	Endogenous	Nil
	exogenous	Sebai & Talbi (2024). Le and Pham (2024), and Rapih and Wahyono (2023)
Outcome class	Macro	Demir et al. (2020), Karim et al. (2022), Rapih and Wahyono (2023), Abdallah et al. (2024) and Feng and Zhang (2023)
	Banking stability	Avom et al. (2022), Sebai and Talbi (2024), Yen Hai Dang and Dao Thieu Thi (2025) and Bhatter et al. (2025)
	Public finance	Nguyen et al (2025) and Huang and Lan (2025)

Source: Author

5. Recent literature on the non-linear effect of financial inclusion

Several studies in the financial inclusion literature identify a nonlinear relationship between financial inclusion and economic outcomes (see the summary in Table 2). Some studies examine the effects of financial inclusion on human development, poverty reduction, and income inequality. Tissaoui et al. (2024) examine the effect of financial inclusion on human development in low- and middle-income countries and find that financial inclusion improves human development across different thresholds in upper-middle- and lower-middle-income countries. Ahmat-Tidjani (2025) examines the effect of financial inclusion on per capita household consumption expenditures in twenty-eight sub-Saharan African countries from 2004 to 2022 and finds that financial inclusion increases per capita household consumption expenditures below a certain GDP threshold. However, above that threshold, financial inclusion does not improve household welfare in the region. Demir et al. (2020) investigate the threshold effect of financial inclusion on income inequality across 106 developed and developing countries in 2011, 2014, and 2017, using a panel threshold regression model. They find that financial inclusion reduces income inequality, but only up to a point; beyond that, it may increase it. Nsiah et al. (2021) examine the effect of financial inclusion on poverty reduction in sub-Saharan Africa from 2010 to 2017 using Hansen's estimation and the differenced generalized method of moments. They find that financial inclusion reduces poverty beyond the threshold of 0.365. Nsiah and Tweneboah (2025) examine the effect of financial inclusion on poverty reduction in Africa and the moderating role of institutional quality across African countries, and find that financial inclusion increases household consumption expenditure below a certain threshold, thereby reducing poverty.

Other studies examine the effects of financial inclusion on financial stability and performance. Sebai and Talbi (2024) examine the relationship between financial inclusion and financial stability in twenty-four developing countries from 2004 to 2020 using the dynamic panel threshold regression. They find that financial inclusion reinforces financial stability at low levels of inclusion but exacerbates financial instability at high levels of inclusion. Kebede et al. (2025) examine the nonlinear effect of financial inclusion on financial stability in 19 African countries from 2006 to 2022 using panel semiparametric regression, panel quantile regression, and two-stage least squares regression. They find

that financial inclusion promotes financial stability below a certain threshold, but reduces it above that threshold. Yen Hai Dang and Dao Thieu Thi (2025) investigate the effect of financial inclusion on bank stability in ASEAN countries using GMM and find that financial inclusion increases financial stability beyond a certain threshold. In contrast, countries with financial inclusion below the threshold experience decreased financial stability. Bhatter et al (2025) examine the relationship between financial inclusion and the financial performance of Indian banks from 2014 to 2023 and find that higher financial inclusion improves financial performance beyond a certain point.

Some studies also examine the effects of financial inclusion on economic growth. Becha et al (2025) examine the effect of digital financial inclusion on regional economic growth in China's 31 provinces between 2003 and 2022 using a panel threshold autoregressive regression model. They find that digital financial inclusion increases economic growth above a certain level of financial inclusion. Basnayake et al. (2024) examine the impact of digital financial inclusion on economic growth in 30 Asia-Pacific countries for 2014, 2017, and 2021 and find that financial inclusion has a positive effect on economic growth above a significant threshold. Karim et al. (2022) examine the impact of financial inclusion on economic growth in 60 countries from 2010 to 2017 and find that financial inclusion has a positive effect on economic growth at both lower and upper threshold levels. Siddiki and Bala-Keffi (2024) examine the relationship between financial inclusion and economic growth across 153 countries from 2011 to 2020 and find a positive effect of financial inclusion on economic growth. However, this relationship varies at different thresholds of financial development.

