Volume 23
Number 4
Winter 2025

ISSN 1854-6935

Managing Global Transitions International Research Journal

EDITOR IN CHIEF
Jana Hojnik

Managing Global Transitions
International Research Journal
ISSN 1854-6935 · www.mgt.fm-kp.si

Continued on p. 366

Managing Global Transitions
International Research Journal
VOLUME 23 · NUMBER 4 · WINTER 2025 · ISSN 1854-6935

https://doi.org/10.26493/1854-6935.23_4

Continued from p. 364

Marinko Škare, *University of Pula, Croatia, mskare@unipu.hr*
Boris Urban, *University of Witwatersrand, South Africa, Boris.urban@wits.ac.za*
Šárka Velčovská, *Technical University of Ostrava, Czechia, sarka.velcovska@vsb.cz*
Manfred Weiss, *Johann Wolfgang Goethe University, Germany, m.weiss@jur.uni-frankfurt.de*

INDEXING AND ABSTRACTING

Managing Global Transitions is indexed/ listed in Scopus, DOAJ, EconLit, Erih Plus, International Bibliography of the Social Sciences, IBZ Online, EconPapers, Cabell's, EBSCO, and ProQuest.

AIMS AND SCOPE

Managing Global Transitions (MGT) is a quarterly, scholarly journal that covers diverse aspects of transitions and welcomes research on change and innovation in increasingly digitalized and networked economic environments, from a societal, organizational, and technological perspective. MGT fosters the exchange of ideas, experience, and knowledge among developed and developing countries with different cultural, organizational, and technological traditions. MGT invites original scientific, research, and review papers advancing the field of transitions in societies, organizations, and technologies.

TOPICS COVERED

Transitions in Societies

- Geo-political transitions, transition experiments, pathways and mechanisms
- Social, demographic, cross-cultural, ethical, geo-political and security aspects of transitions
- Social change, prosperity, wellbeing, happiness
- Policy making, government regulation, social responsibility
- Knowledge-based society and world futures
- New and emerging metrics for measuring, assessing and evaluating societal transitions

Transitions in Organizations

- Organizational analysis and design, modeling, developments and changes in organizational learning and behavior
- International strategy and strategic alliances, networked businesses and operations
- Entrepreneurship and leadership, decision making
- Knowledge sourcing and innovation management, personal development, education and training, HRM
- Business systems and business models
- Connective intelligence and collective intelligence in organizational behavior

Transitions in Technologies

- Managing technological/organizational change and innovation
- Technology networks, technology transfer benefits and risks, technology acquisition and diffusion
- Smart technologies and development discontinuities and sustainability
- Digitalization, IOT, ICT, cybernetics, forecasting
- Technological traditions, strategic surprise and response systems
- Studies that promote understanding of the dynamics of socio-technical systems change
- Science and technology policy that fosters transformative advancement
- Modeling technological change in VUCA (volatile, uncertain, complex, ambiguous) environments

EDITORIAL OFFICE

University of Primorska, Faculty of Management
Izolska vrata 2, 6000 Koper, Slovenia
mgt@fm-kp.si · www.mgt.fm-kp.si

PUBLISHED BY

University of Primorska Press
Titov trg 4, 6000 Koper, Slovenia
zalozba@upr.si · www.hippocampus.si

Revija Managing Global Transitions je namenjena mednarodni znanstveni javnosti; izhaja v angleščini s povzetki v slovenščini. Izid revije je finančno podprla Javna agencija za znanstvenoraziskovalno in inovacijsko dejavnost Republike Slovenije iz sredstev državnega proračuna iz naslova razpisa za sofinanciranje izdajanja domačih znanstvenih periodičnih publikacij.

Agricultural-Induced Environmental Kuznets Curve for South Africa: A Threshold Regression and ARIMA Forecasting Approach

Andrew Phiri
Nelson Mandela University, South Africa
phiricandrew@gmail.com

Rasaq Raimi
Nelson Mandela University, South Africa
s223325562@mandela.ac.za

The purpose of the paper is to examine the impact of the agricultural sector on agricultural emissions in South Africa. To this end, we estimate an agricultural-induced environmental Kuznets curve (EKC) for South Africa between 1990 and 2022 using conventional and threshold regression frameworks. Our regression estimates reveal a 'humped-shaped' relationship between agricultural production and agricultural emissions whereby agricultural production produces lower agricultural emissions above threshold estimates of 4,876 and 6,100 metric tons of CO_2 emissions. Further investigations show that the South African economy has consistently remained above these thresholds since 2010. Moreover, a forecast analysis of the time series using ARIMA models shows that agricultural production is (emissions are) on an upward (a downward) trajectory. However, the forecasting analysis also shows that the South African agricultural sector is not scheduled to reach the net-zero emissions target by 2050. Altogether, these findings imply that whilst South Africa had followed a trajectory of sustainable development prior to the COVID-19 pandemic, the current trajectory may not be sufficient to attain the 2050 Sustainable Development Goals.

Keywords: agricultural sector, agricultural emissions, environmental Kuznets curve (EKC), threshold regression model, ARIMA forecasting, South Africa
JEL *Classification:* C22; C51; Q19; Q56

Received 2025/05/17 · Revised 2025/08/13 · Accepted 2025/08/20

Published online 2025/12/31 https://doi.org/10.26493/1854-6935.23.367-388

Introduction

Our study examines the agricultural-induced environmental Kuznets curve (EKC) for South Africa with the purpose of determining whether the country's agricultural sector is on a path towards being climate neu-

tral. Notably, there has been much research focused on the impact of climate change on South Africa's agricultural production, and the general consensus drawn is that climate change has decreased the country's production yields of staple foods such as maize, soya beans, dry beans, and sunflower (Walker and Schulze 2006; Calzadilla et al. 2014; Tagwi 2022) whilst increasing crop water requirements for sustainable agricultural production (Olabanji et al. 2021). However, very little attention has been paid to the impact of South Africa's agricultural sector on climate change through greenhouse gas (GHG) emissions. Examining the latter, using the EKC, is equally if not more important for the fight against global warming, as such an analysis can reveal whether the technological advancements in the agricultural sector – that make production activities resilient to climate change – can simultaneously reduce GHG emissions from the agricultural sector whilst ensuring sustainable agricultural productivity.

Indeed, the agricultural sector has been the focal point of global policy discussion at the most recent COP28 meeting, with emphasis being placed on the role that sustainable agricultural systems can play in reducing GHG emissions whilst enhancing food security and production systems. These discussions are more relevant for African countries who are mainly dependent on climate-sensitive, traditional sectors like agriculture and mining for their livelihood and are thus more vulnerable to the adverse repercussions of climate change such as prolonged droughts, increased temperatures, soil degradation and crop diseases (Doku et al. 2021; Doku and Phiri 2022). The importance of the agricultural sector in promoting sustainable development in Africa has also been a focal point for African policymakers, as demonstrated at the inaugural 2023 Africa Climate Summit which birthed the 'Nairobi declaration' centred on '… *boosting agricultural yields through sustainable agricultural practices to enhance food stability while minimizing negative environmental impacts* …' (Dal 2023).

We take South Africa as a case study since the country has the highest emissions in Africa (Phiri and Nyoni 2023; Phiri and Sesoai 2024) whilst simultaneously boasting the largest agricultural land on the continent. Therefore, any actions taken by South Africa in her fight towards reducing the country's emissions have the potential to influence the trajectory of Africa's GHG emissions on a global scale. It is also not surprising that South Africa has received a bulk majority of climate financing from Annex I nations committed to the African continent, since the country has

in place the necessary infrastructure and governance to better operationalize the funding for adapting to and mitigating against climate change (Doku et al. 2021; Doku and Phiri 2022; Doku and Phiri 2023; Phiri and Doku 2024).

Figure 1 shows that emissions from South Africa's agricultural sector have been on a slightly downward trajectory since the commitment of climate financing to the country by Annex I nations during the 2009 Copenhagen accord. Conversely, agricultural production has mainly been on an uptrend and yet experienced the most significant surge in the post-2015 period despite the country facing severe drought episodes.

Moreover, the scatterplot between agricultural production and emissions in figure 2 reveals a 'humped-shaped' relationship reminiscent of the EKC, which theoretically hypothesizes on a two-phased emissions-productivity relationship where (i) 'scale effects' dominate during the earlier stages of development when there is much dependency on dirty energy usage for production (i.e. a positive relationship between agricultural production and emissions), (ii) 'technical effects' appear at a later stage of development when the economy is more reliant on cleaner energy technologies that increase productivity without damaging the environment (i.e. a negative relationship between agricultural production

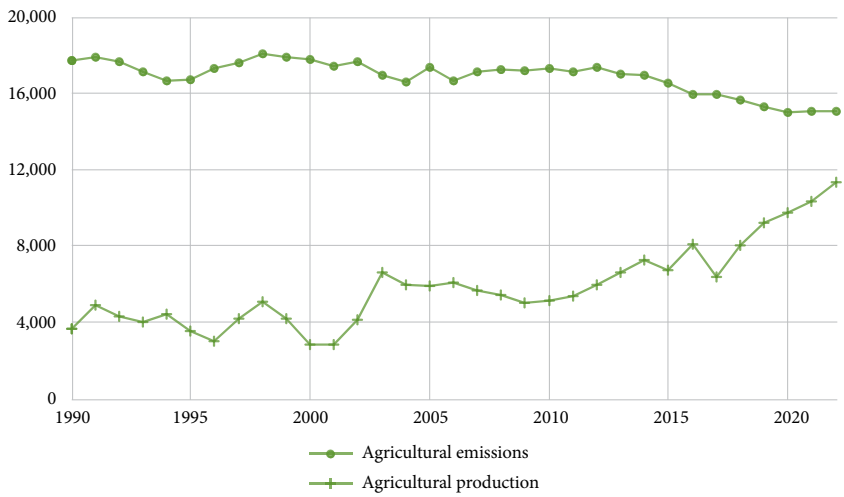

FIGURE 1 Time Series Plot Between Agricultural Emissions and Production (1990–2020)

NOTES Agricultural emissions is measured as carbon dioxide emissions from agriculture in Mt CO_2e. Agricultural production is measured as agricultural value added in millions of US$. Data is sourced from the World Bank Development Indicators.

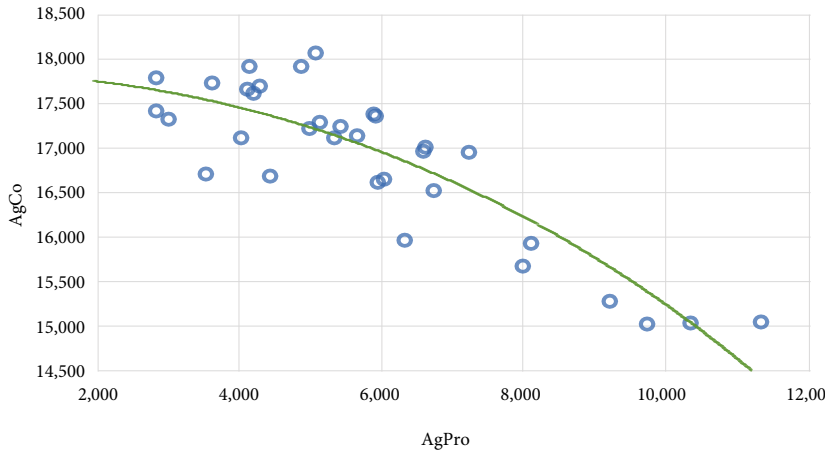

FIGURE 2 Scatterplot Between Agricultural Emissions and Production (1990–2020)
NOTES Agricultural emissions is measured as carbon dioxide emissions from Agriculture in Mt CO_2e. Agricultural production is measured as agricultural value added in millions of US$. Data is sourced from the World Bank Development Indicators.

and emissions). We therefore question whether there exists a significant agricultural-induced EKC relationship for the South Africa economy and, if so, which part of the curve the country is situated on?

The rest of the paper is structured as follows. The second section presents the literature review and the contribution of our study to existing knowledge in this field. In the third section the empirical framework and estimation methods are outlined. The fourth section describes data and presents a preliminary overview of the time-series. The fifth section presents empirical analysis whilst the sixth section concludes the study in the form of policy implications and avenues for future research.

Literature Review and Contribution of This Study

Several previous studies have investigated different forms of the agricultural-induced EKC curve (see table 1). We note that none of the studies presents country-specific research for the South African economy. In fact, all empirical evidence for South Africa is restricted to that presented in panel studies which include the country amongst a host of developing, emerging and industrialized economies (Ogundari et al. 2017; Parajuli et al. 2019; Cetin et al. 2022; Shah et al. 2022; Trofimov 2024). Most of these studies use the conventional method of regressing emissions on economic growth and its squared term whilst including agricultural production as a control variable in the regression. In this sense,

TABLE 1 Summary of Previous Literature on Agricultural-Induced EKC

Author	Scope	Dependent variables	Independent variables	Methods	Results
Ogundari et al. (2017)	43 SSA countries (1990–2009)	AGRIC.CO_2	GDP, GDP^2, FOR, AGRIC, POP, TRADE, POL	FGLS	+ve effect of AGRIC on emissions
Zafeiriou et al. (2017)	Bulgaria, Czech Republic, Hungary (1970–2014)	CO_2	AGRIC, $AGRIC^2$	ARDL	Significant U-shaped agriculture-emissions relationship for Bulgaria and Czech Republic but insignificant for Hungary
Gokmenoglu and Taspinar (2018)	Pakistan (1971–2014)	CO_2	GDP, GDP^2, EC, AGRIC	FMOLS	+ve effect of AGRIC on emissions
Gokmenoglu et al. (2019)	China (1971–2014)	CO_2	GDP, GDP^2, AGRIC	ARDL	+ve effect of AGRIC on emissions
Gurbuz et al. (2021)	Azerbaijan (1992–2014)	CO_2	GDP, GDP^2, EC, AGRIC	ARDL	+ve effect of AGRIC on emissions
Parajuli et al. (2019)	86 countries (1990–2014)	CO_2	GDP, GDP^2, EC, FOR, AGRIC	GMM	+ve effect of AGRIC on emissions
Kułyk and Augustowski (2020)	6 CEE countries (1992–2012)	COS	AGRIC, $AGRIC^2$, GDP, POP, TRADE	GLS	Humped shaped agricultural-emissions relationship
Aziz et al. (2020)	Pakistan (1990–2018)	EF	GDP, GDP^2, FOR, AGRIC, RENEW	QARDL	AGRIC has a +ve and significant (insignificant) effect on CO_2 at quantiles below (above) 0.5
Cetin et al. (2022)	47 developing countries (1976–2017)	CO_2	AGRI., GDP, GDP^2	PMG, DOLS, FMOLS	+ve effect of AGRIC on emissions

Continued on the next page

TABLE 1 *Continued from the previous page*

Author	Scope	Dependent variables	Independent variables	Methods	Results
Ntim-Amo et al. (2022)	Ghana (1980–2014)	CO_2	GDP, GDP^2, EC, AGRIC	ARDL	+ve effect of AGRIC on emissions
Shah et al. (2022)	BRICS (1990–2019)	CO_2	GDP, GDP^2, AGRIC, RENEW, ICT, HC	PMG	+ve effect of AGRIC on emissions
Ganie et al. (2024)	4 South Asian countries (1990–2019)	CO_2	GDP, GDP^2, AGRIC, $AGRIC^2$, RENEW, FIN	CS-ARDL	U-shaped agriculture-emissions relationship
Trofimov (2024)	74 developed and 70 developing countries (1990–2018)	$AGRIC.CO_2$	AGRIC, $AGRIC^2$	FMOLS, DOLS, PMG, POLS, Quantile regressions	Humped shaped agriculture-emissions relationship

NOTES GDP – Economic growth; GDP^2 – Square of GDP; AGRIC – Agricultural production; $AGRIC^2$ – Square of AGRIC; CO_2 – Carbon emissions; $AGRIC.CO_2$ – Carbon emissions from Agricultural sector; RENEW – Renewable energy consumption; FOR – Forestry land; ICT – Information communications technology; HC –Human capital; EC – Energy consumption; ELEC – Electricity consumption, POP – Population growth, TRADE – Trade openness, POL – Political stability, FIN – Financial development. ARDL – Autoregressive distributive lag; POLS – Pooled ordinary least squares; FMOLS – Fully modified ordinary least squares; DOLS – Dynamic ordinary least squares; PMG – Pooled mean group; CS-ARDL – Cross sectional autoregressive distributive lag; QARDL – Quantile autoregressive distributive lag; FGLS – Feasible generalized least squares; GLS – Generalized least squares.

asymmetric EKC dynamics are modelled between economic growth and emissions whilst the impact of agriculture on emissions is restricted to being linear, with most studies finding a positive effect on emissions. Only a few other studies directly model asymmetric relationships between emissions and agricultural productivity and yet the empirical evidence is mixed, with Zafeiriou et al. (2017) and Ganie et al. (2024) finding humped-shaped relationships, whereas Kułyk and Augustowski (2020) and Trofimov (2024) find U-shaped curves.

We build on previous studies by determining the fit of the agricultural-based EKC for South Africa between 1990 and 2022. Unlike previous studies, we make use of the threshold regression model of Hansen (2000) which endogenously estimates the turning point in the EKC and presents formal testing procedures to validate the significance of the estimated 'threshold value'. Notably, several studies have modelled EKC effects using threshold regressions (Sirag et al. 2018; Şentürk 2020; Simionescu 2021; Wang et al. 2022; Li et al. 2023; Yong et al. 2023; Çatik et al. 2024) and these methods are favoured since they provide a more rigorous search for turning points in the data compared to those produced by conventional 'kinked' regressions. Moreover, threshold regressions are preferable to other nonlinear methods such as the quantile regressions used by Aziz et al. (2020) which capture differences in the agricultural productivity–emissions relationship at various locational asymmetries and yet fall short of estimating the precise 'turning point' at which the relationship switches dynamics. This is important for our study as we intend to use the threshold estimates obtained from the threshold regressions as benchmarks to determine '*if and when*' the South African economy transitions from 'scaling' to the 'technical' phase of the EKC (Phiri et al. 2024).

Altogether, our study presents novel evidence validating a 'humped-shaped' relationship between agricultural production and agricultural emissions in South Africa. We specifically find that the country's agricultural sector has transitioned from 'scale effects' to 'technical effects' on the EKC at thresholds of between 4,876 and 6,100 metric tons and the country has consistently remained above these threshold levels in the post-2010 period. These findings, in isolation, imply that the South African agricultural sector has been on a path of sustainable development since the 2009 Copenhagen accord. However, in further conducting a time series forecast of the agricultural production and emissions variables using autoregressive integrated moving average (ARIMA) modelling

techniques, we observe that agricultural production has (emissions have) been on a downward (an upward) trajectory since the COVID-19 pandemic. The main policy implication drawn from these findings is that South Africa has not been on a development path since the COVID-19 pandemic, and the country is not positioned to achieve the SDG 2030 targets of doubling agricultural production by 2030 and reaching net-zero emissions by 2050.

Empirical Framework

TRADITIONAL FRAMEWORK

To examine the agricultural-induced Kuznets curve in South Africa, we follow the works of Kułyk and Augustowski (2020) and Trofimov (2024) and specify the traditional agricultural-induced EKC as:

$$AGRIC.CO2 = \beta 0 + \beta 1\, AGRIC + \beta 2\, AGRIC.SQ + \beta X\, CONTROLS + error \tag{1}$$

where CO_2 is greenhouse emissions from the agricultural sector, AGRIC is the agricultural production, AGRIC.SQ is the squared term on agricultural production which is intended to capture the nonlinear dynamics, CONTROLS are the conditioning variables as determined by theory and economic intuition, and error is a well-behaved error term with $N(0, \sigma^2)$ properties. Following the works of Ogundari et al. (2017), Kułyk and Augustowski (2020), Aziz et al. (2020), Shah et al. (2022), and Ganie et al. (2024) we select human capital (HUMAN), information and communications technology (ICT), renewable energy consumption (RENEW), foreign direct investment (FDI), and trade (TRADE). In line with theory, we expect negative coefficient estimates on the HUMAN, ICT, and RENEW variables and positive ones on the FDI and TRADE variables.

Based on the EKC regression (1), the β coefficients govern the nonlinear dynamics between agricultural production and emissions, with $\beta_1 > 0$, $\beta_2 < 0$, indicating traditional EKC dynamics (i.e. a humped U-shaped relationship), whereas $\beta_1 < 0$, $\beta_2 > 0$ indicates inverse EKC dynamics (i.e. a U-shaped relationship). To compute the turning point, we take the first derivative of equation (1) and equate to zero, i.e.

$$\frac{\partial (AGRIC.CO2)}{\partial (AGRIC.)} = \beta 1 + 2\beta 2\, AGRIC = 0, \tag{2}$$

and solving for the above, we obtain the turning point as:

$$AGRIC^{*} = \frac{-\beta_1}{2\beta_2}. \tag{3}$$

3.2 THRESHOLD REGRESSION

The second framework we use in our study is based on the threshold regression framework of Hansen (2000) from which we specify our 2-regime EKC regression model as:

$$\begin{aligned} AGRIC.CO2 = {} & \alpha_0 + \alpha_1 AGRIC + \alpha_2 HUMAN + \alpha_3 ICT \\ & + \alpha_4 RENEW + \alpha_5 FDI \\ & + \alpha_6 TRADE\ I.(qt \leq AGRIC) \\ & + \beta_0 + \beta_1 AGRIC + \beta_2 HUMAN \\ & + \beta_3 ICT + \beta_4 RENEW + \beta_5 FDI \\ & + \beta_6 TRADE\ I.(qt > AGRIC) + \varepsilon_t, \end{aligned} \tag{4}$$

where I. is an indicator function governing the regime-switching dynamics and q_t is the endogenous threshold value of the threshold variable, AGRIC. We compactly specify regression (4) in matrix format:

$$Y_t = \Theta' x_t + \delta' x_t(\gamma) + \varepsilon_t, \tag{5}$$

where the stacked values are θ' = α's and δ' = α'- β, and θ, δ and γ are the regressions parameters which are estimated as minimization of the sum squared errors function, $S_n(\theta, \delta, \gamma)$, i.e.

$$S_n(\Theta, \delta, \gamma) = (Y - X\Theta - X_\gamma \delta)'(Y - X\Theta - X_\gamma \delta). \tag{6}$$

The optimum value of γ is further obtained by minimizing of the concentrated sum of squared errors function, $S_n(\gamma)$, i.e.

$$S_n(\gamma) = S_n(\hat{\Theta}(\gamma), \hat{\delta}(\gamma), \gamma), \tag{7}$$

where and are the estimated values of θ and δ, and the true value of is obtained as:

$$\hat{\gamma} = \underset{\gamma \in \Gamma_n}{\operatorname{argmin}} S_n(\gamma). \tag{8}$$

A direct way of testing the significance of a threshold effect is to formulate the following null hypothesis:

$$H_0: \alpha_i = \beta_i \tag{9}$$

However, since the threshold is not identified under the null hypothesis in (9), conventional F-tests are unreliable as they produce non-standard distributions. Hansen (1996) thus proposes the use of the bootstrap technique to simulate the asymptotic distribution of a likelihood ratio (LR) test on the following hypothesis:

$$H_0: \gamma = \gamma_0 \tag{10}$$

and to reject for large values of LR(γ) where:

$$LR(\gamma) = \frac{S(\gamma) - S(\hat{\gamma})}{\hat{\sigma}^2}. \tag{11}$$

ARIMA FORECASTING MODEL

Lastly, we use an autoregressive integrated moving average (ARIMA) framework to forecast the future trajectories of the agricultural emissions and production time series. The baseline ARIMA model can be specified as:

$$\Delta Y_t = \alpha_o + \sum_{i=0}^{p} a_i \Delta Y_{t-i} + \sum_{j=0}^{q} b_i \Delta u_{t-i}, \tag{12}$$

where Y_t represents the main time series, u_t denotes the white noise error process, and p and q are the optimum lag lengths of the Y_t and u_t variables, respectively. Equation (12) can be expressed in backshift notation as:

$$(1 - \varphi_1 B - \ldots - \varphi_p B^p)(1-B)^d Y_t = c + (1 + \varphi_1 B + \ldots + \varphi_p B^p) u_t. \tag{13}$$

In modelling the ARIMA model we follow the Box et al. (1974) three-step procedure which consists of (i) identifying the optimal AR and MA lags of the model by selecting the model which produces the lowest Alkaike and Schwarz information criterion, (ii) estimating the ARIMA model using the maximum likelihood (ML) estimators, (iii) forecasting the ARIMA to use the model to iteratively generate h-ahead forecasts based on past values of Y_t and u_t.

Data Descriptions and Preliminary Analysis

To conduct our empirical analysis, we make use of 9 time series variables whose description and source are provided in table 2.

Table 3 summarizes the summary statistics and integration properties of the time series. The standard deviations are relatively large numbers compared to their mean values, implying that the series are highly volatile. Moreover, the reported p-values of the Jarque-Bera statistics all reject the hypothesis of a non-normally distributed series and hence indicate possible nonlinearity in the series. This warrants the use of nonlinear estimators in our empirical analysis. Moreover, the Augmented Dickey-Fuller (ADF) and Dickey-Fuller Generalized Least Squares (DF-GLS) unit root test, which test the null hypothesis of non-stationary behaviour in the time series, all fail to reject the unit root hypothesis in all series except for GOVERN, FDI and trade variables. We therefore log-linearize

TABLE 2 Description of the Data Used

Variable	Symbol	Source
Carbon dioxide emissions from Agriculture (Mt CO_2e)	AGRIC.CO_2	WDI
Agriculture value added (Constant 2015 US$)	AGRIC.PROD	WDI
Squared term of agriculture value added (Constant 2015 US$)	AGRIC.$PROD^2$	OWN
Human capital index	HUMAN	PWT
Governance effectiveness index	GOVERN	WGI
Individuals using internet as a % of the population	ICT	WDI
Renewable energy consumption as a % of total energy consumption	RENEW	WDI
Foreign direct investment as a % of GDP	FDI	WDI
Trade as a % of GDP	TRADE	WDI

NOTES WDI – World Development Indicators; WGI – World Governance Indicators; PWT – Penn World Tables; OWN – own computation.

TABLE 3 Summary Statistics and Unit Root and Preliminary Correlations

Series	Mean	Standard deviation	Jarque-Bera	ADF	DF-GLS
AGRIC.CO^2	16874.65	879.4622	0.00	−1.68	−0.32
AGRIC.PROD	5806.302	2145.229	0.12	−1.84	−2.08
AGRIC.$PROD^2$	38175691	29343363	0.00	−1.47	−1.08
HUMAN	2.372978	0.348474	0.22	−1.95	−2.08
GOVERN	0.484620	0.391872	0.26	-3.94^{**}	-3.46^{**}
ICT	23.93101	26.58919	0.10	−2.01	−1.82
RENEW	12.19394	4.184117	0.12	−1.36	-2.92^{*}
FDI	0.606259	0.921935	0.00	-3.56^{**}	-3.62^{**}
TRADE	49.39234	8.483135	0.64	-3.48^{*}	-3.24^{**}

NOTES '***', '**', '*' denote the 1%, 5% and 10% significance levels, respectively.

the remaining time series to obtain stationarity of the variables, which is crucial for ensuring compatibility with our estimators.

Empirical Results

CONVENTIONAL EKC REGRESSION ESTIMATES

Table 4 presents the findings from the conventional OLS estimators. Note that we estimate 8 regressions, with regression (1) presenting the agricultural-based EKC regression estimated with no control variables, and regressions (2) – (7) including each control variable, whilst regression (8) includes all control variables. Recall that the agricultural emissions and production variables are estimated in their natural logs and therefore we exponentiate the estimated turning values to obtain the true values of these 'optimum points'. To ensure that the regression is robust to serial correlation and heteroscedasticity we use 'Newly-West' standard errors.

In all regressions, we find positive (negative) and significant coefficients on the AGRIC (AGRIC.SQ) and estimate a variety of threshold values ranging from 3,103 (regression 4) to 4,273 (regressions 5 and 7). These findings of a humped-shaped relationship between agricultural production and emissions imply significant fit of the EKC for South Africa's agricultural sector and these findings complement those similarly found in the panel-based studies of Kułyk and Augustowski (2020) and Trofimov (2024). We also find some control variables, such as human capital governance and trade, become statistically significant once all controls are entered into the regression, i.e. regression (8). The positive (negative) signs on the trade (human capital and governance) variables imply that these control variables are harmful towards (helpful for) the environment and these findings concur with those in Ogundari et al. (2017) and Shah et al. (2022).

So far, we have only determined the shape of the EKC curve for South Africa's agricultural sectors and yet we have not determined on which part of the curve the economy currently lies. Therefore, we further analyse the results by plotting the time series for agricultural production between 1992 and 2022 against the range of threshold estimates to determine 'if and when' South Africa transitioned from the 'scale' to 'technical' phases of the EKC. From figure 3, we observe that South African production has continuously lay above the 'range of threshold' estimates reported in table 4 since early 2000. These observations depict that South Africa transitioned to the 'technical' phase of the agricultural-induced

TABLE 4 Threshold Regression Results

Dependent Variable: AGRIC.CO2								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	0.31	1.01	0.30	1.83	0.12	−0.37	0.20	0.91
	(0.83)	(0.58)	(0.85)	(0.45)	(0.94)	(0.87)	(0.89)	(0.67)
AGRIC. PROD	2.31	2.14	2.31	1.93	2.34	2.47	2.34	2.32
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***
AGRIC. PROD^2	−0.14	−0.13	−0.14	−0.12	-0.0.14	−0.15	−0.14	−0.14
	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***	(0.00)***
HUMAN		0.26						−0.35
		(0.26)						(0.00)***
GOVERN			−0.0009					−0.089
			(0.96)					(0.01)**
ICT				−0.0005				0.002
				(0.29)				(0.02)*
RENEW					0.0004			−0.004
					(0.83)			(0.29)
Log(FDI)						−0.003		−0.003
						(0.45)		(0.48)
TRADE							0.0005	0.001
							(0.44)	(0.09)*
Turning point	8.25	8.23	8.25	8.04	8.36	8.23	8.36	8.29
	[3844]	[3752]	[3844]	[3103]	[4273]	[3752]	[4273]	[3959]
R^2	0.80	0.82	0.80	0.82	0.81	0.81	0.81	0.90

NOTES '***', '**', '*' denote the 1%, 5% and 10% significance levels, respectively. P-values of regression estimates are reported in (). Natural value of threshold variable reported in [].

EKC, ultimately implying that country's agricultural sector is on a long-term environmentally sustainable path.

THRESHOLD REGRESSION ESTIMATES

Next, we present the results obtained from estimating 2-regime threshold regressions in table 5. Note that we estimate the same sequence of regressions used in our traditional analysis, thus yielding 8 regressions. The upper (lower) part of table 5 reports the coefficient estimates of the upper (lower) regimes of the nonlinear regression and captures the relationship between agricultural production and other control variables on agricultural emissions above (below) the threshold estimates. The estimated values of the thresholds, along with the LR statistics used to verify significant threshold effects, are reported at the bottom of table 5 and all reported statistics exceed their critical values at a 5% level of signifi-

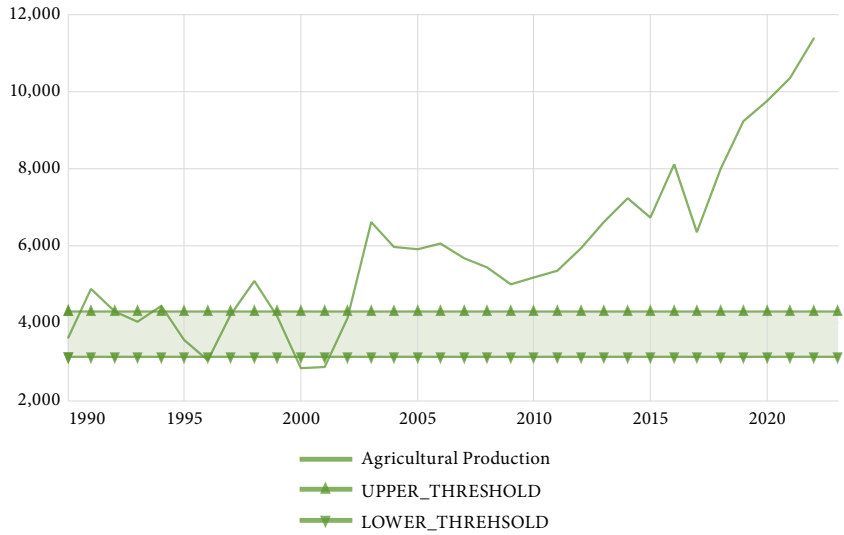

FIGURE 3 Agricultural Production Versus Estimated Thresholds (Conventional Model)

NOTE Vertical axis measures agricultural value added in millions of US$.

cance. Also bearing in mind that the main dependent and independent variables are in logarithm format, we exponentiate these values to obtain their 'original values'.

