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FINANCIAL LITERACY AND HOUSEHOLD SAVING BEHAVIOUR IN GHANA: A THREE-COMPONENT FRAMEWORK FOR FINANCIAL INCLUSION

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This study examines the determinants of household saving behaviour in Ghana, with particular focus on financial literacy and broader dimensions of financial inclusion. Using nationally representative data from the FinScope Consumer Ghana Survey in 2021, we develop a novel three-component framework that disaggregates financial inclusion into financial literacy, financial access, and behavioural biases. Employing an instrumental variable approach to address endogeneity concerns, we find that financial literacy significantly influences saving behaviour, with its effect varying across demographic subgroups. Financial access consistently plays a prominent role in shaping saving decisions. In some contexts, behavioural biases, such as trust and stigma, also serve as strong determinants. Our findings contribute to the literature in a three-fold manner. Primarily, by developing a three-component framework for financial inclusion which can be replicated across developing and developed contexts. Secondly, by providing credible causal identification through a structured auxiliary evidence framework for instrument validation. Thirdly, by offering policy-relevant insights for Ghana's National Financial Inclusion and Development Strategy. Our results suggest that targeted interventions, addressing specific components of financial inclusion, may be more effective than broad-based approaches currently at play.

Keywords: Financial Literacy; Household Saving; Financial Inclusion; Ghana; Instrumental Variables
JEL Classification: D14; G21; O16; O55

1. INTRODUCTION

Ghana's persistently low levels of domestic saving impose a major constraint on long-term economic growth (Patra et al., 2017), requiring the Government of Ghana to

rely heavily on foreign capital to finance key developmental projects (Baidoo et al., 2018; Pal, 2024). This external dependence leaves the Ghanaian economy vulnerable to sudden capital flow reversals (Cavallo, 2019; Prasad et al., 2003). As early as 1995, Ghana's private savings were insufficient to support self-sustaining, long-term growth (Boehmer et al., 1995). Recent data show that saving rates still lag behind the Sub-Saharan African average and those of advanced economies (World Bank, 2024).

In May 2023, the IMF approved a $3 billion Extended Credit Facility arrangement to support the government's progress on inflation control, debt restructuring, and reserve accumulation (Ansong, 2024). Household saving constitutes the largest component of domestic saving (Modigliani, 1970) and is particularly prominent in developing economies where public saving is limited (Loayza et al., 2000). Jappelli and Pagano (1994, p.90) explain how liquidity constraints in underdeveloped financial markets, such as Ghana's, can generate "forced saving", where limited access to credit often compels household saving.

This study focuses on identifying the drivers of household saving behaviour in Ghana as a channel to address low levels of domestic savings. In particular, we investigate how financial literacy affects saving behaviour while accounting for broader dimensions of financial inclusion that are critical in developing economies. Financial literacy, defined as the ability to understand and use personal finance-related information (Huston, 2010), constitutes one important component of financial inclusion, which refers to individuals having affordable access to, and usage of, appropriate financial products and services (Demirgüc-Kunt and Singer, 2017).

We are addressing three primary research questions, in this paper, that collectively examine the nexus between financial literacy, financial inclusion, and household saving behaviour in the Ghanaian context. We initiate the analysis with the investigation of the causal relationship between financial literacy and saving behaviour among Ghanaian households, focusing on the way in which financial literacy influence saving behaviour. Then, we proceed to examine the mediating and moderating roles of broader financial inclusion dimensions in determining household saving behaviour. Finally, we investigate how the relationships between financial literacy, financial inclusion, and saving behaviour exhibits significant heterogeneity across distinct population subgroups, particularly along dimensions of income, education, gender, and geographic location. In doing so, we seek to identify differential treatment effects that may inform the design of targeted policy interventions and enhance the precision of financial inclusion strategies.

Our analysis uses an instrumental variable approach to address endogeneity in financial literacy, drawing on cross-sectional survey data from Ghana. The study contributes to the literature in several key respects. First, it introduces a unique three-component framework that disaggregates financial inclusion into financial literacy, financial access, and behavioural biases, allowing these components to be embedded into a regression model for a comprehensive understanding of saving determinants in developing economies.

Secondly, this study enhances the credibility of causal interpretation by introducing a

novel auxiliary framework to assess the validity of instruments for financial literacy. This addresses a key limitation in existing literature, which is often plagued by insufficient justification for instrument selection (Kaiser and Lusardi, 2024). The framework is applied to demonstrate the value of auxiliary testing when using spatial instruments, uncovering potential violations of the exogeneity assumption.

Finally, this paper addresses the small samples and limited geographical coverage of previous Ghana-specific research by leveraging the nationally representative FinScope Consumer Ghana 2021 Survey. This allows for more generalizable findings and enables detailed examination of Ghana's financial landscape at a critical juncture, serving as a midpoint review of Ghana's National Financial Inclusion and Development Strategy, which aimed to raise formal financial access to 85% by 2023 (Ministry of Finance, Republic of Ghana, 2018).

2. THREE-COMPONENT FRAMEWORK

Financial inclusion refers to individuals' and businesses' ability to access and use financial products and services in order to affordably and appropriately meet their needs (Demirgüc-Kunt and Singer, 2017). The literature has not reached consensus on the exact measurement or definition of financial inclusion (Morgan and Long, 2020), but there is widespread agreement that it encompasses both demand-side and supply-side dimensions (Grohmann et al., 2018, Pesqué-Cela et al., 2021). Klapper and Singer (2018) and Shankar (2013) emphasise the importance of a composite approach to distinguish between involuntary exclusion (due to structural access barriers) and self-determined exclusion (where individuals lack the ability or willingness to use financial services).

Drawing on insights from the literature, we develop a novel three-component framework for financial inclusion:

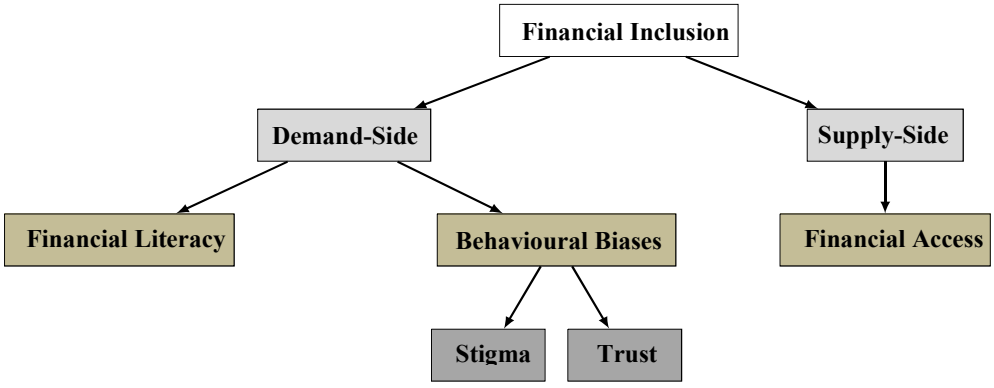


Figure 1. Three-Component Framework

The supply-side of financial inclusion is unanimously measured by financial access through indicators such as bank account ownership (Klapper and Singer, 2018; Pesqué-Cela et al., 2021). We classify individuals into four strands of financial access: banked, other formal, informal and excluded.

The demand-side is multidimensional, encompassing both financial literacy and behavioural biases. Empirical studies find financial literacy to be a primary determinant of demand-side financial inclusion (Askar et al., 2020; Cole et al., 2011; Morgan and Long, 2020), with Pesqué-Cela et al. (2021, p.319) labelling it as a prime candidate to proxy the "quality" of demand-side financial inclusion. Despard and Chowa (2014) notes that there is also a psychological dimension of financial inclusion. Empirical research indicates that behavioural factors, such as trust and confidence, are associated with financial inclusion (Demirgüc-Kunt et al., 2017; Galiani et al., 2022, Koomson et al., 2023). Termed in this paper as behavioural biases, these manifest distinctively in the Ghanaian context, shaped by historical and socioeconomic factors. Koomson et al. (2023) identifies deep-rooted distrust in formal financial institutions as a significant barrier to financial inclusion in Ghana, potentially attributable to banking sector challenges such as the 2017-2019 Ghanaian Banking Crisis (Aboagye, 2020). This institutional distrust is compounded by a perception among Ghanaians that formal financial services are "not for them" (Despard and Chowa, 2014), particularly pronounced in rural communities.

3. LITERATURE REVIEW

3.1. Financial Literacy: Foundations and Measurement

The concept of financial literacy gained research prominence in the early 2000s (Garg and Singh, 2018), evolving from being considered synonymous with financial knowledge (Bucher-Koenen et al., 2017; Hilgert et al., 2003; Lusardi and Mitchell, 2011b) to encompass broader dimensions. The OECD defines three dimensions of financial literacy: financial knowledge, attitudes, and behaviour (OECD, 2016). A widely accepted definition characterises financial literacy as measuring "how well an individual can understand and use personal finance-related information" (Huston, 2010).

Lusardi and Mitchell (2011b) established the benchmark measurement with their "Big Three" questions on inflation, interest, and risk diversification, which test fundamental knowledge that underlies most economic decisions (Lusardi and Mitchell, 2023). However, marked heterogeneity in financial environments between advanced and developing economies precludes a standardised measurement approach. In Ghana, financial literacy may be more meaningfully evaluated through context-specific measures focussing on practical money management (Despard and Chowa, 2014).