Some studies examine the effects of financial inclusion on entrepreneurship, government tax revenue, public services, and domestic savings. Logogye et al. (2025) investigate the existence of a threshold effect in the financial inclusion-entrepreneurship nexus across 68 developing and 28 developed countries from 2006 to 2020, using a dynamic panel threshold regression model. They find that financial inclusion has no impact on entrepreneurship in developing countries below the identified threshold, but once this threshold is surpassed, financial inclusion enhances entrepreneurial activity. In contrast, financial inclusion positively influences entrepreneurship in developed countries both below and above the threshold. Nguyen et al. (2025) examine the non-linear effect of financial inclusion on tax revenue in twenty-one low financial development countries and twenty-two high financial development countries from 2004 to 2020 using Bayesian regression. They find a U-shaped relationship and show that financial inclusion increases tax revenue with 100% probability below a certain threshold, whereas it decreases tax revenue above that threshold. Huang and Lan (2025) examine the relationship between digital financial inclusion and county-level public service quality in 1,445 counties across three regions of China from 2008 to 2022. They find that digital financial inclusion improves financial inclusion above a certain threshold. Emara and Kasa (2021) examine the impact of financial inclusion on domestic savings in emerging markets from 1980 to 2018 using the system generalized method of moments panel estimation method. They find that higher levels of financial inclusion increase the accumulation of domestic savings above a certain threshold. Dinh (2025) examines the influence of digital financial inclusion on sustainable development and the moderating role of inflation, using threshold regression and Bayesian regression. The author finds that digital financial inclusion has a positive impact on sustainable development in low-inflation conditions. Conversely, digital financial inclusion hurts sustainable development in high-inflation environments.

Table 2. Summary of Literature Review

S/N	Topics	Purpose	Non-linear relationship between	Sample	Method	Findings
1.	Demir et al (2020)	To investigate the threshold effect of financial inclusion on income inequality.	Financial inclusion and income inequality.	106 developed and developing countries for 2011, 2014, and 2017.	Panel threshold regression model.	A U-shaped relationship is observed. Financial inclusion reduces income inequality, but only up to a point; beyond that, it does not reduce inequality and may even increase it.
2.	Nsiah et al (2021)	To examine the effect of financial inclusion on poverty reduction in sub-Saharan Africa.	Financial inclusion and poverty reduction	Sub-Saharan African countries from 2010 to 2017.	Hansen's estimation and differenced generalized method of moments methods.	A U-shaped relationship is observed. Greater financial inclusion leads to poverty reduction beyond the threshold level of 0.365.
3.	Emara and Kasa (2021)	To examine the impact of financial inclusion on domestic savings.	Financial inclusion and domestic savings	Emerging markets covering countries from Latin America, Europe, the Middle East, Africa, and Asia from 1980 to 2018.	System Generalized Method of Moments panel estimation method.	A U-shaped relationship is observed. Greater financial inclusion improves the accumulation of domestic savings above a certain threshold level.
4.	Avom et al (2022)	To examine the effect of financial inclusion on bank concentration in Africa.	Financial inclusion and bank concentration	30 African countries from 2004 to 2017.	System generalized methods of moments.	Financial inclusion hurts bank concentration under the first regime and has a positive effect under the second regime.
5.	Ofoeda (2022)	To examine whether anti-money laundering (AML) regulations promote financial inclusion.	Anti-money laundering (AML) regulations and financial inclusion	212 economies (developed, developing, and African) from 2012 to 2019.	Dynamic panel threshold estimation method.	An inverted U-shaped relationship is observed. AML regulations increase financial inclusion below a certain threshold, but they have a detrimental effect on financial inclusion above that threshold.
6.	Sebai and Talbi (2024)	To examine the relationship between financial inclusion and financial stability.	Financial inclusion and financial stability	Twenty-four developing countries from 2004 to 2020.	Dynamic panel threshold regression.	A U-shaped relationship is observed. Financial inclusion reinforces financial stability at low levels of inclusion, whereas it exacerbates financial instability at higher levels.

