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Financial Technology, Financial Inclusion & Household Consumption in Ethiopia

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Abstract

Using Ethiopian Scio-economic household survey data collected in 2018/2019 (ESS4), this study investigates the potential effect of FINTECH and financial inclusion on household consumption using Simultaneous Quantile Regression (QREG).The findings indicate that financial inclusion indicators (bank account holding, formal saving, and formal insurance) positively and significantly influence household consumption especially for low and middle income households while wealthier households will benefit from informal social group insurance (Iddir). Findings in heterogeneity analysis reveal that FINTECH has different levels of influence across regions and urban rural locations. Gender interaction reveals that women benefit more from FINTECH at higher income levels. Younger FINTECH customers, particularly those in higher consumption categories, benefit more, but elderly users may struggle to fully utilize FINTECH services. FINTECH and financial inclusion are also complemented by education. Rural households spend less than urban households as per expectations. They also benefit less from FINTECH than their urban counterparts. Finally, the study suggests that both financial inclusion and FINTECH access should be promoted to enhance the household consumption and welfare in Ethiopia.

Keywords: FINTECH, Financial Inclusion, Household Consumption, Simultaneous Quantile Regression

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Introduction

Financial Technology (FINTECH) refers to the use of digital innovations in financial intermediation (Arner et al., 2015) . It includes firms leveraging technology to enhance financial services and systems (World Bank, 2016), providing households with real-time control over finances (Brainard, 2016). As digital tools rapidly expand, there is increasing interest in whether FINTECH improves financial inclusion and welfare, especially for underserved populations. One of FINTECH's core promises is to ease credit constraints by lowering transaction costs and addressing information asymmetries (Demertzis et al., 2018; Heiskanen, 2017). Mobile technologies, particularly in areas with weak financial infrastructure, have become crucial in broadening access. Mobile payment systems are safer, faster, and more convenient, accelerating the shift from cash-based to digital transactions (GSMA, 2017; Rosenberg, 2006). In Kenya, platforms like M-PESA have increased household spending and reduced poverty, especially among women (Suri & Jack, 2016). In countries like China and across Sub-Saharan Africa, digital platforms have improved consumption by reaching unbanked populations (Agarwal & Chua, 2020; J. Liu et al., 2023).

Ethiopia represents a country where formal financial inclusion remains limited. In 2017, only 35% of adults owned a bank account, and fewer accessed savings, credit, or insurance services (World Bank's Global Findex Database, 2017). This restricts households' ability to manage risk and consumption. However, mobile phone penetration presents new opportunities. Recognizing this, Ethiopia introduced major reforms. In 2022, it allowed foreign firms to operate in the digital finance sector to encourage competition and innovation (National Bank of Ethiopia, 2022). Local platforms like Telebirr and Kacha have emerged, and national strategies such as the Digital Payments Strategy and NFIS aim to expand services, particularly in rural areas. These efforts have raised account ownership from 22% in 2014 to 46% in 2022, with a target of 70% by 2025 (World Bank, 2022).

Still, many challenges remain. Despite improvements in mobile banking and agent networks, disparities persist. Women's account ownership (39%) lags behind men's (55%), and over 75%

of rural areas lack reliable financial access (World Bank, 2022). Key barriers include poor network infrastructure, low digital literacy, and limited mobile ownership (Ethio Telecom., 2023) . Other obstacles include low income, high device costs, and unreliable electricity, which disproportionately affect rural households (Demirgüç-Kunt et al., 2018; World Bank, 2022). Cultural and social norms also shape financial behavior. Many Ethiopians depend on informal financial systems like Iqub and Iddir (community-based savings and insurance groups) due to their accessibility and trustworthiness (Aredo, 2010; World Bank, 2018) . These systems remain vital in rural and low-income communities.

FINTECH can alleviate liquidity constraints by improving access to credit and savings, thereby smoothing household consumption amid income shocks. In other developing economies, such as China, digital finance has increased household spending and reduced inequality (Lai et al., 2020). While Ethiopia's context differs, similar mechanisms may arise through mobile money and digital payment platforms. Digitized social protection programs like Ethiopia's Productive Safety Net Program have already improved household welfare by enabling timely and secure fund delivery(World Bank, 2020) . Nonetheless, FINTECH's inclusive potential remains limited by digital and financial illiteracy. Awareness and competence gaps mainly among women and low-income groups undermine adoption (UN Women, 2021). Without targeted efforts, such as literacy campaigns and affordability measures, FINTECH may reinforce rather than reduce inequality (GSMA, 2023).

Despite the growing relevance of digital finance, few empirical studies investigate its effect on household consumption in Ethiopia. Most are descriptive or lack micro-level evidence. This study addresses that gap using nationally representative data from the Ethiopian Socioeconomic Survey Wave 4 (ESS4). It explores how FINTECH and financial inclusion affect household consumption and how these effects vary by gender, age, education, and location. This study makes three contributions. First, it provides micro-level empirical evidence on the relationship between FINTECH and household consumption in Ethiopia. Second, it assesses how formal financial inclusion measured by access to accounts, savings, credit, and insurance—influences

consumption behavior. Third, it investigates heterogeneous effects across different demographic groups. To the authors' knowledge, this is the first such analysis for Ethiopia using representative household data.