3.2. Financial Inclusion and Savings

These components of financial inclusion uniquely contribute to saving behaviour. Firstly, numerous studies identify financial literacy as a key determinant of saving in both developed and developing economies (Babiarz and Robb, 2013; Cupák et al., 2019; Jappelli and Padula, 2013; Mahdzan and Tabiani, 2013; Murendo and Mutsonziwa, 2017; Pak and Chatterjee, 2016; Ramalho and Forte, 2019). Secondly, financial access drives the saving behaviour of low-income individuals in Mexico (Aportela, 1999), Malawi (Brune et al., 2016) and India (Somville and Vandewalle, 2018). Finally, Behrman et al. (2010) document that unobservable behavioural factors also affect the saving decision and must be controlled for in empirical analyses. This paper leverages the novel framework to integrate all components of financial inclusion into the empirical models to identify causal effects.

The literature points to a degree of interdependence between the components of financial inclusion. As financial systems grow in complexity, financial literacy plays an increasingly important role in navigating financial decision-making, such as saving (Cole et al., 2011; Potrich et al., 2016). In turn, access to formal financial services may complementarily enhance financial literacy through a "learning by doing" process (Lyons and Kass-Hanna, 2021, p.2730) as individuals are exposed to financial tools (Klapper et al., 2015). However, in developing economies, structural barriers to access may prevent financial literacy from influencing behaviour, suggesting a sequential pathway whereby financial access must precede financial literacy (Lyons et al., 2006, 2019).

Policymakers can target specific components based on their relative effectiveness. While Lusardi (2019) and Xu and Zia (2012) provide evidence that financial education1 initiatives can be effective, research from Mexico points to the contrary. Bruhn et al. (2014) found minimal impact from financial education initiatives but identified (in a separate study) that increasing financial access had a sizeable effect (Bruhn and Love, 2014). Experimental evidence from Rwanda also questions the cost-effectiveness of financial literacy training relative to structural access expansions (Sayinzoga et al., 2016). However, Atakora (2013) uses correlation research in Kumasi Central Market and suggests that financial literacy training may be effective in a Ghanaian context. These contrasting standpoints render the disaggregation of financial inclusion essential for understanding the effects of individual components, particularly in developing economies.

3.3. Empirical Evidence and Methodological Considerations

The relationship between financial literacy and financial behaviours has been increasingly explored in contemporary empirical literature. Existing research has found

[1] The aim of financial education initiatives is to increase financial literacy. This term is used synonymously with financial literacy policy.

that financial literacy is associated with retirement planning (Bongini and Cucinelli, 2019; Bucher-Koenen and Lusardi, 2011; Lusardi and Mitchell, 2011a), saving behaviour (Babiarz and Robb, 2013; Cupák et al., 2019; Jappelli and Padula, 2013; Mahdzan and Tabiani, 2013; Pak and Chatterjee, 2016; Ramalho and Forte, 2019), stock market participation (Van Rooij et al., 2011), investment decisions (Hassan Al-Tamimi and Anood Bin Kalli, 2009), financial preparation for income shocks (Loke, 2016), wealth accumulation (Behrman et al., 2010), and a range of additional financial behaviours (Lusardi and Mitchell, 2014).

Research on the effects of financial literacy is predominantly confined to advanced economies (Brochado and Mendes, 2021; Murendo and Mutsonziwa, 2017), while some studies that examine the relationship between financial literacy and financial behaviour exist in Ghana (Baidoo et al., 2018; Owusu et al., 2020), and other developing contexts, including Uganda (Candiya Bongomin et al., 2017), Zimbabwe (Murendo and Mutsonziwa, 2017), Laos, Cambodia and Vietnam (Morgan and Long, 2020, 2019), Namibia (Ashipala and Hakweenda, 2025), Rwanda (Sayinzoga et al., 2016), Malaysia (Loke, 2016; Mahdzan and Tabiani, 2013; Sabri and MacDonald, 2010), Middle Eastern and North African countries (Lyons and Kass-Hanna, 2021), and others.

While existing literature documents positive relationships between financial literacy and saving behaviour across various contexts (Babiarz and Robb, 2013; Cupák et al., 2019; Jappelli and Padula, 2013; Murendo and Mutsonziwa, 2017; Pak and Chatterjee, 2016), methodological limitations threaten causal interpretation. The potential endogeneity of financial literacy poses challenges typically addressed through instrumental variable approaches (Lusardi and Mitchell, 2014). Many studies in developing economies either fail to acknowledge endogeneity or rely on questionable instruments (Morgan and Long, 2020). Additionally, most studies employ small, non-representative samples due to data collection challenges (Lyons and Kass-Hanna, 2021).

4. DATA

4.1. Sample Selection

This study uses data from the FinScope Consumer Ghana 2021 Survey, conducted by FinMark Trust in collaboration with the Ministry of Finance and the Ghana Statistical Service. The dataset provides credible benchmarks for financial inclusion and was designed to inform strategies aimed at raising living standards in Ghana (Ministry of Finance, Republic of Ghana, 2021).

The survey interviewed 5,156 adult participants (15 years and older) using a Computer Assisted Personal Interviewing, with sampling designed to ensure national and regional representativeness across Ghana's 16 regions. Probability Proportional to

Size sampling and household listing data were used to select 470 Enumeration Areas across Ghana. From this dataset, a sample of 3,984 individuals was chosen based on the selection criteria applied. To be precise, we have eliminated 452 individuals earning zero income, given that they cannot contribute to meaningful variation in the saving function (Keynes, 1936), alongside 718 individuals who reported "no income disclosure". We also removed an individual who ambiguously reported their education level and one individual who did not provide data on their housing condition. Descriptive statistics for these 3,984 individuals are presented in Table 1 below.

Table 1. Descriptive Statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Financial Literacy	3,984	1.970	0.462	1	3
Financial Access	3,984	6.190	20.431	1	99
Trust	3,984	0.118	0.323	0	1
Stigma	3,984	0.036	0.185	0	1
Male	3,984	0.471	0.500	0	1
Age	3,984	38.093	14.457	15	103
Age Squared	3,984	1660.052	1306.490	225	10,609
Education	3,984	2.672	1.064	1	5
Housing Quality	3,984	2.433	0.683	1	3
Electricity Access	3,984	0.359	0.479	0	1
Radio Access	3,984	0.732	0.443	0	1
Internet Access	3,984	0.344	0.475	0	1
Consulted on Financial Matters	3,984	0.509	0.500	0	1
Head of Household	3,984	1.384	0.486	1	2
Household Size	3,984	2.128	1.040	1	4
Urban Location	3,984	0.493	0.500	0	1
Income Group	3,984	1.510	0.625	1	3
Own House	3,984	0.579	0.493	0	1
Regions	3,984	5.678	2.904	1	10
Employment Status	3,984	2.145	0.962	1	4
Marital Status	3,984	1.689	0.716	1	3

4.2. Data Description

4.2.1. Saving Behaviour

For the purposes of this research, our dependent variable is $Saving_i$, a binary variable taking the value of 1 if the individual saves/invests/puts money away in any capacity (formal, informal, at home or other), and 0 otherwise. Binary measurement of saving is frequently observed in financial decision-making research (Hausman and Wise, 1978) and is characteristic of studies exploring the relationship between financial literacy and saving behaviour (Baidoo et al., 2018; Beckmann, 2013; Cupák et al., 2019; Mahdzan and Tabiani, 2013; Morgan and Long, 2020; Murendo and Mutsonziwa, 2017).

4.2.2. Financial Literacy

Our main variable of interest is financial literacy. We measure this using a weighted index of three subcategories developed by FinMark Trust:

$$FL_i = \frac{1}{3}FinPlan_i + \frac{1}{3}FinCont_i + \frac{1}{3}FinComm_i, \quad (1)$$

where FL_i is the financial literacy index for individual i, $FinPlan_i$ is the long-term financial planning score, $FinCont_i$ is the financial control score and $FinComm_i$ is the financial commitment score for individual i. Each subcategory is assigned one of three numerical values: $\frac{1}{3}$ ("low"), $\frac{2}{3}$ ("medium"), or $\frac{3}{3}$ ("high"). When all subcategories are summed, the resulting FL_i can range from 1 (all components are "low") to 3 (all components are "high"). This is a novel approach to measuring financial literacy in already established empirical relationship with saving (Babiarz and Robb, 2013; Jappelli and Padula, 2013; Pak and Chatterjee, 2016).

4.2.3. Financial Access

Financial access is controlled for using a factor variable. FA_i captures the four proprietary strands of financial access which are banking, other formal, informal or financially excluded. Murendo and Mutsonziwa, (2017) control for mobile money use and savings club membership in the Zimbabwean context. In Ghana, the rollout of mobile money "fast tracked" financial access targets, enabling 95% of Ghanaian adults to have access to formal financial services in 2021 (Ministry of Finance, Republic of Ghana, 2021, p.36), 92.3% of whom use mobile money. Thus, FA_i is used as a more comprehensive measure of access to financial services. Informal financial services include the use of Susu: the Ghanaian analogue for savings club membership, also referred to as a rotating savings and credit association (ROSCA) (Aryeetey and Udry, 1995; Dovi, 2008). Whilst Susu has served for many years as an important avenue for savings for low-income and financially excluded people in countries across West Africa (Osei-Assibey, 2015), 11.77% of our sample still use a combination of Susu and formal financial services, likely because Susu is a deeply-rooted cultural structure that motivates Ghanaians to honour savings commitments, potentially more than any mobile money platform is capable of (Osei-Assibey, 2015).