7.	Kebede et al (2025)	To examine the non-linear effect of financial inclusion on financial stability.	Financial inclusion and financial stability	19 African countries from 2006 to 2022.	Panel semiparametric regression, panel quantile regression, and two-stage least squares regression.	A U-shaped relationship is observed. Financial inclusion promotes financial stability below a certain threshold, whereas financial inclusion reduces financial stability above that threshold.
8.	Umar et al (2025)	To examine the relationship between financial inclusion and financial stability in developing economies.	Financial inclusion and financial stability	Seventy-two developing countries from 2012 to 2022.	Dynamic panel two-step System GMM estimator.	Financial inclusion improves financial stability up to a certain threshold, but beyond that threshold, its benefits diminish and potentially reverse.
9.	Yen Hai Dang and Dao Thieu Thi (2025)	To investigate the effect of financial inclusion on bank stability.	Financial inclusion and bank stability	ASEAN countries.	GMM method.	A U-shaped relationship is observed. Financial inclusion will increase financial stability above a certain threshold, whereas countries with financial inclusion below the threshold will witness decreased financial stability.
10.	Tissaoui et al (2024)	To examine the effect of financial inclusion on human development in low- and middle-income countries.	Financial inclusion and human development	Seventy-nine nations from 2000 to 2017.	System generalized method of moments.	Financial inclusion improves human development at different thresholds in upper-middle-income and lower-middle-income countries.
11.	Nguyen et al (2025).	To examine the non-linear effect of financial inclusion on tax revenue.	Financial inclusion and tax revenue	Twenty-one low financial development countries and twenty-two high financial development countries from 2004 to 2020.	The Bayesian method.	A U-shaped relationship is observed. Below a certain threshold, financial inclusion promotes tax revenue with a 100% probability. However, when financial inclusion exceeds the threshold, it will negatively affect tax revenue.
12.	Dinh (2025)	To examine the influence of digital financial inclusion on sustainable development and the moderating role of inflation.	Financial inclusion and sustainable development	117 countries from 2004 to 2022.	Threshold regression and Bayesian regression methods.	Digital financial inclusion has a positive impact on sustainable development in low-inflation conditions. Conversely, in high-inflation environments, digital financial inclusion hurts sustainable development.
13.	Logogye et al (2025)	To investigate the existence of threshold effects in the financial inclusion-entrepreneurship nexus.	Financial inclusion and entrepreneurship	Sixty-eight developing and twenty-eight developed countries	Dynamic panel threshold regression model.	In developing countries, financial inclusion has no impact on entrepreneurship below the identified threshold, but once this threshold is surpassed, financial inclusion enhances entrepreneurial activity. In

				over the period 2006 to 2020.		developed countries, financial inclusion positively influences entrepreneurship both below and above the threshold.
14.	Nsiah and Tweneboah (2025)	To examine the effect of financial inclusion on poverty reduction in Africa and the moderating role of institutional quality.	Financial inclusion and poverty reduction	African countries from 2004 to 2020.	Hansen threshold estimation method.	A U-shaped relationship is observed. Financial inclusion increases household consumption expenditure below a certain threshold, thereby reducing poverty.
15.	Bhatter et al (2025)	To explore the relationship between financial inclusion and the financial performance of banking institutions.	Financial inclusion and financial performance	India from 2014 to 2023.	Robust regression.	A U-shaped relationship is observed. Early-stage financial inclusion efforts strain financial profitability due to operational inefficiencies and risk factors, but higher financial inclusion improves financial performance beyond a certain point.
16.	Le and Pham (2024)	To investigate the influence of financial inclusion and digitalization on carbon dioxide (CO_2) emissions.	Financial inclusion and carbon emissions	Thirty-eight countries from 2006 to 2020.	SGMM method and fixed-effect panel threshold models.	The impact of financial inclusion on CO_2 emissions varies with levels of financial inclusion and digitalization.
17.	Ahmat-Tidjani (2025)	To examine the effect of financial inclusion on per capita household consumption expenditures in sub-Saharan Africa.	Financial inclusion and household consumption	Twenty-eight sub-Saharan African countries over the period 2004 to 2022.	Endogenous-threshold dynamic panel model for econometric estimation.	A U-shaped relationship is observed. Financial inclusion increases per capita household consumption expenditure below a certain GDP threshold. However, above that threshold, financial inclusion does not improve household welfare in the region.
18.	Huang and Lan (2025)	To explore the relationship between digital inclusive finance and county-level public service quality.	Financial inclusion and public service quality	1,445 counties across three regions of China between 2008 and 2022.	Entropy weighting method.	A U-shaped relationship is observed. Digital financial inclusion improves financial inclusion above a certain threshold.
19.	Becha et al (2025)	To examine the effect of digital financial inclusion on regional economic growth in China's provinces.	Financial inclusion and economic growth	31 Chinese provinces between 2003 and 2022.	Panel threshold autoregressive regression model.	A U-shaped relationship is observed. Digital financial inclusion increases economic growth above a certain level of financial inclusion.
20.	Basnayake et al (2024)	To examine the impact of digital financial inclusion on economic growth in Asia-Pacific countries.	Financial inclusion and economic growth	30 Asia-Pacific countries for 2014, 2017, and 2021.	Panel threshold model and two-stage least squares method.	A U-shaped relationship is observed. Financial inclusion has a positive effect on economic growth above a significant threshold effect of DFI.