Literature Review

Theoretical Literature Review

Conditioning Theory suggests that frequent use of FITNECH as measured by mobile payments creates a strong connection between payment behaviour and consumption. As consumers adapt to mobile payments, this method becomes a cue that activates purchase intentions, enhancing consumption behaviour (Boden et al., 2020; Feinberg, 1986; Y. Liu et al., 2021). On other hand, the Pain of Paying Theory, proposed by (Zellermayer, 1996), explains the negative emotional response consumers experience when making payments. Mobile payments, unlike cash, reduce the "pain" of spending since they don't involve physical currency or a clear loss of money. This lessens the emotional discomfort of spending, potentially increasing consumer purchases(Prelec & Loewenstein, 1998; Quispe-Torreblanca et al., 2019).

Building on the Pain of Paying Theory and Double-Entry Mental Accounting Theory (Prelec & Loewenstein, 1998) posits that consumer decisions are shaped by a balance between the pleasure of consumption and the pain of paying. The theory suggests that while the pain of paying can diminish satisfaction, anticipating the benefits of consumption can buffer this pain. Consumers maintain two "accounts" in their minds: one for the joy of consumption and one for the pain of payment. The net utility is determined by the balance between these two (Morewedge et al., 2007).

Empirical Literature and Research Hypothesis

FINTECH and Household Consumption: FINTECH adoption, particularly through mobile payments, can increase household consumption by lowering transaction costs and increasing financial inclusion, particularly in underserved areas (Durai & Stella, 2019; T. Yang & Zhang, 2022). According to prior research, mobile payments can increase rural household consumption by reducing credit constraints and improving spending behaviour (Yang et al., 2022). However, some research indicates that FINTECH may not always smooth consumption, particularly when

access is uneven (Ahmad et al., 2020; J. Li et al., 2020a). Furthermore, mobile payments alleviate the psychological pain of spending, encouraging increased consumption (Thaler, 1980). Lower income households benefit the most from FINTECH, as studies show that digital finance promotes consumption through online shopping payments, and loans (Grossman & Tarazi, 2014; J. Li et al., 2019).

Hypothesis 1 (H1): There is a positive and significant relationship between mobile payments and household consumption.

Financial Inclusion and household Consumption: Financial inclusion and household consumption continue to have a mixed connection. Some research demonstrate that increased access to financial services increases household expenditure, particular beyond fundamental needs, while others show little or no impact (Burgess & Pande, 2005; Chakrabarty & Mukherjee, 2022a). Financial inclusion can diversify consumption patterns, stabilize consumption during shocks, and stimulate savings, but its impact differs depending on income, education, and financial literacy(Chakrabarty & Mukherjee, 2022a; Sakyi-Nyarko et al., 2022). Furthermore, research suggests that formal financial inclusion has a greater impact on consumption than informal financial access (Abokyi & Bettin, 2025).

Hypothesis 2 (H2): There is a positive and significant relationship between financial inclusion and household consumption.

Heterogonous Effects of FINTECH on Household Consumption

Heterogeneity across Urban-Rural and Regional Situations is that the effect of FINTECH integration on consumption varies from region to region, while urban areas stand to benefit most from enhanced infrastructure and higher penetration levels of technology (Z. Huang et al., 2023; J. Luo & Li, 2022). There is a scarcity of internet in rural locations as well as inadequate infrastructure, thus reducing FINTECHs' influence (T. Yang & Zhang, 2022). The Age heterogeneity implies that FINTECH adoption has a stronger impact on consumption by younger household heads, which are more technologically advanced and credit-restricted. Digital finance is less likely to be taken up by older household heads and has a weaker impact on their consumption (Jiang et al., 2024; T. Yang & Zhang, 2022). Gender Heterogeneity illustrates that

gender disparities in financial inclusion have a pronounced impact on consumers' behaviour. Women in poorer countries face a higher number of access barriers to consumption (Ghosh & Vinod, 2017). In addition to these, education heterogeneity indicates that increased levels of education lead to wider usage of mobile payments, especially in rural parts of the population. Education bridges the digital divide, increasing access to financial services and rising consumption (Amin-Smith & Attanasio, 2020; X. Yang et al., 2022).

Hypothesis 3 (H3): The effect of FINTECH on consumption varies by gender, urban-rural location, education, and age.

Conceptual Model:

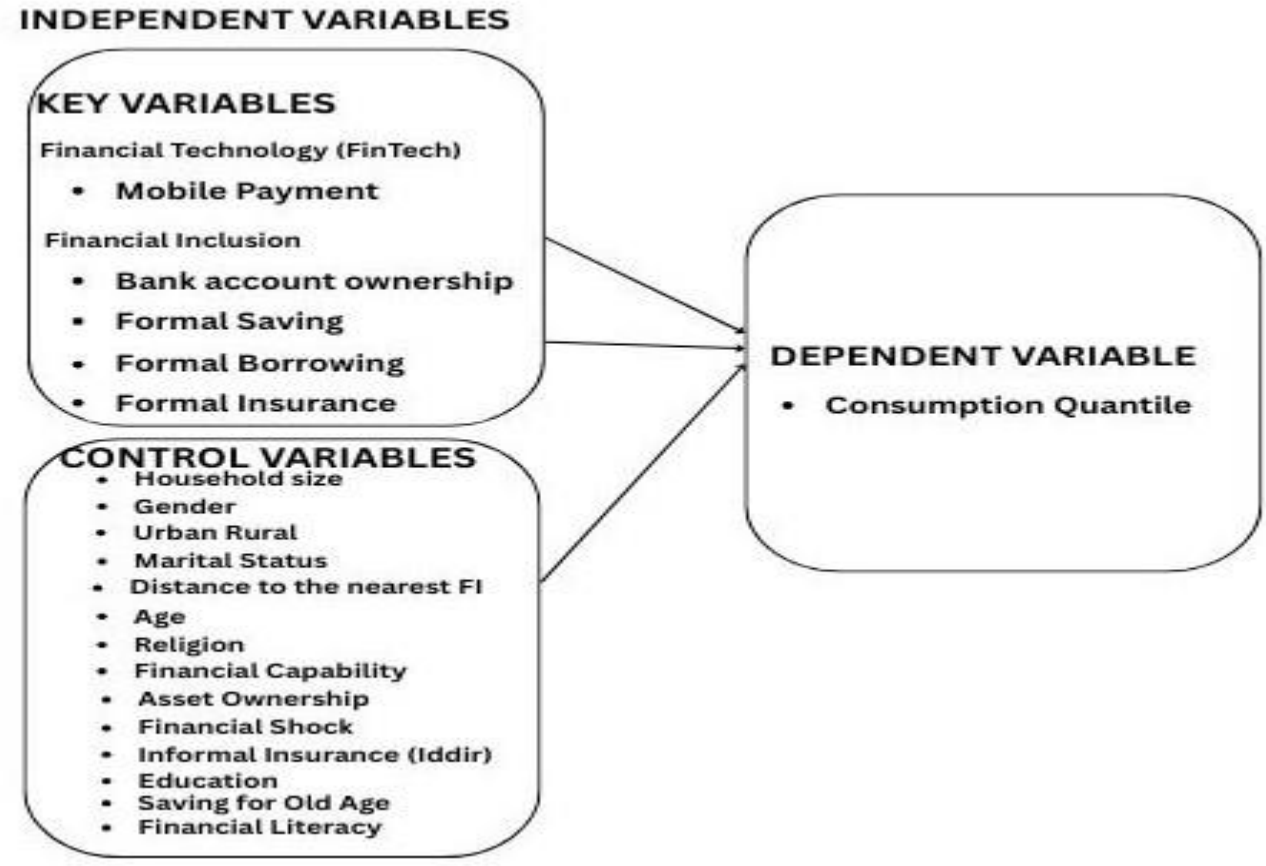

Fig. 1 **Conceptual Model (Designed by Authors)**

Research Methods

Data Source

The unit of analysis for our study are household heads (both male & female) residing both in rural and urban area of 9 regions and two city administrations namely Afar, Tigray, Amhara, Oromia, Gambella, Benishangul Gumuz, Somali, SNNP, Harrai , Dire Dawa and Addis Ababa. To achieve the objective of the study, the data was obtained from the 2018/ 2019 Ethiopian Socio- Economic Survey wave4 (ESS4) (https://microdata.worldbank.org/index.php/ catalog /3823) . It is a household survey conducted by the Central Statistics Agency (CSA) of Ethiopia and the World Bank as part of the Living Standards Measurement Study. ESS4 is conducted in 565 EAs (Enumeration Areas) of which 316 are rural and 219 are urban. ESS4 planned to interview 7,527 households from 565 enumeration areas (EAs) (Rural 316 EAs and Urban 249 EAs). Households that total 6770 from 535 EAs participated in the interview for both the agriculture and household modules. Because of security related reasons the household module was not implemented in 30 EAs. A random sample of 4,498 of household heads was included (67%) in our study after managing missing values. Missing values were treated using mean imputation (for the continuous variable distance to the nearest financial institution) and mode imputation (for a binary variable education). The total imputation rate is less than 5% which is acceptable in most research writings.

Description of Variables

Dependent Variable

Consumption Quantile is a dependent variable in the Quantile Regression (QREG) model and log of consumption is a dependent variable in Ordinary Least Square (OLS) model. Considering the possible non-normality of the dependent variable in OLS model, it was transformed into to logarithms in the regression. In the process, potential outliers were managed in that 9 upper outliers and 3 lower outliers were deleted.

Key explanatory variable

The key explanatory variables are FINTECH and Financial Inclusion. FINTECH is measured by mobile phone to pay bills (Demir et al., 2022; Gosavi, 2018; Iddrisu et al., 2022; Kedir & Kouame, 2022 ; Mbiti & Weil, 2015) and financial inclusion is proxied by bank account holding

, formal saving, formal borrowing and formal Insurance (Demir et al., 2022). Region is used as regional dummy to look into regional variations in assessing the effect of FINTECH and financial inclusion on consumption.

Control variables

Demographics are usually seen as major elements influencing consumption (Jiang et al., 2024; J. Li et al., 2020b; J. Liu et al., 2023). Household head demographic and socio-economic characteristics include: age , gender, education , marital status , Urban -Rural residence , financial literacy , financial capability , and household size . Considering the risk attitude of the household head, financial shocks and Iddir are included in the study. As household resource variable, asset ownership is also included.

Table 1: Variable lists and their Definitions

Variable Name	Type	Definition
Consumption Quantile	Continuous	Annual total Consumption divided in to five equal parts. Each Quantile represents 20% of the data.
FINTECH	Binary	=1 if the household head uses mobile phone to pay bills , 0 if otherwise
Formal Insurance	Binary	=1 if the household head uses formal insurance , 0 if otherwise
Formal Saving	Binary	= 1 if the household head is saving in any way , if otherwise
Formal Borrowing	Binary	= 1 if the household head borrowed at least 150 birr , 0 if otherwise
Bank Account Ownership	Binary	=1 if the household head opened an account at formal financial institution , 0 if otherwise
Household Size	Continuous	Number of individuals living in the household
Age	Continuous	Age of the household ranging from 17 to 99
Marital Status	Binary	=1 if the household head is married, 0 if single
Financial Literacy	Binary	=1 if the household head knows how to open bank accounts , 0 if otherwise
Gender	Binary	=1 if the individual in the household is male , 0 if the individual in the household is female
Urban - Rural Residence	Binary	=1 if the household head lives in Rural area, 0 if the household head lives in Urban area