4.2.4. Behavioural Biases

Behavioural biases are represented as a vector, BB_i, which contains dummies for both $Trust_i$ and $Stigma_i$. $Trust_i$ takes the value of 1 if individuals report not having financial accounts or using financial services due to their distrust in banks. Koomson et al. (2023) identifies how distrust can be derived from exposure to negative financial experiences, such as the 2017-2019 Ghanaian Banking Crisis. Agyei (2018) and Sabri and MacDonald (2010) note that young adults' financial attitudes are particularly sensitive and were likely tarnished by the 2017-2019 Ghanaian Banking Crisis. $Stigma_i$ takes the value of 1 if the reason for not having financial accounts is that they believe they are not for people like "me" or they are afraid of embarrassment or rejection, which may be prominent in Ghana (Despard and Chowa, 2014). This study shows how behavioural biases that affect the decision to financially include oneself (see Figure 1) also affect another financial decision: saving behaviour. Such provisions also constitute an attempt to control for confounding unobserved factors that could bias our findings (Behrman et al., 2010). Similarly, Cumurovic and Hyll (2019) instead control for risk attitudes with regards to career decisions.

4.2.5. Socio-demographic Controls

We build on the existing literature and employ a comprehensive set of controls. The first set are demographic controls. We control for gender since males tend to have higher financial literacy than females (Lusardi and Mitchell, 2011b) and control household financial decisions in Ghana (Fuseini et al., 2019). We also control for age and age squared since financial literacy increases with age before declining in old age (Lusardi and Mitchell, 2011b), and because age is a predictor of saving behaviour due to the life-cycle hypothesis (Modigliani, 1970).

The second set is socio-economic controls. We control for the level of education (no formal[2], primary, secondary, vocational, tertiary), which is positively associated with financial literacy (Lusardi and Mitchell, 2014) and saving (Bernheim et al., 2001). Since saving is a function of income (Keynes, 1936), also correlated positively with financial literacy (Almenberg and Säve-Söderbergh, 2011), we control for three tiers of income based on total personal monthly income in Ghanaian Cedi (GHS): low-income ($0 <$ GHS < 500)[3], middle-income ($500 \leq$ GHS $\leq 1{,}999$) and high-income (GHS $\geq 2{,}000$). These thresholds are informed by the national poverty line (198 GHS per month as of 2016, Tanaka (2019)) and the estimated living wage (900 GHS per month as of 2019, Dokua Sasu (2022)), selected so that the low-income group captures individuals around the poverty line, middle-income group includes those around the estimated living wage, and the high-income group represents those earning over twice the estimated living wage.

[2] Taken as the reference category in all specifications.

[3] Taken as the reference category in all specifications.

We also control for the employment status of the individual (farming and fishing, informal, formal[4], remittances) since the type of employment likely affects saving behaviour (Bosch Mossi et al., 2015). Additionally, it is worth pinpointing that remittances are embedded in the culture of Ghana, representing almost 6.4 percent of GDP in 2023 (Badoe, 2024). Adams and Cuecuecha (2013) observed that households in Ghana receiving internal remittances reduce the likelihood of them being below the poverty line by 17%, while international remittances contribute to almost 97% decrease in the likelihood of being financial disadvantaged. Lastly, it has been argued that remittances from migrants are becoming a potential source of foreign exchange whose magnitude exceeds the amount of ODA to Ghana (Quartey, 2006).

The third set is geographic controls. We control for whether the respondent lives in an urban/rural location (Klapper and Singer, 2015; Morgan and Long, 2020; Murendo and Mutsonziwa, 2017). In a similar approach to (Morgan and Long, 2020), we include 10 regional dummies for the 10 administrative regions of Ghana before the 2018 changes, outlined in the Table 2 below (Ministry of Foreign Affairs, 2023). This allocation spans the entire nation, and retains sufficient sample size, over the more recent division into 16 administrative regions.

Table 2. Regions

Region	Frequency	Percent	Cumulative
Northern	415	10.42	10.42
Volta	335	8.41	18.83
Brong Ahafo	308	7.73	26.56
Western	299	7.51	34.06
Ashanti	800	20.08	54.14
Upper East	200	5.02	59.16
Upper West	128	3.21	62.37
Eastern	528	13.25	75.63
Greater Accra	612	15.36	90.99
Central	359	9.01	100.00
Total	3,984	100.00	

The fourth set is controls for household characteristics, wealth and access to information. We control for household size which both proxies for socio-economic status and affects saving behaviour (Bongaarts, 2001; Edwards, 1996; Loayza et al., 2000). We also control for whether the respondent is head of the household and whether they are consulted in the financial decision-making. Some Ghanaians, especially females, are precluded from saving due to their role in the household (Fuseini et al., 2019). We

[4] Taken as the reference category in all specifications.

also control for whether the respondent has to pay rent for the house that they live in, or whether it is an owned property. This is giving us a good approximation for one's wealth status and ergo corresponding savings behaviour. Another proxy for wealth is the index for housing quality which employs the data on the materials used for the construction of the respondent's house. We scored the quality of the material used for each of the floors, walls, and roofs. The index was the mean quality across the three categories, presented in a range of 0 to 100:

$$HousingQuality_i = \frac{(FloorScor_i + WallScore_i + RoofScor_i)}{3}. \quad (2)$$

We tier the index into "Poor and Fair" (< 50), "Good" ($50 \leq HousingQuality_i \leq 85$), and "Excellent" (> 85). Furthermore, we control for marital status, with the respondent being defined as married/co-living, single, or divorced/widowed[5], playing an important role in their saving behaviour (Love 2010). Lastly, following Murendo and Mutsonziwa (2017), we control for electricity and radio access. We also add a control for internet access, providing a control for a modern-day tool for reducing information asymmetry.

5. METHODOLOGY

5.1. Empirical Strategy

Our baseline specification takes the form:

$$Saving_i = \alpha + \beta_1 FL_i + FA_i'\phi + BB_i'\mu + X_i'\gamma + \epsilon_i, \quad (3)$$

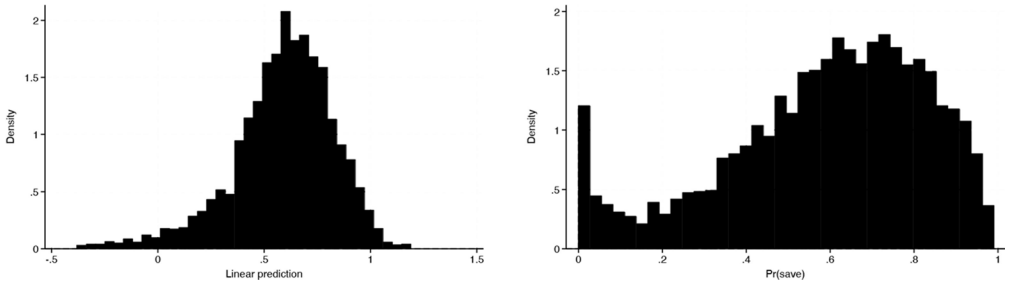
where $Saving_i$ represents household saving behaviour, FL_i is financial literacy, FA_i captures the four proprietary strands of financial access. BB_i stands for the two vectors of behavioural characteristics ($Trust_i$ and $Stigma_i$). Lastly, X_i is the set of control variables, while ϵ_i represents the idiosyncratic error term.

5.2. Model Specification

The probit model is selected for this analysis based on strong theoretical grounds. The probit model is widely used to model binary financial outcomes in development economics (Hausman and Wise, 1978) and in financial literacy research (Babiarz and Robb, 2013; Cupák et al., 2019; Murendo and Mutsonziwa, 2017). The Linear

[5] Taken as the reference category in all specifications.

Probability Model (LPM) can approximate binary outcomes reasonably well (Angrist and Pischke, 2009) and is widely employed in financial literacy literature (Lusardi and Mitchell, 2011a; Morgan and Long, 2020). The major limitations of LPMs are largely mitigated by the large sample size (3,984) and the use of robust standard errors clustered at the locality level (447 localities to be precise)[6].



(a) LPM (b) Probit

Figure 2. Histograms of Predicted Probabilities

However, Figure 2 illustrates that the LPM produces predicted probabilities of saving outside the unit interval [0,1], which could result in biased and inconsistent estimates (Horrace and Oaxaca, 2006). The probit model constrains these predictions within the valid range and is well calibrated: the mean predicted probability (0.5891) closely aligns with the observed mean of the dependent variable, $Saving_i$ (0.5886). Therefore, the LPM estimates will be reported only to establish the direction of causality, and we will employ maximum likelihood estimation as the main model specification.