From table 5, we observe that the threshold estimates obtained from the threshold regressions range between 4,876 and 6,100, and these values are much larger compared to those obtained from the conventional estimators. Below these thresholds, agricultural production and the control variables produce insignificant estimates in regressions (1) to (7), yet produce a positive (negative) and significant effect of agricultural production and human capital (governance and trade) in regression (8). Above the threshold the dynamics switch, with agricultural production and human capital (governance and trade) variables producing positive (negative) coefficient estimates as observed in regressions (2), (3) and (8). Altogether, these findings from the threshold regressions confirm a humped-shaped relationship similarly obtained using traditional estimators. Considering that we obtain higher threshold estimates compared to the 'turning-points' computed by conventional estimators, this suggests the possibility of the economy transitioning from the lower regime to the upper regime at a later stage of development than previously thought. To test this possibility, we once again compare the evolution of agricultural

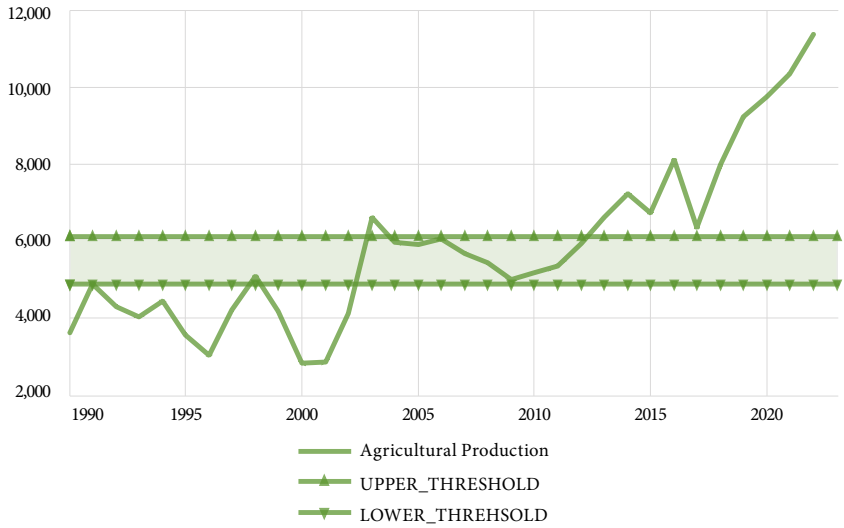

FIGURE 4 Agricultural Production Versus Estimated Thresholds (Threshold Model)
NOTE Vertical axis measures agricultural value added in millions of US$.

production against the estimated threshold points using the time series plot presented in figure 4. As can be observed, South Africa's agricultural production is found to be consistently higher than the range of threshold estimates in the post-2010 period.

ARIMA FORECASTS

Thus far, we have estimated the EKC and their optimum 'turning points' and have further found that the South African sector has already transitioned from the 'scale' phase to the 'technical' phase of the curve, which we treat as evidence of the agricultural sector being on a path of sustainable development. However, the analysis does not give a depiction of the trajectory of these variables in the long-term future, which has important policy implications since the Sustainable Development Goals (SDGs) are geared towards doubling agricultural productivity by 2030 whilst attaining zero-emissions by 2050. We therefore conduct an ARIMA forecasting exercise to determine the path of South Africa's agriculture emissions and production by 2050.

As a first step in the modelling process, we need to identify the optimum number of lags which produces the best fit of the ARIMA (p, d, q) regression for both agricultural emissions and production time series. Recall that the unit root tests found both series to be nonstationary,

TABLE 5 Threshold Regression Results

	Dependent variable: AGRIC.CO2							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Below threshold								
Constant	9.84 (0.00)***	9.58 (0.00)**	9.73 (0.00)***	9.64 (0.00)***	9.80 (0.00)***	9.84 (0.00)***	9.81 (0.00)***	9.97 (0.00)***
AGRIC. PROD	0.009 (0.69)	8.46E−05 (0.99)	0.009 (0.83)	0.01 (0.76)	0.009 (0.83)	0.009 (0.71)	0.0003 (0.87)	0.004 (0.00)***
HUMAN		0.09 (0.34)						0.18 (0.00)***
GOVERN			−0.05 (0.12)					−0.089 (0.01)**
ICT				0.004 (0.14)				0.002 (0.76)
RENEW					−0.007 (0.15)			−0.078 (0.29)
FDI						0.0001 (0.98)		0.003 (0.48)
TRADE							−0.0003 (0.62)	−0.001 (0.09)*
Above threshold								
Constant	11.46 (0.00)***	11.26 (0.00)***	11.31 (0.00)***	11.25 (0.00)***	11.47 (0.00)***	11.32 (0.00)***	11.55 (0.00)***	12.67 (0.00)***
AGRIC. PROD	−0.19 (0.00)***	−0.16 (0.00)***	−0.18 (0.00)***	−0.17 (0.00)***	−0.20 (0.00)***	−0.18 (0.00)***	−0.22 (0.00)***	−0.24 (0.00)***
HUMAN		−0.06 (0.04)*						−0.04 (0.00)***
GOVERN			0.04 (0.09)*					0.89 (0.01)**
ICT				−0.0004 (0.23)				−0.001 (0.42)*
RENEW					0.002 (0.21)			0.004 (0.29)
FDI						0.006 (0.55)		−0.003 (0.48)
TRADE							0.002 (0.17)	0.001 (0.09)*
R^2	0.83	0.86	0.86	0.85	0.85	0.83	0.84	0.88
Threshold value	8.69 [5984]	8.49 [4876]	8.49 [4876]	8.49 [4876]	8.49 [4876]	8.69 [5984]	8.69 [5984]	8.71 [6100]
LR test	33.32***	32.12***	41.75***	21.28***	37.87***	29.89***	35.60***	46.71***

NOTES '***', '**', '*' denote the 1%, 5% and 10% significance levels, respectively. P-values of regression estimates are reported in (). Natural value of threshold variable reported in [].

I(1) processes, hence, we model variables using the autoregressive moving-average (ARMA) processes in their first differences i.e. d = 1. Moreover, we select the optimal lags for the ARIMA model by the minimization of AIC and SC information criterion, which find ARIMA (1, 1, 1) and ARIMA (1, 1, 2) processes to be most suitable for the agriculture emissions and productivity series, respectively.

Table 6 presents the maximum likelihood (ML) estimates of the ARIMA models and for both variables we observe a significant and positive coefficient on the AR part of the model and insignificant values for the MA processes. The Jarque-Bera and Ljung-Box statistics further indicate no autocorrelation in the ARIMA process and 'non-normality' of the regression's residual terms. Collectively, these findings imply that we can rely on our ARIMA models for forecasting purposes.

The forecast values of the agriculture emissions and productivity time series variables over a window period of 2023 to 2050 are presented in figures 5 and 6, respectively, and show that the future trajectory of agricultural production (emissions) is on a downward (upward) trend. This is interesting to note since agricultural production (emissions) was on an upward (downward) trajectory for periods prior to the COVID-19 pandemic and our forecast values indicate a switch in these trajectories over the long run. Notably, Kour (2023) similarly observes an upward future

TABLE 6 ARIMA (p, d, q) Models of Agricultural Production and Emissions

Coefficients	AGRIC.CO2 ARIMA (1, 1, 1)	AGRIC.PROD ARIMA (1, 1, 2)
C	0.39 (0.00)***	0.34 (0.00)***
AR(p)	0.91 (0.00)**	0.95 (0.00)***
MA(q)	0.26 (0.53)	−0.08 (0.68)
σ^2	0.79 (0.00)***	0.89 (0.00)**
Diagnostic tests (p-values)		
Jarque-Bera	0.42	0.81
Ljung-Box[4]	0.54	0.82
Ljung-Box[8]	0.78	0.96
Ljung-Box[12]	0.84	0.99

NOTES '***', '**', '*' denote the 1%, 5% and 10% significance levels, respectively. P-values of regression estimates are reported in (). Lag lengths of Ljung-Box test are reported in [].

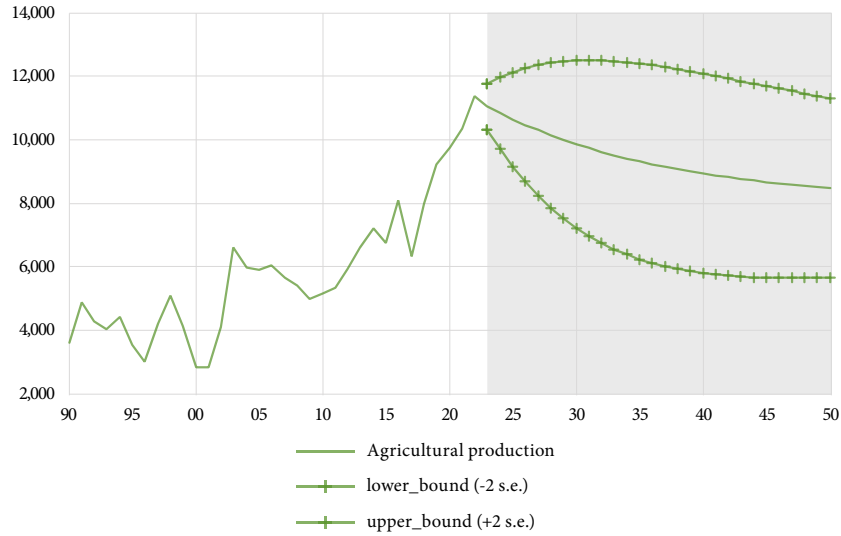

FIGURE 5 ARIMA (1, 1, 1) Forecast of Agricultural Production
NOTE Vertical axis measures agricultural value added in millions of US$.

trajectory of carbon emissions for the South African economy using similar ARIMA forecasting techniques. Moreover, our finding of a lowered future trajectory for agricultural production in South Africa is novel to the literature. Altogether, these trajectories still imply a negative relationship between the variables as they seem to move in opposite future directions, and yet these future paths are highly unsustainable and are not on course to achieving the SDGs.

Conclusion

There has been increasing awareness from global policy makers of the role which the agriculture sector can play in combatting climate change whilst ensuring sustainable food systems and security. To attain these global objectives, the SDGs highlight the need to double the current agricultural productivity by 2030 whilst achieving net zero emissions by 2050. The EKC presents a convenient theoretical framework which can be used to determine whether an economy or sector is on a path of sustainable development. We therefore estimate an agricultural-induced EKC for the South African economy between 1992 and 2022 using conventional and threshold regression analysis and use our results to examine whether the South African agricultural sector has crossed its inflexion point on the EKC.

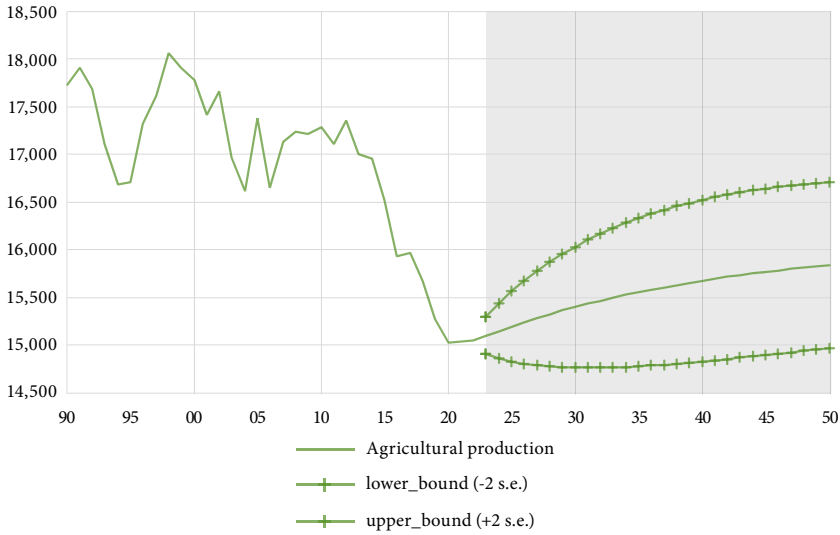

FIGURE 6 ARIMA (1, 1, 2) Forecast of Agricultural Emissions
NOTE Vertical axis measures agricultural value added in millions of US$.

Our study reveals that the South African agricultural sector crossed its inflexion point and has consistently remained above its threshold in the post-2010 period. These findings imply that South African agricultural emissions and productivity have maintained an inverse relationship since crossing its thresholds and these dynamics adhere to the theoretical underpinnings of the traditional EKC. However, our forecasting exercises show that the COVID-19 pandemic may have distorted the previous trajectory of increasing agricultural production whilst reducing emissions. Therefore, these variables are expected to have adverse trajectories in the long-term future whilst maintaining their 'expected' negative relationship.

Overall, our findings imply that whilst the South African agricultural sector had previously been on a sustainable development path, the forecasts of the productivity and emissions variables after the pandemic indicate otherwise. Importantly, we observe that the agriculture production (emissions) is (are) expected to decline (increase) in the long-term future and hence the economy is not on a sustainable path towards achieving the 2030 and 2050 SDG targets. Therefore, policymakers need to focus their energies on finding ways of changing the adverse trajectories of both agriculture production and emissions forecast after the COVID-19 pandemic.

References

Aziz, N., A. Sharif, A. Raza, and K. Rong. 2020. 'Revisiting the Role of Forestry, Agriculture, and Renewable Energy in Testing Environment Kuznets Curve in Pakistan: Evidence from Quantile ARDL Approach.' *Environmental Science and Pollution Research* 27 (9): 10115–10128.

Box, G. E. P., G. M. Jenkins, and J. F. MacGregor. 1974. 'Some Recent Advances in Forecasting and Control.' *Journal of the Royal Statistical Society* 23 (2): 158–179.

Calzadilla, A., T. Zhu, K. Rehdanz, R. S. J. Tol, and C. Ringler. 2014. 'Climate Change and Agriculture: Impacts and Adaptation Options in South Africa.' *Water Resources and Economics* 5:24–48.

Çatik, A. N., A. İlhan, and C. Akdeniz. 2024. 'Testing the Environmental Kuznets Curve Hypothesis in the Transport Sector for OECD Countries: A Dynamic Panel Threshold Approach.' *Environmental Science and Pollution Research* 31 (4): 6372–6384.

Cetin, M. A., I. Bakirtas, and N. Yildiz. 2022. 'Does Agriculture-Induced Environmental Kuznets Curve Exist in Developing Countries?' *Environmental Science and Pollution Research* 29 (23): 34019–34037.

Dal, S. 2023. 'Africa Climate Summit 2023: Climate Change and the Social Dimension.' *Africania* 4 (1): 41–61.

Doku, I., and A. Phiri. 2022. 'Climate Finance and Hunger among Non-Annex-1 Parties: A Lens on Sub-Saharan Africa.' *International Journal of Sustainable Economy* 14 (4): 380–398.

Doku, I., and A. Phiri. 2023. 'Is Climate Finance Helping Stabilise Food Prices in Sub-Saharan Africa?' *Managing Global Transitions* 21 (4): 385–414.

Doku, I., R. Ncwadi, and A. Phiri. 2021. 'Examining the Role of Climate Finance in the Environmental Kuznets Curve for Sub-Sahara African Countries.' *Cogent Economics and Finance* 9 (1): 1965357.

Ganie, A. U. H., A. M. Khah, and M. Ahmad. 2024. 'Investigating the Agriculture-Induced Environmental Kuznets Curve Hypothesis in South Asian Economies.' *Journal of Economic and Administrative Sciences.* https://doi.org/10.1108/JEAS-08-2023-0212.

Gokmenoglu, K. K., and N. Taspinar. 2018. 'Testing the Agriculture-Induced EKC Hypothesis: The Case of Pakistan.' *Environmental Science and Pollution Research* 25 (4): 22829–22841.

Gokmenoglu, K. K., N. Taspinar, and M. Kaakeh. 2019. 'Agriculture-Induced Environmental Kuznets Curve: The Case of China.' *Environmental Science and Pollution Research* 26 (36): 37137–37151.

Gurbuz, I. B., E. Nesirov, and G. Ozkan. 2021. 'Does Agricultural Value-Added Induce Environmental Degradation? Evidence from Azer-

baijan.' *Environmental Science and Pollution Research* 28 (18): 23099–23112.

Hansen, B. E. 1996. 'Inference When a Nuisance Parameter Is Not Identified under the Null Hypothesis.' *Econometrica* 64 (2): 413–430.

Hansen, B. E. 2000. 'Sample Splitting and Threshold Estimation.' *Econometrica* 68 (3): 575–603.

Kour, M. 2023. 'Modelling and Forecasting of Carbon-Dioxide Emissions in South Africa by using ARIMA Model.' *International Journal of Environmental Science and Technology* 20 (10): 11267–11274.

Kułyk, P., and Ł. Augustowski. 2020. 'Conditions of the Occurrence of the Environmental Kuznets Curve in Agricultural Production of Central and Eastern European Countries.' *Energies* 13 (20): 5478.

Li, R., Q. Wang, L. Li, and S. Hu. 2023. 'Do Natural Resource Rent and Corruption Governance Reshape the Environmental Kuznets Curve for Ecological Footprint? Evidence from 158 Countries.' *Resources Policy* 85 (13): 103890.

Ntim-Amo, G., Y. Qi, E. Ankrah-Kwarko, M. Ankrah Twumasi, S. Ansah, L. Boateng Kissiwa, and R. Ruiping. 2022. 'Investigating the Validity of the Agricultural-Induced Environmental Kuznets Curve (EKC) Hypothesis for Ghana: Evidence from an Autoregressive Distributed Lag (ARDL) Approach with a Structural Break.' *Management of Environmental Quality* 33 (2): 494–526.

Ogundari, K., A. A. Ademuwagun, and O. A. Ajao. 2017. 'Revisiting Environmental Kuznets Curve in Sub-Sahara Africa.' *International Journal of Social Economics* 44 (2): 222–231.

Olabanji, M. F., T. Ndarana, and N. C. Davis. 2021. 'Impact of Climate Change on Crop Production and Potential Adaptive Measures in the Olifants Catchment, South Africa.' *Climate* 9 (1): 6.

Parajuli, R., O. Joshi, and T. Maraseni. 2019. 'Incorporating Forests, Agriculture, and Energy Consumption in the Framework of the Environmental Kuznets Curve: A Dynamic Panel Data Approach.' *Sustainability* 11 (9): 2688.

Phiri, A., and B. Nyoni. 2023. 'Clean Versus Dirty Electricity Generation and Economic Growth in South Africa: Time-Frequency Study.' *Economic Change and Restructuring* 56 (4): 2801–2824.

Phiri, A., and I. Doku. 2024. 'Is Climate Finance Aiding Food Security in Developing Countries? A Focus on Sub-Sahara Africa.' *Cogent Economics and Finance* 12 (1): 2312777.

Phiri, A., and T. Sesoai. 2024. 'Renewable, Non-renewable Energy Consumption and Economic Growth in South Africa: Fresh Evidence from ARDL and Wavelet Coherence Analysis.' *International Journal of Energy Economics and Policy* 14 (4): 580–589.

Phiri, A., S. Mhaka, and L. Taonezvi. 2024. 'Too Poor To Be Clean? A Quantile ARDL Assessment of the Environmental Kuznets Curve in

SADC Countries.' *Environment, Development and Sustainability* 26 (11): 27301–27323.

Şentürk, H., T. Omay, J. Yildirim, and N. Köse. 2020. 'Environmental Kuznets Curve: Non-Linear Panel Regression Analysis.' *Environmental Modeling and Assessment* 25:633–651.

Shah, M. I., H. K. K. AbdulKareem, Z. Khan, and S. Abbas. 2022. 'Examining the Agriculture Induced Environmental Kuznets Curve Hypothesis in BRICS Economies: The role of Renewable Energy as a Moderator.' *Renewable Energy* 198:343–351.

Simionescu, M. 2021. 'Revised Environmental Kuznets Curve in CEE Countries. Evidence from Panel Threshold Models for Economic Sectors.' *Environmental Science and Pollution Research* 28 (43): 60881–60899.

Sirag, A., B. T. Matemilola, S. H. Law, and A. N. Bany-Ariffin. 2018. 'Does Environmental Kuznets Curve Hypothesis Exist? Evidence from Dynamic Panel Threshold.' *Journal of Environmental Economics and Policy* 7 (2): 145–165.

Tagwi, A. 2022. 'The Impacts of Climate Change, Carbon Dioxide Emissions (CO_2) and Renewable Energy Consumption on Agricultural Economic Growth in South Africa: ARDL Approach.' *Sustainability* 14 (24): 16468.

Trofimov, I. D. 2024. 'Agriculture-Induced Environmental Kuznets Curve: Evidence from Panel Data.' *SN Business and Economics* 4 (5): 50.

Walker, N. J., and R. E. Schulze. 2006. 'An Assessment of Sustainable Maize Production under Different Management and Climate Scenarios for Smallholder Agro-Ecosystems in KwaZulu-Natal, South Africa.' *Physics and Chemistry of the Earth* 31 (15–16): 995–1002.

Wang, Q., X. Wang, and R. Li. 2022. 'Does Urbanization Redefine the Environmental Kuznets Curve? An Empirical Analysis of 134 Countries.' *Sustainable Cities and Society* 76 (6): 103382.

Yong, S.-W., S.-H. Law, S. Ibrahim, and W. N. W. Mohamad. 2023. 'ICTs, Growth, and Environmental Quality Nexus: Dynamic Panel Threshold Regression.' *Environmental Science and Pollution Research* 30 (8): 20849–20861.

Zafeiriou, E., S. Sofios, and X. Partalidou. 2017. 'Environmental Kuznets Curve for EU Agriculture: Empirical Evidence from New Entrant EU Countries.' *Environmental Science and Pollution Research* 24 (2): 15510–15520.

Shaping Stability: Can the Finance-Growth Nexus Achieve It?

Ahmed Mahmoudi
University of Ibn Tofail, Morocco
ahmed.mahmoudi@uit.ac.ma

Mohamed Torra
University of Ibn Tofail, Morocco
mohamed.torra@uit.ac.ma

This paper assesses the tripartite link between a country's financial (in) stability, its level of financial development, and economic growth. Using a panel of 21 countries over the period 2001–2020 and using the IMF Financial Market Index to proxy financial development, we find (i) that financial stability varies positively with the development of the financial system, and (ii) that the relationship between financial stability and economic growth depends critically on the level of financial development of each country. These results show that in the absence of financial development, the impact of economic growth on financial (in)stability will have different effects. In addition, we performed a subsample analysis by dividing the overall sample into two subsamples based on stability levels. We find that financial development enhances stability more in the more stable subsample, while growth does so in the less stable subsample.

Keywords: financial (in)stability, financial development, economic growth, financial market index, emerging and developing markets
JEL *Classification:* E44, G20, O16

Received 2025/06/28 · Revised 2025/07/17 · Accepted 2025/08/30

Published online 2025/12/31 https://doi.org/10.26493/1854-6935.23.389-421

Introduction

In this paper, our analysis searches into the dynamics of growth, the extent of financial development, and their impact on financial stability. We place particular emphasis on exploring the potential advantages associated with 'more development in the financial sector' in terms of enhancing stability. Furthermore, we investigate whether the stability of the financial system shows variations in response to shifts in levels of financial development. Our approach begins by examining the intricate interplay between financial (in)stability and financial development. Subsequently, we extend our investigation to capture how financial stability responds to the interactions between financial development and growth.

Finally, we assess whether this interaction differs between more stable and less stable countries.

The Financial Stability Board's 2022 annual report highlights the formidable challenges that the current economic landscape poses to financial stability (Financial Stability Board 2022). The report attributes these challenges to a numbers of factors, notably high inflation rates, sluggish economic growth, and a considerably more restrictive set of financial conditions. Similarly, the International Monetary Fund talked about these concerns in its 2022 Global Financial Stability Report. Their report highlighted the strain experienced in global financial markets, primarily due to a combination of geopolitical uncertainties and factors (International Monetary Fund 2022). This has led to a reduction in market liquidity, heightened stress levels in certain non-bank financial institutions, declining asset prices, and subsequently, an escalation in financial stability risks. It has therefore become urgent to understand the determinants and dynamics of financial stability, particularly in developing countries and emerging markets.

Previous studies have highlighted the significance of financial development in a country's financial stability (e.g. Abbas et al. 2021; Ge et al. 2025). Research has shown that well-developed financial systems can enhance stability by improving resource allocation, risk diversification and market efficiency (e.g. Levine 2005). However, in the absence of adequate development, financial systems can instead exacerbate vulnerabilities, increasing the likelihood of crises and instability (e.g. Wang et al. 2021; Elekdog et al. 2025). Moreover, evidence shows similar duality in the case of emerging and developing countries. For example, Avalos and Moreno (2013) find that the development of financial markets, particularly derivatives markets, could support financial stability. In many emerging economies, these markets remain underdeveloped, resulting in high hedging costs. These conditions limit the ability of borrowers and investors to effectively manage their exposure to currency and other risks according to their risk preferences. On the other hand, the same derivatives can also have a destabilizing effect on the financial systems of developing and emerging countries. For instance, Keffala (2015) argues that the use of futures, and especially options, has been linked to weaker banking stability in emerging markets and has been partly implicated in the amplification of the recent global financial crisis.

Evidence also shows that the impact of financial development on financial stability depends on macroeconomic factors and country-spe-

cific initial characteristics. Factors such as inflation, financial inclusion, and financial liberalization can either amplify or attenuate the stabilizing role of financial development. Elgharib (2024) finds that in the MENA region financial inclusion moderates the positive effect that financial development has on stability. Adem (2025) shows that in the case of strict regulatory policies, the effect of financial development becomes negative and reduces financial stability. At the national level, the effect of financial development on stability also depends on initial conditions. Rioja and Valev (2004) show that countries with lower initial levels of financial development experience faster credit growth, which can harm the economy.

Therefore, in this study we investigate how financial development influences financial stability in developing and emerging countries, while accounting for the moderating role of growth. In addition, we examine whether the strength and direction of this relationship varies according to different levels of financial stability. To conclude, this study examines the following questions:

- *RQ1.* How does financial development influence financial stability across developing and emerging countries?
- *RQ2.* How does the relationship between financial development and financial stability vary depending on the level of growth?
- *RQ3.* Does the impact of financial development and economic growth on financial stability differ between more stable and less stable countries?

The structure of this paper is as follows: in the next section, we expand on the literature in question. The third section is where we explain the concepts, models, and statistical approaches we used. Following that, in the fourth section, we provide visualizations, interpretations, and discussions of our empirical results. Finally, we conclude in the fifth section.

Literature Review

While the extensive literature has addressed the debate on the interplay between financial development and economic growth (e.g. Boikos et al. 2022; Keh et al. 2022; Poghosyan 2022), inquiry into the combined impact of these factors on financial system stability has remained a relatively understudied area. From a theoretical standpoint, it is evident that both financial development and economic growth have favourable

effects on financial stability. To elaborate, financial stability is achieved when the financial system effectively supports economic performance and mitigates the emergence of financial imbalances resulting from unpredicted or endogenous events (Schinasi 2004). Simultaneously, financial development signifies efficiency in providing individuals access to essential services at minimal cost, thereby fostering economic growth (Mahmoudi and Torra 2023). This logical alignment implies a positive relationship between these variables. However, it is not that simple. What is even more complex than a two-way relationship is a three-way relationship, involving various internal and external factors, and the unpredictable influence they exert on the combined effect.

Prior studies have consistently underscored the importance of concurrent examination of financial stability, financial development, and growth. In the case of African countries, a study conducted by Batuo et al. (2018) revealed an inverse relationship between financial instability and growth. This suggests that as growth rates decrease, the incidence of financial instability tends to rise. Notably, the introduction of financial liberalization policies into the equation moderates this relationship. This implies that countries pursuing financial liberalization policies often experience a less stable financial system, which, in turn, affects their levels of growth. Interestingly, when financial development is considered as a regressor, the results show a positive coefficient. These findings support the hypothesis that growth has a favourable impact, while financial development has a potentially adverse effect on the stability of the 41 African countries within the study sample. In a similar vein, Sahay et al. (2015) shed light on the concept of the 'benefits-risk trade-off' inherent in the relationship between growth and stability. Their findings demonstrated that when the Financial Development Index surpasses 0.6, the advantages of financial development pose challenges to financial stability while still exerting positive effects on growth. Nevertheless, when the Financial Development Index approaches 1, the negative consequences of an improvement in the level of financial development on financial stability become noticeably significant.

In this paper, our empirical analysis is based on two theoretical approaches. First, it is widely acknowledged that the nexus between financial development and growth plays an important role in bolstering the stability of the financial system, rendering it more resilient and ultimately more profitable, especially in developed nations, where financial markets and institutions wield substantial influence over the country's growth

and overall development. On one hand, they facilitate the allocation of capital, channel savings towards productive investments, oversee their efficient utilization, curtail transaction costs, enable risk diversification, and facilitate trade, among other functions. These dynamics, in turn, lead to a reciprocal growth trajectory. On the other hand, they contribute to the broader development agenda by generating employment opportunities, alleviating poverty, introducing innovative approaches to address retirement challenges (Merton and Muralidhar 2020), enhancing overall well-being, and more. A review of the literature underscores the consensus among both academics and policymakers that the finance-growth relationship is a fundamental driver of progress and a keystone for enhancing stability (e.g. Abbas et al. 2021; Pisicoli 2023). From this perspective, economies characterized by elevated levels of financial development and growth tend to exhibit higher levels of financial stability compared to their counterparts.

Second, an influential theory posits that financial development has the capacity to stimulate a heightened tendency toward risk-taking among economic agents, such as borrowers. This, in turn, can contribute to the exacerbation of financial system instability. To illustrate this concept, consider a normally functioning economy. During euphoric phases, interest rate structures tend to favour short-term financing over long-term options. This shift in interest rates piques the interest of economic agents in short-term financing arrangements. Moreover, any dip in income can push some firms into what is termed 'Ponzi financing', a situation that can trigger bankruptcies, thus unsettling the economic system. Indeed, as managers become increasingly aware of the success of prudently financed projects and witness soaring expectations, two distinct trends materialize: 'Debt is easily provided and highly leveraged units prosper' (Minsky 1977). Consequently, risk premiums come to be perceived as excessive. Fuelled by optimism, economic agents start taking greater risks, leading to a surge in asset prices as a result of the expanded volume of investments (Schinasi 2006). However, it is essential to recognize that excessive investment can eventually have adverse repercussions on the economy. Returns on capital decline, bankruptcy rates surge, businesses curtail their investment initiatives, and economic agents reassess their capacity to meet debt obligations. This sequence of events unfolds a highly volatile macroeconomic landscape on the brink of a financial crisis. Beck et al. (2006) found that financial deepening does not necessarily mitigate the impact of trade volatility, but it does

tend to amplify inflation volatility to some extent. Similarly, Arcand et al. (2015) demonstrate the relationship between financial development and the volume of credit extended to the private sector. In their study, the authors highlight the concept of a 'vanishing effect' of financial development on growth. They note that this effect becomes negative when the volume of credit provided to the private sector exceeds 100% of GDP.

To further investigate the link between financial development, growth, and stability, we ask whether the impact of financial development and growth on financial stability depends on a country's initial level of stability. The rationale is straightforward: if a country is already financially unstable, investing in financial sector development and promoting growth may not necessarily enhance stability – and could even exacerbate fragility. Conversely, in more stable economies, financial deepening might contribute positively to resilience. As we discussed above, the literature presents mixed evidence on the impact of financial development. While it is generally associated with economic growth and stability, its effects may diminish or even reverse and contribute to financial instability (e.g. Halili et al. 2021; Wang et al. 2021), although our global sample does not provide evidence supporting this concern.

Financial instability itself is a factor that can weaken the positive effect of financial development, as it reduces its effectiveness (Loayza and Rancière 2006). This means that the stabilising role of financial development is not uniform, but varies from one country to another depending on their initial stability situation. More broadly, the impact of financial development depends on several contextual factors: for example, it varies according to income level (Naceur et al. 2019) and stage of financial development (Aghion et al. 2005). Overall, these results highlight that financial development can have heterogeneous effects depending on initial stability.

From the above we develop three testable hypotheses. First, financial development is positively associated with financial stability. Second, the relationship between financial development and financial stability is conditional on the level of growth, such that financial development strengthens stability more in countries with higher growth. Third, the effects of financial development and growth on stability differ across countries depending on their baseline stability levels, with financial development having a stronger stabilizing impact in more stable countries and growth playing a larger role in less stable ones.