Financial shock	Binary	= if the household head is worried about being able to cover unexpected expenses , 0 if otherwise
Education	Binary	=1 if the household head has ever attended any school , 0 if otherwise
Asset Ownership	Binary	=1 if the household owns asset exclusively or jointly, 0 if otherwise
Religion	Binary	= 1 if the household is Christians and others , 0 if Muslims
Saving for old Age	Binary	=1 if the households saves for the old age , 0 if Otherwise
Region	Categorical Or Polychotomous	To measure heterogeneity in use of FINTECH and Financial Inclusion for promoting consumption (i.eTigray, Afar, Amhara, Oromia, Somali., SNNP, Gambella ,Harrai , BenishangulGumuz , Addis Ababa &DireDawa)

Model Selection and Robustness

The selection of the appropriate model for the analysis was made by comparing Ordinary Least Square (OLS) to Simultaneous Quantile Regression (QREG). That was because Simultaneous Quantile regression offers various advantages when dealing with heterogeneous data or when seeking insights beyond the mean. OLS estimates the mean relationship between predictors and the dependent variable, while Quantile regression allows for the estimation of effects at various points (Quantiles) in the distribution. It also provides a more comprehensive understanding of the data (Koenker, 2005). Quantile regression is stronger for outliers and non-normality. It also delivers reliable estimates even in the presence of skewed or heteroscedastic data (Iddrisu et al., 2022; Koenker, 2005). It also offers greater flexibility about capturing non-linear relationships and exploring how predictors influence different segments of the population low, middle and high income groups (Koenker & Hallock, 2001). Quantile regression is also more useful for policy analysis. That is because it can reveal how interventions may impact distinct subgroups such as low- or high-income households. Furthermore, by modelling multiple Quantiles simultaneously, Quantile regression is more efficient in large datasets compared to running separate regressions for each Quantile (Koenker, 2005).

Econometrics Strategies

In our economic strategy, we analyzed the effect of FINTECH and Financial Inclusion on household level consumption. We also investigate how the effects of FINTECH use differ across various demographic groups (e.g., age groups, gender, educational differences, and urban-rural residence). The interactions effects between these variables assist in identifying how FINTECH adoption shapes consumption behaviour. We expect that gender (female or male), age (younger vs. older individuals), area (urban vs. rural), and education (educated vs. uneducated) affect how FINTECH variable influence household consumption. We also control all relevant socio-economic and demographic variables. We use Quantile regression model in our estimation following (Altunbaş & Thornton, 2019; Demir et al., 2022; Dirir, 2022; Q. Huang et al., 2017; Iddrisu et al., 2022).

In the context of median regression technique we used, the conditional Quantile of the dependent variable is modelled rather than the conditional mean of the dependent variable in the case of ordinary least squares regression (Koenker & Bassett, 1978). This method is superior to mean regression techniques particularly to protect the relationships from biases that come from outlying observations. In our estimation, we use different Quantiles, such as lower (10^{th}, 20^{th}, 30^{th}), middle (40^{th}, 50^{th}, 60^{th}), and upper (70^{th}, 80^{th}, 90^{th}). We argue that Quantile regression is more robust to outliers in the dependent variable, as it focuses on different parts of the distribution rather than the mean. The Quantile regression equation for a Quantile T :

$$QT(Y|X)=X\beta T+\varepsilon T \quad \ldots\ldots\ldots\ldots \quad (1)$$

QT(Y|X) represents T-th conditional quantile of the outcome variable, consumption quantile instead of modeling the mean (like in OLS); X is a vector (or matrix) of key explanatory variables which include key variables like FINTECH use and financial inclusion indicators (such as bank account, formal saving , formal insurance and formal borrowing); control variables like age, education , gender , marital status , etc. βT a vector of quantile-specific coefficients that indicate how each explanatory variable affects the T-th quantile of Y. These coefficients can differ across quantiles (unlike in OLS), showing distributional heterogeneity**.** εT, the error term at quantile T, capturing unobserved factors.

$$QT(Y|X) = \beta_0^{T+}\beta_1^{T} FINTECH+\beta_2^{T}FI+\beta_3^{T}(FINTECH\times GDR)+\beta_4^{T}(FINTECH\times AGE)+\beta_5^{T}(FINTECH\times EDU)+\beta_6^{T}(FINTECH\times Urban/Rural)+\gamma^{T}Z+\delta^{T}REGION+\varepsilon T \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

QT(Y|X) represents the conditional quantile (e.g., median or other percentiles) of the outcome variable, consumption quantile ; $\beta 0^{T}$ Intercept term at quantile T ; β_1^{T} FINTECH captures the direct effect of FINTECH use on the consumption quantile ; β_2^{T}FI captures the direct effect of Financial Inclusion (such as owning a bank account or using formal financial services) on consumption quantile ; β3T(FINTECH×GDR) represents the interaction between FINTECH use and Gender which tests whether the effect of FINTECH on the outcome differs depending on household's gender ; β_4^{T}(FINTECH×AGE) is the interaction between FINTECH use and age which tests whether the impact of FINTECH on the outcome differs depending on a person's age ; β_5^{T}(FINTECH×EDU) is interaction between FINTECH and Education which tests whether the effect of FINTECH varies by level of education. B_6^{T}(FINTECH× Urban/Rural) is the interaction between FINTECH and Urban or rural resident household which tests whether the effect of FINTECH use varies by living area ; $\gamma^{T}Z$ is a vector of control variables (e.g., gender, marital status, household size, employment, region, etc.) with their associated coefficients included to control for confounding influences ; δ^{T} REGION to account for region- specific characteristics ; and finally ε^{T} is the error term, capturing unobserved factors at quantile T.