5.3. Instrumental Variables

The primary concern of empirical studies investigating the effect of financial literacy on different types of financial behaviours is endogeneity (Kaiser and Lusardi, 2024). Individuals who engage in saving activities may seek financial knowledge as they discover its importance, leading to reverse causality (Fernandes et al., 2014). Omitted variable bias may arise from the failure to control for key unobserved factors influencing both financial literacy and financial behaviour. Those factors include risk aversion, self-esteem, innate ability, intelligence, and motivation (Behrman et al., 2010). The inclusion of BB_i in this study aims to proxy for this unobservable heterogeneity in

[6] Clustering accounts for arbitrary heteroscedasticity and intra-locality correlation in the error term, which may arise from shared unobserved characteristics such as infrastructure or cultural norms (Cameron and Miller, 2015).

saving behaviour. There could also be measurement error in financial literacy which causes attenuation bias (Behrman et al., 2010). Although self-reported data can mitigate the noise component from correct guessing (Lusardi and Mitchell, 2011b), individuals may over or underestimate their financial knowledge and introduce systematic misclassification (Bucher-Koenen and Lusardi, 2011). To address endogeneity in financial literacy, we implement a two-stage least squares approach:

$$FL_i = \delta + \pi Z_i + C_i'\phi + \nu_i \ (First\ Stage), \tag{4}$$

$$Saving_i = \alpha + \beta_1 \widehat{FL_\iota} + C_i'\phi + \epsilon_i \ (Second\ Stage), \tag{5}$$

where Z_i represents our instrumental variables and $\widehat{FL_\iota}$ is the predicted value from the first stage. C_i represents the vector of all other variables specified in Equation (3).

5.3.1. Instrument

Beckmann (2013) highlights the "extreme" difficulty of finding suitable instruments for financial literacy. Kaiser and Lusardi (2024) note that many instruments pass relevance tests but fail to meet this directly untestable exclusion restriction (Morgan and Winship, 2015). Thus, Morgan and Long (2020) note that existing studies often use unconvincing instruments or ignore the endogeneity problem entirely.

We follow Murendo and Mutsonziwa (2017) in using the Regional Average Financial Literacy (RFL) as an instrument for an individual's financial literacy. In general, the use of regional-level instruments in this field of research is well-established (Askar et al., 2020; Christiansen et al., 2007; Klapper et al., 2013; Lachance, 2014; Sekita, 2011). Several studies find that individuals learn about finance from peers or through word-of-mouth (Brown et al., 2008; Duflo and Saez, 2003; Hong et al., 2004). Individuals residing in regions with higher average financial literacy are more likely to acquire financial knowledge through social interactions/ networking, local educational programmes, and community norms, rendering the instrument relevant. Importantly, the experience of others is not under the respondent's control and is thus "exogenous with respect to his or her actions" (Klapper et al., 2013, p.3911). The exogeneity assumption is additionally strengthened by the leave-one-out approach discussed below (Angrist et al., 1999).

5.3.2. Leave-One-Out Construction

The calculation of the regional average financial literacy in this research is distinct from previous studies. To mitigate simultaneity bias associated with spatial instruments (Betz et al., 2018), we drew insights from Angrist et al. (1999) and constructed the instrument using a leave-one-out approach. Using the notation of Fruehwirth et al. (2019), let $RFL_{i,r(i)}$ be the instrument for individual i's level of financial literacy, FL_i,

denoting the average financial literacy score of all individuals living in region r, excluding the financial literacy score of individual i. This formulation harnesses regional variation while strengthening the independence of the instrument from the error term in the structural equation (Angrist et al., 1999). To ensure the validity of this instrument, we follow Morgan and Long (2020), and control for economic development at a regional level.

5.4. Auxiliary Evidence

The exogeneity of instruments for financial literacy is typically assumed. However, a recent review of literature by Kaiser and Lusardi (2024) found that most instruments do not satisfy the exclusion restriction. Despite the significance of this threat to causal inference, researchers rarely employ empirical methods to strengthen their claims. The prevailing standard is to report first-stage diagnostics and overidentification test results (Cupák et al., 2019; Morgan and Long, 2020), which cannot be applied in our just-identified model.

Although the exclusion restriction is not directly verifiable, researchers can demonstrate whether it can be empirically refuted (Angrist and Krueger, 1999). We implement three levels of testing as part of our auxiliary evidence framework: relevance, controlled-reduced form, and overidentification tests. The detailed approach and the relevant steps undertaken in this framework are presented in the Appendix.

6. RESULTS

6.1. Baseline Specification

Table 3 presents the baseline model across specifications. Overall, the consistency of coefficient signs and significance levels provides evidence of robust parameter identification. The instrumental variable estimates in Column (3) yield qualitatively similar results to the baseline specification, supporting the validity of the identification strategy.

Column 2 presents the probit regression estimates examining the effects of components of financial inclusion and the remaining control variables on saving behaviour, with marginal effects reported in the table to facilitate interpretation of economic significance. Financial literacy significantly increases the probability of saving. The financial literacy coefficient of 0.043 indicates that a one-unit increase in financial literacy, equivalent to moving from low to medium level, is associated with a 4.3 percentage point increase in the probability of saving, ceteris paribus. The non-standardised financial literacy measurement restricts cross-country comparability, but the estimate broadly aligns with findings from Murendo and Mutsonziwa (2017),

Morgan and Long (2019, 2020) that a one standard deviation increase in their respective financial literacy indices increases the probability of saving by 17.0, 4.2, 15.8 and 7.3 percentage points across Zimbabwe, Laos, Cambodia and Vietnam, respectively. Our finding also aligns with estimates from a prior study of financial literacy and saving in Ghana (Baidoo et al., 2018).

The magnitude of this effect increases to 6.1 percentage points under instrumental variable estimation, suggesting the standard probit may underestimate the true causal impact due to measurement error or reverse causality bias. However, the Wald test statistic, a method for estimating causality in the presence of endogeneity, was statistically insignificant (p-value: 0.2234), indicating no evidence of selection on unobservables (Miyata et al., 2009; Murendo and Mutsonziwa, 2017). Consequently, we proceed with the probit estimation exclusively.

Within the financial access strand, banking access demonstrates the most substantial positive association. Access to other formal financial services also yields significant effects, while informal sources yields moderate effects, relative to those who are financially excluded. Banking access exhibits a large positive coefficient (0.777), representing the strongest predictor in the model, statistically significant at the 1% level. The comparatively pronounced effect of access, relative to literacy, points towards access being a prerequisite for financial behaviour (Lyons et al., 2006, 2019), where access serves as an enabler of saving, and financial literacy determines the quality of financial behaviour upon securing access (Demirgüc-Kunt et al., 2017). This finding corroborates the geographical exclusion hypothesis advanced in the financial inclusion literature, wherein physical proximity to financial institutions constitutes a binding constraint on market participation (Beck et al., 2007). The magnitude of the coefficient suggests that access to formal financial infrastructure highlights the critical importance of supply-side interventions in financial development policy.

In line with the initial preconceived hypothesis, behavioural biases demonstrate a negative relationship with saving. The role of social capital in general has been widely documented in the empirical literature, explaining numerous phenomenon ranging from economic growth (Knack and Keefer, 1997), size of firms (La Porta et al., 1997), institutions design and performance (Djankov et al., 2003), financial development (Guiso et al., 2004, 2008b), crime (Glaeser et al., 1995), the power of the family (Alesina and La Ferrara, 2002), innovation (Fountain, 1997), all the way to spread of secondary education (Goldin and Katz, 2001; Guiso et al., 2008a). In our case, generalised trust may reflect scepticism toward financial innovation or institutional change, or simply a deep-seated belief that financial institutions should not be trusted when it comes to money matters (Guiso et al., 2008a). Koomson and Danquah (2021) identified that distrust in formal financial institutions impedes financial inclusion in Ghana, especially following the 2017-2019 Ghanaian Banking Crisis (Aboagye, 2020). However, this study demonstrates that these psychological barriers that deter individuals from banking also translate to the saving decision. The statistical significance of stigma validates the study's three-component framework for financial inclusion, especially reinforcing the notion that behavioural biases constitute a unique dimension.

Table 3. Baseline Model

VARIABLES	(1) LPM	(2) Probit	(3) IV-Probit
Financial Literacy	0.040**	0.043**	0.061***
	(0.019)	(0.019)	(0.024)
Financial Access (ref: Excluded)			
Banked	0.663***	0.777***	0.777***
	(0.029)	(0.026)	(0.025)
Other Formal	0.373***	0.484***	0.486***
	(0.027)	(0.026)	(0.025)
Informal	0.054	0.110*	0.112*
	(0.052)	(0.065)	(0.064)
Behavioural Biases			
Trust	-0.037	-0.034	-0.034
	(0.028)	(0.023)	(0.023)
Stigma	-0.092*	-0.076*	-0.075*
	(0.047)	(0.039)	(0.039)
Male	0.052***	0.050***	0.050***
	(0.016)	(0.015)	(0.015)
Age	0.006**	0.006**	0.005**
	(0.003)	(0.003)	(0.003)
Age Squared	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
Education (ref: No Education)			
Primary	0.067**	0.065**	0.066**
	(0.028)	(0.027)	(0.027)
Secondary	0.108***	0.098***	0.098***
	(0.024)	(0.023)	(0.023)
Vocation	0.168***	0.164***	0.163***
	(0.039)	(0.045)	(0.045)
Tertiary	0.120***	0.133***	0.130***
	(0.035)	(0.042)	(0.042)
Housing Quality (ref: Poor and Fair)			
Good	0.027	0.030	0.030
	(0.028)	(0.027)	(0.027)
Excellent	0.052*	0.048*	0.047*
	(0.028)	(0.027)	(0.027)
Electricity Access	0.014	0.015	0.014
	(0.019)	(0.018)	(0.018)
Radio Access	0.065***	0.062***	0.063***
	(0.018)	(0.017)	(0.017)
Internet Access	0.089***	0.088***	0.087***
	(0.019)	(0.018)	(0.018)
Consulted on Financial Matters	0.006	0.006	0.007
	(0.016)	(0.016)	(0.016)
Controls	Yes	Yes	Yes
Observations	3,984	3,984	3,984
Wald test ($corr = 0$)			1.48
Prob > Chi2			0.2234

Note: Cluster-robust standard errors in parentheses ***p<0.01, ** p<0.05, * p<0.1.