21.	Karim et al (2022)	To examine the impact of financial inclusion on economic growth.	Financial inclusion and economic growth.	Sixty countries from 2010 to 2017.	Dynamic panel threshold estimation method.	Financial inclusion is beneficial and positively affects economic growth at both lower and upper thresholds across different regimes.
22.	Ndombi Avouba et al (2023)	To examine the relationship between financial inclusion and economic growth in sub-Saharan Africa.	Financial inclusion and economic growth	West African Economic and Monetary Union (WAEMU) countries from 2014 to 2018.	The PCSE (panel-corrected standard error) model.	A U-shaped relationship is observed. Financial inclusion increases economic growth in WAEMU above a certain threshold.
23.	Rapih and Wahyono (2023)	To examine the effect of traditional and digital financial inclusion on economic growth.	Financial inclusion and economic growth	130 developed and developing countries for 2014 and 2017.	Threshold regression-based comparative analysis.	An inverted U-shaped relationship is observed. The effect of traditional financial inclusion on economic growth is pronounced in countries with low levels of financial inclusion. In contrast, digital financial inclusion positively impacts economic growth in countries with higher levels of it.
24.	Siddiki and Bala-Keffi (2024)	To examine the relationship between financial inclusion and economic growth.	Financial inclusion and economic growth	153 countries from 2011 to 2020.	Panel threshold regression.	Financial inclusion has a positive effect on economic growth, but this relationship varies with different thresholds of financial development.
25.	Abdallah et al (2024)	To examine the effect of digital financial inclusion and air pollution on economic growth.	Financial inclusion and economic growth	31 Chinese provinces from 2003 to 2022.	Panel threshold auto-regressive and panel smooth transition auto-regression models.	A U-shaped relationship is observed. Digital financial inclusion increases economic growth below a certain threshold. However, the positive impact diminishes above the threshold.
26.	Feng and Zhang (2023)	To examine the relationship between economic growth and digital inclusive finance in Guizhou Province in China.	Digital financial inclusion and economic growth	Seventy-two counties in Guizhou Province in China from 2014 to 2021.	Panel smooth transformation model and quantile model.	Above a certain threshold, financial inclusion increases economic growth; below the threshold, it decreases it in Guizhou Province.

Source: Author

6. Explanations for the non-linear relationship between financial inclusion and economic outcomes

This section presents explanations for the non-linear relationship between financial inclusion and certain economic outcomes. The discussion focuses on the non-linear effects of financial inclusion on economic growth, financial stability, environmental quality, tax revenue, entrepreneurship, and sustainable development.

6.1. Non-linear relationship between financial inclusion and economic growth

Existing studies, such as Ndombi Avouba et al. (202,3), show that financial inclusion has a nonlinear or threshold effect on economic growth in African countries. Basnayake et al (2024) report similar evidence in Asia-Pacific countries. An inverted U-shaped relationship between financial inclusion and economic growth is expected because greater financial inclusion – through higher bank account ownership by individuals and businesses and the use of those accounts to accumulate deposits, increase savings, obtain loans, purchase insurance, pay taxes, make new investments and make payments for utilities – will increase access to finance for producers and consumers, increase the level of financial intermediation in the financial sector, increase the financial sector's contribution to GDP, and increase economic growth.