Econometric Analysis and Findings

Effect of FINTECH Use on Household Level Consumption

First, the empirical investigation looked at how FINTECH affected household consumption. Our hypothesis is that household heads that experience mobile phone utilization are more likely to use the mobile payment to carry out their consumption needs and thus consume more. The result of the Quantile regression in table 3 presents a more detailed analysis of how consumption across different points of the consumption distribution is affected by FINTECH, financial inclusion indicators and various socioeconomic and demographic factors. Consistent with the current literature (Jiang et al., 2024) who investigated the effect of digital financial inclusion on consumption varies depending on household consumption level. Our key variable of interest is

mobile phones to pay bills (mobile payment in short) as a proxy for FINTECH (Demir et al., 2022; Gosavi, 2018; Iddrisu et al., 2022; Kedir & Kouame, 2022; Mbiti & Weil, 2015).

The effect of FINTECH use on household consumption is not statistically significant in the OLS model, implying that there is no overall effect. Quantile regression, on the other hand, offers a more detailed picture. FINTECH has a positive and substantial influence in the lower and middle quantiles (q10, q20, q30, and q50), with the highest effect at q30. This suggests that FINTECH technologies, such as mobile banking, mobile money, and digital payments, are particularly helpful in increasing consumption among low- and middle-income people. These consumers may rely on FINTECH to overcome conventional financial access restrictions, control risks, and smooth their spending. From q60 onwards, the effect becomes statistically negligible, implying that richer families gain less from FINTECH, most likely because they already have access to more extensive financial services. Our findings are consistent with the findings of the following researchers : (Agarwal & Chua, 2020; Aydin & Burnaz, 2016; Boden et al., 2020; Dong & Zang, 2024; Jiang et al., 2024; Lai et al., 2020; J. Li et al., 2020b; J. Liu et al., 2023; S. Luo et al., 2022; Nursafarina & Firmialy, n.d.; T. Yang & Zhang, 2022; Zhang et al., 2022).

Effect of Financial Inclusion on Household Level Consumption

In the OLS model, bank account ownership is positively and significantly associated with household consumption and at almost all quantiles (q10 to q80) in QREG, with the highest effects around q30 and q50. This research highlights the significance of formal financial inclusion in promoting consumption, particularly among middle-income households. Having a bank account makes it easier to save, borrow money, and conduct safe transactions, all of which can lead to increased financial stability and welfare. The small effect at q90 shows that among the wealthiest families, bank account access is already common and no longer a distinguishing factor in consumption.

Saving is positively and substantially related with household consumption in the lower and middle quantiles (q10 to q50), with a peak at q30. This demonstrates the importance of saving in boosting financial resilience among low- and middle-income households. Savings enable households to better withstand shocks, invest in health and education, and smooth consumption. The effect diminishes and becomes negligible at higher quantiles (q60-q90), showing that wealthy families may rely on more varied assets or investments in addition to basic savings accounts.

In the OLS model, insurance has a considerable negative influence on consumption. Quantile regressions, on the other hand, help to explain this trend. The effect is negligible at the bottom end of the consumption distribution (q10 to q40), most likely because poorer families lack access to or understanding of valuable insurance products. Starting at q50, the impact becomes positive and strong, notably at q60, q70, and q80. This shows that insurance is more successful in safeguarding consumption among wealthy families, potentially due to having more assets to cover or having more access to good insurance products. Our findings are consistent with prior research findings by (Abokyi & Bettin, 2025; Burgess & Pande, 2005; Cavoli & Gopalan, 2023; Chakrabarty & Mukherjee, 2022b; Compaoré & Sawadogo, 2024; Dupas & Robinson, 2013) who investigated that financial inclusion positively and significantly affect household consumption.

Borrowing has no substantial influence on household consumption in both the OLS and quantile regression models. This suggests that credit does not have a significant role in boosting household consumption in the current setting. Borrowing may be employed primarily for investment rather than consumption, excessive interest rates, over-indebtedness, or credit limits, all of which limit the efficiency of borrowing for consumption smoothing. Our findings in this aspect is contrary to findings of (X. Li et al., 2011) who found out that household with access to microcredit has significantly higher levels of consumption compared to those without access.

Moreover, the Quantile regression shows that household size has a strong and negative influence on consumption across all quantiles, most likely due to resource dilution effects. Education is a strong and positive driver of household consumption at all quantiles. Educated households tend

to consume more because education improves income, financial decisions, and access to better opportunities. Financial literacy does not seem to affect consumption at household level in different Quantiles. Our findings contradict the findings of (Dong & Zang, 2024; Jiang et al., 2024; J. Liu et al., 2023). In their study, they reported that financial literacy positively and significantly affect consumption. The urban-rural disparity has a negative and significant effect on consumption at all Quantiles. That is rural household heads experience lower consumption than urban households. Our findings are similar with the findings of (W. Yang et al., 2022; Zhang et al., 2022). Moreover,(S. Luo et al., 2022) further explained that FINTECH development plays a higher influential role in enhancing urban household consumption than rural counter parts. Gender does not significantly affect consumption at lower quantiles (q10 and q20) and negatively and significantly affect consumption from q30 to q80 . Our findings imply that compared to families headed by men, those led by women consume less. The higher we go along the consumption distribution, the wider the disparity between men and women. Religion significantly and negatively affects consumption at all Quantiles indicating that the impact of religion is more evident on consumption of households. It implies that Christian and others (i.e waqefena, traditional and pegan) families consume much less than Muslim households, particularly at lower quantiles of the consumption distribution. Married families consume much more than single households, with this effect becoming more evident as consumption levels rise (for example, from q50 to q80). The effect of informal community-based insurance mechanism (Iddir) is negative in OLS model, but it becomes positive and significant at higher consumption Quantiles, which implies that informal insurance plays a more beneficial role in consumption for wealthier households. Financial shock is regularly linked to reduced consumption, particularly at lower quantiles. Age has a negative influence on log consumption, although the effects are inconsistent across quantiles.