Ghanaian adult males are 5 percentage points more likely to save than females, ceteris paribus. Furthermore, age profile reveals linear rather than the expected inverted-U relationship, with positive linear and negative quadratic terms both being significant. This contradicts life-cycle models, which predict that financial participation increases with income and sophistication during working years, then declines in retirement (Modigliani, 1970). Education displays a clear gradient where higher education levels, especially vocational and tertiary, strongly predict saving behaviour (Frisancho, 2020). This educational gradient provides empirical support for the hypothesis that cognitive skills and institutional familiarity acquired through formal schooling reduce transaction costs and information asymmetries in financial markets (Lusardi and Mitchell, 2014). This suggests potential complementarity between formal education levels and financial market participation, which we will explore further in our analysis of sub-samples.

Information infrastructure variables demonstrate theoretically consistent positive associations. Radio access and internet access both exhibit significant positive effects, supporting the information asymmetry reduction hypothesis. This likely explains the prominent role of media in disseminating financial information in Ghana (Atakora, 2013). These findings align with models of financial market participation under incomplete information, where access to information channels reduces search costs and enhances product awareness (Stiglitz and Weiss, 1981). Furthermore, as hypothesized, our wealth proxy (housing quality) exhibits significant effects whereby excellent housing quality corresponds to significant positive effects (0.048) on the probability of saving. Being consulted on financial matters is hypothesized as a key determinant of saving for females in Ghana (Fuseini et al., 2019), but the gender control in the model is the likely culprit for its insignificant effect in the baseline model.

6.2. Gender and Mobile-Money Subcategorization

6.2.1. Gender Analysis

In Table 4, the gender-stratified analysis (Column 1 and 2) reveals significant heterogeneity in financial literacy effects, indicating differential returns to financial knowledge acquisition across demographic groups. Specifically, the marginal effect for males (0.060) exceeds that for females (0.032), for whom the effect is insignificant, suggesting substantial gender-based disparities in the returns to financial literacy. This finding aligns with theoretical predictions from human capital models, which posit that returns to education and skills may vary systematically across demographic groups due to structural market imperfections or discrimination effects (Arrow, 1973; Becker, 1964), that may be induced in Ghana's patriarchal society (Fuseini et al., 2019).

Similarly, our results suggest that structural access to formal financial services and available resources are more powerful contributors than knowledge for males, aligning with Allen et al. (2016), who found that males in Sub-Saharan Africa are more likely to

save when formal mechanisms are accessible.

Table 4. Gender and Mobile Money

VARIABLES	(1) Male	(2) Female	(3) Mobile Money	(4) No Mobile Money
Financial Literacy	0.060**	0.032	0.038*	-0.018
	(0.025)	(0.026)	(0.021)	(0.029)
Financial Access (ref: Excluded)				
Banked	0.799***	0.768***		0.744***
	(0.038)	(0.030)		(0.046)
Other Formal	0.518***	0.463***		0.082***
	(0.039)	(0.027)		(0.024)
Informal	0.070	0.133*		0.053
	(0.112)	(0.074)		(0.033)
Behavioural Biases				
Trust	-0.050	-0.019	-0.042	0.028
	(0.032)	(0.031)	(0.025)	(0.025)
Stigma	-0.180***	-0.005	-0.104**	0.025
	(0.057)	(0.048)	(0.042)	(0.043)
Male			0.044***	0.018
			(0.017)	(0.027)
Age	0.006	0.004	0.002	0.004
	(0.004)	(0.004)	(0.003)	(0.004)
Age Squared	-0.000	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Education (ref: No Education)				
Primary	0.082*	0.049	0.054*	0.014
	(0.042)	(0.036)	(0.031)	(0.029)
Secondary	0.075**	0.110***	0.090***	0.029
	(0.033)	(0.029)	(0.027)	(0.027)
Vocation	0.153***	0.151**	0.151***	
	(0.054)	(0.069)	(0.048)	
Tertiary	0.106**	0.154**	0.129***	0.004
	(0.054)	(0.066)	(0.044)	(0.082)
Housing Quality (ref: Poor and Fair)				
Good	0.049	0.007	0.021	0.000
	(0.034)	(0.039)	(0.030)	(0.031)
Excellent	0.032	0.050	0.032	-0.004
	(0.034)	(0.039)	(0.029)	(0.034)
Electricity Access	0.031	-0.002	0.017	0.004
	(0.026)	(0.023)	(0.021)	(0.020)
Radio Access	0.056**	0.064**	0.059***	0.080***
	(0.024)	(0.022)	(0.018)	(0.023)
Internet Access	0.095***	0.078***	0.081***	0.007
	(0.025)	(0.026)	(0.020)	(0.037)
Consulted on Financial Matters	-0.006	0.014	-0.005	0.065**
	(0.024)	(0.021)	(0.017)	(0.024)
Controls	Yes	Yes	Yes	Yes
Observations	1,879	2,105	3,464	466

Note: Cluster-robust standard errors in parentheses ***p<0.01, ** p<0.05, * p<0.1.

A noticeable divergence between gender groups was also in the effect stigma plays in saving behaviour. Males who face challenges surrounding social stigma are 18 percentage points less likely to save, relative to males that do not suffer from such behavioural biases (Jain et al., 2023, Aftab et al., 2025). However, this effect is negligible for females (0.5 percentage points) and statistically insignificant. This gender-disaggregated analysis reveals important heterogeneity implying that saving strategies may require differentiated approaches for male and female populations to address the varying magnitudes of barriers and facilitators across demographic groups (Berlinger et al., 2025; Preston and Wright, 2024; Wagner and Walstad, 2022).

6.2.2. *Mobile Money*

Mobile money refers to the use of mobile phones to access financial services such as money transfers, savings, and payments. In Ghana, mobile money has "fast tracked" financial access targets (Ministry of Finance, Republic of Ghana, 2021, p.36), especially among the unbanked and under-banked populations who face challenges accessing traditional financial institutions (Amoah et al., 2020; Yu and Ibtasam, 2018). Cobla and Osei-Assibey (2018) show that mobile money influences the financial behaviour of Ghanaian students. Therefore, understanding how saving determinants differ for mobile money users versus non-users offers a critical dimension to this Ghanaian analysis.

When we segregate the sample based on mobile money usage, a striking divergence in the role of financial literacy across the two subsamples is revealed. Among mobile money users, financial literacy demonstrates a positive and statistically significant effect on saving behaviour, suggesting that financially literate individuals who have access to mobile money platforms are more likely to engage in saving activities. This finding aligns with theoretical expectations that financial literacy enhances the effective utilization of financial technologies (Lusardi and Mitchell, 2014). Conversely, among non-users of mobile money, financial literacy shows no significant relationship with saving behaviour. This differential effect suggests that financial literacy may require complementary financial infrastructure to translate into actual saving behaviour, consistent with the literature on financial inclusion and technological adoption (Demirgüc-Kunt et al., 2017).

Educational effects also demonstrate interesting patterns across the subsamples. Among mobile money users, both primary and secondary education show positive effects on saving behaviour relative to no education, with vocational training showing the strongest effect, coefficient (0.151). In contrast, among non-users, educational attainment shows minimal effects, with no coefficient reaching statistical significance. This pattern suggests that education may interact synergistically with mobile money access to promote saving behaviour, possibly through enhanced ability to navigate digital financial platforms or increased awareness of saving opportunities (Aker and Mbiti, 2010). The differential impact of financial literacy and education also suggests that mobile money platforms may serve as complementary infrastructure that enables

these human capital investments to translate into actual financial behaviour (Mbiti and Weil, 2015).

The analysis reveals pronounced gender differences in saving behaviour, but only among mobile money users. Male mobile money users demonstrate significantly higher propensity to save, while gender shows no significant effect among non-users. This pattern suggests that mobile money platforms may either amplify existing gender disparities in financial behaviour or provide differential benefits to male users, possibly due to varying levels of technological adoption, financial autonomy, or usage patterns (Jack and Suri, 2014). For non-users, consultation on financial matters shows a positive effect, suggesting that traditional information channels may play a more crucial role in promoting saving behaviour.

Furthermore, among mobile money users, stigma demonstrates a negative and statistically significant effect, suggesting that individuals who experience social stigma may be less likely to save even when they have access to mobile money platforms. This finding may reflect broader social and psychological barriers to financial participation, surpassing stereotypical concepts like financial myopia, loss aversion, over-confidence, optimism and inattention (Karlan et al., 2014). Interestingly, among non-users, behavioural biases show no significant effects when it comes to saving, suggesting that the impact of psychological factors may be more pronounced when individuals have access to modern financial tools.