This suggests a positive relationship between financial inclusion and economic growth, a finding supported by studies such as Ozili (2025a), Van et al. (2021), and Ozili et al. (2023). However, a threshold effect may exist, which could lead to a negative relationship if higher levels of financial inclusion drive excessive financialization of the economy. In this situation, greater access to and use of specific financial services by individuals and businesses lead to a rapid increase in the prices of financial assets, thereby creating financial bubbles in the financial system without contributing to growth and productivity in the real sector of the economy.

On the other hand, a U-shaped relationship between financial inclusion and economic growth may be expected if financial inclusion does not yield immediate gains in the early years but does so in later years. This would be the case in countries where the financial sector does not make a significant contribution to GDP growth. In such countries, financial inclusion will not have an immediate positive impact on economic growth, but could yield benefits in later years.

6.2. Non-linear relationship between financial inclusion and financial stability

Existing studies, such as Kebede et al. (2025), Sebai and Talbi (2024), and Yen Hai Dang and Dao Thieu Thi (2025), also document a nonlinear relationship between financial inclusion and financial stability. An inverted U-shaped relationship between financial inclusion and financial stability is expected, as greater financial inclusion should ideally lead to a greater inflow of deposits into the banking sector. Financial inclusion is achieved when an account is opened, and deposits are made immediately at a bank branch. Banks will use deposits from depositors to meet their short-term funding needs, improve their liquidity position, and enhance their resilience to external shocks, thereby strengthening bank stability (Han & Melecky, 2013; Ozili, 2025b). However, the positive effect occurs only if financial inclusion is achieved mainly through the opening of bank accounts and the immediate placement of deposits into those accounts. The threshold effect observed in several studies is driven primarily by the 'digital-technology-effect', which has enabled financial inclusion without the immediate placement of deposits in banks. As more people and businesses use digital technologies, such as fintech and bank apps, to open formal accounts without immediately depositing funds, those new accounts will not contribute to improving bank stability. Rather, those accounts, even though they attract small fees, may become inactive or dormant over time, thereby offering little or no benefit to bank stability. On the other hand, a U-shaped relationship between financial inclusion and

financial stability may be expected if financial inclusion does not yield immediate gains for financial stability in the early years but does so in later years. This would be the case in countries where financial inclusion is achieved mostly through non-deposit channels, such as mobile money accounts, which do not have an immediate positive impact on bank stability but could benefit financial stability in the future.

6.3. Non-linear relationship between financial inclusion, environmental quality and climate change

Existing studies document a non-linear relationship between financial inclusion and environmental quality and climate change (Jingpeng et al, 2023; Bakhsh et al, 2025). An inverted U-shaped relationship between financial inclusion and environmental quality and climate change is expected because greater financial inclusion should ideally give individuals and businesses greater access to financial services, such as loan products, insurance and investment products, which they can use to support environmental resource conservation activities, promote green finance, increase investment in clean energy technology, and support activities that preserve the environment and the climate. The positive effect of financial inclusion on environmental quality and climate change is corroborated by Shabir (2024). However, a threshold effect would exist if users of financial services have more pressing survival needs that lead them to abandon sustainability principles and environmental or climate-change goals when using those services. In such situations, many people and businesses will prefer to use affordable financial services to meet their basic survival needs before thinking about the needs of the environment. When this happens, greater financial inclusion would not improve environmental quality or climate change mitigation. This can potentially explain the threshold effect of financial inclusion on environmental quality and climate change. On the other hand, a U-shaped relationship between financial inclusion and environmental and climate change may be expected if financial inclusion does not yield immediate gains for the environment and the climate in the early years but does so in later years.