Data and Econometrics

DATA SOURCES AND THE STUDY VARIABLES

To investigate the intricate relationship among financial (in)stability, financial development, and growth, we have compiled a novel dataset. This dataset is based on annual cross-national data from 21 emerging and developing countries, covering the period 2001–2020. A comprehensive list of these 21 countries may be found in table 2. Our data sources primarily include the Global Financial Development database (GFD), the World Development Indicators (WDI) from the World Bank, and information from the International Monetary Fund (IMF), along with data provided by the Federal Reserve Economic Data (FRED) database, and Chinn and Ito (2006). We will briefly discuss the specific variables employed as proxies in our analysis in the following paragraphs.

FINANCIAL (IN)STABILITY

In the existing literature, different measures are employed to assess financial (in)stability. The common one, attributed to Roy (1952), is the z-score. This measure serves as an indicator of 'bank soundness', gauging the proximity of a bank to insolvency. In simpler terms, it quantifies the likelihood that the value of a bank's assets might dip below the value of its liabilities, signifying that a higher z-score corresponds to a higher likelihood of the bank's solvency. This relationship can be expressed mathematically as follows:

$$Z_{i,t} = \frac{ROA_{i,t} + (E/A)_{i,t}}{\sigma(ROA)_{i,t}}, \tag{1}$$

where: $ROA_{i,t}$, $(E/A)_{i,t}$ and $\sigma(ROA)_{i,t}$ are the return on assets, the equity-to-assets ratio, and the standard deviation of return on assets, respectively. In this study, we evaluate bank soundness by employing the natural logarithm of the z-score, following a similar approach utilized by several previous studies such as Shabir et al. (2024) and Vashisht and Mundi (2025), among others. This logarithmic transformation helps in mitigating the influence of extreme values that can be observed in the z-score. Moreover, to ensure that changes in the z-score value are not solely attributed to fluctuations in profitability and capital levels, rather than reflecting the overall performance over the entire period, we adopt a rolling three-year time window (Heitmann et al. 2025).

The second measure is stock price volatility, which is widely used to proxy the soundness of the financial system (e.g. Vuong et al. 2024; Zheng et al. 2025). As well as assessing the solvency levels of the banking system through the z-score, this additional measure captures market perceptions of uncertainty and systemic stress. By using these two measures, we integrate both balance-sheet-based and market-based perspectives on financial stability. However, we anticipate an opposite sign to that of the z-score coefficient due to the contrasting implications of these two variables.

Financial Development

When assessing financial development, researchers commonly rely on three key indicators. The first indicator, frequently used to gauge the depth of financial institutions, is the ratio of credit to the private sector relative to GDP. This ratio quantifies the proportion of loans extended by various financial entities, such as banks (e.g. commercial banks) and other financial institutions (e.g. insurance companies), to the private sector in relation to the overall GDP. The second indicator, derived from the first, is the ratio of bank credit to the private sector as a percentage of GDP. This indicator specifically focuses on loans issued by banks to the private sector concerning the nation's gross domestic product. The final indicator, referred to as broad money to GDP, represents the total amount of currency circulating in the economy. Nevertheless, it is essential to acknowledge that these indicators have their limitations. As noted by Sahay et al. (2015), although bank lending to the private sector remains a significant component of financial development, it accounts for less than 15% of all subcomponents used to measure financial development comprehensively. Similarly, Beck (2015) points out that the ratio of private credit to GDP predominantly considers the quantity of loans extended by regulated financial institutions, overlooking the quality and quantity of loans provided by unregulated financial entities. This narrow focus may inaccurately portray the depth of the financial system, particularly in countries where access to financial services is initially limited.

Therefore, in this study, we use the Financial Markets Index, initially proposed, developed, and employed by Čihák et al. (2012) and Sahay et al. (2015), to address these concerns. This index is calibrated on a scale from 0 to 1, where 0 represents the lowest level and 1 signifies the highest level of development. Therefore, countries with values approaching 1 are considered to be the most advanced in terms of financial development.

Growth

We present growth through two distinct perspectives. Initially, we gauge economic growth by examining the annual expansion in GDP. Subsequently, we measure well-being by evaluating GDP per capita. The GDP per capita, which measures a nation's economic output per person, serves as a vital indicator of a country's level of growth. In this analysis, we employ the natural logarithm of GDP per capita. This approach, as suggested in the literature (Fang et al. 2014; Batuo et al. 2018), offers a more precise representation of the growth rate and provides better control over the 'highly skewed' nature of GDP per capita data. We also assess variations in growth rates through GDP growth (annual %), which is retained in its standard format. Both of these variables play a crucial role in helping us comprehend the extent to which growth influences financial (in)stability.

Control Variables

In line with existing literature (e.g. Ramey and Ramey 1995; Demirgüç-Kunt and Detragiache 1998; Ma and Lv 2023), we incorporate five control variables aimed at capturing the potential influences on financial system stability. These variables are selected to account for macroeconomic factors that could impact the performance of the banking sector.

The first control variable is the inflation rate, which reflects the extent of price changes across the economy. These changes can lead to market volatility, indirectly increasing the risk of banking problems. High or volatile inflation erodes the real value of financial assets, increases uncertainty about future cash flows, and can weaken the intermediary role of banks, which can destabilize the financial system. We measure this variable using the annual growth rate of the GDP deflator. The second control variable pertains to the volatility of the economy's growth rate, calculated through a rolling three-year time window of the standard deviation of the annual GDP growth rate (Khan 2022). The volatility of growth reflects the instability of the economic environment in which banks operate, which directly influences financial stability.

Additionally, we consider financial and trade openness as indicators of a country's susceptibility to external shocks in both the financial and real sectors. For financial openness, we employ the Chinn-Ito index, attributed to Chinn and Ito (2006). Unlike trade openness, which relies on the ratio of imports and exports to GDP, the Chinn-Ito index, also known as the KAOPEN index, assesses the level of capital account openness for each

country. The KAOPEN index measures cross-border financial mobility, which can both impact financial development and increase vulnerability to external shocks. In contrast, trade measures integration into global goods markets, which shapes the banking sector through trade finance, foreign exchange operations, and exposure to fluctuations in global demand.

Furthermore, given the nature of our sample and following the recommendation of Roodman (2009), we introduce time dummies to account for time-specific effects.

Summary Statistics

Table 1 shows the summary statistics for the various variables used.

All variables in table 1 are country-level variables obtained from the databases of the Global Financial Development (GFD), the World Development Indicators (WDI) of the World Bank, the International Monetary Fund (IMF), the Federal Reserve Bank of St. Louis (FRED), and Chinn and Ito (2006). The full sample contains 3,780 observations. The table is in two parts. The first is a list of all the variables used in the estimation study.

- Financial (in)stability is defined by two measures: first, the three-year rolling window of the natural logarithm of the Z-score, calculated as the return on assets plus the ratio of assets to capital divided by the standard deviation of the return on assets; second, the vola-

TABLE 1 Summary Statistics (Period 2001–2020; 21 Countries)

	Variable	Observation	Mean	Standard deviation	Minimum	Maximum
Dependent variables	Z-Score	420	2.87	0.60	0.80	4.19
	Volatility of stock price	420	17.91	8.34	5.62	52.97
Independent variables	FMD	420	0.35	0.17	0.02	0.74
	Log. GDP per capita	420	8.71	1.25	6.46	11.31
	Growth rate	420	3.95	4.24	−21.40	26.17
Control variables	Economic volatility	420	2.08	2.00	0.03	12.13
	Inflation rate	420	5.63	8.87	−25.95	85.54
	Financial openness	420	0.28	1.45	−1.93	2.30
	Trade openness	420	81.22	37.63	23.12	210.37

tility of the stock price, measured as the 360-day standard deviation of the return on the national stock market index.

- *FMD* represents the Financial Markets Index provided by the IMF.
- The *GDP growth rate* (annual %) and the *log. GDP per capita* (in logarithms) are used as proxies of growth.
- *Economic volatility* (the three-year rolling window standard deviation of GDP growth), *Inflation rate* (GDP deflator, annual %), *Financial openness* (the Chinn-Ito index) and *Trade openness* (Merchandise trade (% of GDP)) are used as controlling variables.

Table 2 presents a detailed list of key variables for each country. Within this dataset, the first column of table 2 provides the mean logged z-scores

TABLE 2 The Averages of the Main Variables or Each Country

Country	*Z*-score	Volatility of the stock price	*FMD*	Log. *GDP* per capita	Growth rate	Economic volatility	Inflation rate	Financial openness	Trade openness
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
South Africa	2.59	18.62	0.43	8.65	2.15	1.16	6.43	−1.24	53.60
Bangladesh	2.74	13.91	0.17	6.93	5.98	0.64	6.85	−1.24	36.43
Egypt	2.88	26.08	0.36	8.03	4.25	1.02	11.04	0.86	47.04
India	2.76	21.09	0.50	7.17	5.98	1.63	5.55	−1.24	43.20
Indonesia	1.42	20.65	0.30	7.93	4.91	0.68	7.64	0.43	49.86
Israel	3.38	17.69	0.40	10.41	3.28	1.78	1.49	2.13	66.19
Jordan	3.98	11.81	0.42	8.33	4.17	0.91	4.36	2.30	112.33
Kuwait	2.81	12.68	0.40	10.40	3.24	4.25	3.24	1.03	93.15
Lebanon	2.88	15.02	0.11	8.93	2.02	2.55	7.01	0.66	78.58
Kenya	1.71	30.99	0.07	7.69	1.95	4.90	15.52	−1.66	97.30
Malaysia	2.84	12.07	0.58	9.04	4.35	1.99	2.79	−0.32	162.44
Morocco	3.66	12.31	0.24	7.92	3.68	1.96	1.06	−1.24	67.92
Oman	2.87	12.57	0.29	9.89	2.94	2.54	4.24	2.19	92.32
Pakistan	2.38	18.97	0.25	7.17	4.05	1.29	7.48	−1.24	28.68
Philippines	3.10	20.29	0.34	7.83	4.77	1.54	3.37	−0.28	69.83
Qatar	3.22	18.12	0.62	11.07	8.42	4.07	3.71	2.30	93.08
Saudi Arabia	2.99	22.77	0.54	9.98	3.47	2.86	4.01	1.03	74.78
Thailand	3.00	19.10	0.33	9.17	1.13	2.81	5.23	0.93	61.70
Tunisia	2.64	8.72	0.12	8.21	2.44	1.82	4.76	−1.24	94.86
UAE	3.23	17.12	0.48	10.76	3.37	3.24	3.35	2.30	143.85
Vietnam	3.47	23.80	0.40	7.68	6.41	0.61	9.06	−0.54	138.56

for all 21 countries. A closer examination of the z-scores reveals Jordan leading the way with a score of 3.98, while Indonesia ranks lowest with a score of 1.42. The average z-score for this sample is around 2.87, implying that approximately 52.4% of the countries in the dataset have z-scores above the average. The standard deviation of 0.60 indicates relatively limited variation from the mean.

Our assessment of the Financial Market Index (table 2, column 3) reveals a wide range, from a low of 0.07 in Kenya to a high of 0.62 in Qatar. The average Financial Markets Index stands at 0.35, indicating that approximately 52.4% of the sample is above average. Examining the results, we find that 19.05% of our sample falls into the category of low-ranking countries, characterized by an average index below 0.2. On the other hand, 14.28%, 42.86 %, and 23.81% of the sample belong to the groups with average indices below 0.3, 0.44, and 0.64, respectively. Notably, no country attains a score surpassing 0.64.

Table 2 reports the main estimation variables, averaged per country.

Columns 4 and 5 present estimations of growth. It is noteworthy that our two indicators, namely GDP per capita and GDP growth, do not always align. To illustrate, let us consider Qatar, the United Arab Emirates, and Israel. The average natural logarithm of GDP per capita places Qatar in the lead at 11.07, followed by UAE at 10.76, and Israel at 10.41. However, the GDP growth rate does not tell the same story. In table 2, Column 5, Qatar is still in first place with an average growth rate of 8.42%, while the UAE and Israel are in 13th and 14th place with growth rates of 3.37% and 3.28%, respectively. This underlines the importance of using several economic growth indicators. The standard deviations of inflation rate, financial openness, and trade openness are 8.87, 1.45, and 37.63, respectively, indicating a moderate to large degree of variation from the mean values. Another interesting statistic concerns economic volatility. The coefficient of variation is 0.96 (= 2/2.08), indicating that economic volatility fluctuates widely from its mean. Mathematically, this means that the standard deviation is equal to 96% of the mean, which is considerably high.

Table 3 reports information on the correlation between the variables of the regression. The results indicate that financial stability, as measured by the z-score, is positively and significantly correlated with financial market development. Additionally, the z-score and GDP per capita show a strong positive correlation, while GDP growth exhibits an insignificant relationship with financial stability. Higher inflation is associated with lower financial stability, as reflected in the negative correlation coeffi-

TABLE 3 Correlation Matrix Estimation (2001–2020)

Variables	Z-score	FMD	Log. GDP per capita	Growth rate	Economic volatility	Inflation rate	Financial openness
FMD	0.184***						
Log. GDP per capita	0.320***	0.432***					
Growth rate	0.032	0.198***	−0.040				
Economic volatility	−0.055**	0.027	0.346***	−0.174***			
Inflation rate	−0.215***	−0.103**	−0.180***	0.015	0.189***		
Financial openness	0.339***	0.420***	0.742***	0.048	0.118**	−0.143***	
Trade openness	0.204***	0.291***	0.369***	0.059	0.158***	−0.054	0.290***

NOTE *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

cient (−21.5%). Furthermore, financial systems characterized by greater trade and financial openness tend to exhibit lower risk, as indicated by their significant correlations with the z-score. All these correlations are significant at the 1% level, except for economic volatility, which is significant at the 5% level. Moreover, economic volatility exhibits a negative correlation with the z-score.

EMPIRICAL METHODOLOGY

Methodology

To investigate the connections between financial (in)stability, financial development, and growth, we conducted a series of regression analyses using country-level data. Specifically, we regressed financial (in)stability on financial development and growth while controlling for other relevant factors. In this study, we focus solely on the development of financial markets as our variable. Given that our sample consists of developing and emerging countries, this approach will help us shed light on its importance for growth and stability.

We initiated our examination by exploring the association between financial (in)stability and financial development, utilizing the Financial Markets Index as our primary measure. We sought to determine whether a higher financial markets development is linked to increased stability, in line with the findings of Sahay et al. (2015). Subsequently, we expanded our analysis to investigate whether the relationship between financial (in)stability and financial development is influenced by growth.

Subsequently, in order to obtain a more focused conclusion, we modify the framework by splitting the sample into two subsamples for countries below and above the median log z-score of the overall sample. A significant aspect of our study is estimating how changes in the financial markets index can impact the connection between financial (in)stability and growth. To achieve this, we formulated the following model:

$$\begin{aligned} FS_{i,t} = {} & \alpha + \beta_0 FS_{i,t-1} + \beta_1 FMD_{i,t} + \beta_2 Gper_{i,t} + \beta_3 Gro_{i,t} \\ & + \beta_4 (FMD_{i,t} * Gper_{i,t}) + \beta_5 (FMD_{i,t} * Gro_{i,t}) \\ & + \delta_k \sum_k X_{i,t} + \mu_t + \epsilon_{i,t} \end{aligned} \tag{1}$$

In this equation, the time period and country are denoted as t and i, respectively. The variable $FS_{i,t}$ represents the financial (in)stability indicator, measured by the three-year rolling window of the natural logarithm z-score, as previously explained. Additionally, we incorporate the logged dependent variable, denoted as $FS_{i,t-1}$ on the right-hand side of our estimation model, following the recommendations of Deephouse (1999) and Wooldridge (2013). The inclusion of $FS_{i,t-1}$ in the equation serves the purpose of controlling for omitted variables. It is conceivable that countries with a high level of financial stability, indicated by a high z-score, may exhibit a higher level of financial development (and possibly growth). Moreover, there could be unobserved factors that simultaneously influence $FS_{i,t}$ along with $FMD_{i,t}$ (and growth indicators). Such a scenario would violate the assumptions of the classical linear regression model (CLRM), resulting in a biased and inconsistent estimator, as discussed by Baltagi (2005). Therefore, by introducing $FS_{i,t-1}$ into the equation, we aim to measure, to a certain extent, the true effect of financial development (and growth) on financial (in)stability, particularly when the initial levels of financial (in)stability in two countries are similar. The issue of endogeneity, arising from unobserved omitted variables, will be addressed in a subsequent sub-section.

Furthermore, within our model, $FMD_{i,t}$, $Gper_{i,t}$ and $Gro_{i,t}$ represent the Financial Markets Index, the logarithm of GDP per capita, and the annual growth rate of GDP for the period from 2001 to 2020, respectively. Additionally, we introduce $FMD_{i,t} \times Gper_{i,t}$ and $FMD_{i,t} \times Gro_{i,t}$ as interaction terms, capturing the combined effects of the financial markets index and our two indicators of growth (namely, log(GDP per capita) and GDP growth rate) on financial (in)stability. This allows us to estimate the

joint influence of financial development and growth on financial (in)stability, meaning that:

- First, the interaction term $FMD_{i,t} \times Gper_{i,t}$ examines the combined effects of financial development and GDP per capita on financial (in)stability. It seeks to understand how the relationship between a country's economic well-being per person and financial (in)stability varies across different levels of financial development.
- Second, the interaction term $FMD_{i,t} \times Gro_{i,t}$ investigates the joint effects of financial development and the annual growth rate on financial (in)stability. It aims to analyse how the relationship between a nation's annual growth rate and financial (in)stability changes with varying levels of financial development. These interactions will be explored in detail in the fourth section.

The vector of control variables is denoted by $Xi,_t$ and includes variables such as the inflation rate, financial and trade openness, and economic volatility. To account for unobserved time-specific effects and errors in our model, the terms μ_i and $\varepsilon_{i,t}$ were incorporated, respectively.

To anchor our empirical specification in theory, we expect financial development (*FMD*) to have a positive effect on financial stability (*FS*), as more developed financial systems improve resource allocation and risk diversification (Umar et al. 2020). Similarly, stronger economic growth should enhance stability by improving asset quality and bank profitability (Apau et al. 2023). The interaction terms between *FMD* and growth indicators should also be positive, reflecting the idea that financial development amplifies the stabilizing effects of growth. Among the control variables, economic volatility and inflation should have destabilizing effects, in line with the idea that macroeconomic instability erodes bank balance sheets (Qin et al. 2025). Conversely, greater financial openness and great-

TABLE 4 The Expected Impact of Variables

Variable	Expected impact
Explanatory variables: Financial development	+
Growth	+
Financial development × Growth	+ (for both interaction terms)
Control variables: Economic volatility	–
Inflation rate	–
Financial openness	+
Trade openness	+

er trade openness should promote stability by improving risk-sharing opportunities and strengthening resilience to internal shocks (Ma and Yao 2022). The summary of the expected effects of these different variables is in table 4.

Data Specifications and the Choice of Estimator

In a 2015 editorial published in the *Journal of Operations Management (JOM)*, Guide and Ketokivi (2018) emphasize the imperative need to address endogeneity more rigorously in research. Neglecting to tackle this issue can significantly bias research outcomes. As elucidated in Davidson and MacKinnon (2004), endogeneity typically arises from two main sources. First, it can be attributed, as mentioned earlier, to unobserved omitted variable(s) that concurrently influence both the dependent variable and one (or more) of the explanatory variable(s). Second, it can be attributed to simultaneity, indicating that the dependent variable and one (or more) of the explanatory variable(s) are mutually determined (Wooldridge 2010). In our model, we believe that endogeneity may arise due to simultaneity. The literature suggests that while financial development can influence financial stability, prevailing stability conditions may also shape financial markets' incentives to develop (e.g. Espinoza et al. 2013; Vithessonthi 2014).

In accordance with the editorial recommendations and drawing on the insights from Ketokivi and McIntosh (2017), we employ the instrumental variable approach proposed by Lu et al. (2018) for addressing endogeneity unless stated otherwise. Moreover, our data's characteristics necessitate specific model specifications. In addition to addressing the endogeneity concern, we identify potential heteroscedasticity within our dataset. It is well-established that under heteroscedasticity, the two-stage least squares (2SLS) approach is not the most efficient choice (Baum et al. 2007). Therefore, in this paper, we propose a two-step analytical approach. First, we employ a base regression with 2SLS-IV robust standard errors, as recommended by Cameron and Trivedi (2005), to address the heteroscedasticity issue. In the second step, as a robustness check, we use the generalized method of moments (GMM) estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998), which combines moment conditions in first differences and in levels. Following Roodman (2009), we use a reduced instrument matrix and limit the number of instruments to less than the number of banks in the sample to avoid overfitting. Standard errors are corrected using Windmeijer's

(2005) finite sample adjustment. Lagged levels dated *t-2* and earlier are used as instruments for the difference equation, while lagged differences are used as instruments for the level equation.

The Choice of Instrumental Variables

Given the practical impossibility of accounting for all unobserved variables in our model, the endogeneity problem is a pervasive concern, as noted by Rossi (2014). In our context, the literature suggests the presence of a potential omitted variable that could simultaneously influence financial (in)stability, financial development, and growth. This variable is financial liberalization. Evidence shows a causality link between financial liberalization and each of these three variables. From a learning perspective, the initial idea is that financial liberalization helps to develop a country's domestic financial markets by increasing the efficiency of its functions through the reduction of government control over capital movements, leading to both growth and stability (Abraham et al. 2019). However, in emerging markets, this conventional view is not always valid. While financial liberalization can indeed foster financial development, particularly in countries with stronger legal institutions (Ahmed 2013), it can also exacerbate financial instability if the regulatory environment is weak (Broner and Ventura 2008). As far as growth is concerned, there is generally a positive and favourable impact (Bekaert et al. 2005). In short, whatever the direction of the impact of financial liberalization on our variables, the link is rather proven, which leads us to think that our model could suffer from endogeneity.

We use five instruments, selected in accordance with the established literature to ensure both their relevance (strong correlation with endogenous regressors) and their exogeneity (independence from the error term). More specifically, the second lag of the dependent variable is used as an instrument for FS_{t-1}, a common strategy in dynamic panel models that ensures correlation with the regressor while avoiding endogeneity bias. For financial development, we rely on the country's legal origin (La Porta et al. 1999; Central Intelligence Agency 2003) and its first lagged value, as these two elements have been widely validated as exogenous determinants of financial structure, unaffected by contemporary shocks. Finally, labour and natural resource endowments are used as instruments of growth at the national level, as they are largely determined by geography and history, making them plausible as exogenous to stability, while being strongly linked to long-term growth.

Results and Discussion

All the results reported are robust to heteroscedasticity and panel-clustered.

FINANCIAL (IN)STABILITY AND FINANCIAL DEVELOPMENT

Initial Results

The results presented in table 5 show the important role of financial markets development in promoting financial stability. We start our estimations by accounting for economic volatility (*Economic volatility*) and the level of a country's financial markets development (*FMD*). In regression (1), FMD exhibits a positive and statistically significant impact at the 1% level. This implies that an improved financial market is closely linked to enhanced stability. From an economic perspective, the estimates in Column (1) indicate that a one standard deviation increase in FMD (0.21) results in a 0.363 standard deviation change in the z-score. As anticipated, these results align with the hypothesis that well-developed financial markets are associated with reduced financial instability (Sahay et al. 2015) and that developed countries tend to be more stable and resilient against both internal and external shocks (Denizer et al. 2002). These findings persist when we modify our model specifications. In regression (2), FMD enters negatively and significantly at the 5% level, meaning that higher financial development is correlated with lower share price volatility. However, we observe a smaller magnitude than the previous impact on the z-score. This confirms our findings from regressions (1) and (3). Furthermore, to comprehensively capture the effect of FMD on the z-score, we control for several country-level characteristics in Column (3). Alongside economic volatility (*Economic volatility*), we incorporate variables such as inflation rate (*Inflation rate*), financial openness (*Financial openness*), trade openness (*Trade openness*), and time dummies (*Time dummies*). Notably, these additional indicators do not alter our conclusions.

Moreover, our results are confirmed by system GMM estimates. In Column (4), financial markets development enters the regression positively, demonstrating its significance at the 1% level. As can be seen, the estimates show no difference between the results in Columns (3) and (4), indicating that clustering the 2SLS estimations by country addressed the heteroscedasticity problem.

Beyond Robustness

To enhance the robustness of our initial findings, we conducted a series of supplementary tests. First, to gain greater control over a country's level of financial development, we introduced an exclusionary threshold for the Financial Markets Index. Although our primary focus was on emerging and developing countries in this study, our sample encompassed nations with developed (FMI > 0.44), moderately developed (0.44 > FMI > 0.20), and underdeveloped (FMI < 0.20) financial markets. This diversity raised concerns regarding the heterogeneity of the sample. Therefore, we refined our sample to only include countries with a minimum financial markets index of 0.2 (FMI > 0.2). Importantly, our results remained consistent, and our conclusions held.

FINANCIAL (IN)STABILITY, FINANCIAL DEVELOPMENT AND GROWTH

Estimation Results

Moving beyond the simple 'bivariate' relationship between financial (in) stability and financial development, previous arguments suggest that the influence of the financial system's development on its stability is contingent on growth. To gain a more comprehensive understanding of the significance of financial development for its stability, we now investigate whether the relationship between financial (in)stability and financial development is conditional on growth.

Table 5 reports estimation results of financial (in)stability indicators on the financial development variable. The sample includes 21 countries over the period 2001–2020. All variables are country-level variables. Unless otherwise stated, the dependent variable is *z-score* calculated as the natural logarithm of the three-year rolling window of the country's z-score. The dependent variable in Column (2) is *volatility of stock price,* which represents the volatility of the equity price index. $FSi_{,t-1}$ is the first lagged value of the dependent variable. *Time dummies* is a time dummy that captures country-specific effects. All the regressions are estimated using the instrumental variables approach. The regressions are estimated using two-stage least squares (2SLS), with the exception of regression (4) for which the GMM system is used. The standard errors are robust and clustered by country. Heteroscedasticity is checked by the Breusch-Pagan test. Endogeneity is tested by the Durbin-Wu-Hausman test and the GMM distance test. In addition, we report 'instruments relevancy' tests.

TABLE 5 Financial (In)Stability and Financial Development

Variable	2SLS			GMM
	Z-score	Volatility of stock price	Z-score	
	(1)	(2)	(3)	(4)
$FS_{i,\,t-1}$	0.787***	0.99***	0.591***	0.595***
	(0.522)	(0.854)	(0.418)	(0.415)
FMD	0.605***	−0.055**	0.211***	0.211***
	(0.469)	(0.026)	(0.119)	(0.1
Economic volatility	−0.806**	0.377**	−0.124**	−0.122**
	(0.662)	(0.199)	(0.087)	(0.088)
Inflation rate	—	—	−0.041	−0.040
			(0.030)	(0.031)
Financial openness	—	—	0.251**	0.250**
			(0.101)	(0.107)
Trade openness	—	—	1.135	1.130
			(1.030)	(1.035)
Log. GPD per capita	—	—	0.533***	0.534***
			(0.331)	(0.330)
Growth rate	—	—	0.097*	0.098*
			(0.055)	(0.530)
Time dummies	—	—	Included	Included
Heteroscedasticity test	0.0001	0.0002	0.0071	—
Endogeneity test	0.000***	0.001***	0.002***	0.0022***
Instruments legitimacy tests:				
Instrument validity test	0.778	0.693	0.544	0.545
Weak instrument test	0.005***	0.002***	0.000***	—
Under-identification test	0.001***	0.022**	0.000***	0.0002***
Number of countries	21	21	21	21
Number of observations	420	420	420	420

NOTES *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Table 6 presents the results of our direct and interactive estimations involving financial (in)stability, financial development, and growth. These estimations encompass various national characteristics and incorporate interaction terms between each growth variable and the level of financial development in each country. We utilized instrumental variables in these regression analyses. Drawing from the existing literature (e.g. Solow 1956; Gerbens-Leenes et al. 2010), we employed the size of the labour force and the percentage of total natural resource rents in GDP as instruments for growth. Given the specific specifications of our model, we contend that the influence of these instruments on financial (in) stability operates primarily through their effect on growth rather than

TABLE 6 Financial (In)Stability and Financial Development

Variable	2SLS				GMM
	Z-score	Z-score	Z-score	Volatility of stock price	
	(1)	(2)	(3)	(4)	
$FS_{i,\,t-1}$	0.591***	0.620***	0.696***	0.867***	0.692***
	(0.310)	(0.444)	(0.499)	(0.686)	(0.48)
FMD	0.367***	0.4**	0.492***	−0.094***	0.491***
	(0.224)	(0.289)	(0.306)	(0.001)	(0.302)
Economic volatility	−0.100**	−0.085*	−0.223*	0.145*	−0.223*
	(0.077)	(0.030)	(0.100)	(0.065)	(0.102)
Inflation rate	- 0.072	−0.055	- 0.100	0.239**	- 0.108
	(0.053)	(0.024)	(0.054)	(0.117)	(0.055)
Financial openness	0.196**	0.204**	0.156**	−0.011**	0.155**
	(0.082)	(0.107)	(0.097)	(0.001)	(0.096)
Trade openness	−0.116	−0.006	0.003	−0.07*	0.004
	(0.066)	(0.001)	(0.001)	(0.001)	(0.001)
Log. GPD per capita	0.199***	0.128**	0.216***	−0.306***	0.216***
	(0.101)	(0.045)	(0.110)	(0.188)	(0.111)
Growth rate	0.023	0.026*	0.015*	−0.122**	0.014*
	(0.009)	(0.001)	(0.001)	(0.071)	(0.001)
FMD × Log. GDP per capita	0.264***	—	0.348**	−0.188***	0.349**
	(0.163)		(0.222)	(0.009)	(0.221)
FMD × Growth rate	—	0.105*	0.055*	−0.117**	0.055*
		(0.069)	(0.001)	(0.033)	(0.002)
Time dummies	Included	Included	Included	Included	Included
Heteroscedasticity test	0.001	0.000	0.005	0.000	–
Endogeneity test	0.002***	0.000***	0.001***	0.000***	0.004***
Instruments legitimacy tests:					
Instrument validity test	0.782	0.776	0.341	0.500	0.309
Weak instrument test	0.005***	0.000***	0.000***	0.000***	—
Under-identification test	0.001***	0.000***	0.000***	0.049**	0.001***
Number of countries	21	21	21	21	21
Number of observations	420	420	420	420	420

NOTES *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

through alternative channels. Recognizing the central role of a country's growth level in this relationship, we considered two distinct measures of growth: GDP per capita, to measure the levels of wealth per person, and the country's GDP growth rate. As table 6 illustrates, the direction of the relationship between financial (in)stability and GDP per capita significantly depends on the country's level of financial development.

Table 6 reports estimation results of financial (in)stability indicators on financial development and growth variables that include the interactions between financial development and growth variables. Unless otherwise stated, the dependent variable is *z-score* calculated as the natural logarithm of the three-year rolling window of the country's z-score. The dependent variable in Column (4) is *volatility of stock price,* which represents the volatility of the equity price index. *FMD* × *Log. GDP per capita* is the interaction term of the Financial Markets Index and log. GDP per capita. *FMD* × *Growth rate* is the interaction term of the Financial Markets Index and country's growth rate. The regressions are estimated using two-stage least squares (2SLS), with the exception of regression (5), for which the GMM system is used.

In regressions where we control for the interaction between financial development and GDP per capita, the latter variable enters the equation positively and significantly. This outcome suggests that an increase in a country's per capita output has a positive influence on maintaining the stability of its financial system. Indeed, the findings in Columns (1) and (3) reveal the direct impact of higher per capita output on the preservation of banking stability.

Moreover, the results indicate that growth is contingent on financial development. Specifically, the interaction between FMD and GDP per capita enters positively and significantly in regressions (1) and (3). This implies that the stabilizing effects of high individual well-being are amplified when the financial markets are highly developed. In more financially advanced countries, a growing economy enhances the resilience of the financial system against shocks and destabilization issues. Therefore, disregarding these interactions between the level of wealth per capita and financial development could lead to less effective policies for maintaining financial stability. Notably, these results remain robust even when we employ alternative variables and estimators. The findings in Columns (4) and (5) affirm the same conclusions when estimating our model. In essence, both regressions demonstrate that GDP per capita has a risk-mitigating effect on the financial system.