Mobile money users that have internet access have a higher propensity to save, suggesting complementarity between different forms of digital financial services. Radio access also demonstrates a positive effect, potentially reflecting the role of information dissemination in promoting financial behaviour. Among non-users, technology access variables show different patterns, with radio access showing a strong positive effect. The varying effects of technology access variables suggest that different information channels may be optimal for different population subgroups, with further implications for increased financial education as well as outreach strategies (Aker and Mbiti, 2010).

The contrasting patterns that we observe between Columns 3 and 4 highlight the complex relationship between formal financial services, mobile money adoption, and saving behaviour. This potentially alludes to different market segments that these technologies serve, rather than functioning as universal financial inclusion tools.

6.3. Education and Income Subcategorization

The results presented in Table 5 reveal compelling heterogeneous effects of financial literacy and saving behaviour across educational attainment and income strata. These findings align with the concept that financial knowledge is a form of human capital investment (Lusardi and Mitchell, 2014). Financial literacy demonstrates the strongest positive association with saving behaviour among individuals with no formal education, suggesting that rudimentary financial knowledge may be particularly valuable for those without educational credentials. This finding supports the premise that while compulsory

education generally promotes financial inclusion, the extent of its impact varies among different socioeconomic groups, with education serving different roles across demographic segments (Park and Yi, 2025). The effect remains positive but diminishes in magnitude for those with primary education and secondary education, before strengthening again among individuals with higher education. This U-shaped pattern indicates that financial literacy may serve as a compensatory mechanism for formal education in accessing financial services, while also providing additional benefits to highly educated individuals who can leverage both educational and financial knowledge.

The income-stratified analysis reveals a distinctive gradient, with financial literacy effects strongest among low-income (0.045), compared to middle- (0.039) and high-income (0.008) groups. This pattern aligns with theoretical predictions regarding optimal investment in financial human capital, where high-income individuals may already possess sufficient financial sophistication or access to professional financial services, ergo rendering additional financial literacy less effective.

Particularly interesting are the results for financial access. Banking and other formal access demonstrate substantial positive effects across all educational categories except higher education. This progression suggests that formal financial access becomes less constraining as educational attainment increases, possibly due to enhanced ability to navigate financial systems and access alternative financing channels. Similar results are seen in the income-based analysis, indicating that formal financial access does not drive the saving behaviour as much for higher-income individuals than for low- and middle-income individuals.

Variables representing behavioural biases reveal nuanced patterns consistent with established research on financial decision-making heuristics (Almansour et al. 2023, Kahneman et al. 1982, Pompian 2015, Tversky and Kahneman 1974). Trust effects vary significantly across subgroups, with negative impacts observed across all strands of income and largely across education groups. These effects however, except in the case of secondary education subgroup, have been statistically insignificant. Stigma effects demonstrate negative associations with saving behaviour primarily among all education subgroups, as well as low- and high-income individuals. The particularly strong negative effect (-0.283) among high-income individuals suggests that social perceptions regarding financial assistance or certain financial products may create barriers even for those with substantial resources.

The demographic control variables reveal consistent age effects across most subgroups, with positive linear relationships and negative quadratic terms suggesting optimal ages for financial engagement that vary by educational and income levels. The gender variable shows limited significant effects, appearing only for individuals with no education and low-income, suggesting that gender disparities in financial outcomes may be most pronounced at the educational and income extremes. Access to reliable electricity is a significant driver of saving only for the higher education subgroup. The effect of radio and internet access is largely homogenous across subgroups, with particularly pronounced positive effects for individuals with secondary school level education, and low- and middle-income groups, suggesting that digital financial services

may be most beneficial for those with intermediate educational attainment and lower income levels.

Table 5. Education and Income Subgroups

	Education			
	(1)	(2)	(3)	(4)
VARIABLES	None	Primary	Secondary	Higher
Financial Literacy	0.102**	0.038	0.013	0.085*
	(0.050)	(0.050)	(0.025)	(0.049)
Financial Access (ref: Excluded)				
Banked	0.642***	0.870***	0.722***	
	(0.101)	(0.141)	(0.123)	
Other Formal	0.402***	0.652***	0.408***	
	(0.098)	(0.133)	(0.124)	
Informal		0.260		
		(0.198)		
Behavioural Biases				
Trust	-0.028	0.061	-0.059*	0.011
	(0.051)	(0.062)	(0.031)	(0.062)
Stigma	-0.013	-0.217**	-0.080	-0.048
	(0.079)	(0.095)	(0.054)	(0.151)
Male	0.078**	0.072	0.031	0.038
	(0.039)	(0.047)	(0.021)	(0.034)
Age	0.008	0.003	0.005	0.006
	(0.006)	(0.009)	(0.004)	(0.009)
Age Squared	-0.000	0.000	-0.000	-0.000
	(0.001)	(0.001)	(0.000)	(0.000)
Education (ref: No Education)				
Primary				
Secondary				
Vocation				
Tertiary				
Housing Quality (ref: Poor and Fair)				
Good	-0.027	0.067	0.053	-0.010
	(0.045)	(0.080)	(0.040)	(0.089)
Excellent	0.032	0.086	0.062*	-0.089
	(0.048)	(0.089)	(0.038)	(0.088)
Electricity Access	0.036	-0.043	-0.000	0.114**
	(0.041)	(0.054)	(0.023)	(0.041)
Radio Access	0.051	0.077	0.084***	-0.008
	(0.037)	(0.051)	(0.022)	(0.043)
Internet Access	0.111*	0.083	0.101***	0.030
	(0.066)	(0.066)	(0.023)	(0.054)
Consulted on Financial Matters	0.003	0.006	0.012	0.007
	(0.034)	(0.045)	(0.020)	(0.042)
Controls	Yes	Yes	Yes	Yes
Observations	771	471	2,218	361

Note: Cluster-robust standard errors in parentheses ***p<0.01, ** p<0.05, * p<0.1.

Table 5. Education and Income Subgroups (cont')

		Income	
	(5)	(6)	(7)
VARIABLES	Low	Middle	High
Financial Literacy	0.045*	0.039	0.008
	(0.026)	(0.027)	(0.054)
Financial Access (ref: Excluded)			
Banked	0.846***	0.631***	0.116**
	(0.083)	(0.144)	(0.055)
Other Formal	0.550***	0.361**	
	(0.083)	(0.144)	
Informal	0.195		
	(0.132)		
Behavioural Biases			
Trust	-0.044	-0.021	-0.029
	(0.033)	(0.031)	(0.077)
Stigma	-0.136**	0.078	-0.283**
	(0.053)	(0.063)	(0.144)
Male	0.068***	0.032	0.076
	(0.022)	(0.024)	(0.051)
Age	0.006*	0.004	0.006
	(0.004)	(0.004)	(0.010)
Age Squared	-0.000	-0.001	-0.000
	(0.000)	(0.001)	(0.000)
Education (ref: No Education)			
Primary	0.056*	0.077*	0.008
	(0.034)	(0.044)	(0.105)
Secondary	0.116***	0.071**	0.022
	(0.029)	(0.036)	(0.086)
Vocation	0.232***	0.101	0.077
	(0.074)	(0.063)	(0.111)
Tertiary	0.060	0.101	0.132
	(0.074)	(0.055)	(0.127)
Housing Quality (ref: Poor and Fair)			
Good	0.064*	-0.051	0.073
	(0.037)	(0.041)	(0.060)
Excellent	0.090**	-0.017	
	(0.036)	(0.041)	
Electricity Access	-0.011	0.025	-0.041
	(0.025)	(0.022)	(0.058)
Radio Access	0.067***	0.070**	0.051
	(0.022)	(0.025)	(0.073)
Internet Access	0.064**	0.106***	0.088
	(0.026)	(0.027)	(0.054)
Consulted on Financial Matters	0.018	-0.025	0.180***
	(0.021)	(0.025)	(0.060)
Controls	Yes	Yes	Yes
Observations	2,234	1,420	236

Note: Cluster-robust standard errors in parentheses ***p<0.01, ** p<0.05, * p<0.1.

These differential effects have important implications for targeted financial education interventions. The evidence suggests that universal financial literacy programs may be suboptimal, with patterns of vulnerability among specific population subgroups requiring tailored approaches (Lusardi, 2019). For individuals with limited formal education and/or low-income, basic financial literacy appears to provide substantial benefits. The behavioural bias patterns indicate that interventions should incorporate decision-making frameworks that account for the differential susceptibility to trust and stigma effects across educational and income levels.

6.4. Regional Segregation

To understand regional wealth, we looked at the percentage of individuals in each region that fell into the high-income category, in order to segregate the 10 regions into 3 tiers of wealth. The low-wealth regions include Northern, Brong-Ahafo, Upper East and Eastern. The medium-wealth regions include Volta, Western and Central. The high-wealth regions include Greater Accra, Upper West and Ashanti.