6.4. Non-linear relationship between financial inclusion and tax revenue

Without financial inclusion, financial transactions in the informal sector will not be taxed because tax authorities do not monitor them. Financial inclusion will bring these financial transactions into the formal financial system, allowing them to be monitored for tax purposes. Existing studies, such as Raouf (2022) and Nguyen et al (2025), document a non-linear relationship between financial inclusion and tax revenue. Generally, an inverted U-shaped relationship between financial inclusion and tax revenue is expected if greater financial inclusion will not only increase the visibility and audit trail of financial transactions for taxation purposes, but it will also increase the tax base, increase the number and size of taxable financial transactions, and increase the amount of tax revenue to the government. This positive effect is corroborated in Oz-Yalaman (2019). However, a threshold effect may exist, as documented in Raouf (2022) and Nguyen et al (2025). An inverted U-shaped relationship may be expected if financially included individuals and businesses use the savings, income, and loans obtained from the formal financial system to stimulate activities in the informal sector. For instance, individuals may take out a credit card loan from a bank and use it to set up a small business that they operate from their home, which is invisible to tax authorities. This means they may not pay the appropriate business tax to the government, thereby reducing tax revenue even though they are financially included. The implication is that, although financial inclusion can increase tax revenue as people use their accounts and mobile money apps to make digital payments or to access loans, these financial services may be used to stimulate economic activities in the informal sector, increase the size of the informal sector, and encourage tax evasion, which leads to low tax revenue to the government. On the other hand, a U-shaped relationship between financial inclusion and tax revenue may be expected if financial

inclusion does not yield immediate gains in the early years but does so in later years. This is likely to be the case in countries where the government chooses to make financial inclusion a top priority and to postpone or delay the collection of taxes on financial transactions to a future date, so that the taxes will not discourage unbanked adults from participating in the formal financial system.

6.5. Non-linear relationship between financial inclusion and poverty reduction

Existing studies, such as Nsiah and Tweneboah (2025) and Nsiah et al. (2021), document a nonlinear relationship between financial inclusion and poverty reduction. An inverted U-shaped relationship between financial inclusion and poverty reduction is expected if financial inclusion provides poor people with access to a transaction account, which they use to obtain savings, loans, and insurance products that help lift them out of poverty. They can use available savings, loans, and insurance products to obtain a loan to start a small business, insure their business, generate income, acquire income-generating assets, and rise above poverty (Tran & Le, 2021; Ozili, 2020). This suggests that greater financial inclusion should lead to reductions in poverty. However, a threshold effect may exist if financially included poor people with access to savings, loans, and insurance products use these financial services in ways that worsen their well-being rather than improve it. For example, poor individuals and households may use loans inappropriately. They may become overindebted to banks and digital lending apps, leading to social consequences like increased anxiety, frustration, and depression, which could plunge them back into poverty again (Ozili, 2020). On the other hand, a U-shaped relationship between financial inclusion and poverty reduction may be expected if financial inclusion does not yield immediate gains in the early years but does so in later years. This is likely to be the case in countries where greater access to and use of financial services alone are insufficient to break the cycle of poverty, owing to cultural, non-market, and structural barriers that make it difficult for people to escape poverty within a short period. However, once these barriers are removed, greater use of financial services will lead to a further reduction in poverty rates.