FINTECH and Gender, Age, Education and Urban/Rural Interaction Effects

The OLS model shows a negative and significant interaction between FINTECH and Gender and is also significantly negative from q30 to q70. This suggests that male-headed households benefit less from FINTECH than female-headed households at these consumption levels. However, at q80, the interaction becomes positive and significant, indicating that FINTECH benefits men

more possibly due to better access, skills, or control over digital tools. The interaction between FINTECH and urban/rural location is strongly negative from q10 to q80, with the strongest negative effect occurring at q50. This shows that rural families benefit less from FINTECH than their urban counterparts in terms of consumption growth. Rural areas may experience weak connection and digital literacy obstacles, decreasing the positive impact of FINTECH. The disparity is most pronounced at q50, where rural consumers lag well behind urban users in FINTECH-enabled consumption growth. The rural-urban digital difference in FINTECH usefulness is readily apparent. The OLS model shows a slight positive relationship between FINTECH and age, but it becomes strongly negative at q80. This suggests that younger FINTECH customers, particularly those in higher consumption categories, benefit more, but elderly users may struggle to fully utilize FINTECH services, possibly due to technology

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Table 3 : The Effect of FINTECH and Financial Inclusion on Household Consumption: Gender , Age , Urban/Rural , and Education Interaction Effects with FINTECH

	Log Consumption	Cons-quint (Low Level Consumption)			Cons-quint (Middle Level Consumption)			Cons-quint (High Level Consumption)		
VARIABLES	OLS	q10	q20	q30	q40	q50	q60	q70	q80	q90
FINTECH	-0.0118	0.923*	0.858***	1.016***	0.837***	0.599***	0.373	0.346	0.400**	-0
	(0.0153)	(0.533)	(0.301)	(0.278)	(0.258)	(0.204)	(0.279)	(0.217)	(0.180)	(0)
Bank account	2.84e-05	0.465***	0.657***	0.655***	0.671***	0.574***	0.460***	0.331***	0.202***	0
	(0.00468)	(0.111)	(0.107)	(0.0840)	(0.104)	(0.0671)	(0.0585)	(0.0541)	(0.0323)	(0)
Saving	-0.00317	0.391***	0.352***	0.301***	0.262***	0.247***	0.224***	0.189***	0.136***	-0
	(0.00446)	(0.101)	(0.0931)	(0.0862)	(0.0854)	(0.0558)	(0.0474)	(0.0390)	(0.0277)	(0)
Insurance	-0.0133*	0.0930	0.0603	0.0902	0.0946	0.166*	0.190***	0.181***	0.140***	-0
	(0.00738)	(0.0946)	(0.0765)	(0.0983)	(0.0892)	(0.0937)	(0.0617)	(0.0692)	(0.0474)	(0)
Borrowing	0.000277	0.0505	0.0517	0.0680	0.0842	0.0323	-0.0157	-0.0295	-0.0234	0
	(0.00568)	(0.103)	(0.0906)	(0.0742)	(0.0589)	(0.0519)	(0.0435)	(0.0216)	(0.0293)	(0)
FINTECH_Gender	-0.0251***	-0.0372	0.114	0.117	0.191*	0.190*	0.206	0.145	0.141**	-0
	(0.00962)	(0.206)	(0.111)	(0.114)	(0.103)	(0.114)	(0.133)	(0.0887)	(0.0655)	(0)
FINTECH_Urban/ Rural	-0.00462	-0.908***	-0.809***	-0.589***	-0.451***	-0.468***	-0.360***	-0.442***	-0.326***	-0
	(0.00846)	(0.221)	(0.198)	(0.186)	(0.118)	(0.131)	(0.128)	(0.163)	(0.0896)	(0)
FINTECH_Age	0.000547*	0.000788	9.69e-05	-0.00393	-0.00533	-0.00277	-0.00173	-0.00232	-0.00435**	0
	(0.000299)	(0.00767)	(0.00439)	(0.00381)	(0.00361)	(0.00255)	(0.00315)	(0.00273)	(0.00177)	(0)
FINTECH_Education	0.00272	-0.297	-0.495**	-0.679***	-0.518***	-0.429***	-0.287	-0.189	-0.189	-0
	(0.00930)	(0.280)	(0.220)	(0.163)	(0.152)	(0.148)	(0.179)	(0.141)	(0.142)	(0)
Household Size	-0.000730	-0.347***	-0.342***	-0.338***	-0.306***	-0.276***	-0.251***	-0.201***	-0.152***	0
	(0.000757)	(0.0211)	(0.0200)	(0.0126)	(0.0158)	(0.0114)	(0.0115)	(0.0113)	(0.0150)	(0)
Distance to nearest FI	4.27e-07	0.000339	0.000259	0.000204	0.000165	0.000121	8.90e-05	5.18e-05	1.62e-05	0
	(5.79e-06)	(0.00118)	(0.000607)	(0.000292)	(0.000179)	(0.000180)	(0.000236)	(0.000269)	(0.000216)	(0)
Gender	-0.00794*	-0.0859	-0.126	-0.121*	-0.145***	-0.136***	-0.133***	-0.134***	-0.126***	-0
	(0.00481)	(0.0849)	(0.0811)	(0.0626)	(0.0490)	(0.0344)	(0.0343)	(0.0217)	(0.0338)	(0)
Religion	-0.00593	-0.358***	-0.309***	-0.268***	-0.237***	-0.185***	-0.166***	-0.100**	-0.0628**	0
	(0.00406)	(0.0584)	(0.0602)	(0.0496)	(0.0561)	(0.0577)	(0.0373)	(0.0486)	(0.0305)	(0)
Marital Status	0.00552	-0.114	-0.00113	0.0494	0.0508	0.0975**	0.127***	0.152***	0.137***	-0
	(0.00452)	(0.0842)	(0.0751)	(0.0771)	(0.0592)	(0.0411)	(0.0364)	(0.0360)	(0.0374)	(0)
Education	0.0112***	0.596***	0.564***	0.615***	0.580***	0.581***	0.515***	0.394***	0.261***	-0
	(0.00416)	(0.0820)	(0.0955)	(0.0714)	(0.0789)	(0.0631)	(0.0887)	(0.0620)	(0.0540)	(0)
Iddir	-0.00542	-0.0495	-0.0210	-0.0148	0.0141	0.0695	0.0842**	0.101***	0.0959***	-0
	(0.00356)	(0.0716)	(0.0577)	(0.0557)	(0.0440)	(0.0444)	(0.0418)	(0.0238)	(0.0205)	(0)
Financial shock	-0.0137***	-0.135*	-0.0980	-0.0917**	-0.0646	-0.0683*	-0.0404	-0.0422	-0.0224	-0
	(0.00440)	(0.0716)	(0.0608)	(0.0429)	(0.0399)	(0.0372)	(0.0298)	(0.0360)	(0.0245)	(0)