The most striking finding concerns the concentration of financial literacy effects in low-wealth regions, where the coefficient reaches 0.122, while showing negligible and statistically insignificant effects in medium- and high-wealth areas. This pattern aligns with Lusardi and Mitchell (2014)'s theoretical framework suggesting that financial literacy has diminishing marginal returns in environments where financial markets are already well-developed and accessible. The result supports the financial literacy gap hypothesis proposed by (Klapper et al., 2013), which suggests that basic financial knowledge becomes increasingly critical in resource-constrained environments where individuals face greater financial vulnerability and have fewer institutional safeguards to protect them from poor financial decisions.

The banking access results demonstrate a clear gradient effect across wealth categories, with coefficients for formal banking remaining remarkably consistent (0.755, 0.805, 0.768 for low-, medium-, and high-wealth regions, respectively). This finding contradicts the financial access saturation hypothesis and instead supports Beck, Demirgüc-Kunt and Levine (2007)'s argument that formal financial services maintain their developmental impact even in relatively wealthy contexts. The consistency of these effects suggests that formal banking infrastructure continues to provide substantial benefits across all development contexts, possibly through different mechanisms, risk management and credit access in poor regions, versus investment and wealth accumulation opportunities in wealthier areas.

The "Other Formal" financial services category shows an interesting inverted-U pattern, suggesting that alternative formal financial mechanisms may serve as complements rather than substitutes to traditional banking. This finding is consistent with the financial ecosystem approach advocated by (Demirgüc-Kunt and Klapper, 2013), which 46haracteri the importance of diverse financial service providers in creating robust financial systems. The stability of these coefficients across wealth

categories indicates that non-bank formal financial services provide consistent value regardless of regional economic development levels.

Table 6. Region Wealth

VARIABLES	(1) Low	(2) Middle	(3) High
Financial Literacy	0.122***	0.007	0.004
	(0.030)	(0.038)	(0.030)
Financial Access (ref: Excluded)			
Banked	0.755***	0.805***	0.768***
	(0.058)	(0.046)	(0.036)
Other Formal	0.476***	0.486***	0.481***
	(0.058)	(0.042)	(0.035)
Informal	0.162	0.063	
	(0.109)	(0.104)	
Behavioural Biases			
Trust	-0.029	0.007	-0.058
	(0.038)	(0.039)	(0.037)
Stigma	-0.021	-0.069	-0.089
	(0.058)	(0.059)	(0.092)
Male	0.045*	0.024	0.063***
	(0.025)	(0.035)	(0.022)
Age	0.010**	0.006	-0.000
	(0.004)	(0.005)	(0.004)
Age Squared	-0.000**	-0.000	0.000
	(0.000)	(0.000)	(0.000)
Education (ref: No Education)			
Primary	0.046	0.170***	-0.008
	(0.042)	(0.054)	(0.041)
Secondary	0.132***	0.181***	0.008
	(0.035)	(0.043)	(0.037)
Vocation	0.196**	0.332***	0.047
	(0.092)	(0.094)	(0.063)
Tertiary	0.101	0.256***	0.048
	(0.077)	(0.091)	(0.064)
Housing Quality (ref: Poor and Fair)			
Good	-0.024	0.034	0.090
	(0.037)	(0.049)	(0.057)
Excellent	0.012	0.045	0.093
	(0.037)	(0.047)	(0.060)
Electricity Access	0.051*	-0.031	-0.005
	(0.028)	(0.029)	(0.031)
Radio Access	0.044	0.021	0.108***
	(0.031)	(0.031)	(0.025)
Internet Access	0.057**	0.084**	0.102***
	(0.031)	(0.034)	(0.028)
Consulted on Financial Matters	0.018	-0.019	0.020
	(0.026)	(0.031)	(0.026)
Controls	Yes	Yes	Yes
Observations	1,451	993	1,536

Note: Cluster-robust standard errors in parentheses ***p<0.01, ** p<0.05, * p<0.1.

7. CONCLUSION

Our findings indicate that financial literacy significantly influences saving behaviour, revealing heterogeneous impacts across demographic subgroups, particularly among gender and education dimensions. Regional 48haracterize48n offers interesting insight into discrepancy across financial literacy and the role that both education and behavioural biases play in the paradigm under examination. Through the application of a comprehensive three-component framework for financial inclusion, we establish credible causal identification of financial literacy effects while simultaneously accounting for the broader dimensions of financial inclusion that 48 haracterize developing economy contexts. Our analytical approach yields several important empirical and policy contributions that challenge conventional approaches to financial inclusion.

The disaggregation of financial inclusion into distinct, measurable components, demonstrates that these dimensions operate through different mechanisms in influencing saving behaviour, with limited complementarity observed between components. This finding challenges the conventional wisdom of pursuing broad-based financial inclusion strategies and instead supports the efficacy of targeted policy interventions tailored to address specific dimensional weaknesses within the financial system.

These empirical results offer particularly timely insights for Ghana's implementation of the National Financial Inclusion and Development Strategy, which was ongoing during the time of data collection in 2021. As policymakers grapple with persistent challenges, including pronounced regional disparities in financial access and persistently low levels of financial literacy across demographic groups (Ofori-Acquah et al., 2023), our findings provide an evidence-based foundation for strategic adjustments. Documented heterogeneous effects across population subgroups underscore the necessity of differentiated policy approaches that move beyond one-size-fits-all interventions toward more nuanced, demographically informed strategies. These policies should particularly focus on the need for the intersection of educational attainment and economic resources. Financial education programmes should be targeted at low-income individuals and/or individuals with little to no education, where the effect of financial literacy on saving behaviour is especially pronounced. While the saving behaviour of males is particularly responsive to financial literacy, early childhood intervention for females would massively reshape their role in later life household financial management (Fuseini et al., 2019). This allows for the shift in attitudes towards gender parity on both the micro as well as macro level, improving both household power dynamic and national financial standards.

This paper also contributes to the expanding literature on financial inclusion in developing economies by demonstrating the analytical value of decomposing financial inclusion into constituent components. The three-component framework developed in this study offers a replicable methodological approach that can inform similar

investigations across diverse set of developing (with especial accentuation on African) economies. Our regional subsample analysis reveals that the relationship between saving behaviour and its determinants is highly context-dependent, varying significantly across regional wealth levels in ways that challenge both theoretical predictions and conventional policy wisdom. This is particularly apparent in regions with very low or very high concentration of wealth, underscoring the importance of tailored interventions that account for local economic conditions and development levels. This highlights the need for more nuanced empirical frameworks that can accommodate complex, non-linear relationships observed across different development contexts.

Several promising avenues for future research emerge from our analysis. Longitudinal studies examining the dynamic relationships between financial inclusion components over time would enhance our understanding of how these dimensions evolve and interact as financial systems mature. The extension of our analytical framework to other Sub-Saharan African economies would provide valuable insights into the generalisability of our findings. Also, this will allow for the robustness of our three-component approach across different institutional and economic environments to be tested. The heterogeneity in effects across wealth categories suggests that future research should move beyond average treatment effects to explore the conditional nature of financial inclusion interventions and their varying impacts across different economic environments. Investigating the welfare implications of targeted versus overarching financial inclusion strategies represents a particularly promising area for policy-oriented analysis.

Lastly, we provide policymakers with actionable evidence for designing more effective financial inclusion interventions while contributing to the academic discourse on the mechanisms through which financial systems influence household economic behaviour in developing economies. The evidence bolsters a shift toward more targeted, context-sensitive approaches that recognise the complex interplay between financial literacy, demographic characteristics, and local economic conditions in shaping saving behavioural profiles.

APPENDIX

This appendix assesses the validity of RFL and demonstrates the importance of selecting the appropriate spatial unit when using spatial instruments in the IV approach.

A1. Current IV Literature and Our Hypothesis

Askar et al. (2020) and Murendo and Mutsonziwa (2017) state that RFL is a valid instrument for financial literacy in Indonesia and Zimbabwe, respectively, without substantial supporting evidence[7].

Morgan and Long (2020) claimed to replicate the approach of Murendo and Mutsonziwa (2017) by using RFL in their analysis of data from Laos. In the nutshell, what they have actually implemented was the District Average Financial Literacy (DFL). There is a critical difference between regional and district averages. In particular, Laos'148 districts are subsets of its 18 regions (provinces) (Lao Statistics Bureau, 2025), indicating a non-trivial divergence in the spatial aggregation of the instrument.

Recent literature has raised concerns that spatial instruments may violate the exclusion restriction due to spillovers, simultaneity, or interdependence (Betz et al., 2018). While spatial instruments (RFL and DFL, for example) are conventionally accepted on theoretical grounds, we extend the concerns raised by Betz et al. (2018) to argue that the exogeneity assumption is, in fact, contingent on the spatial unit of the instrument.

Specifically, we posit that the exogeneity justification for DFL is less plausible than for its regional analogue (RFL), compromising the credibility of Morgan and Long (2020)'s IV estimates, if untested. The rationale is that DFL (defined at a finer spatial level than RFL) is more likely to be correlated with unobserved district-level factors, beyond financial literacy, that directly influence saving behaviour. Smaller spatial units (districts) mean that local economic shocks, proximity to financial institutions or financial norms of the community (Agyei, 2018), may simultaneously affect the average financial literacy (the instrument) and the individual saving decision (the outcome) through channels that are not mediated by individual financial literacy. In contrast, more aggregated instruments (RFL) tend to somewhat average out local heterogeneities, reducing the likelihood of direct effects on saving behaviour, as noted by Bayer et al. (2008).