6.6. Non-linear relationship between financial inclusion and entrepreneurship

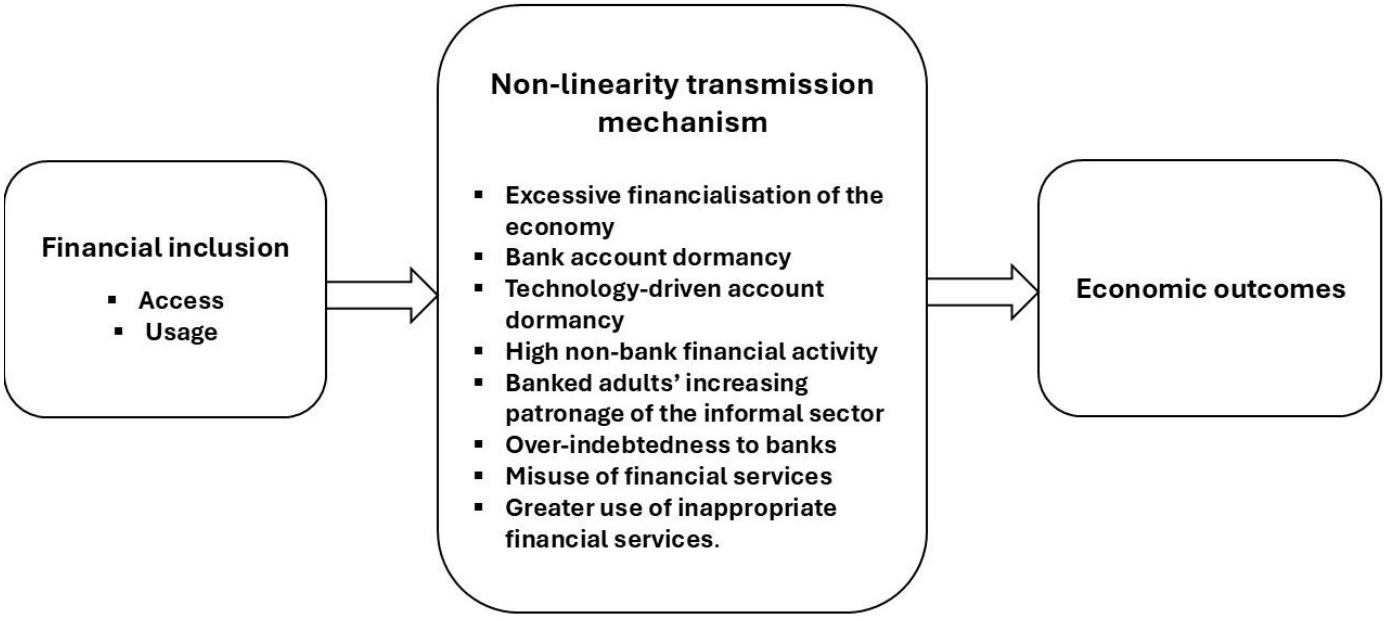
Existing studies, such as Logogye et al (2025), document a non-linear relationship between financial inclusion and entrepreneurship. An inverted U-shaped relationship between financial inclusion and entrepreneurship is expected if financial inclusion yields immediate gains for entrepreneurship but later negative effects. For instance, in some jurisdictions, financial inclusion provides entrepreneurs with access to transaction accounts that enable them to obtain loans and insurance products immediately, helping them start a business, generate profits, expand their operations, and create jobs. However, a threshold effect may exist if financially included entrepreneurs, who already have access to loan and insurance products, use existing financial services in ways that adversely affect their entrepreneurial growth. For example, financially included entrepreneurs and small businesses with low financial literacy may obtain costly loans that they cannot repay, thereby stunting business growth and leading to failure. On the other hand, a U-shaped relationship may be expected if financial inclusion does not yield immediate gains for entrepreneurship in the short term but yields positive gains in subsequent years. This is likely to be the case in business environments or countries where ownership of a transaction account alone does not guarantee access to loans or insurance products for entrepreneurs seeking to start a business. In such jurisdictions, entrepreneurs will be required to meet additional requirements or conditions before they can set up a small business and grow their venture.

6.7. Non-linear relationship between financial inclusion and sustainable development

Existing studies, such as Dinh (2025), document a non-linear relationship between financial inclusion and sustainable development. An inverted U-shaped relationship between financial inclusion and sustainable development is expected because financial inclusion can provide access to savings, credit, and insurance products which individuals, households, small businesses and corporations can use to eradicate poverty, eliminate hunger, improve good health and well-being, obtain quality education, promote gender equality, access clean water, access affordable and clean energy and obtain decent work (Kuada, 2019). However, a threshold effect will exist if higher levels of financial inclusion lead to a negative impact on sustainable development. This is likely to be the case if financial inclusion is not the only enabler of sustainable development. Access to finance is only one of many factors that contribute to achieving the Sustainable Development Goals. On the other hand, a U-shaped relationship may be expected if financial inclusion is unlikely to yield immediate benefits for sustainable development in the early years but may yield positive benefits in later years.

In summary, the discussion in the subsections above identifies the mechanisms underlying the non-linear relationship between financial inclusion and economic outcomes. These mechanisms include excessive financialization of the economy, bank account inactivity and dormancy, high non-bank financial activity, banked adults' increasing patronage of the informal sector, over-indebtedness to banks, misuse of financial services, and greater use of inappropriate financial services. These mechanisms are shown in Figure 1.