In economic terms, as demonstrated in regression (1) of table 6, financial instability is projected to decrease by 0.24 standard deviations for each one standard deviation increase in GDP per capita (1.25). Moreover, for the same one standard deviation increase in GDP per capita, the reduction in risk is even more substantial (0.31 standard deviations), when considering financial market development. Additionally, regressions (2)

and (3) introduce the interaction between FMD and GDP growth. In both regressions, GDP growth enters positively and significantly, indicating that an increase in a country's annual growth rate has a positive impact on financial system stability. However, the significance level of the interaction between FMD and GDP growth appears to decrease from 1% to 10%. Although the interaction results suggest a positive influence on financial stabilization, the effect is less pronounced compared to the first interaction. Regression (2) suggests that financial instability is expected to decrease by nearly 0.11 standard deviations for each one standard deviation increase in GDP growth (4.24). However, when FMD is taken into account, the reduction in financial instability's standard deviation becomes 0.186, representing a 69% stronger mitigating effect.

To summarize, our findings provide strong evidence that financial development can amplify the impact of growth on financial stability. Our estimation results have underscored the significance of financial development in enhancing financial system stability, and this effect extends to magnify the positive impact of growth. The results of the interaction between financial development and growth align with our initial expectations. However, the impact of GDP per capita is more pronounced than that of GDP growth, and this can be attributed to several factors. Firstly, our small sample size may have limited our ability to detect the impact of GDP growth, particularly in countries with under-developed financial systems. And secondly, GDP growth focuses on changes in the economy-wide rate over a specific period, which may not capture the long-term stability dynamics of the financial system.

Model Relevancy

In unreported regressions, we assessed the effectiveness of our instrumental variables approach. Comparing the ordinary least squares estimates (OLS) with the instrumental variables (IV) estimates, we observed that the absolute values of the interaction coefficients in OLS were smaller than those obtained with IV. This discrepancy suggests that OLS tends to underestimate the true effects of financial development and growth on financial stability when endogeneity is present. For instance, the *Durbin-Wu-Hausman test* results in Column (3) of Table 6 provided strong evidence of endogeneity in our model ($p = 0.001$). The same conclusion was supported by the results of the *GMM distance test* ($p = 0.004$) in Column (5), both of which successfully rejected the null hypothesis of exogeneity. Additionally, we reported the results of the *Sargan test* ($p =$

TABLE 7 Estimation of Financial (In)Stability, Financial Development and Growth for the Two Subsamples: Less Stable and Stable

Variable	Overall sample (5)	Less stable (1)	Stable (2)
FMD	0.491***	0.168***	0.543***
	(0.322)	(0.097)	(0.382)
Economic volatility	−0.223*	−0.388*	−0.102*
	(0.111)	(0.173)	(0.025)
Financial openness	0.155**	0.057**	0.183**
	(0.042)	(0.002)	(0.088)
Log. GDP per capita	0.216***	0.311***	0.119***
	(0.111)	(0.154)	(0.037)
FMD × Log. GDP per capita	0.349**	0.351**	0.330**
	(0.116)	(0.125)	(0.2)
Number of countries	21	11	10

NOTES *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

0.341) and *Hausman's J test* (p = 0.309). Both of these tests did not reject the null hypothesis, indicating the validity of the instruments used and the correct specification of the model. To examine the weakness of the instruments, we attempted to conduct the widely-used *Stock-Yogo test*. However, this test could not be effectively applied in our model due to the inability of the *Breusch-Pagan test* (p = 0.005) to satisfy the assumption of homoscedasticity (Sanderson and Windmeijer 2016). This suggests the presence of heteroscedasticity in our data. As an alternative, we resorted to the *Anderson-Rubin Wald test* (p = 0.000) and the *Kleibergen and Paap test* (p = 0.000). Both of these tests successfully rejected the respective null hypotheses of weak identification and under-identification.

Table 7 presents the results of estimating financial (in)stability indicators on financial development and growth variables for less stable and stable countries. The subsample of less stable countries is made up of 10 countries, while the subsample of stable countries is made up of 11 countries. The regressions are estimated using the GMM system.

SUBSAMPLING ANALYSIS

Given the influence of a country's initial level of stability, we divide the full sample into two subsamples: countries with a higher log z-score are referred to as the 'stable' sample and countries with a lower log z-score are referred to as the 'less stable' sample. We have reported only those variables that were influenced by the division of the sample:

- Less stable countries are: South Africa, Bangladesh, India, Indonesia, Kuwait, Kenya, Malaysia, Oman, Pakistan, Tunisia, and Vietnam.
- Stable countries are: Thailand, Egypt, Israel, Jordan, Lebanon, Morocco, the Philippines, Qatar, Saudi Arabia, and UAE.

Table 7 shows that FMD has a positive impact on both subsamples, but that there is a difference in the level of magnitude. Specifically, the coefficients are 0.168 and 0.543 for the less stable and stable subsamples, respectively, with a difference of 223%. From an economic point of view, this means that a one-unit increase in the log z-score increases the impact of FMD on the stability by 0.375. This implies that the development of financial markets increases financial stability, but with a more pronounced impact in stable countries. This is consistent with the literature which suggests that the benefits of financial development depend on a country's initial conditions. While some studies highlight the risk of rapid financial development and economic expansion leading to instability (Klomp 2010; Koh et al. 2020), our results suggest that in stable countries, financial market development plays a stronger stabilizing role. Although we do not find a negative impact in less stable countries, the smaller magnitude of the coefficient suggests a more limited stabilizing effect in such contexts.

Another notable observation concerns the interaction terms. The results indicate no significant difference between the two interaction terms in the subsamples, despite the variable impact of FMD – particularly for *FMD* × *Log. GDP per capita*. We attribute this to the role of growth in log. GDP per capita in the less stable countries, which compensates for differences in the impact of FMD across stability levels. This is reflected in the difference in magnitude, with coefficients of 0.311 and 0.119 in the less stable and stable subsamples, respectively. These results indicate that, for less stable countries, economic growth, particularly through GDP per capita, plays a greater stabilizing role than the development of financial markets and potentially offsets the reduced impact of the latter, implying that growth is more conducive to financial stability than financial development (Batuo et al. 2018).

The subsampling also has an effect on the influence of economic volatility and financial openness. In contrast to the stable subsample, the positive impact of financial openness is weaker and the absolute value of economic volatility is greater in the less stable subsample.

TABLE 8 Estimation of nonlinear relationship for the two subsamples: less stable and stable

Variable	Less stable (1)	Stable (2)
FMD	0.690***	0.834**
	(0.498)	(0.570)
FMD^2	−0.633*	1.085
	(0.322)	(0.645)
Number of countries	11	10

NOTES *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

This change due to the division of the sample prompted us to go further and ask the following question: does a possible non-linear relationship between financial development and stability remain insignificant even when distinguishing between stable and less stable financial systems? Table 8 reports the results.

As the results show, FMD^2 enters insignificantly in the stable countries, as in the overall sample. However, in the less stable subsample, FMD^2 enters negatively and significantly at the 10% level. This implies a concave relationship, meaning that while FMD initially enhances stability, this impact reverses and financial development begins to increase instability. This aligns with the notion that financial development can have non-linear effects, where excessive financial deepening, in the absence of sufficient stability, may amplify vulnerabilities rather than mitigate them. It supports the view that financial market expansion, when some conditions are not met, can exacerbate risks rather than enhance resilience after a certain point (Arcand et al. 2015). Our results imply that one of these conditions is an initial level of financial stability.

Conclusion

This paper (i) assessed the impact of financial development on financial (in)stability and (ii) explored the potential link through which growth interferes with their relationship. Our theoretical model emphasized the importance of a well-developed financial market for stability, on the one hand, and its trade-off, on the other. The theory highlights the potential conflict that promoting financial development can have on the economy, and in particular on stability. The literature points out that promoting financial development is not always favourable and that although a high level of financial development is necessary to promote growth, the evidence also shows the opposite impact on stability.

In line with theory, we initially find that financial development tends to promote greater stability. We confirm that the impact of growth on financial stability depends on a country's financial markets. This indicates that growth can affect the stability of the financial system in different ways depending on a country's initial level of financial development, emphasizing how ignoring it can lead to incomplete conclusions about the impact of growth and volatility, inflation rate, and financial and trade openness on financial (in)stability.

We also found that the country's initial stability levels are also important. To examine this, we divided the sample into stable and less stable countries, based on the median of the log of the z-score. The results indicate that while financial development has a positive effect in both subsamples, its magnitude is much smaller in the less stable countries. We also find that growth, particularly in terms of GDP per capita, is more stability-enhancing for less stable countries than financial development. Finally, we confirm the existence of a non-linear relationship between financial development and stability, but only within the less stable subsample.

On the basis of the empirical results obtained here, we have come to the conclusion that financial (in)stability is affected by financial development, growth and their interactions. However, given that the empirical results for 'stable' and 'less stable' countries are different, we take this into account in our recommendations. For less stable countries, strengthening financial stability requires prioritizing economic growth, as our findings suggest that GDP per capita has a greater stabilizing effect than financial development. This means that governments should focus on inclusive, broad-based growth strategies, such as investments in infrastructure, education, and reforms aimed at improving productivity, which generate long-term resilience. At the same time, targeted financial reforms should focus on strengthening confidence in institutions and improving regulators' oversight capacity before pursuing rapid liberalization. It is therefore essential to sequence reforms: growth-oriented policies should precede or accompany the gradual deepening of the financial sector in order to avoid amplifying vulnerabilities.

For stable countries, financial development plays a more important role in strengthening stability. Given its greater positive impact in this subsample, policymakers could prioritize measures to deepen financial markets and improve access to financial services while maintaining rigorous regulatory oversight. Expanding capital markets, promoting

financial innovation within a framework of strict prudential rules, and improving the efficiency of credit allocation can help maintain stability. Furthermore, as we found no evidence of a nonlinear relationship in stable countries, the risk that financial development will lead to instability appears less of a concern. However, regulators must remain vigilant, as international data suggest that excessive credit booms and weak governance can ultimately undermine stability.

Declarations

All authors declare that they have no conflicts of interest.

References

Abbas, F., O. Masood, and S. Ali. 2021. 'Financial Development and Bank Risk-Taking: Empirical Evidence from the USA.' *Intellectual Economics* 15 (1): 64–87.

Abraham, F., S. L. Schmukler, and A. F. Alatabani. 2019. *Financial Liberalization: Benefits, Risks and Country Experiences (English).* World Bank Group.

Adem, M. 2025. 'Intricacies of Financial Liberalization, Business Models, and Financial Development on Bank Stability in Africa.' *Emerging Markets Review* 69:101344.

Aghion, P., P. Howitt, and D. Mayer-Foulkes. 2005. 'The Effect of Financial Development on Convergence: Theory and Evidence.' *Quarterly Journal of Economics* 120 (1): 173–222.

Ahmed, A. D. 2013. 'Effects of Financial Liberalization on Financial Market Development and Economic Performance of the SSA Region: An Empirical Assessment.' *Economic Modelling* 30 (1): 261–273.

Apau, R., A. Sibindi, and L. Jeke. 2023. 'Effect of Macroeconomic Dynamics on Bank Asset Quality under Different Market Conditions: Evidence from Ghana.' *Risks* 11 (9): 158.

Arcand, J.-L., E. Berkes, and U. Panizza. 2015. 'Too Much Finance?' *Journal of Economic Growth* 20:105–148.

Arellano, M. and O. Bover. 1995. 'Another Look at the Instrumental Variable Estimation of Error-Components Models.' *Journal of Econometrics* 68 (1): 29–51.

Avalos, F. and R. Moreno. 2013. 'Hedging in Derivatives Markets: The Experience of Chile.' *BIS Quarterly* Review:53–63.

Baltagi, B. H. 2005. *Econometric Analysis of Panel Data.* 3rd ed. Wiley.

Batuo, M., K. Mlambo, and S. Asongu. 2018. 'Linkages between Financial Development, Financial Instability, Financial Liberalisation and Economic Growth in Africa.' *Research in International Business and Finance* 45:168–179.

Baum, C. F., M. E. Schaffer, and S. Stillman. 2007. 'Enhanced Routines for Instrumental Variables: Generalized Method of Moments Estimation and Testing.' *The Stata Journal* 7 (4): 465–506.

Beck, T. 2015. 'Finance and Growth: Beware the Measurement.' *Centre for Economic Policy Research,* 30 September. https://cepr.org/voxeu/columns/finance-and-growth-beware-measurement.

Beck, T., M. Lundberg, and G. Majnoni. 2006. 'Financial Intermediary Development and Growth Volatility: Do Intermediaries Dampen or Magnify Shocks?' *Journal of International Money and Finance* 25 (7): 1146–1167.

Bekaert, G., C. R. Harvey, and C. Lundblad. 2005. 'Does Financial Liberalization Spur Growth?' *Journal of Financial Economics* 77 (1): 3–55.

Blundell, R. and S. Bond. 1998. 'Initial Conditions and Moment Restrictions in Dynamic Panel Data Models.' *Journal of Econometrics* 87 (1): 115–143.

Boikos, S., T. Panagiotidis, and G. Voucharas. 2022. 'Financial Development, Reforms and Growth.' *Economic Modelling* 108 (2): 105734.

Broner, F. A., and J. Ventura. 2008. 'Rethinking the Effects of Financial Liberalization.' Presented at the 9th Jacques Polak Annual Research Conference, Washington, 13–14 November.

Cameron, A. C., and P. K. Trivedi. 2005. 'Linear Models.' In *Microeconometrics: Methods and Applications,* edited by A. C. Cameron, and P. K. Trivedi. Cambridge University Press.

Chinn, M. D., and H. Ito. 2006. 'What Matters for Financial Development? Capital Controls, Institutions, and Interactions.' *Journal of Development Economics* 81 (1): 163–192.

Central Intelligence Agency. 2003. *The World Factbook.* Potomac Books.

Čihák, M., A. Demirgüç-Kunt, E. H. B. Feyen, and R. E. Levine. 2012. 'Benchmarking Financial Systems around the World.' Policy Research Working Paper 6175, World Bank Group.

Davidson, R., and J. G. MacKinnon. 2004. 'Instrumental Variables Estimation.' In *Econometric Theory and Methods,* edited by R. Davidson and J. G. MacKinnon. Oxford University Press.

Deephouse, D. L. 1999. 'To Be Different, or To Be The Same? It's a Question (and Theory) of Strategic Balance.' *Strategic Management Journal* 20 (2): 147–166.

Demirgüç-Kunt, A., and E. Detragiache. 1998. 'The Determinants of Banking Crises in Developed and Developing Countries.' *IMF Economic Review* 45:81–109.

Denizer, C. A., M. F. Iyigun, and A. Owen. 2002. 'Finance and Macroeconomic Volatility.' *The B.E. Journal of Macroeconomics* 2 (1). https://doi.org/10.2202/1534-6005.1048.

Elekdog, S., Emrullahu D., and S. B. Naceur. 2025. 'Does FinTech Increase Bank Risk-Taking?' *Journal of Financial Stability* 76:101360.

Elgharib, W. M. 2024. 'Financial Inclusion, Financial Development and Financial Stability in MENA.' *Review of Accounting and Finance* 23(4): 489–505.

Espinoza, R. A., G. Fayad, A. and Prasad. 2013. 'Nonperforming Loans and Financial Stability.' In *The Macroeconomics of the Arab States of the Gulf.* Oxford University Press.

Fang, W., H.-C. Huang, and S. M. Miller. 2014. 'Does Financial Development Volatility Affect Industrial Growth Volatility?.' *International Review of Economics and Finance* 29:307–320.

Financial Stability Board. 2022. *Promoting Global Financial Stability: 2022 FSB Annual Report.*

Ge, J., H. Tang, Y. Dong, Z. Yang, and C. Chen. 2025. 'Digital Financial Effect on Risk-Taking of Small- and Medium-Sized Commercial Banks: Mediation through Management Costs.' *Finance Research Letters* 77:107109.

Gerbens-Leenes, P., S. Nonhebel, and M. S. Krol. 2010. 'Food Consumption Patterns and Economic Growth: Increasing Affluence and the use of Natural Resources.' *Appetite* 55 (3): 597–608.

Guide, V. D. R. J., and M. Ketokivi. 2018. 'Notes from the Editors: Redefining some Methodological Criteria for the Journal.' *Journal of Operations Management* 37 (1): 5–8.

Halili, A., J.-P. Fenech, and S. Contessi. 2021. 'Credit Derivatives and Bank Systemic Risk: Risk Enhancing or Reducing?' *Finance Research Letters* 42:101930.

Heitmann, D., J.-A. Koch, M. S. Islam, and S. A. Eva. 2025. 'The Impact of Central Bank Digital Currencies on the Financial Stability of Banks: Dynamic Panel Estimation.' *Finance Research Letters* 84:107791.

International Monetary Fund. 2022. *Global Financial Stability Report.*

Keffala, M. R. 2015. 'How Using Derivatives Affects Bank Stability in Emerging Countries? Evidence from the Recent Financial Crisis.' *Research in International Business and Finance* 35:75–87.

Keh, C-G., P.-T. Gan, Y.-T. Tan, F. S. B. A. Hadi, and N. B. A. Jalil. 2022. 'Financial Development and Economic Growth in Malaysia: A Nonlinear ARDL Application.' *International Journal of Sustainable Economy* 14 (2): 197–215.

Ketokivi, M., and C. N. McIntosh. 2017. 'Addressing the Endogeneity Dilemma in Operations Management Research: Theoretical, Empirical, and Pragmatic Considerations.' *Journal Operations Management* 52 (3). https://doi.org/10.1016/j.jom.2017.05.001.

Khan, H. H. 2022. 'Bank Competition, Financial Development and Macroeconomic Stability: Empirical Evidence from Emerging Economies.' *Economic Systems* 46 (4): 101022.

Klomp, J. 2010. 'Causes of Banking Crises Revisited.' *The North American Journal of Economics and Finance* 21 (1): 72–87.

Koh, W. C., M. A. Kose, P. S. Nagle, F. L. Ohnsorge, and N. Sugawara. 2020. 'Debt and Financial Crises.' Policy Research Working Paper 9116, World Bank Group.

La Porta, R., F. Lopez-de-Silanes, A. Shleifer, and R. Vishny. 1999. 'The Quality of Government.' *Journal of Law, Economics and Organization* 15 (1): 222–279.

Levine, R. 2005. 'Finance and Growth: Theory and Evidence.' In *Handbook of Economic Growth,* edited by P. Aghion and S. N. Durlauf. Elsevier.

Loayza, N. V., and R. Rancière. 2006. 'Financial Development, Financial Fragility, and Growth.' *Journal of Money, Credit and Banking* 38 (4): 1051–1076.

Lu, G., X. D. Ding, D. X. Peng, and H. H.-C. Chuang. 2018. 'Addressing Endogeneity in Operations Management Research: Recent Developments, Common Problems, and Directions for Future Research.' *Journal of Operations Management* 64:53–64.

Mahmoudi, A., and M. Torra. 2023. 'Libérer le potentiel de l'Afrique: Explorer le lien synergique entre le développement financier et la croissance économique.' *International Journal of Accounting, Finance, Auditing, Management and Economics* 4 (3–2). https://ijafame.org/index.php/ijafame/article/view/985.

Ma, Y., and L. Lv. 2023. 'Financial Development, Financial Instability, and Fiscal Policy Volatility: International Evidence.' *North American Journal of Economics and Finance* 64 (1): 101873.

Ma, Y. and C. Yao. 2022. 'Openness, Financial Structure, and Bank Risk: International Evidence.' *International Review of Financial Analysis* 81 (2): 102065.

Merton, R. C., and A. Muralidhar. 2020. 'SELFIES: A New Pension Bond and Currency for Retirement.' *Harvard Law Forum on Corporate Governance,* 20 May. https://corpgov.law.harvard.edu/2020/05/20/selfies-a-new-pension-bond-and-currency-for-retirement

Minsky, H. P. 1977. 'The Financial Instability Hypothesis: An Interpretation of Keynes and an Alternative to "Standard" Theory.' *Nebraska Journal of Economics and Business* 16 (1): 5–16.

Naceur, S. B., B. Candelon, and Q. Lajaunie. 2019. 'Taming Financial Development to Reduce Crises.' IMF Working Paper 94, International Monetary Fund.

Pisicoli, B. 2023. 'Financial Development, Diversity, and Economic Stability: Micro and Systemic Evidence.' *International Economics* 175:187–200.

Poghosyan, T. 2022. 'Financial Development and Growth in the Caucasus and Central Asia.' IMF Working Paper 134, International Monetary Fund.

Popov, A. 2017. 'Evidence on Finance and Economic Growth'. ECB Working Paper 2115, European Central Bank.

Qin, X., G. Peng, and M. Zhao. 2025. 'Effects of Inflation and Macroprudential Policies on Bank Risk: Evidence from Emerging Economies.' *International Review of Financial Analysis* 97 (2): 103841.

Ramey, G., and V. A. Ramey. 1995. 'Cross-Country Evidence on the Link Between Volatility and Growth.' *The American Economic Review* 85 (5): 1138–1151.

Rioja, F., and N. Valev. 2004. 'Does One Size Fit All? A Reexamination of the Finance and Growth Relationship.' *Journal of Development Economics* 74 (2): 429–447.

Roodman, D. 2009. 'How to do Xtabond2: An Introduction to Difference and System GMM in Stata.' *Stata Journal* 9 (1): 86–136.

Rossi, P. E. 2014. 'Even the Rich Can Make Themselves Poor: A Critical Examination of IV Methods in Marketing Applications.' *Marketing Science* 33 (5): 655–672.

Roy, A. D. 1952. 'Safety First and the Holding of Assets.' *Econometrica* 20 (3): 431–449.

Sahay, R., M. Čihák, and P. N'Diaye. 2015. 'Rethinking Financial Deepening: Stability and Growth in Emerging Markets.' *Revista de Economía Institucional* 17 (33): 73–107.

Sanderson, E., and F. Windmeijer. 2016. 'A Weak Instrument F-Test in Linear IV Models with Multiple Endogenous Variables.' *Journal of Econometrics* 190 (2): 212–221.

Schinasi, G. J. 2004. 'Defining Financial Stability.' IMF Working Paper 187, International Monetary Fund.

Schinasi, G. J. 2006. *Safeguarding Financial Stability: Theory and Practice.* International Monetary Fund.

Shabir, M., P. Jiang, Y. Shahab, W. Wang, Ö. Işık, and I. Mehroush. 2024. 'Diversification and Bank Stability: Role of Political Instability and Climate Risk.' *International Review of Economics and Finance* 89 (6): 63–92.

Solow, R. M. 1956. 'A Contribution to the Theory of Economic Growth.' *The Quarterly Journal of Economics* 70 (1): 65–94.

Umar, M., X. Ji, D. Kirikkaleli, and Q. Xu. 2020. 'COP21 Roadmap: Do Innovation, Financial Development, and Transportation Infrastructure Matter for Environmental Sustainability in China?' *Journal of Environmental Management* 271:111026.

Vashisht, S., and H. S. Mundi. 2025. 'Do Well-Connected Bank CEOs Mitigate the Impact of Geopolitical Risk on Bank Stability? Evidence from an Emerging Market.' *Finance Research Letters* 84:107777.

Vithessonthi, C. 2014. 'The Effect of Financial Market Development on Bank Risk: Evidence from Southeast Asian Countries.' *International Review of Financial Analysis* 35:249–260.

Vuong, G., P. Nguyen, W. Barky, and M. Nguyen. 2024. 'Stock Return Volatility and Financial Distress: Moderating Roles of Ownership Struc-

ture, Managerial Ability, and Financial Constraints.' *International Review of Economics and Finance* 91:634–652.

Wang, R., J. Liu, and H. Luo. 2021. 'Fintech Development and Bank Risk Taking in China.' *The European Journal of Finance* 27 (4–5): 397–418.

Windmeijer, F. 2005. 'A Finite Sample Correction for the Variance of Linear Efficient Two-Step GMM Estimators.' *Journal of Econometrics* 126 (1): 25–51.

Wooldridge, J. M. 2010. *Econometric Analysis of Cross Section and Panel Data.* MIT Press.

Wooldridge, J. M. 2013. *Introductory Econometrics: A Modern Approach.* South-Western.

Zheng, X., Y. Gao, H. Li, and X. Zhao. 2025. 'Foreign Investor Trading, Local Investor Mimicry and Stock Price Volatility.' *Pacific-Basin Finance Journal* 93:102875.

Information and Communications Technology and Financial Development as Catalysts for Gender Equality in Brazil's Agricultural Sector

Freiderick Yohanna Letong
Near East University,
North Cyprus
20235068@std.neu.edu.tr

Fatma Türüç Seraj
Near East University,
North Cyprus
fatma.turuc@neu.edu.tr

Mehdi Seraj
Near East University,
North Cyprus
mehdi.seraj@neu.edu.tr

Huseyin Ozdeser
Near East University,
North Cyprus
huseyin.ozdeser@neu.edu.tr

In this study, we examined the effects of information and communications technology (ICT) and financial development on mitigating gender inequality in Brazil, using autoregressive distributed lag (ARDL) approaches, between 1991 and 2022. The ARDL bounds test was employed to find the presence of co-integration within the series of data. Both in the short run and the long run, financial development has a significant negative impact on gender disparity; this means that policies aimed at enhancing women's financial and consumption services should be promoted in the short run. In the long run, we can conclude that ICT developments lead to a decrease in gender inequalities, which may imply the need for strategic, long-term planning to increase ICT infrastructure, especially in deprived areas. This includes subsidising affordable internet, skills training for women in the ICT field, and promoting women's participation in the technology industry. In addition, the impact of optimal financial development varies over time; hence, there is a need for flexibility and sustainability in financial development. Policy makers should therefore continue to strengthen and enhance financial inclusion initiatives, as well as regularly follow up on the impact of these initiatives on gender equality.

Keywords: gender inequality, information and communications technology, financial development, human capital index, agriculture
JEL *Classification:* J16, J24

Received 2025/05/20 · Revised 2025/07/29 · Accepted 2025/08/21

Published online 2025/12/31 https://doi.org/10.26493/1854-6935.23.423-450

Introduction

Gender inequality is a persistent barrier to decent social and economic prosperity. Disparities in education, employment, and political representation harm women and gender minorities disproportionately (Cech and Waidzunas 2021; Adeosun and Owolabi 2021). Cultural norms and systematic biases have institutionalised gender inequity for centuries, affecting social and economic life (Jayachandran 2015; Kohli 2017). Women's empowerment is crucial for inclusive development, making gender equality a central pillar of the Sustainable Development Goals (SDGs).

Information and communications technology (ICT) has transformed the digital age, aiding economic, innovative, and human development; however, women face barriers to access, literacy, and participation in the digital sector (Palvia et al. 2018; Fernández-Portillo et al. 2020; Appiah-Otoo and Song 2021). Even where ICT can reduce structural inequality, long-term gender inequities persist, hindering opportunities. Access to education, employment, and decision-making platforms can improve gender equity when ICT is inclusive (González et al. 2016; Yeganehfar et al. 2018).

Finance is also crucial to tackling gender inequality. Ghosh and Vinod (2017), and Ozili (2021a) highlight systemic hurdles to lending, savings, and financial market leadership for women. Inclusion in financial systems and the adoption of gender-sensitive policies can enhance women's employment, entrepreneurship, and economic leadership (Cavalcanti and Tavares 2016; Kübler et al. 2018), while financial growth can enhance women's economic freedom and contribute to social justice (Tchamyou 2019; Ozili 2021b).

After the U.S. and Argentina, Brazil is the third-largest exporter of agricultural goods, a result of its favourable climate, plentiful natural resources, and a well-developed agro-industrial sector. Brazil's soybean, corn, and cattle production contribute to global food security and economic growth (World Population Review n.d.). Agriculture, which encompasses forestry, fisheries, livestock, and cereals, has contributed 6–7% to Brazil's GDP for several years. Brazil's GDP grew to 6.24% in 2023, driven by agriculture, forestry, and fisheries, up from 5.77% in 2022, according to the World Bank's 2024 Global Economy report. However, Brazil's percentage is still below the South American average of 7.7% (The Global Economy n.d.). Given the current severe climatic risks, Scot Consultoria (2025) expects a sectoral share of 6.3 to 6.8% in 2023 and

6.1% in 2024. This illustrates the sector's structural strength in the economy, as well as its dependence on production seasonality and overseas demand.

An integrated agrifood system comprising upstream suppliers, agro-processing companies, and logistical networks contributes to GDP; Brazil's integrated industry accounts for 22% of the country's GDP, 40% of its export revenues, and 16% of formal employment, according to the World Bank's Global Monitoring Report (World Bank Group 2025) and domestic sources. CEIC Data shows that agribusiness contributes 23.8% to GDP through services and industrial connections. Brazilian agrifood exports increased from 23% in 2000 to 37% in 2021, indicating improvements in industry productivity and competitiveness (Organisation for Economic Co-operation and Developmen 2023). Thus, while agriculture contributes to a single-digit percentage of GDP, its price chain drives rural growth, job creation, and international trade (World Bank Group 2025). The Gini coefficient (a scale of 0–1), which measures gaps in income, indicates that Brazil has the highest income inequality in Latin America (Mourao and Junqueira 2021; Signor et al. 2019). Brazil has several sources of economic disparity, including education (Faria dos Santos and Cruz Vieira 2015). In addition, countrywide direct monetary income may potentially promote inequality (Medeiros and Souza 2013).

ICT and financial development may reduce gender disparity in the Brazilian agriculture sector. Previous research has explored gender inequity across various sectors, but this study focuses specifically on gender inequality in the agricultural sector. As a major contributor to Brazil's GDP and employment, agriculture is a key area that must be considered, since agrarian reform enhances agricultural productivity and economic prosperity.

Gender inequality in Brazil is now understood primarily in terms of digital access, financial growth, and agricultural inequality. This perspective supports aggregate cross-country or country-level results that overlook sector-specific institutional processes. This study will fill that gap by presenting a sector-specific approach spanning three decades, using Brazil as an example, where agriculture is vital to the economy and gender inequality persists. The report is crucial given Brazil's governmental attempts to promote rural connection and internet access, expand women-specific financial products like Pronaf Mulher, and meet the SDGs. Gender disparity in agriculture is measured by the female-to-male ratio, which is obtained by dividing the number of female employees by the

number of male employees. This statistic lends sectoral depth to Brazilian gender inequality literature.

The remainder of the study is organized as follows: a summary of the literature examined is in The second section. The third section discusses the model, data, and econometric approaches. Details on the empirical findings are presented in the fourth section. Finally, the fifth section provides an overview of the study's key results as well as policy recommendations.

Literature Review

The gender gap in the workplace is still an immense and many-faceted problem that carries wide echoes not only for people as individuals, but also for groups and nations at large. The timely resolution of issues of gender inequality in labour remains crucial as long as women are confronted with the obstacles of equal access, opportunities, and representation at work. Thus, significant scholarly research has investigated the complex relationship between gender inequality and labour to understand its causes, effects, and expressions, and promote workplace inclusion and gender equality. Clark (1997) suggests that labour market inequalities, which may have decreased expectations, may have made women happier at work. Despite a lack of scientific evidence, especially from other nations, this viewpoint is gaining traction. In 2019, Perugini and Vladisavljević evaluated 2013 EU-SILC data to study gender differences in work satisfaction and inequality across 32 European countries. The data suggest that achieving early gender equality can help reduce work satisfaction gaps. Egalitarian women may have similar aspirations to men. In contrast to male-dominated occupations, education does not affect alignment. Rodríguez-Modroño et al. (2022) found gender inequality in digital labour platforms due to asymmetric and segregated interactions. The COLLEEM study in 16 European countries found that women use these platforms for "feminized" tasks, work fewer hours, and earn less than men. According to their research, platform analysis should encompass gender dynamics, workers' reliance on platforms, and labour force diversity.

Vyas (2021) examined gender inequality and the trends of EU women in gig jobs and found that despite digital platforms, outdated labour market stereotypes about women endure. Abuse of flexibility and algorithmic bias exacerbate the precarious conditions faced by women gig workers. After analysing employment practices, intersectionality, and the gender wage gap on traditional and digital platforms, the author concluded that

the EU must protect female gig economy workers to reduce gender inequality. In 2019, Kuitto et al. explored how parental leave affects young Finnish men and women. Multi-trajectory analysis and longitudinal Finnish Centre for Pensions registration data from 2005 to 2016 were utilized to evaluate the labour market links of workers born in 1980. Both sexes have five professional paths, yet early gender pay disparity persists despite similar job lengths. Women take more parental leave than men, resulting in unequal income and employment. The study suggests dividing parental leave more fairly to reduce gender inequalities in early professional development, which may impair women's career progression, pay, and pension. In another investigation, Barth et al. (2021) examine why the gender pay gap persists despite women's gains in the labour market. This discrepancy is explained by the 2000 U.S. Decennial Census and the Longitudinal Employer-Household Dynamics (LEHD) Data. The research indicated that switching occupations and professional progression gaps contribute to increased inequality, with varied consequences for different educational backgrounds. Established companies account for 27% of the income growth gap among college-educated persons. The slight income rise among non-college graduates is due to the establishment. Marriage also contributes to the widening income disparity between educated groups.