A2. Notation

We evaluate three spatial defined instruments for financial literacy, collectively referred to as Spatial Average Financial Literacy (SFL) measures:

(1) RFL: Regional Average Financial Literacy (used in this study)

(2) DFL: District Average Financial Literacy (used in Morgan and Long (2020))

(3) LFL: Locality Average Financial Literacy (the most disaggregated spatial unit available)

All SFLs are constructed analogously to $RFL_{i,r(i)}$, using the leave-one-out approach discussed in Section 5.3.1, but averaged over their respective spatial units. Generalising the notation, let $SFL_{i,s(i)}$ denote the spatial average financial literacy (RFL, DFL, LFL) for spatial unit s, excluding individual i. To account for unobserved spatial

[7] Askar et al. (2020) do provide some overidentification results.

heterogeneity at the same level as the instrument, each $SFL_{i,s(i)}$ is estimated alongside fixed effects, $\theta_{s(i)}$, at the corresponding spatial level, s. This specification absorbs any spatially correlated omitted variables which would otherwise violate the exclusion restriction and bias the instrument (e.g., when DFL is the instrument, district fixed effects have been used) (Gibbons et al., 2015).

A3. Testing

The auxiliary evidence framework is established to test and verify our hypothesis that regional average financial literacy was the correct spatial unit to be used as a valid instrument. A diagram is presented below, which shows the process of elimination approach to identifying the correct spatial instrument.

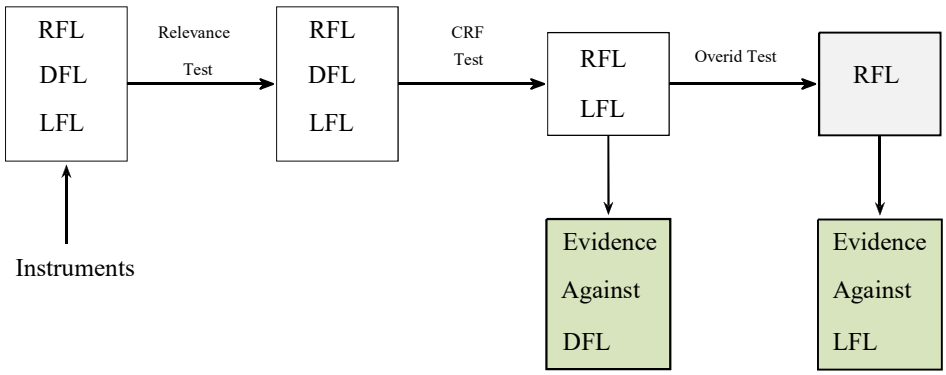


Figure A1. Auxiliary Evidence Framework: Application

A1.1 Relevance

The relevance condition is formally tested using first-stage diagnostics. The first stage regression is specified as:

$$FL_i = \delta + \pi SFL_{-i,s(i)} + C_i'\phi + \nu_i. \quad \text{(A1)}$$

Since the dependent variable is bounded by construction, $FL_i \in [1,3]$, and is relatively normally distributed within the bounds (shown in Figure A2), ergo allowing us to estimate the first-stage regression using OLS.

The relevance condition for all spatial instruments is strongly supported by comprehensive empirical evidence that the instrument is highly predictive of financial literacy. It also proven not to be weak under any conventional definition. The Cragg Donald Wald F-Statistic for RFL (10,000), DFL (4162) and LFL (11,000) far exceeds

the Staiger and Stock (1994) rule of thumb (F-statistic >10) and the Stock-Yogo 10% maximal IV bias critical value, confirming that the instrument is not weak at the 10% bias threshold.

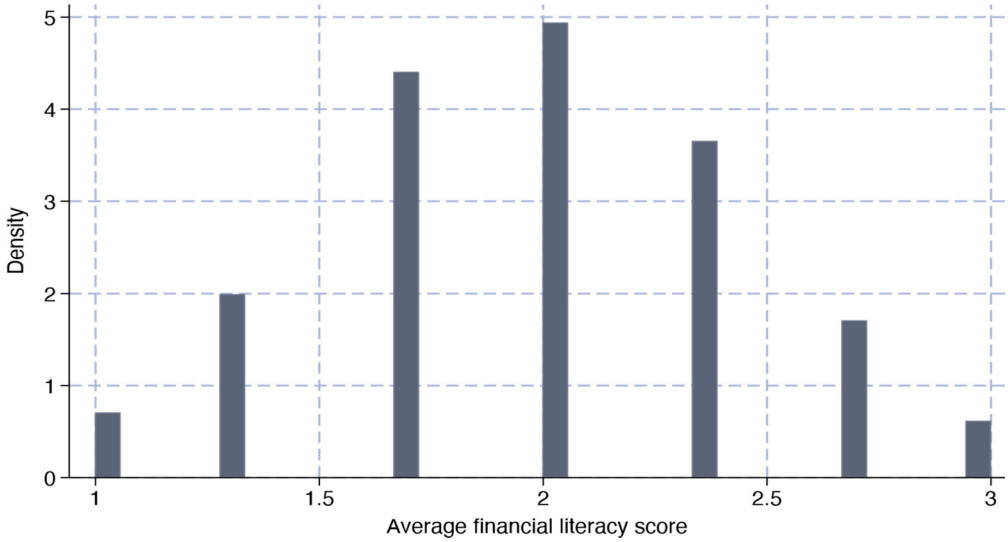


Figure A2. Financial Literacy Distribution

Further correlation analysis confirms our hypothesis that peer effects influence individual's financial literacy. As expected, our results in Table A1 show that the smaller the spatial unit is, the stronger is the effect observed.

Table A1. Pairwise Correlations

Pairwise Corr	RFL	DFL	LFL
FL	0.2815	0.3653	0.4247

A2.2. Controlled Reduced-Form[8]

Following the approach of Morgan and Long (2020) we test for correlation between the instrument and the dependent variable re-estimating Equation (3), controlling for the

[8] To the best of our knowledge, this test is undefined so the name was appropriately selected by the authors.

$SFL_{i,s(i)}$[9]:

$$Saving_i = \alpha + \beta_1 FL_i + \pi SFL_{-i,s(i)} + C_i'\phi + \epsilon_i. \quad \text{(A2)}$$

Table A2 shows that both RFL and LFL have statistically insignificant effect on saving, which does not flag a potential exclusion restriction violation. However, DFL has a statistically significant effect on saving behaviour when financial literacy is controlled for, suggesting that the instrument may directly influence the outcome variable through channels other than financial literacy (Morgan and Long, 2020). This indicates a potential violation of the exogeneity assumption. Despite Morgan and Long (2020) performing this analysis to justify the exogeneity of another instrument used, the authors did not report their results for the instrument in question, namely DFL.

The VIFs reported in the table indicate severe multicollinearity in the regionally defined model. This could lead to false confidence in exogeneity, rendering further testing mandatory.

Table A2. Controlled Reduced-Form

	(1)	(2)	(3)
VARIABLES	Regional	District	Locality
FL	0.049	0.015	0.120***
	(0.031)	(0.026)	(0.039)
RFL	3.501		
	(9.772)		
DFL		-1.063***	
		(0.357)	
LFL			0.268
			(0.257)
Observations	3,984	3,982	3,979
Mean VIF	1767.18	6.60	4.21
Instrument VIF	43850.64	148.12	114.04

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Estimated with OLS.

A2.3. Overidentification Tests

Figure A1 illustrates that previous stages of auxiliary evidence have not refuted either RFL or LFL as a valid instrument.

To formally test for joint instrument validity via overidentification tests, we used survey data to generate a potential instrument candidate, the Denial of Access to

[9] Note that this is equivalent to a reduced-form regression, controlling for FL_i.

Educational Opportunities (DAEO). Using DAEO as an instrument is an effective way to encompass the past (involuntary) exposure to mandated financial education (Kaiser and Lusardi, 2024). Formal education is a primary determinant of financial knowledge (Lusardi and Mitchell, 2014) and generally, education-based instruments yield convincing results (Behrman et al., 2010). This instrument captures barriers to education; not individual characteristics. Unlike actual education attainment, which may reflect intellectual capabilities or household socioeconomic status, perceived denial reflects external constraints such as school provision, gender discrimination, regional disparities. These external factors do not directly affect saving behaviour beyond their influence on financial literacy, rendering the instrument exogenous.

Assuming DAEO to be a valid instrument, we conduct overidentification tests, presented in the Table A3, which outlines the Sargan Test p-values from TSLS estimation for the instrument combination of DAEO and both RFL (Column 1) and LFL (Column 2).

Table A3. Overidentification Tests

	(1)	(2)
TEST	DAEO and RFL	DAEO and LFL
Sargan Test (p-value)	0.6139	0.0546
Cragg-Donald Wald F-Stat	5269.142	5424.425

For RFL, we fail to reject the null hypothesis that the overidentifying restrictions are valid. On the other hand, for LFL, we reject the null hypothesis at the 10% significance level, suggesting LFL invalid. The Cragg-Donald Wald F-statistics are reported for both pairs of instruments to confirm the reliability of these tests.

Finally, we conclude that RFL is therefore uncorrelated with the error term, providing strong evidence in support of RFL as a valid instrument.

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