Asset Ownership	-0.0225***	-0.140	0.0303	0.0952	0.0646	0.0213	-0.0321	-0.0193	0.0504	0
	(0.00687)	(0.137)	(0.164)	(0.0830)	(0.0518)	(0.0431)	(0.0315)	(0.0492)	(0.0350)	(0)
Saving for old age	0.0198***	0.117	0.0846	0.0504	0.0521	0.00300	0.0547	0.0334	0.0550	-0
	(0.00595)	(0.163)	(0.0951)	(0.0822)	(0.0725)	(0.0590)	(0.0591)	(0.0569)	(0.0423)	(0)
Financial Capability	-0.470***	-0.135	-0.103	-0.135	-0.0898	-0.0602	0.0303	0.0666	-0.0223	0
	(0.0285)	(0.210)	(0.216)	(0.160)	(0.182)	(0.148)	(0.147)	(0.101)	(0.0826)	(0)
Age	-0.000356***	0.00188	0.000323	0.00310**	0.00289*	0.00244**	0.00155	0.00159	0.000970	0
	(0.000135)	(0.00228)	(0.00134)	(0.00130)	(0.00160)	(0.000963)	(0.00125)	(0.00108)	(0.000808)	(0)
Financial Literacy	0.00270	0.102	0.0775	0.0558	0.0378	0.0632	0.0215	-0.00228	-0.0109	-0
	(0.00416)	(0.0678)	(0.0715)	(0.0391)	(0.0592)	(0.0539)	(0.0539)	(0.0354)	(0.0251)	(0)
Base Year : Tigray										
Afar Region	0.292***	0.0673	0.299*	0.0903	0.115	0.0664	0.0219	0.00248	-0.0493	0
	(0.00920)	(0.150)	(0.156)	(0.0993)	(0.0797)	(0.0679)	(0.0713)	(0.0935)	(0.109)	(0)
Amhara Region	0.491***	0.203	0.381***	0.245***	0.256***	0.184**	0.176***	0.146	0.129	0
	(0.00957)	(0.148)	(0.136)	(0.0851)	(0.0879)	(0.0791)	(0.0682)	(0.101)	(0.0834)	(0)
Oromia Region	0.667***	0.126	0.327*	0.201**	0.196**	0.170**	0.186**	0.149*	0.105	0
	(0.0105)	(0.166)	(0.177)	(0.101)	(0.0819)	(0.0746)	(0.0741)	(0.0838)	(0.0919)	(0)
Somali Region	0.821***	0.0383	0.238	0.0324	0.139	0.124	0.110	0.117	0.0197	0
	(0.0115)	(0.200)	(0.153)	(0.121)	(0.106)	(0.101)	(0.0750)	(0.112)	(0.117)	(0)
Benishangul Region	0.941***	-0.0401	0.162	0.0782	0.0872	0.0780	0.112	0.129	0.110	0
	(0.00892)	(0.216)	(0.169)	(0.119)	(0.112)	(0.0602)	(0.0798)	(0.0906)	(0.0990)	(0)
SNNP Region	1.050***	0.0921	0.174	0.122	0.174**	0.0880	0.104	0.116	0.0650	0
	(0.00923)	(0.102)	(0.116)	(0.0941)	(0.0865)	(0.0646)	(0.0795)	(0.104)	(0.0933)	(0)
Gambella	1.165***	0.184*	0.257*	0.0789	0.179*	0.153***	0.155***	0.110	0.0885	0
	(0.00895)	(0.106)	(0.148)	(0.167)	(0.0985)	(0.0505)	(0.0579)	(0.0698)	(0.0895)	(0)
Harari Region	1.299***	0.0954	0.236*	0.0587	0.159	0.0999	0.110	0.101	0.118	0
	(0.00934)	(0.124)	(0.123)	(0.118)	(0.0992)	(0.0654)	(0.0872)	(0.104)	(0.105)	(0)
Addis Ababa City	1.568***	-0.0553	0.190	0.0211	0.132	0.136**	0.187***	0.137*	0.0962	0
	(0.0104)	(0.130)	(0.149)	(0.131)	(0.0954)	(0.0673)	(0.0602)	(0.0725)	(0.0922)	(0)
Diredawa City	2.135***	0.0135	0.142	0.0486	0.148	0.109*	0.157**	0.160**	0.0998	0
	(0.0173)	(0.0825)	(0.128)	(0.103)	(0.0948)	(0.0653)	(0.0651)	(0.0780)	(0.0889)	(0)
Constant	9.981***	3.016***	3.264***	3.605***	3.755***	3.927***	4.219***	4.474***	4.804***	5***
	(0.0143)	(0.192)	(0.247)	(0.186)	(0.140)	(0.132)	(0.167)	(0.149)	(0.140)	(0)
Observations	4,480	4,492	4,492	4,492	4,492	4,492	4,492	4,492	4,492	4,492
R-squared / Pseudo R^2	0.967	0.2599	0.2877	0.2689	0.2728	0.2254	0.2250	0.1444	0.0333	0.0000
	R.E in parentheses *** p<0.01, ** p<0.05, * p<0.1	Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1								