From 1980 to 2019, Akhtar et al. (2023) investigated Malaysian economic progress, gender inequality, evaluating trade openness, female labour force participation, and economic development using autoregressive distributed lag models. The nonlinear analysis demonstrates that positive and negative shocks complicate long-term female labour force participation and economic growth. Granger causality research has identified one-way and two-way connections between trade openness, economic growth, gender parity, and the labour force participation of males and females. These data demonstrate that economic growth is facilitated by trade openness, gender balance, and female labour force participation. To strengthen Malaysia's economy, the report recommends government assistance for institutional quality, economic effectiveness, and female professional engagement. Women are overrepresented among low-paid workers; hence, Caliendo and Wittbrodt (2022) study how the 2015 German minimum wage affects the gender wage gap. Regional minimum wages are examined using a difference-in-difference approach, employing data from the Structure of Earnings Survey, which covers nearly one million workers in 60,000 firms. The regional gender wage gap narrowed

in the lowest salary percentiles. The 10th percentile gender earnings gap in minimum wage areas reduced by 4.6 percentage points (32%) between 2014 and 2018. By 18%, the 25th percentile declined. The minimum wage can reduce the gender wage gap outside of low-wage industries and into higher-income categories, but less so near the mean salary.

In regard to ICT and inequality, Singh (2020) examines the research on female equality and shared mobility in the rapidly growing mobile sector, driven by smartphones and apps. Private transportation has revolutionized transportation, but its consequences on gender equality remain uncertain. Recent research has examined the impact of shared mobility on modal shift, car ownership, environmental challenges, congestion, and transit ridership. The benefits of shared mobility, including comfort, security, and accessibility, are often disregarded by women. A lack of research suggests that expanding shared mobility services may increase men's use and reduce the mixed-gender female urban mobility gap. Comprehensive empirical studies in strong economies are recommended to identify why this gender propensity has developed and how to overcome it for achieving urban transportation gender equality.

Segovia-Pérez et al. (2020) examined gender inequalities that persist in ICT employment, despite legislative measures aimed at helping women attain IT careers. Environmental constraints, gender bias, and separation affect women's educational and career choices in this male-dominated area. ICT professionals have emerged in all engineering specializations as new sectors develop. However, gender inequity endures. Women working in ICT-dominated companies can help minimize ICT discrimination and the gender wage gap, according to the study. Incomes are categorized using wage decomposition from the 2018 Spanish Income Structure Survey. Research shows female ICT professionals dislike tech and skill-based employment. Qazi et al. (2022) examine the relationship between gender and ICT learning, use, and competency. Eight journal databases were searched using stringent selection criteria to identify forty-two empirical, peer-reviewed papers and conference presentations published between 2006 and 2020. Such a small-scale meta-analysis can help determine the gender gap in attitudes using a limited number of publications. Statistics demonstrated boys' advantages despite the minor effect size. Qazi et al. (2022) note that more meta-analysis research utilizing several ICT use and skills criteria is needed to validate these effects, but they are promising. Collaboration between stakeholders to enhance IT skills and laws that limit school ICT use to beneficial purposes were

also reviewed. The paper recommends future research and stresses the necessity to overcome current obstacles.

Abdu et al. (2015) examined how financial inclusion reduces poverty and enhances society's ability to meet the World Bank Group's universal target for financial inclusion. This study uses the Global Findex 2011 to evaluate gender disparities and financial inclusion in Nigeria. Financial inclusion is determined by age, income, and education using the Binary Probit Model and Fairlie decomposition. Economic inclusion is higher among younger, wealthier, and better-educated people. Women, poor individuals, and seniors lower these odds. The analysis found that male-headed households had higher financial options. This gender gap is attributed to wealth and access to secondary education. Education and income disparities affect gender financial access. To achieve the Sustainable Development Goals concerning poverty and gender equality, Nwosu and Orji (2017) evaluated Nigerian credit and firm performance. Using 2010 Nigerian Enterprise Survey data, propensity score matching (PSM) examines how formal credit influences key performance measures. Econometrics shows that credit-limited enterprises have reduced production, capital, labour, employment, and fixed asset investment. Biases hurt women-owned businesses more. This persists despite bias-adjusted computations and the use of sampling weights. Protecting Nigerian small, middle, and micro enterprises from loan access concerns could improve business growth by easing credit laws and mainstreaming government assistance for SMEs.

Between 1996 and 2014, Tchamyou et al. (2019) examined the impact of ICT on income inequality in 48 African countries with financial development. The Generalized Method of Moments (GMM) measures financial depth, efficiency, activity, scale, and ICT linkages. ICT reduces the negative relationship between nations with deeper and larger financial systems and inequality, but only the positive relationship in time-invariant variables is stable. Research classifies financial depth as formal, semi-formal, informal, and non-formal. ICTs make finance accessible to people with low incomes, formalizing it. This study examines the growth of the financial sector and ICT-supported financial access to close post-2015 SDG gaps in Africa, with the aim of improving microfinance.

Poverty, income inequality, and financial inclusion are studied using model nation data from 116 wealthy and developing nations by Omar and Inaba (2020). A financial inclusion index was created using outreach and skewed annual panel data from 2004 to 2016. The study examines

how internet use, age dependence, inflation, income inequality, and GDP per capita affect financial inclusion in emerging nations. Financial inclusion may lessen poverty and income inequality somewhat. This illustrates how expanding access for the poor to formal financial services benefits society as a whole.

Ratnawati (2020) states that financial inclusion enhances social development, economic progress, poverty reduction, income inequality, financial stability, and overall well-being in many Asian countries. GMM is used to evaluate financial inclusion in household banking use, banking access, and financial sector activity. The Gini coefficient and poverty rates illustrate income and poverty imbalance nationwide. Nonperforming loans and the bank's Z-Score reflect stability. Hypothesis testing indicates that comprehensive financial inclusion promotes financial stability, reduces income inequality, contributes to poverty reduction, and fosters economic development. Unfortunately, financial inclusion has a limited impact on outcomes in eleven Asian nations. This article suggests that regulators evaluate these data to create financial inclusion regulations that align with the Sustainable Development Goals and enhance citizen well-being.

Chisadza and Biyase (2023) examine global economic inequality and financial growth from 1980 to 2019. This approach is unique because it utilizes a collective financial growth index that incorporates both historical and current financial success indicators. Also examined are the consequences of income disparity in industrialized, emerging, and least developed nations. This study demonstrates how the ambiguity of financial development influences social class income disparities. Financial development is associated with poverty in developing nations but not in prosperous nations. When financial markets and institutions are fragmented, economic development and income disparity are problematic. Banking helps reduce income disparity in most emerging and least developed economies, but stock markets exacerbate it. Analysis indicates complex and nonlinear relationships between the least developed and emerging states, as well as between the developed and emerging nations. According to the findings, financial inclusion and inequality reduction must take into account the distinctive characteristics of emerging nations, which affect financial growth.

Altuzarra et al. (2021) examined gender inequality as a barrier to economic growth in SSA, SA, MENA, LAC, and EAP from 1990 to 2017 using the World Bank Development Indicators database. The study's GMM

analysis suggests that gender equality in schooling promotes economic growth. Educational equality may have helped SSA nations more than other developing nations. There is no statistically significant gender gap in employment. All emerging nations have a strong link between women in parliaments and economic growth, while SSA countries do not. However, even in countries with increased female political engagement, women may struggle to influence political agendas and economic growth.

Kam et al. (2022) examined gendered inequalities in Nigeria's civil service, female labour participation, and economic growth using several approaches. The paper calculates the gender gap in economic growth effects using panel data regression. A content- and consistency-focused study reveals gender inequality and challenges faced by Nigerian women in the civil service. Gender imbalance damages the human capital of public service personnel and hinders economic growth, according to the report. The data suggests that strengthening education and civil service job criteria can minimize gender disparity and increase economic growth.

Iheonu et al. (2020) analysed Western African female labour force participation and income discrepancy from 2004 to 2016. The study examines unemployment, female workforce participation, and income inequality measures, including the Gini coefficient, Atkinson index, and Palma ratio. Fixed-effect and instrumental variable models are used. Most empirical studies suggest that income inequality hinders the participation of West African women in the workforce. An inverted U-shaped relationship exists between inequality and female unemployment. Policy recommendations based on the results finish the report.

Kim (2021) uses multi-level, multi-perspective analysis to examine gender imbalance in institutions, societies, and cultures. Hypothetical comparisons of OECD and non-OECD nations across five categories, utilizing 17 variables, reveal macro- and micro-level gender inequality. Regression analysis is employed to examine the impact of commercial and political freedoms, women's representation in government, human development, health, and demographic factors on gender inequality in 18 OECD and 16 non-OECD countries. The fertility rate and business attitude limit gender equality the most in the five models. One of the 11 important model factors for non-OECD nations states that politicians must reform their institutions. We also noted employee-level problems. The study reveals how institutional networks and financial independence balance gender disparities, setting the stage for political changes

to ensure equal rights and change formal and informal institutions that discriminate against women. Ishfaq et al. (2023) argue that Pakistan's female labour force participation rate inequality hinders economic growth. A 1991–2021 World Development Indicators (WDI) time series dataset is used to identify socioeconomic and environmental elements affecting FLPR operations. The ARDL model calculates the effects of long-term CO_2 emissions, female education, fertility rate, GDP, and FLPR. GDP and education increased FLPR over time, but CO_2 emissions and fertility rate decreased it. The study concluded that improving health, education, and training can improve public support for Pakistan's success.

While national-specific context matters, discussions of gender inequality have focused on transnational or continental topics; however, Brazilian literature on female empowerment, resource allocation, and agriculture is growing. Historical and sociocultural institutional variables contribute to the gender imbalance in Brazilian agriculture. Brazilian literature explores the complex interrelationships between work, gender, social progress, and rural agriculture. These studies demonstrate that rural Brazilian women are excluded from decision-making and empowerment due to restrictions on land, credit, productive inputs, and institutions.

Agricultural control and resource limitations contribute to gender disparity. Deere (2003) states that women's limited access to land and other production tools perpetuates structural inequality and restricts their economic involvement. Institutional insensitivity and cultural gender norms exacerbate these limitations, especially in semi-arid and disadvantaged Brazilian regions (Silva et al. 2020; Medeiros 2014). According to 2015 microdata, non-urban women earn less than men. Santos and Garibaldi de Hilal (2018) argue that employment market discrimination exacerbates this discrepancy. Leoncini et al. (2024) attribute the salary gap to systemic bias and occupational segregation.

Academics should worry about the gender digital divide. Infrastructure and social issues such as gender role limits and educational inequalities hinder rural Brazilian women's ICT access, the poll revealed (Kuhnen and Rosendo 2018). Digital barriers impede women's access to markets, financial services, training, and agricultural innovation. Digital illiteracy and gender-sensitive ICT policies are needed to close this gap and boost agricultural output. Women are more likely to migrate from rural to urban areas in Brazil, and emerging areas get jobs and enterprises from industrialized agriculture (Kuhnen and Rosendo 2018).

Brazil has made progress in implementing specific policy concepts and rural development programmes; however, the lives of farm women have not yet improved uniformly. Multi-component methods, such as asset redistribution (e.g. land and financial resources), social protection, legal reform, and targeted capacity building, must address these inequities. These policies acknowledge regional differences, particularly in marginalized rural communities, and engage women in active agricultural and rural policymaking.

Methodology and Data

The purpose of this research is to analyse the role of information and communications technology (ICT) and financial development in bridging the gender inequality gap in Brazil, with a focus on the agricultural sector. To carry out this research, the economic model adopted for the study is as follows:

$$GI = f(ICT, FINDEV, HDI, GDP) \tag{1}$$

In the equation above, *GI*, as indicated in the model, is a representation of Gender Inequality in the agricultural sector calculated as the employment in agriculture of females (% of female employment) divided by employment in agriculture of males (% of male employment). Although this variable sheds light on the differences in labour force participation, it fails to reflect the full range of GI, namely, wage differentials, unequal access to productive assets, and institutionalized limitations in the decision-making process. The purely empirical selection of this single-dimensional proxy was conditioned by the fact that there are consistent, sector-specific time series covering the study period (1991–2022). More comprehensive composite indices, such as the Gender Inequality Index (GII) or the Women's Empowerment in Agriculture Index (WEAI), would have provided more detailed information. However, their time and coverage duration are not as broad as required here. In turn, the employment-based indicator can be taken as a practically oriented and reasonable indicator of sectoral gender inequality over time. It should be noted, however, that future research on GI will be strengthened by the inclusion of multidimensional indices once such data becomes more accessible in disaggregated form.

ICT is a surrogate for information and communications technology, reflecting individuals using the internet (% of population). FINDEV rep-

resents financial development, quoting domestic credit to the private sector (% of GDP). HDI is a proxy for the human development index, and lastly, GDP represents gross domestic product per capita (constant USD 2015). All the data in this study were sourced from the Brazilian annual statistics from 1991–2022, taken from the World Development Index of the World Bank, except the HDI, which is from the UNDP (United Nations Development Programme) database.

The empirical model's linear requirements are represented in Equation (2):

$$GI_{it} = \beta_0 + \beta_1 ICT_{it} + \beta_2 FINDEV_{it} + \beta_3 HDI_{it} + \beta_4 GDP_{it} + \varepsilon_{it} \quad (2)$$

Subscripts i and t above in Equation 2 denote country and time, respectively, β_0 stands for the constant term, while the coefficients β_1, β_2, β_3, and β_4, indicate the elasticities of gender inequality, information and communications technology, financial development, human development index, and gross domestic product, respectively, and ε represents the error term.

The ARDL model (Pesaran and Shin 1999; Pesaran et al. 2001) was used in this study. It combines partial sum decompositions with both positive and negative decompositions to produce asymmetric effects in the short and long run. Each variable in the ARDL model had its lag lengths chosen based on the Schwarz Information Criterion (SIC), which is best applied in small samples. According to this criterion, only Gender Inequality (GI) and Financial Development (FINDEV) were left to include in lagged forms since they demonstrated considerable dynamic effects. The SIC did not imply later lags of the variables of ICT, HDI, and GDP, but including them in the model in their contemporaneous form, the model also excluded them altogether. This method achieves the parsimony of the model and also considers the most pertinent form of temporal dynamics that shape gender inequality. This model represents a standard method of modelling ARDL where variable-specific lags are not imposed, but are data-driven instead. The asymmetric ARDL allows for the unrestricted examination of non-stationarity and nonlinearity in an error-correcting model. The linear ARDL model is effective at detecting cointegrating associations in small data sets. Furthermore, it allows for statistical conclusions on long-run estimates that other cointegration methodologies cannot, regardless of the regressors' integration order (I (0) or I (1)). However, in the presence of I (2) variables, the linear ARDL cointegration

strategy is unsuccessful. When applied in its broadest sense, the ARDL model can be described as follows:

$$\phi(L)Y_t = \alpha_0 + \alpha_1 w_t \beta^1 X_{it} + U_t. \quad (3)$$

Results and Interpretation

DESCRIPTIVE STATISTICS

Descriptive statistics are the foundation of any empirical study, which comprises the summary statistics represented by the measures of central tendency and variation. They are gathered in table 1.

The descriptive statistics shed light on the gender inequality study using a variety of variables, including Gender Inequality (GI), Information and Communications Technology (ICT), Financial Development (FINDEV), Human Development Index (HDI), and GDP. The mean Gender Inequality score is 0.422, indicating a modest degree. Information and Communications Technology and Financial Development have means of 31.91 and 52.85, respectively, with significant variability reflected in their standard deviations. Human Development Index and GDP have means of 0.702 and 7640.16, respectively, indicating a substantially higher level of development than the other metrics. Skewness and kurtosis values indicate varied degrees of divergence from the normal distribution, as demonstrated in Financial Development: 1.510930 and 6.834944, respectively. The Jarque-Bera test highlights the divergence from normality, which is particularly noticeable in Financial Development (31.78458) and warrants additional examination. The summary statistics, together with

TABLE 1 Descriptive Statistics

	GI	ICT	FINDEV	HDI	GDP
Mean	0.422193	31.90528	52.84752	0.702156	7640.160
Median	0.397478	29.52919	50.12947	0.704500	7722.184
Maximum	0.591767	81.34269	134.1136	0.764000	9216.132
Minimum	0.319116	0.003288	27.68567	0.624000	5911.687
Std. Dev.	0.082026	29.14426	21.94003	0.046639	1070.321
Skewness	0.688898	0.335236	1.510930	−0.144795	−0.063482
Kurtosis	2.213084	1.674739	6.834944	1.635970	1.491497
Jarque-Bera	3.356746	2.941133	31.78458	2.592586	3.055603
Probability	0.186677	0.229795	0.000000	0.273544	0.217012
Sum	13.51016	1020.969	1691.121	22.46900	244485.1
Sum Sq. Dev.	0.208575	26331.02	14922.31	0.067430	35513193
Observations	32	32	32	32	32

a total of 32 observations for each indicator, provide a complete picture of the dataset, which is critical for understanding and interpreting gender disparity patterns and associated causes.

STATIONARY TEST

The stationarity of the data was determined using both the Augmented Dickey-Fuller (ADF) test (Dickey and Fuller 1979) and the Phillips-Perron (PP) test (Phillips and Perron 1988). The demand for unambiguous distinctions and exact measurements drove the selection of these methods. An important condition for using an ARDL technique is that all variables be classified as either I(0), I(1), or a combination of I(0) and I(1), with none falling under I(2). Tables 2 and 3 represent the ADF test and PP test, respectively.

The critical finding is that all variables are deemed statistically insignificant at level I(0), which shows that none of them are stationary. Nonetheless, stationarity is asserted by the first difference, because all variables are statistically significant in the ADF test. Moreover, the PP analysis also establishes that all variables are integrated of order one I(1) instead of I(0).

ARDL BOUND TEST

The ARDL bound test was employed to determine the presence of co-integration within the series of data. If the estimated value of the F-statistic is located below the level corresponding to the critical value, then the null hypothesis is sustained. The null hypothesis that there is no co-inte-

TABLE 2 ADF Test Result

Variables	Level	Prob	1st difference	Prob
GI	−1.162614	0.6771	−3.569533	0.0127
ICT	1.764465	0.9995	−4.029013	0.0041
FINDEV	−2.769712	0.0747	−5.390861	0.0001
HDI	−1.778172	0.3838	−3.965960	0.0048
GDP	−1.018282	0.7342	−4.382068	0.0017

TABLE 3 PP Test Result

Variables	Level	Prob	1st difference	Prob
GI	−1.138693	0.6875	−3.586073	0.0122
ICT	1.231832	0.9976	−4.188736	0.0028
FINDEV	−2.355266	0.1622	−5.676273	0.0001
HDI	−1.703994	0.4194	−3.888572	0.0059
GDP	−1.034056	0.7284	−4.398716	0.0016

TABLE 4 ARDL Bound Test Result

F-statistic		10.207944				
		10%		5%		1%
Sample Size	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
30	2.525	3.560	3.058	4.223	4.280	5.840
Asymptotic	2.200	3.090	2.560	3.490	3.290	4.370

NOTES I(0) and I(1) are respectively the stationary and non-stationary bounds.

gration is rejected if the statistics breach the upper threshold for I(1) (Pesaran et al. 2001). The computed F-statistic value (10.207944) indicates that the null hypothesis is rejected, suggesting a long-run connection between the independent and dependent variables at the 1%, 5%, and 10% signi1ficance levels.

ARDL LONG-RUN RESULT

Long-run analysis is helpful in empirical research because it enables researchers to establish the long-run coefficients and relationship between variables that would otherwise be hard to discover in the short run. This is important because when researchers focus on the long run, it is easier for them to distinguish between variability and change, therefore enhancing the understanding of what causes the occurrences in the long run. This is useful for creating effective policies and strategies, especially regarding the timing and persistence of actions. In this study, the ARDL long-run results for the dependent variable, Gender Inequality (GI), presented in table 5, reveal significant connections with the independent variables. Specifically, the lagged GI values, which show how past values influence current outcomes, have a significant impact on current levels of gender inequality, with coefficients of 1.268076, −0.889524, and 0.463907 for lagged periods of one, two, and three, respectively. This suggests that previous levels of gender inequality continue to have an impact on the current condition, with the most recent lag having the most effect.

In addition, information and communications technology (ICT) has a strong negative correlation with gender inequality, much like we observed a value of −0.00495 and a t-stat of −4.273326, meaning that access to internet services can promote gender equality. This study verifies the study of Shah and Krishnan (2024), who studied the relationships between ICT, gender inequality, and income inequality from 86 nations between 2013 and 2016. The findings conclude that ICT can reduce gen-

der disparity. Also, Valberg (2020) investigated how ICT influences the gender balance within workforce participation. The research provides empirical evidence supporting the assertion that ICTs have a positive effect on reducing gender disparity in the labour force rate, primarily due to the increased female labour force participation rate globally, as evidenced by panel data from 156 countries spanning 1991 to 2014. Despite the anticipated improvements in the gender share in employment and female literacy rate for employment, the change is lower in developing countries, and therefore, a reminder that ICT is not always a 'leapfrogging' technology. Other researchers (Amanze 2023; Javed 2023; Noor et al. 2021) also emphasize the importance of ICT development in addressing gender inequality.

In some ways, ICT has the potential to perpetuate the existing gender disparity within the agricultural sector. Women, more often than men, have limited access to ICT resources and accompanying tools that include digital literacy, even internet connection, and cellphones. This difference also limits their access to crucial agricultural information that can enhance income and production rates, including product prices, weather conditions, and related technologies. It may also help to supply female farmers with the needed educational content by addressing some of the identified deficits and targeting interventions that would allow for the proper ICT education and training of female farmers. Thus, there are numerous ways through which women can improve their efficiency and economic condition; they can use internet services and mobile applications for financial services and business opportunities, as well as for gaining recommendations regarding agriculture and farming. ICT can also help women participate in policymakers' forums and agricultural groups and co-operatives, thereby enhancing their voice in the sector. Long-term strategies should prioritize the growth of ICT infrastructure, particularly in underserved and rural areas, to ensure that women have equitable access to digital technology. This could include investing in low-cost internet access, offering ICT training programmes for women, and encouraging female engagement in tech-related industries.

Financial Development (FINDEV) also demonstrates a significant impact, with both current and lagged values showing significance. This is evident from coefficients of 0.009445, −0.004364, 0.001445, and −0.001736 for FINDEV and its lagged values. This result on the effect of financial development on inequality can be compared with the out-

come of studies by other researchers (Ratnawati 2020; Tchamyou 2021), who confirm the crucial role financial development plays in combating inequality, especially as related to gender. Previous research, including Bittencourt (2010) and Kanat et al. (2024), has also indicated a significant relationship between financial development and gender inequality. Financial development still plays a crucial role in the struggle for gender equality in supporting the sustainable growth of agriculture, since it provides suitable financial solutions that meet the various challenges that women encounter. This is useful in the fight against gender inequality in the agriculture industry as it offers women the required capital by coming up with the right financial products and structures that will give them a better standing economically. Since the keys to productivity enhancement through funding of profitable investments, adoption of efficient techniques for promoting agricultural productivity, and managing risks are provided by credit, insurance, and savings, the gender barriers to accessing these services by women farmers can be addressed through the application of integrated financial services.

In addition, the Human Development Index (HDI) reflects a direct correlation with gender inequality. With a coefficient of 3.808932 and a t-statistic of 3.981399, this suggests a positive association between the advancement of human development and the promotion of gender inequality. The HDI coefficient has a surprisingly positive and significant value, indicating that human development growth is not necessarily associated with low gender inequality in the agricultural sector. This finding can be attributed to the persistence of institutional and structural bottlenecks, such as limited land ownership, inequitable use of agricultural resources, and ingrained gender norms, which continue to hinder the equitable distribution of developmental benefits (Schwaab et al. 2019). This finding is similar to that of Ghosh (2018), who studied the relationship between gender equality, growth, and human development in India. The study found that, despite increasing literacy and educational levels among women, their participation in the labour force decreases, along with a narrowing of wage and income gaps. Additionally, Branchi and Bozon Penteado (2020) found that women in Brazil have higher levels of education than men. Nevertheless, the percentage of political representation of women is intolerably low, meaning that the level of human development does not necessarily reduce the rate of gender inequality in Brazil. Additionally, due to the prevalence of structural and cultural barriers, the gender disparity in the agricultural labour force in Brazil has not declined

over time with human development (Valencia et al. 2021; Schwaab et al. 2019; Bezner Kerr 2017). Women, therefore, may lack access to resources and may not own property or be qualified for decision-making roles in the agricultural industry despite the betterment of women's health, education, and overall livelihoods (Valencia et al. 2021; Bezner Kerr 2017). Also, the countryside often falls behind in implementing larger-scale social changes, and it is the women who are now locked out of training, financial services, technology, etc. These structures mean that a strategic approach to change might not fully address the causes of unequal gender access to agriculture, even when human developmental indicators improve.

The Gross Domestic Product (GDP) variable in table 5 shows a coefficient near −4.99E−05 and a p-value barely exceeding the standard 0.05, thereby implying a negative and notably non-significant association between GDP and gender inequality. This observation indicates that there is a statistically insignificant, economically trivial relationship between GDP per capita and gender inequality in Brazil, especially in its agricultural sector. Although this result suggests that economic growth as measured by GDP per capita does not possess a significant direct impact on gender gaps in either of the outcomes in question, it would be methodologically inadequate to conclude that GDP does not affect shaping gendered outcomes. Instead, the finding aligns with previously published literature, indicating that economic growth is a necessary but insufficient condition to halt the vicious cycle of gender injustices, as it must be complemented by institutional reforms, open labour policies, and equitable access to economic opportunities (Seguino 2001). Disadvantaged structural conditions, such as unequal access to land, financial resources, and unfair labour policies, along with persistent sociocultural norms, often hinder complete female economic participation, despite aggregate income growth in a country.

The short-run ARDL test provides the basis for understanding the immediate dynamics and correlation coefficients between the variables in question. In brief, it is apparent that the short-run ARDL test results and findings augment the long-term analysis, furnishing a better understanding of the data and providing keen insights into the temporal impacts and instantaneous implications. For decision-making systems where responses must be made at short time intervals, these results are highly constructive in defining the short-term cause-and-effect and feedback dependencies.

TABLE 5 ARDL Long-run Result (Dependent Variable: GI)

Variable	Coefficient	t-Statistic	Prob.
GI(−1)	1.268076	8.822388	0.0000
GI(−2)	−0.889524	−4.084219	0.0008
GI(−3)	0.463907	2.866093	0.0107
ICT	−0.004951	−4.273326	0.0005
FINDEV	0.009445	3.910148	0.0011
FINDEV(−1)	−0.004364	−4.484829	0.0003
FINDEV(−2)	0.001445	4.144681	0.0007
FINDEV(−3)	−0.001736	−5.720611	0.0000
HDI	3.808932	3.981399	0.0010
GDP	−4.99E−05	−2.021849	0.0592

TABLE 6 ARDL Short-run Result

Variable	Coefficient	t-Statistic	Prob.
CointEq(−1)*	−0.157540	−8.902903	0.0000
D(GI(−1))	0.425617	4.152937	0.0004
D(GI(−2))	−0.463907	−4.302443	0.0003
D(FINDEV)	0.009445	8.873359	0.0000
D(FINDEV (−1))	0.000291	1.580773	0.1282

Table 6 shows the ARDL short-run results, which provide evidence of the immediate implications of variables on Gender Inequality (GI) and Financial Development (FINDEV). The coefficient for the lagged relationship Cointegration Equation (CointEq(−1)) is −0.157540, and the t-statistic is −8.902903, indicating a significant negative impact. This implies that any deviation of the long-run equilibrium relation in the short run is corrected automatically, which represents a dynamic adaptation process towards equilibrium. The coefficients for the first and second lagged differences in GI are 0.425617 and −0.463907, respectively. Both coefficients exhibit significant t-statistics, implying a strong short-term link between changes in gender inequality levels across time.

The coefficient for the first lagged difference of FINDEV is 0.009445, with a high t-statistic of 8.873359, demonstrating a substantial positive link between changes in financial development and changes in gender inequality in the near term. However, the coefficient for the second lagged difference of FINDEV (D(FINDEV(−1))) is modest (0.000291) and statistically insignificant, implying that the effect of earlier financial development on gender inequality in the current period is minimal and not significant. These findings shed light on the short-term dynamics

between gender inequality and financial development, highlighting the importance of considering the immediate effects in understanding their relationship.

RESIDUAL DIAGNOSTIC TESTS

Diagnostic tests on the model's residuals give information about its adequacy and possible flaws. The first step is the Breusch-Godfrey LM Test, which is used to detect serial correlation in the residuals. The derived statistic value of 1.103240 is less than the critical limit, and the corresponding probability of 0.3573 shows that there is no significant evidence of serial correlation. This proves that the residuals do not have a regular pattern over time, and hence, the independence assumption required for the model's reliability is proved.

Moving on to the Ramsey RESET Test, which looks for potential model misspecification by testing for omitted non-linear variables, the low statistic value of 0.033578, along with a high probability of 0.8569, suggests that there is no meaningful evidence to reject the null hypothesis. As a result, the model appears to reflect the nonlinear interactions between the variables appropriately. Lastly, the Breusch-Pagan-Godfrey Heteroscedasticity Test, which is applied to check the presence of heteroscedasticity in residuals, gives a statistic value of 1.063227 and a probability of 0.4405. The probability goes beyond the traditional significance criteria; therefore, there is no convincing evidence of heteroscedasticity, meaning that the variance of the residuals stays the same for all observations. The structural stability of the model was also evaluated using the CUSUM and CUSUM of Squares tests (figures 1 and 2). The model stability is visually represented by the blue lines that cross the top and bottom red lines in the diagrams, respectively, and show that there is no variation from the 5% significance plot.

To summarize, these diagnostic tests collectively demonstrate that the model assumptions are reasonably met, increasing confidence in the dependability of the model's outcomes and interpretations.

Summary and Recommendations for Policy

The paper has provided a discussion on the interaction between information and communications technology (ICT), financial development and gender inequality in the agricultural sector of Brazil between 1991 and 2022 using the ARDL analysis strategy. To examine gender inequality, sectoral employment ratios were utilized, whereas ICT and financial

TABLE 7 Residual Diagnostic Test Result

Name of the Test	Statistics value	Probability
Breusch-Godfrey LM Test	1.103240	0.3573
Ramsey reset test	0.033578	0.8569
Heteroscedasticity Test: Breusch-Pagan-Godfrey	1.063227	0.4405

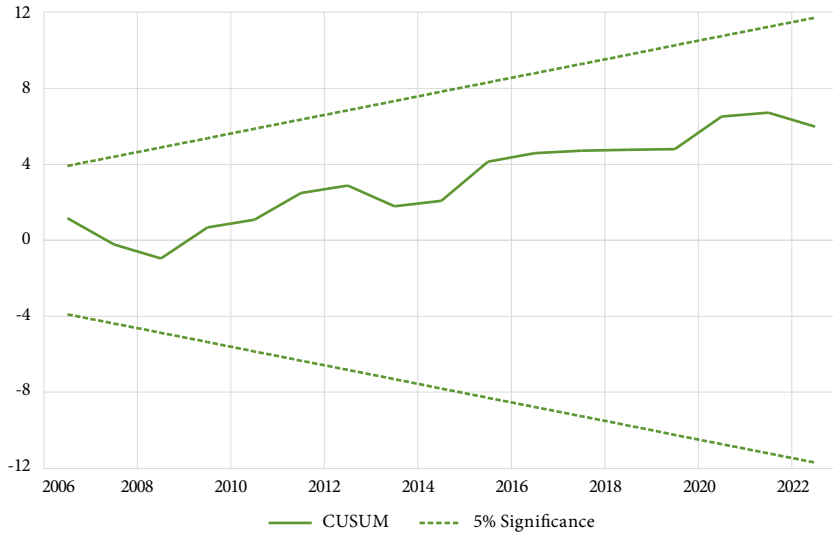

FIGURE 1 CUSUM Test

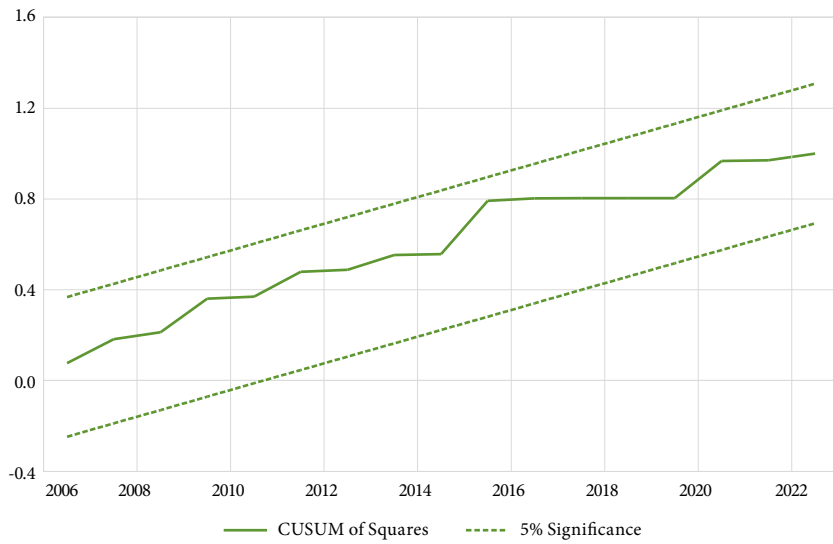

FIGURE 2 CUSUM of Squares Test

development were symbolized by internet use and domestic credit to the private sector, respectively. Also included were the Human Development Index (HDI) and GDP per capita. The results are confirmation of substantial and policy-relevant correlations, with long-standing results on gender equity, rural development, and inclusive economic growth.