Figure 1: Non-linear transmission mechanism



7. Areas for future research

Several non-linear relationships remain unexplored in the financial inclusion literature. For example, the nonlinear relationship between financial inclusion and social inclusion remains unexplored. Such research studies are important because, as more people join the financial sector and have access to affordable, useful financial services, they may feel empowered and motivated to participate in community and social bonding activities that build social cohesion and increase social inclusion. However, as people gain better access to life-changing financial services, such as wealth and income products, they may self-isolate from people they previously interacted with and from those below their

social status, thereby undermining social inclusion. Another area worth exploring is the potential nonlinear relationship between financial inclusion and women's economic participation. This is important because greater provision of gender-specific financial products and services can improve women's access to and use of financial services; however, over time, not all women will be able to access loans to start a business or acquire income-generating assets that can generate wealth, due to cultural and societal norms. Therefore, there is no guarantee that the provision of adequate, tailored financial services to meet women's needs will automatically translate into greater women's economic participation, especially when some women prefer that the male household head access financial services on their behalf. Furthermore, it is worth exploring whether there is a nonlinear relationship between financial inclusion and the size of the informal sector. As financial inclusion increases, more people are expected to move their economic activities into the formal economy, thereby reducing the size of the informal sector. However, financial inclusion may reduce the size of the informal sector only to a point, beyond which further increases may increase informality rather than decrease it. This might occur if financially included people access formal loans and use them to engage in, or stimulate, activities in the underground economy, such as crime, drug peddling, and other vices. In addition, future research should employ additional statistical methods to test the nonlinear relationship between financial inclusion and other economic outcomes. In addition to the threshold regression, dynamic panel, and generalized method of moments methods, other techniques that can be explored include logarithmic and exponential models, as well as polynomial models that use polynomial functions to fit a curved relationship in the dataset. There is also a need for more country-specific research examining the non-linear relationship between financial inclusion and other economic outcomes.

8. Conclusion

Research on financial inclusion is increasing rapidly, with many studies documenting a linear relationship between financial inclusion and economic outcomes. However, there is little insight into whether a nonlinear relationship exists between financial inclusion and economic outcomes, and little explanation of why such a relationship may exist. This study cross-examined the recent literature on the non-linear relationship between financial inclusion and economic outcomes. It also offered explanations for why a non-linear relationship may exist between financial inclusion and economic outcomes. It also offered insights into relevant theories of financial inclusion that support the non-linear relationship, as well as methodological approaches that help unravel this relationship in financial inclusion research. It was found that the non-linear relationship between financial inclusion and economic outcomes often takes a U-shaped form, where higher levels of financial inclusion initially harm economic outcomes but yield positive effects beyond a specific threshold in later years. The study also found that the non-linear relationship can take an inverted-U shape, where high levels of financial inclusion initially have a positive effect on economic outcomes but a negative effect beyond a specific threshold in later years.

The finance-specific implication of the findings is that greater use of financial services can generate financial flows that are beneficial for financial sector development up to a threshold, beyond which further use may not translate into higher financial sector development. Therefore, practitioners and policymakers should be aware that the use of financial services and their benefits may reach an inflection point.

The policy implication is that the level of financial inclusion may reach an inflection point in its relationship with economic outcomes. It is recommended that policymakers pay attention to this inflection point and determine how it can influence policymaking on financial inclusion. It can signal that the persistent efforts of government authorities to increase financial inclusion may yield positive results up to a point at which further increases may have negative effects.

This insight is relevant for policymaking and practice. It can assist policymakers in making sound financial inclusion policies by first understanding and identifying the mechanisms causing a non-linear relationship between financial inclusion and economic outcomes such as excessive financialization of the economy, bank account dormancy, high non-bank financial activity, banked adults' increasing patronage of the informal sector, over-indebtedness to banks, misuse of financial services and greater use of inappropriate financial services. Thereafter, policy tools and programs, such as financial literacy and education, cashless policy promotion, and consumer protection regulations, can be deployed to mitigate these factors that drive an unwanted non-linear relationship between financial inclusion and economic outcomes.

The study also suggested some directions for future research which include investigating the non-linear relationship between financial inclusion and social inclusion, the non-linear relationship between financial inclusion and women economic participation, the non-linear relationship between financial inclusion and the size of the informal sector, and the need to use other statistical methods to test the non-linear relationship between financial inclusion and other economic outcome variables, as well as the need for more country-specific research examining the non-linear relationship between financial inclusion and economic outcomes.

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