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adoption challenges. This might be due to elder consumers' aversion to technology or their unfamiliarity with newer digital financial systems.

From Q20 to Q50, there is a strong negative influence of FINTECH on education. This shows that FINTECH benefits less-educated families more in the lower-middle of the consumption distribution, most likely because technology helps them overcome conventional access barriers. However, when quantiles rise, education loses value in defining FINTECH's influence on consumption. The findings suggest that FINTECH might act as an equalizer for financial access, particularly in areas where traditional education-linked financial literacy is limited.

Regional Effects Relative to Base Year -Tigray

Afar consistently has a substantial and favorable influence across the OLS and most quantiles, with a peak at q30. This shows that households in Afar have much greater spending levels than those in Tigray, particularly in the bottom and middle layers. This might be due to greater focus of regional initiatives or reduced population growth. Amhara has a substantial beneficial effect in the OLS model, but loses significance from q10 to q30 in the QREG model. This shows that consumption is greater than in Tigray, particularly among low-income households.

Oromia has a robust and significant favourable influence from q10 to q50, with the highest effect at q30. At higher quantiles, the benefit becomes less significant. This shows Oromia's considerably higher wellbeing among the lower and medium consumption groups. Households in Oromia, particularly those in the lower middle class, have better living condition than Tigray. However, no substantial changes are observed among the wealthy. Somali has no significant influence across most quantiles, implying that consumption levels are roughly identical to Tigray, with the exception of a somewhat positive effect at q30. This means that Somali household consumption levels are roughly equivalent to those of Tigray.

Benishangul-Gumuz Region has the strongest and most constant beneficial effect across all regions, with a high level of significance from q10 to q60. This region has higher household consumption across the distribution than Tigray, most likely due to its small population. The

SNNP Region has modest positive effcets, which are significant in OLS and at q30 models but generally insignificant otherwise. This shows a little improvement in consumption in comparison to Tigray. Middle-income households receive the most of the benefit. Gambella has a moderately positive but negligible influence in most quantiles, demonstrating no substantial changes in consumption with Tigray.

Harari consumes much more than Tigray in OLS and across most quantiles, particularly between q30 and q70. This might be due to its metropolitan setting and improved infrastructure. Dire Dawa and Addis Abeba exhibit consistently strong, positive, and significant effects in the OLS model and across all quantiles, particularly from q10 to q50. These urban regions have better infrastructure, financial access, and public services, which lead to greater household spending levels.

Conclusion

The results indicate that in order to optimize the effects of FINTECH and financial inclusion on household spending, certain regulations are necessary. Priority should be given to increasing access to digital financial services like mobile banking and mobile money as well as enhancing rural infrastructure and connection. It is imperative to overcome digital literacy challenges, especially for women, the elderly, and those with poor educational attainment, in order to guarantee inclusive access. In order to strengthen formal financial inclusion, more people must possess bank accounts, mobilize savings, provide financial incentives, and raise public awareness. Making insurance products accessible and cheap for low-income households is essential to enhancing risk protection.

Enhancing credit accessibility through regulatory reforms and tailored financial products can foster stronger financial stability even when credit may not directly affect consumption. Informal support networks like Iddir are still important and ought to be acknowledged since they are particularly helpful for households in the middle- to high-income quantiles. Supportive policies can strengthen their involvement in consumption smoothing. Regional and socioeconomic inequalities also require investment in disadvantaged areas, culturally and religiously sensitive

outreach programs, and gender-responsive banking rules. Finally, achieving the full advantages of formal finance and FINTECH for household well-being depends on increasing digital and financial literacy throughout the population.

Limitations and future research

The research gaps in FINTECH, financial inclusion, and household consumption in Ethiopia highlight the need for more rigorous, longitudinal, and context-specific studies. Key areas for future research include understanding rural and gender dynamics, integrating informal financial systems, addressing digital literacy, and evaluating policy impacts

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