The conclusion made, which is one of the most important, is that there exists a negative correlation between ICT and gender inequality in the long term, which supports the idea that digital inclusion is a transformative aspect. ICT helps expand the use of market information, finance services, and capacity development platforms for women. In the Brazilian context, where the rural areas are still digitally excluded, this highlights the immediate necessity of coordinated investment on the federal and state levels in affordable broadband services, mobile communications, and digital literacy initiatives among women. Collaboration among the Ministry of Communications, local municipalities, and agri-tech firms can accelerate the rollout of this. Also, digital empowerment is in line with the national strategies in Brazil on digital transformation, as well as its role in agricultural productivity and innovation.

Financial development plays a more complicated role. Although access to credit leads to less gender disparity in the short run, in the long run, this is the variable, indicating that structural adjustments in the financial system are required. Such programmes as Pronaf Mulher should be extended and transformed to consider collateral needs, enhanced outreach, and provision of custom financial products to women farmers. Gender-disaggregated reporting should be prescribed by financial regulators, such as the Central Bank of Brazil, to hold them accountable. Fintech and cooperative banks can be supported in providing their inclusive services by promising to provide them with subsidies and boosting their innovativeness.

Notably, the research notes that HDI gains are not enough to improve gender inequality in agricultural practices. Regardless of achievements in education and health, citizen inertia is still practiced in terms of systematic cultural and institutional limitations, particularly in the areas of land ownership, political representation, and access to resources. This requires legal and policy changes to address protection of women's rights over their land, inclusion of gender-responsive budgets in rural development initiatives, and encouraging female membership of the cooperatives and agricultural leadership mechanisms.

These findings are of direct concern to the industry. There is a growing concern to guarantee ethical sourcing, gender equity, and sustainability by agribusinesses, cooperatives, and food exporters. Inclusion of women in the agricultural value chains, workforce capacity, and leadership enhances resilience, productivity, and market competitiveness. By developing gender-sensitive approaches, the actors in the industries, particularly when cooperating with public institutions, may strengthen the position of Brazil in world markets, discharging SDG-oriented duties.

Nevertheless, an important weakness of this work is the aggregation of countrywide data, which fails to take into consideration the structural variety of the Brazilian agricultural sector. The combination of small, family-based farming systems with large export-oriented agriculture agribusiness also makes for many differences in labour systems, access to finance and technologies, and gender relationships. Accordingly, the relationships between variables in the findings are average sector-wide relationships that could conceal key variance in the expression of gender inequality across these relatively different agricultural subsectors. Future studies should focus on including disaggregated data or micro-level data to differentiate between farm types, production scales, and regional dynamics, thereby providing a more accurate picture of gender disparity in the Brazilian agricultural sector.

Conclusively, the treatment of gender inequality in the Brazilian agricultural sector requires multi-sector coordination and working within realities. ICT and financial development are a potent tool, their effectiveness being determined by the degree to which they are entrenched in policies, institutions, and market structures. Policymakers, development agencies, and even the private sector should coordinate efforts that integrate technological growth, inclusive finance, cultural transformation, and institutional responsibility. It is by these kinds of broad-based and all-encompassing measures that Brazil will be able to realize a more equitable, productive, and internationally competitive agricultural economy.

References

Abdu, M., A. Buba, I. Adamu, and T. Muhammad. 2015. 'Drivers of Financial Inclusion and Gender Gap in Nigeria.' *The Empirical Econometrics and Quantitative Economics Letters* 4 (4): 186–199.

Adeosun, O. T., and K. E. Owolabi. 2021. 'Gender Inequality: Determinants and Outcomes in Nigeria.' *Journal of Business and Socio-Economic Development* 1 (2): 165–181.

Akhtar, R., M. M. Masud, N. Jafrin, and S. M. Shahabudin. 2023. 'Economic Growth, Gender Inequality, Openness of Trade, and Female Labour Force Participation: A Nonlinear ARDL Approach.' *Economic Change and Restructuring* 56 (3): 1725–1752.

Altuzarra, A., C. Gálvez-Gálvez, and A. González-Flores. 2021. 'Is Gender Inequality a Barrier to Economic Growth? A Panel Data Analysis of Developing Countries.' *Sustainability* 13 (1): 367.

Amanze, R. 2023. 'ICT as a Tool for Women's Empowerment.' In *Nigerian Women in Cultural, Political and Public Spaces,* edited by M. Sotunsa and A. M. Yakubu. Palgrawe Macmillan.

Appiah-Otoo, I., and N. Song. 2021. 'The Impact of ICT on Economic Growth: Comparing Rich and Poor Countries.' *Telecommunications Policy* 45 (2): 102082.

Barth, E., S. P. Kerr, and C. Olivetti. 2021. 'The Dynamics of Gender Earnings Differentials: Evidence from Establishment Data.' *European Economic Review* 134 (2): 103713.

Bezner Kerr, R. 2017. 'Chapter 10 - Gender and Agrarian Inequities.' In *Agricultural Systems,* 2nd ed., edited by S. Snapp and B. Pound. Academic Press.

Bittencourt, M. 2010. 'Financial Development and Inequality: Brazil 1985–1994.' *Economic Change and Restructuring* 43 (2): 113–130.

Branchi, B. A., and T. Bozon Penteado. 2020. 'Measuring Brazilian Inequality Using the Gender Inequality Index.' *International Journal for Innovation Education and Research* 8 (8): 659–668.

Caliendo, M., and L. Wittbrodt. 2022. 'Did the Minimum Wage Reduce the Gender Wage Gap in Germany?' *Labour Economics* 78 (3): 102228.

Cavalcanti, T., and J. Tavares. 2016. 'The Output Cost of Gender Discrimination: A Model-based Macroeconomics Estimate.' *The Economic Journal* 126 (590): 109–134.

Cech, E. A., and T. J. Waidzunas. 2021. 'Systemic Inequalities for LGBTQ Professionals in STEM.' *Science Advances* 7 (3): eabe0933.

Chisadza, C., and Biyase, M. 2023. 'Financial Development and Income Inequality: Evidence From Advanced, Emerging and Developing Economies.' *Annals of Financial Economics* 18 (1). https://doi.org/10.1142/S2010495222410020?urlappend=%3Futm_source%3Dresearchgate.

Clark, A. E. 1997. 'Job Satisfaction and Gender: Why are Women So Happy at Work?' *Labour Economics* 4 (4): 341–372.

Deere, C. D. 2003. 'Women's Land Rights and Rural Social Movements in the Brazilian Agrarian Reform.' *Journal of Agrarian Change* 3 (1–2): 257–288.

Dickey, D. A., and W. A. Fuller. 1979. 'Distribution of the Estimators for Autoregressive Time Series with a Unit Root.' *Journal of the American Statistical Association* 74 (366a): 427–431.

Faria dos Santos, V., and W. da Cruz Vieira. 2015. 'Income Inequality in the Urban and Rural Sectors of the Northeast Region of Brazil.' *Review of Urban and Regional Development Studies* 27 (2): 134–147.

Fernández-Portillo, A., M. Almodóvar-González, and R. Hernández-Mogollón. 2020. 'Impact of ICT Development on Economic Growth: A Study of OECD European Union Countries.' *Technology in Society* 63:101420.

Ghosh, M. 2018. 'Gender Equality, Growth and Human Development in India.' *Asian Development Perspectives* 9 (1): 68–87.

Ghosh, S., and D. Vinod. 2017. 'What Constrains Financial Inclusion for Women? Evidence from Indian Micro data.' *World Development* 92:60–81.

González, A. M., B. Revelles, E. Almeda, N. Vergés Bosch, and J. S. García. 2016. 'Women in ICT: Opportunities for Their Inclusion in an International Labor Market.' In *ICT for Promoting Human Development and Protecting the Environment,* edited by F. J. Mata and A. Pont. Springer.

Iheonu, C. O., O. Nwodo, U. Anaduaka, and U. Ekpo. 2020. 'Inequality and Female Labour Force Participation in West Africa.' *European Journal of Government and Economics* 9 (3): 252–264.

Ishfaq, S., M. S. Awan, and F. N. Shah. 2023. 'Gender Inequality and Factors Affecting Women Participation in Labour Market.' *International 'Journal of Academic Research for Humanities* 3 (1): 253–261.

Javed, R. 2023. 'Impact of Information and Communication Technology in Achieving Gender Equality: A Panel Data Analysis.' Degree thesis, Quaid I Azam University.

Jayachandran, S. 2015. 'The Roots of Gender Inequality in Developing Countries.' *Annual Review of Economics* 7:63–88.

Kam, A. J. Y., J. S. Oboh, Z. Othman, and J. Sufian. 2022. 'The Impact of Gender Inequality on Economic Growth: An Explanatory Sequential Mixed Methods Study of Female Labour Participation in the Civil Service.' *European Journal of Government and Economics* 11 (2): 210–233.

Kanat, O., Z. Yan, M. M. Asghar, S. A. H. Zaidi, and A. Sami. 2024. 'Gender Inequality and Poverty: The Role of Financial Development in Mitigating Poverty in Pakistan.' *Journal of the Knowledge Economy* 15 (3): 11848–11876.

Kim, S. Y. 2021. 'Determining Critical Factors of Gender Inequality: Evidence from 34 OECD and Non-OECD Countries.' *World Development Perspectives* 21 (1): 100284.

Kohli, S. 2017. 'Gender Inequality in India.' *International Journal of Humanities and Social Science Studies* 3 (4): 178–185.

Kübler, D., J. Schmid, and R. Stüber. 2018. 'Gender Discrimination in Hiring Across Occupations: A Nationally-Representative Vignette Study.' *Labour Economics* 55:215–229.

Kuhnen, T. A., and D. Rosendo. 2018. 'Domination and Power Relations in Brazilian Agriculture: A Gender Analysis of the Concept of Adequate Food.' *Ethic@* 17 (2): 259–289.

Kuitto, K., J. Salonen, and J. Helmdag. 2019. 'Gender Inequalities in Early Career Trajectories and Parental Leaves: Evidence from a Nordic Welfare State.' *Social Sciences* 8 (9): 253.

Leoncini, R., M. Macaluso, and A. Polselli. 2024. 'Gender Segregation: Analysis Across Sectoral Dominance in the UK Labour Market.' *Empirical Economics* 67:2289–2343.

Medeiros, M. A. 2014. 'The Other End of the Bargain: The Socioeconomics of Marital Dissolution in Rural Northeast Brazil.' *Transforming Anthropology* 22 (2): 105–120.

Medeiros, M., and P. Souza. 2013. 'The State and Income Inequality in Brazil.' *Social Science Research Network*. https://ssrn.com/abstract=2257857.

Mourao, P., and A. Junqueira. 2021. 'Through the Irregular Paths of Inequality: An Analysis of the Evolution of Socioeconomic Inequality in Brazilian States Since 1976.' *Sustainability* 13 (4): 2356.

Noor, A., Z. Asghar, H. Sarwar, and I. Arfeen. 2021. 'Role of the ICT in Women Empowerment and Achieving SDGs: A Case Study of Women Labor Force in Developing Countries.' *ETIKONOMI* 20 (2): 339–348.

Nwosu, E. O., and A. Orji. 2017. 'Addressing Poverty and Gender Inequality through Access to Formal Credit and Enhanced Enterprise Performance in Nigeria: An Empirical Investigation.' *African Development Review* 29 (S1): 56–72.

Organisation for Economic Co-operation and Development. 2023. 'Agricultural Policy Monitoring and Evaluation 2023: Adapting Agriculture to Climate Change.' *Organisation for Economic Co-operation and Development,* 30 October. https://www.oecd.org/en/publications/agricultural-policy-monitoring-and-evaluation-2023_b14de474-en/full-report/brazil_6226dfb7.html

Omar, M. A., and K. Inaba. (2020). 'Does Financial Inclusion Reduce Poverty and Income Inequality in Developing Countries? A Panel Data Analysis.' *Journal of Economic Structures* 9 (1): 37.

Ozili, P. K. 2021a. 'Financial Inclusion in Nigeria: Determinants, Challenges, and Achievements.' In *New Challenges for Future Sustainability and Wellbeing,* edited by E. Özen, S. Grima, and R. Dalli Gonzi. Emerald.

Ozili, P. K. 2021b. 'Financial Inclusion Research Around the World: A Review.' *Forum for Social Economics* 50 (4): 457–479.

Palvia, P., N. Baqir, and H. Nemati. (2018). 'ICT for Socio-Economic Development: A Citizens' Perspective.' *Information and Management* 55 (2): 160–176.

Perugini, C., and M. Vladisavljević. 2019. 'Gender Inequality and the Gender-Job Satisfaction Paradox in Europe.' *Labour Economics* 60:129–147.

Pesaran, M. H., and Y. Shin. 1999. 'An Autoregressive Distributed-Lag Modelling Approach to Cointegration Analysis.' In *Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium,* edited by S. Strøm. Cambridge University Press.

Pesaran, M. H., Y. Shin, and R. J. Smith. 2001. 'Bounds Testing Approaches to the Analysis of Level Relationships.' *Journal of Applied Econometrics* 16 (3): 289–326.

Phillips, P. C. B., and P. Perron. 1988. 'Testing for a Unit Root in Time Series Regression.' *Biometrika* 75 (2): 335–346.

Qazi, A., N. Hasan, O. Abayomi-Alli, G. Hardaker, R. Scherer, Y. Sarker, S. Kumar Paul, and J. Z. Maitama. 2022. 'Gender Differences in Information and Communication Technology Use and Skills: A Systematic Review and Meta-Analysis.' *Education and Information Technologies* 27 (3): 4225–4258.

Ratnawati, K. 2020. 'The Impact of Financial Inclusion on Economic Growth, Poverty, Income Inequality, and Financial Stability in Asia.' *The Journal of Asian Finance, Economics and Business* 7 (10): 73–85.

Rodríguez-Modroño, P., A. Pesole, and P. López-Igual. 2022. 'Assessing Gender Inequality in Digital Labour Platforms in Europe.' *Internet Policy Review* 11 (1). https://doi.org/10.14763/2022.1.1622.

Santos, C., and A. V. Garibaldi de Hilal. 2018. 'Same, Same but Different? Women's Experiences with Gender Inequality in Brazil.' *Employee Relations* 40 (3): 486–499.

Schwaab, K. S., V. R. Dutra, P. F. Marschner, and P. S. Ceretta. 2019. 'How Much Heavier is a "Hoe" for Women? Wage Gender Discrimination in the Brazilian Agricultural Sector.' *Contextus: Revista Contemporânea de Economia e Gestão* 17 (2): 37–62.

Scot Consultoria. 2025. 'O PIB e sua relação com a agropecuária (GDP and its relationship with agriculture.' *Scot Consultoria,* 25 February. https://www.scotconsultoria.com.br/noticias/artigos/58605/o-pib-e-sua-relacao-com-a-agropecuaria.

Segovia-Pérez, M., R. B. Castro Núñez, R. Santero Sánchez, and P. Laguna Sánchez. 2020. 'Being a Woman in an ICT Job: An Analysis of the Gender Pay Gap and Discrimination in Spain.' *New Technology, Work and Employment* 35 (1): 20–39.

Seguino, S. 2001. 'Gender Inequality and Economic Growth: A Cross-Country Analysis.' Social *Science Research Network,* 2 August. https://papers.ssrn.com/abstract=252913.

Shah, C. S., and S. Krishnan. 2024. 'ICT, Gender Inequality, and Income Inequality: A Panel Data Analysis Across Countries.' *Information Systems Frontiers* 26 (2): 709–727.

Signor, D., J. Kim, and E. Tebaldi. 2019. 'Persistence and Determinants of Income Inequality: The Brazilian Case.' *Review of Development Economics* 23 (4): 1748–1767.

Silva, B. B., B. Sales, A. C. Lanza, L. Heller, and S. Rezende. 2020. 'Water and Sanitation are Not Gender-Neutral: Human Rights in Rural Brazilian Communities.' *Water Policy* 22 (1): 102–120.

Singh, Y. J. 2020. 'Is Smart Mobility also Gender-Smart?' *Journal of Gender Studies* 29 (7): 832–846.

Tchamyou, V. S. 2019. 'The Role of Information Sharing in Modulating the Effect of Financial Access on Inequality.' *Journal of African Business* 20 (3): 317–338.

Tchamyou, V. S. 2021. 'Financial Access, Governance and the Persistence of Inequality in Africa: Mechanisms and Policy Instruments.' *Journal of Public Affairs* 21 (2). https://doi.org/10.1002/pa.2201.

Tchamyou, V. S., G. Erreygers, and D. Cassimon. 2019. 'Inequality, ICT and Financial Access in Africa.' *Technological Forecasting and Social Change* 139:169–184.

The Global Economy. n.d. 'GDP share of agriculture in South America.' https://www.theglobaleconomy.com/rankings/Share_of_Agriculture/South-America/.

Valberg, S. 2020.' ICT, Gender, and the Labor Market: A Cross-Country Analysis.' In *Digitalisation and Development: Issues for India and Beyond,* edited by D. Maiti, F. Castellacci, and A. Melchior. Springer.

Valencia, V., H. Wittman, A. D. Jones, and J. Blesh. 2021. 'Public Policies for Agricultural Diversification: Implications for Gender Equity.' *Frontiers in Sustainable Food Systems* 5:718449.

Vyas, N. 2021. '"Gender Inequality- Now Available on Digital Platform": An Interplay between Gender Equality and the Gig Economy in the European Union.' *European Labour Law Journal* 12 (1): 37–51.

World Bank Group. 2025. 'New World Bank Study Discusses Policies to Make Brazil's Agrifood Sector More Competitive, Sustainable, and Inclusive.' *World Bank Group,* 10 April. https://www.worldbank.org/en/news/press-release/2025/04/10/new-world-bank-study-brazil-agrifood-sector-public-policies.

World Population Review. n.d.. 'Agricultural Exports by Country 2025.' https://worldpopulationreview.com/country-rankings/agricultural-exports-by-country

Yeganehfar, M., A. Zarei, A. R. Isfandyari-Mogghadam, and A. Famil-Rouhani. 2018. 'Justice in Technology Policy: A Systematic Review of Gender Divide Literature and the Marginal Contribution of Women on ICT.' *Journal of Information, Communication and Ethics in Society* 16 (2): 123–137.

Regional Disparities in Health-Seeking Behaviour in Nigeria: Evidence from the World Bank General Household Survey

Uche Abamba Osakede
Bowen University, Nigeria
uche.osakede@bowen.edu.ng

M. Femi Ayadi
University of Houston-Clear Lake, USA
ayadim@uhcl.edu

Regional disparities in socioeconomic factors shape health-seeking behaviour (HSB). This study examined HSB across Northern and Southern Nigeria and the role of socioeconomic factors on HSB. Data was drawn from Wave 4 of the 2018/2019 post-harvest General Household Survey of approximately 5,000 households. Logistic regression and Chi-square ($\chi 2$) tests were applied. Findings show that health care is predominantly sought from private providers, especially in the South. No significant regional difference was found between formal and informal care use. Older adults rely on informal care providers such as traditional healers and faith-based centres. Household income significantly influences provider choice, while gender matters mainly in the North, where women utilise public more than private facilities. Longer distances and waiting times increase the likelihood of public facility use, and severe illness drives reliance on public providers. Policy should improve formal health care access for older adults, strengthen public facilities to manage severe illnesses and women's health, especially in the North, and tighten oversight of private providers, particularly in the South, to ensure quality health care.

Keywords: health-seeking behaviour, formal and informal health care, public and private health care, Northern and Southern Nigeria
JEL *Classification:* I14, I18

Received 2025/07/05 · Revised 2025/09/02 · Accepted 2025/09/29

Published online 2025/12/31 https://doi.org/10.26493/1854-6935.23.451-483

Introduction

Health-seeking behaviour (HSB) is defined as any activity undertaken by individuals who perceive themselves to have a health problem or to be ill, for the purpose of finding an appropriate remedy (Ward et al. 1997). HSB can also be defined as any activity undertaken by persons who find themselves with a health-related problem with the aim of seeking an appropriate remedy. It captures decision-making regarding health

conditions and is usually not homogeneous, as it is determined by several demographic factors (Khadka et al. 2022).

Differences in HSB are evident across populations and reflect inequity and inequality in access to health care services (Ugwueje 2012; Reddy et al. 2020). It also limits the achievement of health targets, one of which is the Sustainable Development Goal (SDG) of better health across populations (Whitehead 1992; Gwatkin 2000; United Nations Development Program n.d.-a).

In Africa, non-inclusive payments for health care, cultural diversity and differences in norms, values and literacy rates often account for differences in HSB across populations. While this disparity exists, studies in the literature provide findings for HSB of individuals mainly across gender, and rural and urban location of residents (Reddy et al. 2020; Begashaw et al. 2016; Das et al. 2018). However, HSB across populations is commonly defined by the regional location of persons, as each region is often characterised by differences in culture, beliefs and perception that define provider choice of health care, and this in turn influences health outcome.

Although Nigeria operates under a unified health care system, striking disparities exist between the Northern and Southern regions in terms of health care access, utilisation, and outcomes. Abubakar et al. (2022), for instance, established that there is a greater concentration of hospitals and other formal health structures in the South as compared with the North, despite the proportionally larger population in the North. Southern states are generally better served by health facilities than the North, reflecting deep-rooted socioeconomic and infrastructural inequalities.

These disparities are reflected in maternal and child health outcomes, with the North reporting substantially higher maternal mortality rates and poorer reproductive health indicators compared to the South. Findings by Meh et al. (2019) and Ononokpono et al. (2020) show variations in the levels of maternal mortality between the Northern and Southern regions in Nigeria with maternal mortality more pronounced in the North than the South. In addition, Ononokpono et al. (2020) revealed a North-South divide in the use of postnatal care (PNC), with higher PNC uptake in the Southern than in the Northern region. This further establishes inequities in child health across the region.

In terms of routine immunisation, coverage remains consistently lower in the North, where children face both supply-side barriers, such as inadequate service points, and demand-side challenges linked to

sociocultural norms. Findings by Sani et al. (2025) using the 2018 Nigeria Demographic and Health Survey (NDHS) showed a low rate (26%) of children who were fully immunised in Nigeria, with marked regional disparities across North and South. Interestingly, the results showed the lowest rates of full immunisation coverage in the North West (13%) and North East (18%), compared with the South East (42%) and South South (41%), that had the highest rate.

With reference to population health outcomes, the figures reveal a high prevalence of poor health indicators in Nigeria, with notable differences across regions. For instance, it is shown that crude mortality rates as of 2020 were as high as 11 per 1,000 live births, and this figure exceeds that of 8 per 1,000 across the globe and in Sub-Saharan Africa (World Bank Group n.d.-a). Estimates of infant mortality rates are also high at approximately 72 per 1,000 live births compared to global estimates of 27 and SSA figures of 50 per 1,000 (World Bank Group n.d.-b). Across regions in Nigeria, infant deaths are higher in the North than in the South (Adeleke et al. 2022). This is often associated with low female literacy and high poverty statistics in the Northern region (World Bank Group 2024). Poor health outcomes in Northern Nigeria are also attributed to high insecurity concerns and unfavourable climatic conditions (Chukwuma and Ekhator-Mobayode 2019; Osayomi et al. 2020; Adeleke et al. 2022).

Given disparities in health outcomes, health infrastructure and socioeconomic conditions, this study seeks to provide answers to the question of the pattern of HSB in Nigeria across the North and Southern regions. The study focuses on whether differences in socio-demographic profiles, cultural and religious norms, economic inequalities, and health care system availability reflect HSB across the regions. The emphasis is to provide region-specific policies that can be implemented to improve health care access and utilisation and consequently health improvement in both regions. HSB is examined across the regions in terms of the use of private and public, formal and informal providers, using the General Household Survey data provided by the World Bank. Formal health care providers are qualified, licensed professionals delivering services within recognised health facilities such as hospitals, clinics, and health centres (Andersen 1995). In contrast, informal care providers generally include unlicensed or unregulated practitioners such as traditional healers, spiritualists, drug vendors, and unqualified medical practitioners. They operate outside the formal health care system and are often the first point of contact in low-resource settings (Sudhinaraset et al. 2013). Based on data

availability, informal care in this study is captured as persons who seek care from traditional healers and faith-based homes. This study adopts Andersen and Newman's (1973) model of health care use and in line with the model, the determinants of HSB are considered in three categories: predisposing, enabling and the need for care factors (Babitsch et al. 2012; Tesfaye et al. 2017; Saah et al. 2021; Tolera et al. 2020).

This study differs from earlier attempts to examine HSB in the extant literature in several ways:

1. First, previous studies in this area focused on settings such as urban and rural settlements and gender differences in HSB (Reddy et al. 2020; Das et al. 2018). Studies on HSB have also adopted a patient care perspective mainly for a particular disease condition or age group (Ugwueje 2012; Zhang et al. 2020; Gabrani et al. 2021; Abera Abaerei et al. 2017; Tiwari et al. 2022). However, findings on HSB, with no consideration for specific illness condition, are relevant as they reflect the general behaviour of the populace regarding health provider choice. This is because the social determinants that shape human interaction play an important role in health provider choice at the individual, family and community levels (World Health Organization 2010; United Nations Development Program n.d.-b).
2. Second, this study assesses the predictors of health care utilisation from a population base that includes all states in Nigeria; hence, the results possess high external validity. Studies in the literature generally made use of self-administered questionnaires and structured interviews using population samples, and findings in this regard may not provide external validity as they may not reflect the behaviour of the generality of the populace (Reddy et al. 2020; Zhang et al. 2020; Das et al. 2018; Gabrani et al. 2021; Abuduxike et al. 2019; Tiwari et al. 2022).
3. Third, the results are presented across regions and health care provider types, which is informative for specific regional health policy initiatives aimed at reducing disparities in health outcomes. Findings in this regard will aid the government, stakeholders, policymakers, and health service providers in adequately allocating and managing existing resources and pursuing the attainment of the SDG on health (Ngwakongnwi 2017; Bakar and Samsudin 2016; Poortaghi et al. 2015).

4. Last, this study contributes to Andersen and Newman's behavioural model of health services utilisation by introducing the distance to the health facility as an enabling factor, waiting time as a measure of perceived self-efficacy and illness severity as a need factor for HSB. Distance to health facilities is considered an enabling factor in terms of access to health information, and waiting time captures perceived self-efficacy as it reflects some form of patient satisfaction regarding early diagnosis and treatment. The need for care, as captured in the form of illness severity, influences where individuals seek care. These variables are important determinants of HSB, yet results are scarce on their effects in the literature, particularly in relation to Andersen and Newman's behavioural model of health services utilisation that is widely applied in studies of this type. Findings in this regard will contribute to the existing literature on the determinants of HSB.

The rest of this paper is organised in the following format. A review of the empirical literature is presented in the second section, while the methodology applied is discussed in the third section. The fourth section presents the empirical results and discussions, and the fifth section provides the conclusion and recommendations.

Literature Review

Theoretical foundations explaining HSB in the extant literature are mainly the Health Belief Model (HBM) and Andersen's Behavioural Model (ABM) (Rosenstock 1966; Andersen 1968; Andersen and Newman 1973). The Health Belief Model (HBM), first introduced by Rosenstock (1966) and later expanded by Becker (1974), predicts that an individual's likelihood of adopting a specific health behaviour depends on their perceptions of the disease severity, susceptibility to the disease, and the perceived benefits versus barriers to engaging in the behaviour. For an individual to seek health care, the perceived threat of illness and the expected benefits of treatment must outweigh the barriers. The model also incorporates factors such as self-efficacy and cues to action in seeking health care. The central tenet of the theory is that individuals are more likely to seek health care when they perceive themselves as vulnerable to a health problem, recognize it as serious, believe that treatment will be effective, and view barriers to care as minimal. Studies that have applied the Health Belief Model are often focused on preventive care (Nafisa and Murti 2024; Nisriina and Murti 2024; Haliza et al. 2024).

The ABM, first introduced by Andersen (1968) and further expanded by Andersen and Newman (1973), captures the drivers of health care utilisation in three forms: predisposing, enabling, and need factors. Predisposing factors include demographic characteristics, social structure, and health beliefs. Enabling factors refer to an individual's financial resources, such as income and access to health insurance, while need factors relate to an individual's perception of illness or a diagnosed condition. The model suggests that health care is sought not only when illness is perceived but also when diagnosed by health professionals, provided individuals have the enabling resources to access care. The ABM is more often adopted in explaining HSB across populations than the HBM, because it relies on the use of objective and measurable variables, which are easier to obtain and analyse. In contrast, the HBM depends heavily on subjective perceptions of susceptibility, severity, and barriers, which are difficult to quantify and analyse.

Recent studies have consistently demonstrated that HSB is shaped by a combination of demographic, socioeconomic, and structural factors. A recent study by Obels et al. (2025) in South Sudan employed a household survey and logistic regression to identify the determinants of HSB across three states. The findings showed that the state of residence and awareness of community health workers are key predictors of HSB. The findings also showed that the age of respondents, travel time, and distance to the health facility significantly influenced the choice of where care was sought.

Rata Mohan et al. (2025) focused on gender-based differences in HSB using data from the National Health and Morbidity Survey in Malaysia. The results revealed that professional treatment was preferred to self-medication, with women, particularly in urban settings and those with poor self-rated health, more likely to seek medical care. Education, ethnicity, and employment status also shaped care-seeking, with patterns differing between men and women.

Findings by Elfaki et al. (2024) explored HSB among Sudanese immigrants in Saudi Arabia using an online survey of 494 respondents. While most participants (66.6%) reported visiting primary health care centres, the prevalence of self-medication was also high (45.7%). Age and lack of health insurance emerged as significant determinants of HSB.

Similarly, Hamid et al. (2024) analysed HSB among older persons in Ethiopia, employing community-based cross-sectional data. The study identified literacy, community-based health insurance, chronic illness,

and family support as the main predictors of health care use. The findings suggest a key role of inclusive payment mechanisms, education and family structures as predictors of HSB among vulnerable groups such as the elderly.

Earlier findings by Apuleni et al. (2021) in Zambia examined HSB for common childhood illnesses using secondary data from the Health for the Poorest Population (HPP) Project. The results showed that most respondents sought care from health facilities, with maternal education and marital status identified as key predictors.

Regarding gender effects on HSB, Reddy et al. (2020) showed that most women in rural Telangana seek health care from unqualified medical practitioners and use home therapies as the first consultation source for their health medications. In a similar study, Das et al. (2018) highlight key differences in HSB across gender, based on the disparity in motives and expectations. The results shown using in-depth interviews and a semi-structured questionnaire revealed that men and women use formal and informal health care providers in an urban slum of Kolkata, India. However, females generally sought health care to maintain socio-cultural norms and prefer providers that offer long discussions and assist in preventing economic and social sanctions. On the other hand, males seek health care providers who offer fast and complete recovery to enable them to return to their role as breadwinners.

In terms of private and public health provider choice, Abuduxike et al. (2019) showed that in Cyprus, most individuals had a preference for public providers and only 39.1% of individuals preferred private health service providers. These differences can be attributed to the disparities in the socioeconomic characteristics of individuals who utilised public and private health sectors.

Findings by Abera Abaerei et al. (2017) showed the reverse, indicating that 95.7% of individuals utilised health care service providers in Gauteng, South Africa; however, most individuals (75%) in their study sample did not use public health facilities due to low-quality service provision.

In Nigeria, Olasehinde (2018) provides findings for HSB in Nigeria with a focus on health care service demand across socioeconomic variables using the multinomial logistic regression. Findings showed the key role of income, age, gender, place of residence, marital status, religion, educational attainment and household size on health care demand. These results, however, did not provide evidence of HSB across provider types and across regions in Nigeria. In a similar study, Mwami and

Oleche (2017) provide findings for the key role of socioeconomic variables in choosing a health service provider in Kenya. The findings showed an increase in the use of health services with rising costs, indicating that higher expenses are often perceived as a signal of quality provision. The findings, however, did not relate the perceived quality of health services, in terms of high cost, to the type of provider.

Findings by Begashaw et al. (2016) indicated that the choice of health care provider varies across settings and gender. Using descriptive methods and binary logistic regression, the findings showed a lower rate of care-seeking from modern facilities among rural dwellers (48.1%) compared to urban residents (80.7%). The results also showed a high self-treatment among persons in rural areas (46.1%) compared to those in urban settlements (35.3%). Other drivers identified include perceived severity of illness, acute disease duration, and distance from health facilities. Among rural residents, where cultural influence is stronger, marital status emerged as a major determinant.

Findings on HSB across health facilities are also provided by Dey and Mishra (2014) in India. The results revealed that older individuals, females, lower-income groups, illiterates, and those with access to primary public services are more likely to utilise government health facilities than private providers.

Overall, the empirical results in the extant literature showed the key role of socioeconomic status of individuals and place of residence in seeking health care; however, the results for HSB in Nigeria are scarce and particularly across provider types and regions. Northern and Southern regions in Nigeria are dissimilar in socio-demographic and economic characteristics, cultural disposition, social customs and religious practices (LeVan et al. 2019). These differences have the potential to influence the HSB of individuals in these areas, yet empirical findings in this regard are scarce in the literature, motivating further study on HSB in Nigeria and across the regional divide.

Methodology

This study adopts Andersen and Newman's (1973) framework of health care services utilisation in examining HSB. This is due to its wide applicability, objective and measurability of variables, and adaptability in developing countries (Pushpalata and Chandrika 2017). The model shows that an individual's use of health care depends on three components: predisposing, enabling and need for care factors. In Andersen and

Newman's model of health care use, the predisposing component reflects an individual's inclination to use health services before the onset of illness. Such factors include health beliefs, knowledge of health issues, values, attitudes and socio-demographic characteristics (Saah et al. 2021). They are often captured using age, gender, marital status, education, occupation, religion, and race/ethnicity. Enabling factors refer to access to health information, financial capacity, and perceived self-efficacy (Saah et al. 2021). The need for care factor refers to illness-related variables such as the perceived severity and duration of illness (Saah et al. 2021). That is, an individual will seek health care where there is the need for care or some perception of illness, to find an appropriate remedy (Ward et al. 1997; Oberoi et al. 2016).

EMPIRICAL MODEL

Given that health care as a good can enter directly into the individual's utility function because of the satisfaction derived from being healthy (Grossman 2017), the individual maximises a well-behaved utility function given as:

$$U_c = U(H, NH), \tag{1}$$

where H is the consumption of health service, and NH is the consumption of non-health good.

Subject to a budget constraint:

$$Y = P_h H + + P_{nh} N, \tag{2}$$

where Y represents the consumer's income, P_h is the price for health good, and P_{nh} the price for a non-health good. Using the conventional optimisation procedure, the Lagrange function is specified as:

$$L = U(H,\ NH) + \lambda(Y - P_h H - P_{nh} NH). \tag{3}$$

So, the first-order conditions for the individual's decision problem are:

$$H\text{: } H_H = \lambda_Y\ P_h \tag{4a}$$

$$NH\text{: } H_{NH} = \lambda_Y\ P_{nh} \tag{4b}$$

$$\lambda\text{: } Y - P_h H - P_{nh} N = 0 \tag{4c}$$

Equations (4a) to (4c) can be solved jointly to obtain the general form of the individual's demand function for health and non-health goods as:

$$H^{*} = D_{H}(\, Y, P_{h},\ P_{nh},\ ,\ ) \tag{5a}$$

$$NH^{*} = D_{NH}(\, Y, P_{h},\ P_{nh},\ ) \tag{5b}$$

Given the optimal demand specifications, it is apparent that the demand for health depicted by (H^{*}) can be influenced by the consumer's income Y, price of the health good P_h and the price of a non-health good P_{nh}. In this study, the demand model for health is used to capture HSB. This is because individuals generally demand health from a preferred health care provider. We focused on the need for medical care in the model, considering only persons who reported a particular health need. The model of health care demand is examined across formal and informal, as well as public and private, providers.

For the empirical model of the study, we omitted the price for non-health good due to data limitations. The price of health care is measured using the amount paid for medical consultation. We include additional independent variables in the model in line with Andersen and Newman's behavioural model of health services utilisation. The predisposing factors are captured using age (AGE) and aging (AGE^2), gender (GE), marital status (MS), educational attainment (EA), religion (REL), household size (HHZ), and place of residence of the individual (RES), whether in North or Southern Nigeria. Enabling factors were measured using the monthly income earnings of the individual (Y), employment status (Emp), distance to health provider (DIST) and waiting time (WT). Here, distance to a health facility is considered an enabling factor in terms of access to health information and waiting time as an additional measure to capture perceived self-efficacy. Based on available data in the GHS, the need for care factor in terms of illness severity (ILLSEV) is measured using the response to whether the individual had to stop usual activities in the four weeks preceding the survey due to illness. The empirical specification of the model for HSB is hence stated as:

$$HSB_i = D_{Hi}\begin{pmatrix} P_{hi},\ AGE_i,\ AGE_i^2,\ GE_i,\ MS_i,\ EA_i,\ REL_i, HHZ_i,\ _i, \\ RES_i,\ Y_i,\ Emp_i,\ DIST_i,\ \ WT_i,\ ILLSEV_i \end{pmatrix}, \tag{5a}$$

where D_{Hi} captures the decision to seek health care or not from a par-

ticular provider. Responses to where individuals sought health care comprised hospital, dispensary, pharmacy, chemist, clinic, maternity home, maternal and child health posts, consultant's home, traditional healers' home, and faith-based home. The first eight choices are grouped as formal and the last two as informal providers due to the lack of regulation of the medical activities of traditional healers and faith-based homes. Responses to who ran the establishment where individuals sought health care comprised federal, state, local government, private, community, NGO, religious bodies and others. The first three providers are government-related and grouped as public, while the others are private. Community, NGO, religious bodies and others are quite small in the sample (2.32%) and are included in the private category.

We expect that higher health care costs at formal providers will lead individuals to prefer informal treatment options. The stock of health capital declines with age, so older individuals often require more health care. However, the effect of age on health care choice is unpredictable, as individual cultural values play a crucial role. The role of gender in health care demand is uncertain, as it depends on health capital and individual preferences. Similarly, the effect of marital status cannot be stated definitively; married individuals may pool resources and utilise formal providers, or may choose otherwise based on cultural and religious inclinations. More educated persons are likely to earn higher incomes, access better health information, and therefore show a stronger preference for formal health care. The influence of religion is unpredictable due to the interaction between literacy and religious beliefs.

The effect of household size on health care provider choice is unpredictable, as decisions are primarily driven by affordability rather than household composition. Similarly, the influence of place of residence, whether North or South, cannot be determined, given that cultural beliefs and practices in these regions play a key role in provider selection.

Individuals with higher incomes are expected to prefer formal health care providers due to greater affordability. Employed persons are similarly more likely to use formal care because of financial empowerment, although utilisation across different employment types is uncertain. Longer distances to health providers are expected to reduce both access to health information and service use, meaning facilities located closer to communities will generally be more frequently utilised. Similarly, providers with shorter waiting times are likely to be more frequently used. The effect of illness severity on provider choice is uncertain: some in-

dividuals may prefer informal providers such as traditional healers or religious centres, while others may opt for formal health care providers.

ESTIMATION TECHNIQUE

Equation (6) is estimated using the logistic regression approach. The logistic regression quantifies the effect of a predictor in terms of a log-odds ratio using the maximum likelihood estimation (MLE) (Hailpern and Visintainer 2003). It translates the original logit coefficients to the odds ratio (OR) so that the parameter value is the exponential of the logit coefficient (Gujarati 2020). The odds ratio is preferred because HSB is a binary categorical dependent variable. It is also chosen above other categorical dependent variable models because it is less sensitive to changes in the marginal frequencies than other measures of association. The odds ratio is also commonly applied in most studies with a categorical dependent variable because it is appropriate for all study designs and easy to interpret (Sperandei 2014; Bewick et al. 2005). The logistic regression method is specified as follows:

$$\log it\,(p) = \log\left(\frac{p}{1-p}\right), \tag{7}$$

where p is the proportion of observations with an outcome of 1, and $1\text{-}p$ is the probability of an outcome of 0. The ratio $(p/(1\text{-}p))$ is called the odds and the logit is the logarithm of the odds.

An OR value which is more than 1 implies that the independent variable increases the probability of the occurrence of the event. In contrast an OR value which is less than 1 decreases this probability (Eren et al. 2014).

Findings are also shown using the chi-square ($\chi 2$) test. The chi-square statistic is applied for tests of independence using cross-tabulation. The distributions of categorical variables are simultaneously presented, and the test of independence assesses whether an association exists between the variables by comparing the observed pattern of responses to the pattern that would be expected if the variables were truly independent of each other. The chi-square statistic is stated as:

$$\chi 2 = \sum \frac{(f_o - f_e)^2}{f_e}, \tag{8}$$

where f_o is the observed frequency and f_e is the expected frequency if no relationship existed between the variables. In this case, the analysis is conducted to determine whether there is a significant association

between seeking care from public and private, formal and informal care providers in Northern and Southern Nigeria.

The logistic regression model is applied to determine the predictors of HSB while controlling for potential confounders such as age, gender, education, income, and location. This directly addresses the aim of identifying determinants of health care choices beyond simple associations, allowing for adjusted inferences. Chi-square tests were used to assess bivariate associations between categorical variables in terms of region and health care provider choices. This is to establish whether regional differences in health-seeking patterns exist at a descriptive level. The multivariate logistic regression allowed for the simultaneous adjustment of key socio-demographic and economic variables, thereby minimising potential confounding bias and ensuring that the observed associations between region and HSB reflected the combined effect of all included covariates, rather than being driven by any single characteristic. In addition, stratified analyses by region were conducted to check the consistency of patterns across different subgroups. Furthermore, non-response bias was addressed through the use of sampling weights provided by the GHS-Panel dataset, which ensured national and zonal representativeness of estimates.

DATA SOURCE

Data for this study were extracted from wave 4 of the 2018/2019 post-harvest General Household Survey (GHS) data in Nigeria (World Bank Group n.d.-c). The GHS panel is implemented by the National Bureau of Statistics (NBS) in collaboration with the World Bank. It is a nationally representative survey of approximately 5,000 households obtained from the six geopolitical zones in Nigeria. The GHS is a comprehensive analysis of agricultural information, welfare indicators and socio-economic characteristics of individuals and households. The 2018/19 is the fourth round, with prior rounds conducted in 2010/11, 2012/13, and 2015/16. The GHS-Panel households were visited twice: first after the planting season (post-planting) between July and September 2018 and second after the harvest season (post-harvest) between January and February 2019 (World Bank Group n.d.-c). The data is drawn from a two-stage sampling design. Wave 4 data comprised a refresh sample of 360 enumeration areas (EAS), 60 per geopolitical zone, drawn from the national master frame, from which 10 households were randomly selected, giving about 3,600 households. In addition, 159 EAS from the original 2010

sample were revisited, yielding approximately 1,507 households. Overall, 4,976 households across 519 EAs were successfully interviewed in both urban and rural areas. Due to security challenges, parts of Borno State and some conflict zones were excluded, with replacements drawn within zones. Survey weights were constructed to correct for non-response and ensure representativeness at national and zonal levels (World Bank Group n.d.-c).

Results and Discussion

DESCRIPTIVE STATISTICS OF STUDY VARIABLES

Descriptive statistics of variables used in the study across forms of HSB are shown in table 1.

The results from table 1 show that respondents who sought care from private providers spent almost twice as much on health care (41,267) as those who sought care from public providers (23,044). Higher health spending is also observed for those who sought informal (59,785) rather than formal care (30,815). In terms of age and the square of age, the results did not show any key difference in the age groups of persons who sought health care across provider types. However, those who seek health care from informal providers are slightly older than those who seek formal health care. In terms of gender, the percentage distribution of respondents shows that there are more females (54.5%) than males (45.5%) in the study sample, and a similar distribution is reflected across the HSB groups in the study. Similarly, the sample comprised more persons who are married or in a loose union (58.6%) than otherwise (41.4%). The number of persons with at least primary education (62.3%) is almost double of those with no formal education, who cannot read or do simple calculations (37.7%).

More respondents are Christians (88.1%) than Muslims (11.1%). The average household size is approximately 6, with slightly more household members found among households that seek public health care (7). The average income of respondents in the sample is N16,922, with the income of those who seek care from private sources slightly higher at about N17,453. Persons employed (88.8%) far outweigh those who do not have any form of employment. Travel distance in minutes to seek consultation is approximately 16 minutes. The time spent travelling to seek care is longer for persons who seek public care (17 minutes) than for all other forms of healthcare sought. Travel time to seek care is shorter for those seeking private care (9 minutes) compared to other healthcare types. The

TABLE 1 Descriptive Statistics of Variables Used in the Study Across Forms of HSB

Variables	Definition	Formal health care providers	Informal health care providers	Private providers	Public providers	Total
Price	Average of the sum of spending for the first consultation, transport cost to and from consultation, amount spent for over-the-counter drugs, and amount spent for admission where it applies in Naira	30,815	59,785	41,267	23,044	31,636
Age in years	Age of respondent in completed years	29	34	30	29	30
Age Square	Square of the age of respondents in completed years	1,415	1,752	1,427	1,384	1,456
Gender	Gender of respondent					
Male		1,849 (46.3)	150 (47.2)	1,292 (46.9)	541 (44.7)	2,152 (45.5)
Female		2,149 (53.8)	168 (52.8)	1,461 (53.1)	669 (55.3)	2,580 (54.5)
Marital Status						
Married/Loose union	Persons who are married or in a loose union	1,544 (57.7)	131 (56.7)	1,025 (54.8)	514 (65.7)	1,898 (58.6)
Not married	Persons who are divorced, separated or widowed or never married	1,131 (42.3)	100 (43.3)	846 (45.2)	268 (34.3)	1,339 (41.4)
Educational Attainment	Highest qualification attained					
No formal Education	No formal education	1,079 (38.9)	97 (47.6)	744 (36.9)	327 (44.1)	1,226 (37.7)
At least primary education	Persons with at least primary education – can read or do a simple calculation	1,694 (61.1)	107 (52.5)	1,271 (63.1)	415 (55.9)	2,025 (62.3)
Religion	Religion of respondents					
Christian		359 (88.2)	23 (92.0)	309 (92.0)	47 (69.1)	429 (88.1)
Muslim		48 (11.8)	2 (8.0)	27 (8.0)	21 (30.9)	58 (11.1)
Household Size	The average number of household members	6	6	6	7	6

Continued on the next page

TABLE 1 *Continued from the previous page*

Variables	Definition	Formal health care providers	Informal health care providers	Private providers	Public providers	Total
Residence	Place of residence of respondent during the survey					
North		2,051 (92.1)	176 (7.9)	1,090 (39.6)	941 (77.8)	3,998 (92.6)
South		1,947 (93.2)	142 (6.8)	1,663 (60.4)	269 (22.2)	318 (7.4)
Income	Total monthly per capita household consumption spending in Naira	16,787	14,733	17,453	15,143	16,922
Employment	Employment status of respondent					
Unemployed	Respondent is unemployed but worked on some subsistence agriculture	393 (11.7)	29 (10.4)	306 (13.1)	82 (8.3)	449 (11.4)
Employed	Respondent is employed	2,962 (88.3)	251 (89.6)	2,033 (86.9)	906 (91.7)	3,546 (88.8)
Distance	Travel distance for the respondent to seek medical consultation in minutes	16	18	15	19	16
Waiting time	How long respondent had to wait to be attended to for consultation in minutes	11	12	9	17	11
Illness Severity	Response to the question of whether the respondent					
Yes	had to stop usual activities in the past 4 weeks	2,011 (50.3)	176 (55.4)	1,217 (44.2)	779 (64.4)	2,226 (49.6)
No	because of illness?	1,987 (49.7)	142 (44.7)	1,536 (55.8)	431 (35.6)	2,265 (50.4)

SOURCE Author's computation from GHS 2018/2019 data. *Note*: Number of persons reported with percentage values in the bracket.

TABLE 2 Chi-square ($\chi 2$) Test for HSB Across Health Care Providers in Northern and Southern Nigeria

	South	North	Total	
Informal	142 (6.8)	176 (7.9)	318 (7.4)	Pearson chi-square(1) = 1.9301
Formal	1,947 (93.2)	2,051 (92.1)	3,998 (92.6)	Pr = 0.165
Private	1,663 (86.1)	1,090 (53.7)	2,753 (69.5)	Pearson chi-square(1) = 490.305
Public	269 (13.9)	941 (46.3)	1,210 (30.5)	Pr = 0.000

NOTE Average values reported with the percentage in the bracket.

statistics for illness sevErity are slightly lower for persons with severe cases (49.6%) and those without (50.4%).

HSB ACROSS HEALTH CARE PROVIDERS IN NORTHERN AND SOUTHERN NIGERIA

In table 2, there is a chi-square test for HSB across health care providers in Northern and Southern Nigeria

The results in table 2 show that health care is sought mainly from private (69.5%) rather than public (30.5%) providers in Nigeria. The use of private health facilities is twice that of public facilities. This finding suggests key implications for health outcomes as private health care providers in Nigeria, as in other developing economies, are characterised by a high distribution of unlicensed providers (Basu et al. 2012). The use of private facilities is greater in the South (86.1%) than in Northern Nigeria (53.7%). In contrast, more Northern residents use public facilities (46.3%) than Southerners (13.9%). From the results, it is evident that the use of public health facilities in the North is thrice that in Southern Nigeria. Findings for a higher preference for private health care providers over public are similar to that of Abera Abaerei et al. (2017), in Gauteng, South Africa, showing that most individuals (75%) in their study sample did not use public health facilities due to low-quality service provision. The findings are, however, contrary to that of Abuduxike et al. (2019), indicating that only 39.1% of individuals preferred private health service providers in Cyprus. These results suggest high usage of private health care providers in Africa.

The results showed that most individuals seek formal (92.6 %) rather than informal (7.4%) health care provision in Nigeria. The number of those that seek care from informal providers is slightly higher in the North (7.9%) than in Southern Nigeria (6.8%). On the other hand, the number of those that seek formal health care is slightly higher in the

South (93.2%) than in the North (92.1%). The finding of a high preference for formal care in Nigeria aligns with Rata Mohan et al. (2025), who showed that most individuals in Malaysia prefer professional treatment over self-medication.

The result of the chi-square test in table 2 shows no statistical difference in the HSB of persons in Northern and Southern Nigeria in terms of informal and formal health care use. Findings, however, suggest a 1% statistically significant difference in the proportion of persons seeking health care from private and public health facilities in Northern and Southern Nigeria. This indicates a significant variation in the use of private health facilities between Northern and Southern Nigeria. The results revealed a significantly higher preference for the use of public over private health facilities in the North compared to the South. These results enunciate arguments that differences in socioeconomic features and health infrastructure across regions imply some differences in HSB and, by extension, health outcome (Ugwueje 2012; Ononokpono et al. 2020; Reddy et al. 2020; Abubakar et al. 2022).

HSB IN NORTHERN NIGERIA

The results on the specific drivers of HSB across health care providers in Northern Nigeria are presented in table 3.

The logistic regression results in table 3 suggest that the variables that significantly influence HSB for formal health care providers in Northern Nigeria are age, the square of age and monthly income earnings. The findings associate lower odds of seeking formal health care services with an increase in age. This is reflected in the statistics for age (OR = 0.9922, CI [0.986 – 0.998], p = 0.01) and the square of age (OR = 0.9999, CI [0.9998 – 1.0000], p = 0.08). Older individuals in Nigeria generally have lower incomes and may be unable to afford formal health care, as access to services in the Nigerian health system often requires out-of-pocket payments (World Bank Group n.d.-e). This supports earlier findings by Basu et al. (2012) and Pandey et al. (2019), which underscore financial constraints as critical barriers to accessing care among older adults. The results are also in line with that of Elfaki et al. (2024), indicating age as a significant determinant of HSB among Sudanese immigrants in Saudi Arabia.

An increase in monthly income earnings is associated with higher odds of seeking formal care in Northern Nigeria (OR = 1.8276, CI [1.330 – 2.500], p = 0.001). The result suggests that those who use informal health

TABLE 3 Logistic regression estimates for the determinants of HSB in Northern Nigeria

Variables	Formal Providers OR (SE) [95% CI], p-value	Public Providers OR (SE) [95% CI], p-value
Log price of health care	0.866 (0.4552) [0.356 – 2.110], p = 0.75	1.0931 (0.2049) [0.746 – 1.600], p = 0.65
Age	0.9922** (0.003) [0.986 – 0.998], p = 0.01	1.006*** (0.0021) [1.002 – 1.010], p = 0.001
Age square	0.9999* (0.000) [0.9998 – 1.0000], p = 0.08	1.0001*** (0.000) [1.0000 – 1.0002], p = 0.002
Gender		
Male	1.0421 (0.1639) [0.770 – 1.410], p = 0.78	0.7993** (0.0713) [0.670 – 0.950], p = 0.01
Marital status		
Married/Loose union	1.0197 (0.203) [0.690 – 1.510], p = 0.93	1.5981*** (0.1943) [1.160 – 2.200], p = 0.004
Educational attainment		
No Educational attainment:	0.7339 (0.1597) [0.490 – 1.100], p = 0.14	0.8581 (0.1009) [0.690 – 1.070], p = 0.18
Religion		
Christian	0.9798 (0.000) [0.980 – 0.980], p = 0.99	0.4793 (0.2217) [0.260 – 0.880], p = 0.02
Household size	1.008 (0.0198) [0.970 – 1.050], p = 0.75	1.0069 (0.011) [0.985 – 1.030], p = 0.54
Log monthly income	1.8276*** (0.2787) [1.330 – 2.500], p = 0.001	0.9894 (0.0805) [0.840 – 1.160], p = 0.89
Employment status		
Employed	0.7988 (0.2064) [0.490 – 1.300], p = 0.36	1.5717*** (0.2649) [1.120 – 2.200], p = 0.009
Distance to the health facility in minutes	0.9973 (0.0039) [0.990 – 1.005], p = 0.54	1.0236*** (0.0036) [1.016 – 1.031], p = 0.001
Waiting time in minutes	1.0143 (0.0074) [1.000 – 1.030], p = 0.05	1.0584*** (0.0045) [1.050 – 1.070], p = 0.001
The severity of illness		
Stop work activities	0.313 (0.1829) [0.811–1.661], p = 0.42	1.7583*** (0.1603) [1.400 – 2.210], p = 0.001
Model Summary		
LR $\chi2$ (11)	Number of obs = 152 LR $\chi2$ (10) = 9.44	Number of obs = 145 LR $\chi2$ (10) = 21.41
Prob > $\chi2$	Prob > $\chi2$ = 0.4907	Prob > $\chi2$ = 0.0184
Pseudo R2	Log likelihood = −13.775811 Pseudo R2 = 0.2553	Log-likelihood = −78.288535 Pseudo R2 = 0.1203

NOTE: *** p < 0.01, ** p < 0.05, * p < 0.1.

care providers in Northern Nigeria are mainly low-income earners. The implication is that poverty rates prevalent in Northern Nigeria will induce high use of informal health care providers, which has negative implications for health status in the region. The result reinforces existing knowledge that income is a key enabling driver of HSB as reflected in the ABM. The findings are similar to that of Lagarde and Ostry (2018), who note that economic capacity significantly determines access to quality health care and provider choice. The suggestion that informal providers are more commonly used by the poor aligns with Agyemang-Duah et al. (2020), who observed that informal care is often a function of affordability rather than preference.

Regarding HSB across public and private health facilities in Northern Nigeria, findings showed that the key drivers are age, the square of age, gender, marital status, religion, employment, distance to the health facility, waiting time and illness severity.

The findings show that increase in age is associated with higher odds of seeking care from public health providers (OR = 1.006, CI [1.002 – 1.010], p = 0.001), with a similar pattern observed for the square of age (OR = 1.0001, CI [1.0000 – 1.0002], p = 0.002). This result is expected with low health care costs for the public relative to private providers and low earning chances for most people as they grow older. Males are associated with lower odds of seeking health care from public facilities (OR = 0.7993, CI [0.670 – 0.950], p = 0.01). The implication, therefore, is that females are more likely to seek health care from public providers of care in Northern Nigeria. This finding reflects the nature of economic empowerment across gender as males are better equipped financially and hence will demand more costly health care from private providers than females. The result aligns with Morales (2012), who suggests that men often opt for private services due to greater financial autonomy, while women, especially in resource-constrained households, rely more on subsidised public health care. The results also reflect the findings of Lagarde and Ostry (2018), indicating that economic capacity is a significant determinant of access to health care and provider choice. Similarly, the findings align with Das et al. (2018), showing that males tend to seek health care providers who offer rapid and complete recovery, enabling them to resume their role as breadwinners. Married individuals or those in a consensual or loose union have higher odds of seeking health care from public providers (OR = 1.5981, CI [1.160 – 2.200], p = 0.004) compared with unmarried persons. This finding can

be associated with a higher chance of using health insurance by married people and better health that often characterises married compared to unmarried persons. As noted by Pandey et al. (2019), higher usage of public services by married individuals supports the theory that marital status enhances access to health insurance, shared resources, and health awareness.

The results showed that Christians in the North are more likely than Muslims to seek care from public rather than private health facilities (OR = 0.4793, 95% CI [0.260 – 0.880], p = 0.02). This suggests the presence of religious and cultural influences in health care utilisation. This finding aligns with Gyimah et al. (2006), who found that religious affiliation influenced both maternal and child health care decisions in Ghana. The results also showed that employed persons are more likely to use a public health facility than those who are unemployed (OR = 1.5717, CI [1.120 – 2.200], p = 0.009). This can be associated with access to health insurance, often available for those employed, and insurance policies in public health facilities. Akokuwebe and Idemudia (2022) note that employment often provides insurance benefits that make public health services more accessible to working populations.

The results showed that increased distance to the health care facility is associated with higher odds of using public health providers (OR = 1.0236, CI [1.016 – 1.031], p = 0.001). Similarly, an increase in waiting time is associated with higher odds (OR = 1.0584, CI [1.050 – 1.070], p = 0.001) for the use of public health facilities. This finding is unexpected. The results suggest that longer distances and an increase in waiting time do not deter the use of public health facilities in Nigeria. These findings suggest a low spread of health facilities in Nigeria, particularly public health facilities. With a high prevalence of poverty in Nigeria, most persons will seek public health care providers where the government subsidises health care (World Bank Group n.d.-d). This finding can also be associated with perceived better-quality delivery of health care in public health facilities as they are characterised by the availability of well-trained providers of health care and health infrastructure that can be used to cater for diverse illness types and at cheaper rates (Basu et al. 2012; Agyemang-Duah et al. 2020). A similar finding for the use of health care facilities with longer distances was also shown by Osakede et al. (2016) using data from Nigeria. The results showing a higher likelihood of the use of public health facilities with longer distances in Nigeria are contrary to those of Obels et al. (2025) in South Sudan, indicating that longer distances from a health

facility, whether public or private, reduced the chances of seeking health care from that facility.

Findings also showed higher odds of seeking care from public providers in severe cases of illness (OR = 1.7583, CI [1.400 – 2.210], p = 0.001). Higher preference for public over private facilities, particularly for severe illness cases, can be associated with the availability of diverse health specialists and consultancy services in public health facilities, accommodated by government budgetary allocation to health. As shown by Osakede (2022), improvements in population health are connected to an increase in government spending on health care. The results may also reflect the lower cost of care in public facilities, particularly for severe cases that often entail higher treatment expenses. The findings align with Agyemang-Duah et al. (2020), noting that public health providers have better health insurance acceptance and more affordable health care services and this increases preference for public health care providers. The result is also in line with that of Singu and Kaur (2017), showing that public health facilities are preferred for health care service provision, particularly due to access to health insurance and affordability.

HSB IN SOUTHERN NIGERIA

Findings in table 4 showed that the determinants of HSB across formal and informal providers in Southern Nigeria are the price of health care, age and the square of age, educational attainment, employment status, waiting time and illness severity.

The results in table 4 showed that higher health care prices reduce the odds of seeking care from formal providers (OR = 0.3619, CI [0.198 – 0.662], p = 0.001). This suggests that seeking informal health care is explained by the inability to afford formal care providers. The results also associate lower odds of seeking formal health care providers with an increase in age (OR = 0.9892, CI [0.982 – 0.996], p = 0.002) and the square of age (OR = 0.9999, CI [0.9998 – 1.0000], p = 0.003). The implication is that older persons have a preference for informal health providers. This aligns with the World Bank Group (n.d.-e), emphasising that out-of-pocket payment systems in Nigeria disproportionately affect older persons with reduced income. This is worrisome as ageing is often associated with illnesses requiring greater expertise, and this skill is not readily available among informal health care providers, as shown by Agyemang-Duah et al. (2020).

TABLE 4 Logistic regression estimates for the determinants of HSB in Southern Nigeria

Variables	Formal Providers OR (SE) [95% CI], p-value	Public Providers OR (SE) [95% CI], p-value
Log price of health care	0.3619*** (0.1431) [0.198 – 0.662], p = 0.001	1.2578 (0.2353) [0.830 – 1.905], p = 0.27
Age	0.9892*** (0.0035) [0.982 – 0.996], p = 0.002	1.0075*** (0.0027) [1.002 – 1.013], p = 0.004
Age square	0.9999*** (0.0000) [0.9998 – 1.0000], p = 0.003	1.0001*** (0.0000) [1.0000 – 1.0002], p = 0.006
Gender		
Male	0.8904 (0.1552) [0.645 – 1.229], p = 0.47	0.8913 (0.1188) [0.688 – 1.155], p = 0.39
Marital status		
Married/Loose union	1.125 (0.2206) [0.743 – 1.703], p = 0.58	1.1159 (0.1678) [0.823 – 1.513], p = 0.47
Educational attainment		
No Educational attainment	0.706* (0.1477) [0.480 – 1.040], p = 0.07	0.8622 (0.1452) [0.627 – 1.185], p = 0.36
Religion		
Christian	0.0202 (1.99) [0.00006, 6.69], p = 0.23	0.5694 (0.4537) [0.234 – 1.386], p = 0.21
Household size	1.0215 (0.0366) [0.951 – 1.098], p = 0.56	0.9081*** (0.0262) [0.859 – 0.959], p = 0.001
Log monthly income	1.1147 (0.1751) [0.811 – 1.532], p = 0.50	1.5985*** (0.1893) [1.200 – 2.131], p = 0.001
Employment status		
Employed	0.5578** (0.1879) [0.311 – 0.998], p = 0.049	1.6339** (0.3937) [1.017 – 2.625], p = 0.042
Distance in minutes to the health facility	0.9934 (0.0083) [0.977 – 1.010], p = 0.41	1.0184*** (0.0048) [1.009 – 1.028], p < 0.001
Waiting time in minutes	0.9939** (0.0034) [0.987 – 1.000], p = 0.05	1.0515*** (0.0058) [1.040 – 1.063], p < 0.001
The severity of Illness		
Stop work activities due to illness	0.5552*** (0.0977) [0.398 – 0.774], p = 0.001	2.6745*** (0.3651) [2.010 – 3.560], p < 0.001
Model Summary		
LR $\chi2$ (11)	Logistic regression Number of obs = 70 LR $\chi2$ (9) = 16.15	Number of obs = 97 LR $\chi2$ (11) = 18.56
Prob > $\chi2$	Prob > $\chi2$ = 0.0639	Prob > $\chi2$ = 0.0695
Pseudo R2	Log likelihood = −9.9390352 Pseudo R2 = 0.4482	Log-likelihood = −50.716376 Pseudo R2 = 0.1547

NOTE Odds ratio reported with standard errors in parentheses; *** p < 0.01, ** p < 0.05, * p < 0.1.

Findings showed that those with no formal education are less likely to seek health care from formal than from informal providers (OR = 0.706, CI [0.480 – 1.040], p = 0.07). This is expected as persons with no formal education earn less, reducing their ability to afford formal health care. This result aligns with Raghupathi and Raghupathi (2020) and Zajacova and Lawrence (2018), noting large health inequalities across individuals with different educational attainments.

The results also showed that being employed is associated with lower odds of using formal providers compared to being unemployed (OR = 0.5578, CI [0.311 – 0.998], p = 0.049). While this result is not expected, it can be explained by the fact that employed individuals in Southern Nigeria may face time constraints and opportunity costs that reduce their likelihood of seeking care from formal providers that often require longer consultation times, waiting periods, and bureaucratic processes. Conversely, unemployed individuals may have more flexible time and thus greater ability to access formal services. Additionally, employed individuals may opt for cheaper or closer informal providers for minor ailments to avoid income losses.

The results showed that longer waiting time is associated with slightly lower odds of using formal providers (OR = 0.9939, CI [0.987 – 1.000], p = 0.05). Long waiting times at formal health facilities can discourage people from using these services, particularly when informal providers offer faster access to care. In the context of Southern Nigeria, crowded public hospitals and limited staff often result in prolonged waiting periods, which can reduce patient preference for formal care, even for those who can afford it. The results align with findings by Strobel (2024), who showed a decline in patients' demand for formal health care with an increase in waiting time, even during periods of emergencies. Similar results are shown by Adhikari et al. (2021) in India, revealing low use of formal health care due to the complexities of navigating various departments in hospitals and little confidence in the quality of formal health care.

In terms of illness severity, individuals who stopped work due to illness have lower odds of using formal providers (OR = 0.5552, CI [0.398 – 0.774], p = 0.001). Severe illness may push individuals toward immediate, accessible care from informal providers or pharmacies, rather than formal hospitals, especially if formal care is perceived as costly or time-consuming. The result again aligns with Strobel (2024), indicating a decline in the use of formal health care during emergencies. The findings

are also similar to that of Adepoju et al. (2023), showing a delay in the patronage of formal health centres in seeking health care for tuberculosis treatment in urban slums in Lagos.

In terms of HSB across private and public providers in Southern Nigeria, the results reveal that the main determinants include: age, the square of age, household size, monthly income earnings, employment status, the distance to the health facility, waiting time and illness severity. Findings showed that an increase in age raises the likelihood of seeking health care from public rather than private facilities (OR = 1.0075, CI [1.002 – 1.013], p = 0.004). Similar results are shown by the square of age (OR = 1.0001, CI [1.0000 – 1.0002], p = 0.006). The positive association between age and public facility use is consistent with Morales (2012) and Lagarde and Ostry (2018), who documented that older individuals are more inclined to choose cost-effective health care options due to reduced earning capacity. The results further showed that an increase in household size reduces the odds of seeking health care from a public health provider (OR = 0.9081, CI [0.859 – 0.959], p = 0.001). This result suggests that households with more members would likely use private health facilities. This is unexpected as public health care costs less than private. However, coordinating care for many household members can be time-consuming, especially if the public facility has long queues. Families may find it more convenient to access care nearby rather than travel to a public hospital.

Increase in income is associated with higher odds of choosing public providers over private providers (OR = 1.5985, CI [1.200 – 2.131], p = 0.001). High-income earners often reside in urban areas where well-equipped public hospitals are more accessible, further encouraging their use. In addition, they are more likely to be covered by formal health insurance, which is often used at public health facilities. A similar result was presented by Bhattacharya et al. (2016), showing that the demand for higher quality of public health services rises with income. However, where the rich become dissatisfied with the quality of available public services, they will be motivated to form their own club for self-provision of public health care services.

Findings also suggest that employed persons have a higher likelihood of using a public over private health facility (OR = 1.6339, CI [1.017 – 2.625], p = 0.042). It is expected that employed persons would prefer private over public health facilities; however, with access to health insurance, they are more likely to utilise public facilities, due to the broader coverage and integration of health insurance within public health centres

(Agyemang-Duah et al. 2020). The finding that employed individuals are more likely to use public facilities is supported by Akokuwebe and Idemudia (2022), who attribute this to employer-provided insurance and the prevalence of insurance acceptance in public facilities.

The results suggest that an increase in the distance to the health facility does not reduce the odds of using a public health facility (OR = 1.0184, CI [1.009 – 1.028], p = 0.001). Similarly, an increase in waiting time does not deter the use of public health facilities (OR = 1.0515, CI [1.040 – 1.063], p = 0.001). These results are unexpected and similar to those in Northern Nigeria. The results reflect the limited geographical spread of public health facilities and the affordability advantage of public health care. The findings can again be related to the fact that public health facilities are better equipped with adequate human resources and medical equipment that ensure quality health care delivery (Basu et al. 2012; Agyemang-Duah et al. 2020). Again, the perceived quality of public hospitals, especially tertiary or teaching hospitals, in terms of offering specialised services, advanced diagnostics, experienced staff and handling complex cases, can make them attractive despite longer distances and potentially longer waiting times. Furthermore, higher insurance uptake in public health facilities can encourage utilisation even with longer distances and waiting time as it implies a more inclusive form of payment for health care (Singu and Kaur 2017; Agyemang-Duah et al. 2020). As earlier stated, similar results were obtained by Osakede et al. (2016) using data from Nigeria. The results are contrary to those of Obels et al. (2025) in South Sudan, indicating that longer distance from a health facility reduces the likelihood of the choice of that facility for health care use.

The results also showed that persons with cases of severe illness have higher odds of using public over private health facilities (OR = 2.6745, CI [2.010 – 3.560], p = 0.001). As earlier mentioned, the expected quality delivery of health care in public health facilities motivates preference for health service provision in such facilities, especially where the illness is severe. This result is supported by Basu et al. (2012) and Agyemang-Duah et al. (2020), who highlight perceived higher quality and better insurance acceptance in public facilities. Similarly, Singu and Kaur (2017) note that affordability and insurance access drive the choice of public facilities. Osakede (2022) observed that government health budget allocations improve population health outcomes. The implication is that an increase in government health spending tends to favour public health care, thereby strengthening infrastructural capacity in these facilities to

manage critical illness cases, which in turn makes them a preferred option for patients with severe conditions.

Conclusion

This study examined HSB across Northern and Southern Nigeria, focusing on health care provider types. Findings revealed a general preference for private and formal providers across both regions, though public facility use was three times higher in the North. No significant regional difference was observed across formal versus informal care choices. Older persons in both regions rely more on informal providers. A rise in household income increased the preference for formal providers in both regions but reduced public facility use in the South and informal care use in the North. Gender differences as a driver of health care provider choice were observed only in the North, where women more frequently used public facilities. Public provider use was also associated with longer waiting times, greater distances, and severe illnesses, suggesting perceptions of higher-quality care for critical cases.

Policy interventions should therefore be regionally targeted. Efforts should focus on providing inclusive health care across regions, especially for older adults, to reduce reliance on unregulated care. Public facilities should also be strategically distributed, and well-equipped, and capable of managing severe illnesses. In the North, equipping public facilities with infrastructure that supports women's health is critical. Strategies should also address income-related disparities in health care access. Strengthening the private sector through regulation is also essential, given the high reliance on private providers nationwide. The regulation of private health care providers should be intensified in the South.

This study draws on a nationally representative population, covering all states in Nigeria, which enhances the external validity of the findings. The results across geographical zones and health care provider types offer practical insights for policy interventions aimed at reducing health disparities and advancing health-related SDGs. Though the reliance on secondary survey data limits its ability to fully capture cultural and subjective determinants of HSB, future research can employ mixed-methods approaches to explore contextual and qualitative factors that shape health care choices.

Acknowledgements

Funding: This study received no external funding.

Competing Interests: Authors declare no competing interest of any form.
Availability of data: Data is publicly available on the World Bank site.

References

Abera Abaerei, A., J. Ncayiyana, and J. Levin. 2017. 'Health-Care Utilization and Associated Factors in Gauteng Province, South Africa.' *Global Health Action* 10 (1): 1305765.

Abubakar, I., S. L. Dalglish, B. Angell, O. Sanuade, S. Abimbola, A. L. Adamu, I. M. O. Adetifa et al. 2022. 'The Lancet Nigeria Commission: Investing in Health and the Future of the Nation.' *The Lancet* 399 (10330): 1155–1200.

Abuduxike, G., Ö. Aşut, S. A. Vaizoğlu, and S. Cali. 2019. 'Health-Seeking Behaviours and Its Determinants: A Facility-Based Cross-Sectional Study in the Turkish Republic of Northern Cyprus.' *International Journal of Health Policy and Management* 9 (6): 240–249.

Adeleke, R., T. Osayomi, A. Iyanda, and O. Alabede. 2022. 'Spatial Analysis of Economic Predictors of Under-Five Mortality in Nigeria.' *Open Health* 3 (1): 103–113.

Adepoju, V. A., O. Oladimeji, and O. D. Sokoya. 2023. 'Health-Seeking Behaviour Regarding Coughs in Urban Slums in Lagos, Nigeria.' *Medicines* 10 (7): 38.

Adhikari, B., S. Pokharel, S. Raut, J. Adhikari, S. Thapa, K. Paudel, G. C. Narayan et al. 2021. 'Why Do People Purchase Antibiotics Over-The-Counter? A Qualitative Study with Patients, Clinicians and Dispensers in Central, Eastern and Western Nepal.' *BMJ Global Health* 6 (5): e005829.

Agyemang-Duah, W., C. Peprah, and P. Peprah. 2020. 'Factors Influencing the Use of Public and Private Health Care Facilities among Poor Older People in Rural Ghana.' *Journal of Public Health* 28:53–63.

Akokuwebe, M. E., and E. S. Idemudia. 2022. 'A Comparative Cross-Sectional Study of the Prevalence and Determinants of Health Insurance Coverage in Nigeria and South Africa: A Multi-Country Analysis of Demographic Health Surveys.' *International Journal of Environmental Research and Public Health* 19 (3): 1766.

Andersen, R. 1968. 'A Behavioural Model of Families' Use of Health Services.' Research Series 25, Center for Health Administration Studies, University of Chicago.

Andersen, R. 1995. 'Revisiting the Behavioural Model and Access to Medical Care: Does it Matter?' *Journal of Health and Social Behaviour* 36 (1). https://doi.org/10.2307/2137284.

Andersen, R., and J. F. Newman. 1973. 'Societal and Individual Determinants of Medical Care Utilization in the United States.' *Milbank Memorial Fund Quarterly: Health and Society* 51 (1): 95–124.

Apuleni, G., C. Jacobs, and P. Musonda. 2021. 'Predictors of Health Seeking Behaviours for Common Childhood Illnesses in Poor Resource Settings in Zambia, a Community Cross Sectional Study.' *Frontiers in Public Health* 9:569569.

Babitsch, B., D. Gohl, and T. von Lengerke. 2012. 'Re-revisiting Andersen's Behavioural Model of Health Services Use: A Systematic Review of Studies from 1998–2011.' *GMS Psycho-Social-Medicine* 9. https://doi.org/10.3205/psm000089.

Bakar, A. A., and S. Samsudin. 2016. 'Determinants of Health Care Seeking Behaviour: Does Insurance Ownership Matters?' *International Journal of Economics and Financial Issues* 6 (7): 6–11.

Basu, S., J. Andrews, S. Kishore, R. Panjabi, and D. Stuckler. 2012. 'Comparative Performance of Private and Public Health Care Systems in Low-And Middle-Income Countries: A Systematic Review.' *Plos Medicine* 9 (6): e1001244.

Becker, M. H., ed. 1974. 'The Health Belief Model and Personal Health Behaviour.' *Health Education Monographs* 2 (4): 324–473.

Begashaw, B., F. Tessema, and H. A. Gesesew. 2016. 'Health Care Seeking Behaviour in Southwest Ethiopia.' *Plos One* 11 (9): e0161014.

Bewick, V., L. Cheek, and J. Ball. 2005. 'Statistics Review 14: Logistic Regression.' *Critical Care* 9 (1): 112–118.

Bhattacharya, S., Saha, S., and Banerjee, S. 2016. 'Income Inequality and the Quality of Public Services: A Developing Country Perspective.' *Journal of Development Economics* 123. https://doi.org/10.1016/j.jdeveco.2016.07.003.

Chukwuma, A., and U. E. Ekhator-Mobayode. 2019. 'Armed Conflict and Maternal Health Care Utilization: Evidence from the Boko Haram Insurgency in Nigeria.' *Social Science and Medicine* 226:104–112.

Das, M., F. Angeli, A. J. S. M. Krumeich, and O. C. P. van Schayck. 2018. 'The Gendered Experience with Respect to Health-Seeking Behaviour in an Urban Slum of Kolkata, India.' *International Journal for Equity in Health* 17 (1): 24.

Dey, D. K., and V. Mishra. 2014. 'Determinants of Choice of Health Care Services Utilization: Empirical Evidence from India.' *Indian Journal of Community Health* 26 (4): 356–363.

Elfaki, N. S., H. A. Abdelgyoum, A. and Elhelali. 2024. 'Factors Influencing Health-Seeking Behaviour among Sudanese Immigrants in Saudi Arabia.' *BMC Public Health* 24 (1): 1666.

Eren, E., S. Arslanoğlu, A. Aktaş, A. Kopar, E. Ciğer, K. Önal, and H. Katılmiş. 2014. 'Factors Confusing the Diagnosis of Laryngopharyngeal Reflux: The Role of Allergic Rhinitis and Inter-rater Variability of Laryngeal Findings.' *European Archives of Oto-Rhino-Laryngology* 271 (4): 743–747.

Gabrani, J., C. Schindler, and K. Wyss. 2021. 'Health Seeking Behaviour among Adults and Elderly with Chronic Health Condition(s) in Albania.' *Frontiers in Public Health* 9:616014.

Grossman, M. 2017. 'On the Concept of Health Capital and the Demand for Health.' In *Determinants of Health: An Economic Perspective,* edited by M. Grossman. Columbia University Press.

Gujarati, D. N. 2020. *Basic Econometrics.* Prentice Hall.

Gwatkin, D. R. 2000. 'Health Inequalities and the Health of the Poor: What Do We Know? What Can We Do?' *Bulletin of the World Health Organization* 78:3–18.

Gyimah, S. O., B. K. Takyi, and I. Addai. 2006. 'Challenges to the Reproductive-Health Needs of African Women: On Religion and Maternal Health Utilization in Ghana.' *Social Science and Medicine* 62 (12): 2930–2944.

Hailpern, S. M., and P. F. Visintainer. 2003. 'Odds Ratios and Logistic Regression: Further Examples of Their Use and Interpretation.' *Stata Journal* 3 (3): 213–225.

Haliza, A. N., B. Murti, and D. G. Tamtomo. 2024. 'Meta Analysis: Application of Health Belief Model on Tertiary Preventive Behaviour in Type 2 Diabetes Mellitus Patients.' *Journal of Health Promotion and Behaviour* 9 (3): 185–198.

Hamid, S., Z. W. Beko, H. S. Mekonnen, and M. H. Salih. 2024. 'Proportion and Factors Influencing Health Care-Seeking Behaviour among Older People in Motta Town, East Gojjam: A Community-Based Cross-Sectional Study, Ethiopia, 2023.' *BMC Public Health* 24 (1): 2092.

Khadka, S., O. Shrestha, G. Koirala, U. Acharya, and G. Adhikari. 2022. 'Health Seeking Behaviour and Self-Medication Practice among Undergraduate Medical Students of a Teaching Hospital: A Cross-Sectional Study.' *Annals of Medicine and Surgery* 78:103776.

Lagarde, C., and J. D. Ostry. 2018. 'Economic Gains from Gender Inclusion: Even Greater Than You Thought.' *IMF Blog,* 28 November. https://www.imf.org/en/Blogs/Articles/2018/11/28/blog-economic-gains-from-gender-inclusion-even-greater-than-you-thought.

LeVan, C., I. O. Hassan, V. A. Isumonah, C. M. A. Kwaja, S. B. Momale, C. O. Nwankwor, and K. Okenyodo. 2019. 'Study on Marginalized Groups in the Context of ID in Nigeria National Identification for Development ID4D Project.' WBG Report 138503, World Bank Group.

Meh, C., A. Thind, B. Ryan, and A. Terry. 2019. 'Levels and Determinants of Maternal Mortality in Northern and Southern Nigeria.' *BMC Pregnancy and Childbirth* 19 (1): 417.

Morales, Z. 2012. 'Empowering Women Is Smart Economics.' *World Bank Blogs,* 15 October. https://blogs.worldbank.org/en/psd/empowering-women-is-smart-economics.

Mwami, M. N., and M. O. Oleche. 2017. 'Determinants of Utilization of Health Care Services in Kenya.' *International Journal of Academic Research in Business and Social Sciences* 7 (10): 132–156.

Nafisa, N., and B. Murti. 2024. 'Application of the Health Belief Model in Breast Self-Examination: A Meta-Analysis.' *International Conference on Public Health Proceedings* 9 (1): 48.

Ngwakongnwi, E. 2017. 'Measuring Health Services Utilization in Ethnic Populations: Ethnicity and Choice of Frameworks.' *Public Health: Open Journal* 2 (2): 53–58.

Nisriina, Z. N., and B. Murti, B. 2024. 'Health Belief Model on the Acceptance of COVID19 Vaccines: Meta-Analysis.' *International Conference on Public Health Proceedings* 8 (1). https://doi.org/10.26911/ICPH10/Promotion/2023.01.

Obels, I., H. L. S. Coleman, M. Straetemans, M. van Gurp, G. W. Lutwama, and E. Jacobs. 2025. 'Determinants of Health Seeking Behaviour in South Sudan: A Cross-Sectional Household Survey.' *BMC Public Health* 25 (1): 46.

Oberoi, S., N. Chaudhary, S. Patnaik, and A. Singh. 2016. 'Understanding Health Seeking Behaviour.' *Journal of Family Medicine and Primary Care* 5 (2): 463–464.

Olasehinde, N. 2018. 'Health Care Seeking Behaviour in Nigeria.' *Journal of Population and Social Studies* 26 (3): 207–218.

Ononokpono, D. N., E. Gayawan, and S. A. Adedini. 2020. 'Regional Variations in the Use of Postnatal Care in Nigeria: A Spatial Analysis.' *Women and Health* 60 (4): 440–455.

Osakede, U. A. 2022. 'Infrastructure and Health System Performance in Africa.' *Managing Global Transitions* 20 (4): 375–400.

Osakede, U. A., O. A. Lawanson, O. R. Amoo. 2016. 'Willingness to Pay for Community-Based Health Insurance Scheme among Pregnant Women in Lagos State.' *African Journal of Health Economics* 5 (2): 15–24.

Osayomi, T., O. B. Ogbonnaiye, and A. E. Iyanda. 2020. 'Hotspots and Drivers of Acute Respiratory Infection among Children in Nigeria.' *South African Journal of Child Health* 14 (4): 224–227.

Pandey, K. R., F. Yang, K. A. Cagney, F. Smieliauskas, D. O. Meltzer, and G. W. Ruhnke. 2019. 'The Impact of Marital Status on Health Care Utilization among Medicare Beneficiaries.' *Medicine* 98 (12): e14871.

Poortaghi, S., A. Raiesifar, P. Bozorgzad, S. E. J. Golzari, S. Parvizy, and F. Rafii. 2015. 'Evolutionary Concept Analysis of Health Seeking Behaviour in Nursing: A Systematic Review.' *BMC Health Services Research* 15 (1): 523.

Pushpalata, N. K., and K. B. Chandrika. 2017. 'Health Care Seeking Behaviour: A Theoretical Perspective.' *Paripex: Indian Journal of Research* 6 (1): 790–792.

Raghupathi, V., and W. Raghupathi. 2020. 'The Influence of Education on Health: An Empirical Assessment of OECD Countries for the Period 1995–2015.' *Archives of Public Health* 78 (1): 20.

Rata Mohan, D. S., S. Jawahir, A. Manual, N. E. Abdul Mutalib, S. N. Mohd Noh, I. Ab Rahim, J. A. Hamid et al. 2025. 'Gender Differences in Health-Seeking Behaviour: Insights from the National Health and Morbidity Survey 2019.' *BMC Health Services Research* 25 (1): 900.

Reddy, P. M. C., T. Rineetha, D. Sreeharshika, and K. Y. Jothula. 2020. 'Health Care Seeking Behaviour among Rural Women in Telangana: A Cross Sectional Study.' *Journal of Family Medicine and Primary Care* 9 (9): 4778–4783.

Rosenstock, I. M. 1966. 'Why People Use Health Services.' *Milbank Memorial Fund Quarterly* 44 (3): 94–127.

Saah, F. I., Amu, H., Seidu, A. A., and Bain, L. E. 2021. 'Health Knowledge and Care Seeking Behaviour in Resource-Limited Settings Amidst the COVID-19 Pandemic: A Qualitative Study in Ghana.' *Plos One* 16 (5): e0250940.

Sani, J., S. Halane, M. M. Ahmed, A. M. Ahmed, and M. D. Hersi. 2025. 'Regional Disparities and Maternal Sociodemographic Determinants of Full Immunization Coverage among Children Aged 12–23 Months in Nigeria: Insights from NDHS 2018.' *Pediatric Health, Medicine and Therapeutics* 16:157–170.

Singu, H. B., and R. Kaur. 2017. 'Determinants of Health Seeking Behaviour among Low-Income Households of Punjab: Does Health Insurance Coverage Matter?' *International Journal of Public Sector Performance Management* 3 (4): 447–462.

Sperandei, S. 2014. 'Understanding Logistic Regression Analysis.' *Biochemia Medica* 24 (1): 12–18.

Strobel, S. 2024. 'Who Responds to Longer Wait Times? The Effects of Predicted Emergency Wait Times on the Health and Volume of Patients Who Present for Care.' *Journal of Health Economics* 96:102898.

Sudhinaraset, M., M. Ingram, H. K. Lofthouse, and D. Montagu. 2013. 'What is the Role of Informal Health Care Providers in Developing Countries? A Systematic Review.' *Plos One* 8 (2): e54978.

Tesfaye, G., D. Loxton, C. Chojenta, A. Semahegn, and R. Smith, R. 2017. 'Delayed Initiation of Antenatal Care and Associated Factors in Ethiopia: A Systematic Review and Meta-Analysis.' *Reproductive Health* 14 (1): 150.

Tiwari, G., A. K. Thakur, S. Pokhrel, G. Tiwari, and D. P. Pahari. 2022. 'Health Care Seeking Behaviour for Common Childhood Illnesses in Birendranagar Municipality, Surkhet, Nepal: 2018.' *Plos One* 17 (3): e0264676.

Tolera, H., T. Gebre-Egziabher, and H. Kloos. 2020. 'Using Andersen's Behavioural Model of Health Care Utilization in a Decentralized Pro-

gram to Examine the Use of Antenatal Care in Rural Western Ethiopia.' *Plos One* 15 (1): e0228282.

Ugwueje, E. A. 2012. 'Cultural Environment, Health Seeking Behaviour and Survival Chances of under-five children in South East Nigeria.' *International Journal of Development and Management Review* 7 (1).

United Nations Development Program. n.d.a. 'What are the Sustainable Development Goals?' https://www.undp.org/united-states/sustainable-development-goals.

United Nations Development Program. n.d.-b. 'UNDP's Strategy for Health and Development.' https://undp-capacitydevelopmentforhealth.org/strategy/.

Ward, H., T. E. Mertens, and C. Thomas. 1997. 'Health Seeking Behaviour and the Control of Sexually Transmitted Disease.' *Health Policy and Planning* 12 (1): 19–28.

Whitehead, M. 1992. 'The Concepts and Principles of Equity and Health.' *International Journal of Health Services* 22 (3): 429–445.

World Health Organization. 2010. 'A Conceptual Framework for Action on the Social Determinants of Health.' *World Health Organization,* 13 July. https://www.who.int/publications/i/item/9789241500852.

World Bank Group. n.d.-a. 'Death Rate, Crude per 1,000 People: Nigeria.' https://data.worldbank.org/indicator/SP.DYN.CDRT.IN?locations=NG.

World Bank Group. n.d.-b. *Mortality Rate, Infant per 1,000 Live Births: Nigeria.* https://data.worldbank.org/indicator/SP.DYN.IMRT.IN?locations=NG.

World Bank Group. n.d.-c. 'General Household Survey, Panel 2018–2019, Wave 4 Nigeria, 2018–2019.' https://microdata.worldbank.org/index.php/catalog/3557.

World Bank Group. n.d.-d. 'Nigeria Poverty Assessment 2022: A Better Future for All Nigerians.' https://www.worldbank.org/en/news/infographic/2022/03/21/afw-nigeria-poverty-assessment-2022-a-better-future-for-all-nigerians

World Bank Group. n.d.-e. 'Out-Of-Pocket Expenditure (% of Current Health Expenditure): Nigeria.' https://data.worldbank.org/indicator/SH.XPD.OOPC.CH.ZS?locations=NG.

World Bank Group. 2024. 'Poverty and Equity Brief: Nigeria.' http://documents.worldbank.org/curated/en/099108001062551445

Zajacova, A., and E. M. Lawrence. 2018. 'The Relationship between Education and Health: Reducing Disparities through a Contextual Approach.' *Annual Review of Public Health* 39:273–289.

Zhang, Q., S. Feng, I. O. L. Wong, D. K. M. Ip, B. J. Cowling, and E. H. Y. Lau. 2020. 'A Population-Based Study on Health Care-Seeking Behaviour of Persons with Symptoms of Respiratory and Gastrointestinal-Related Infections in Hong Kong.' *BMC Public Health* 20 (1): 402.

Kmetijsko pogojena okoljska Kuznetsova krivulja za Južno Afriko: pristop z regresijo pragov in napovedovanjem ARIMA

Andrew Phiri in Rasaq Raimi

Namen članka je preučiti vpliv kmetijskega sektorja na kmetijske emisije v Južni Afriki. V ta namen ocenjujemo kmetijsko pogojeno okoljsko Kuznetsovo krivuljo za Južno Afriko med letoma 1990 in 2022 z uporabo konvencionalnih ter pragovnih regresijskih okvirjev. Naše regresijske ocene razkrivajo »grbasto« razmerje med kmetijsko proizvodnjo in kmetijskimi emisijami, pri čemer kmetijska proizvodnja povzroča nižje kmetijske emisije nad pragovnimi ocenami 4.876 in 6.100 metričnih ton emisij CO_2. Nadaljnje raziskave kažejo, da je južnoafriško gospodarstvo od leta 2010 dosledno ostalo nad temi pragovi. Poleg tega analiza napovedi časovnih vrst z uporabo modelov ARIMA kaže, da je kmetijska proizvodnja na naraščajoči (emisije pa na padajoči) poti. Vendar analiza napovedi tudi kaže, da južnoafriški kmetijski sektor ne bo dosegel cilja neto nič emisij do leta 2050. Skupaj ti izsledki pomenijo, da je Južna Afrika pred pandemijo covida-19 sledila poti trajnostnega razvoja, vendar trenutna pot morda ne bo zadostna za dosego ciljev trajnostnega razvoja do leta 2050.

Ključne besede: kmetijski sektor, kmetijske emisije, okoljska Kuznetsova krivulja, pragovni regresijski model, napovedovanje z ARIMA, Južna Afrika
Klasifikacija JEL: C22; C51; Q19; Q56
Managing Global Transitions 23 (4): 367–388

Informacijska in komunikacijska tehnologija ter finančni razvoj kot katalizatorja za enakost spolov v brazilskem kmetijskem sektorju

Ahmed Mahmoudi in Mohamed Torra

V tej raziskavi smo preučevali učinke informacijske in komunikacijske tehnologije (IKT) ter finančnega razvoja na zmanjševanje neenakosti med spoloma v Braziliji, z uporabo pristopov z avtoregresivnim porazdeljenim zamikom (angl. *autoregressive distributed lag* – ARDL) v obdobju med letoma 1991 in 2022. Uporabljen je bil ARDL-test mejnih vrednosti za ugotavljanje prisotnosti kointegracije v podatkovnih serijah. Tako na kratki kot na dolgi rok ima finančni razvoj pomemben

negativni vpliv na razlike med spoloma; to pomeni, da je treba na kratki rok spodbujati politike, usmerjene v izboljšanje finančnih in potrošniških storitev za ženske. Na dolgi rok lahko zaključimo, da razvoj IKT vodi k zmanjšanju neenakosti med spoloma, kar lahko pomeni potrebo po strateškem, dolgoročnem načrtovanju za povečanje IKT-infrastrukture, zlasti na prikrajšanih območjih. To vključuje subvencioniranje dostopnega interneta, usposabljanje žensk za veščine na področju IKT ter spodbujanje njihove udeležbe v tehnološki industriji. Poleg tega se vpliv optimalnega finančnega razvoja s časom spreminja; zato sta pri finančnem razvoju potrebni fleksibilnost in trajnostnost. Odločevalci bi morali tako še naprej krepiti in izboljševati pobude za finančno vključenost ter redno spremljati vpliv teh pobud na enakost spolov.

Ključne besede: neenakost spolov, informacijska in komunikacijska tehnologija, finančni razvoj, indeks človeškega kapitala, kmetijstvo
Klasifikacija JEL: E44, G20, O16
Managing Global Transitions 23 (4): 389–421

Oblikovanje stabilnosti: ali lahko povezava med financami in rastjo to doseže?

Freiderick Yohanna Letong, Mehdi Seraj, Fatma Türüç Seraj in Huseyin Ozdeser

Pričujoči članek ocenjuje tristransko povezavo med finančno (ne)stabilnostjo države, stopnjo njenega finančnega razvoja in gospodarsko rastjo. Z uporabo panela 21 držav v obdobju 2001–2020 ter indeksa finančnega trga IMF kot nadomestka za finančni razvoj ugotavljamo: (i) da se finančna stabilnost pozitivno spreminja glede na razvoj finančnega sistema in (ii) da je odnos med finančno stabilnostjo ter gospodarsko rastjo kritično odvisen od ravni finančnega razvoja posamezne države. Ti rezultati kažejo, da bo imel v odsotnosti finančnega razvoja vpliv gospodarske rasti na finančno (ne)stabilnost različne učinke. Poleg tega smo izvedli analizo podvzorca, tako da smo celoten vzorec razdelili na dva podvzorca glede na ravni stabilnosti. Ugotavljamo, da finančni razvoj bolj krepi stabilnost v stabilnejšem podvzorcu, medtem ko rast to počne v manj stabilnem podvzorcu.

Ključne besede: finančna (ne)stabilnost, finančni razvoj, gospodarska rast, indeks finančnega trga, trgi v vzponu in razvijajoči se trgi
Klasifikacija JEL: J16, J24
Managing Global Transitions 23 (4): 423–450

Regionalne razlike v vedenju pri iskanju zdravstvene oskrbe v Nigeriji: dokazi iz splošne ankete gospodinjstev s strani Svetovne banke

Uche Abamba Osakede in Mary Olufemi Ayadi

Regionalne razlike v socioekonomskih dejavnikih oblikujejo vedenje pri iskanju zdravstvene oskrbe. Ta raziskava je preučevala iskanje zdravstvene oskrbe v severni in južni Nigeriji ter vlogo socioekonomskih dejavnikov pri tem iskanju. Podatki so bili pridobljeni iz četrtega vala splošnega anketiranja gospodinjstev po žetvi 2018/2019, ki je zajelo približno 5.000 gospodinjstev. Uporabljeni sta bili logistična regresija in test hi-kvadrat (χ^2). Ugotovitve kažejo, da ljudje zdravstveno oskrbo iščejo večinoma pri zasebnih ponudnikih, zlasti na jugu. Med regijami ni bilo ugotovljenih pomembnih razlik med uporabo formalne in neformalne oskrbe. Starejši odrasli se zanašajo na neformalne ponudnike, kot so tradicionalni zdravilci in verski centri. Dohodek gospodinjstva pomembno vpliva na izbiro ponudnika, medtem ko je spol pomemben predvsem na severu, kjer ženske javne ustanove uporabljajo pogosteje kot zasebne. Daljše razdalje in čakalne dobe povečujejo verjetnost uporabe javnih ustanov, medtem ko huda bolezen spodbuja zanašanje na javne ponudnike. Politike bi morale izboljšati dostop do formalne zdravstvene oskrbe za starejše odrasle, okrepiti javne ustanove za obvladovanje hudih bolezni in zdravja žensk, zlasti na severu, ter zaostriti nadzor nad zasebnimi ponudniki, zlasti na jugu, da se zagotovi kakovostna zdravstvena oskrba.

Ključne besede: vedenje pri iskanju zdravstvene oskrbe, formalna in neformalna zdravstvena oskrba, javna in zasebna zdravstvena oskrba, severna in južna Nigerija
Klasifikacija JEL*:* I14, I18
Managing Global Transitions 23 (4): 451–483