Saving on the Phone - Evidence from Ghanaian Cocoa Farmers

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Abstract

The poor and rural population in Sub Saharan Africa suffers from low financial inclusion. Yet, excluding population parts from accessing formal financial services means lost opportunity for household level, as well as for the whole economy. Evidence suggests that formal saving helps to accumulate larger amounts: Recent studies show how saving contributes to smoothing consumption and increasing resilience. A powerful tool for enhancing marginalized groups' financial inclusion are mobile financial services. In Ghana's rapidly developing banking and savings sector open questions remain. We investigate factors affecting Ghanaian cocoa farmers decision to save, as well as their savings amount. Among other factors, we focus on different savings instruments such as mobile saving on the phone, bank accounts or the traditional group saving method Susu. We employ data from a structured telephone survey conducted in 2021 among 405 randomly sampled cocoa farmers. The results of a two-step Heckman approach show that while Susu or a bank account enhance savings, saving on the phone decreases the amount. However, female farmers seem to benefit from this technology. In the light of a rapidly developing digital finance sector in Ghana, our results provide valuable information for governments and the private sector.

1. Introduction

The poor and rural population in Sub Saharan Africa (SSA), among them especially smallholder farmers, face the burden of low financial inclusion. Yet, researchers and development agents worldwide agree, that access to financial services is the key to pro-poor development: Being able to take up credits or accumulate savings, households become more resilient, respond better to shocks and invest e.g. in small businesses or farming inputs. Formal accounts, either from a bank or a mobile money provider, allow safe and private cash

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storage. Dupas and Robinson (2013) show that when poor Kenyan households are provided with basic savings mechanisms, they manage to set more money aside for health-related causes. In a study among Nepalese households, Prina (2015) finds that, when they were given access to bank saving accounts with minimum transaction costs, the respondents increased their ability to cope with shocks. Further, they stated that their overall financial situation had improved. However, despite efforts to increase financial inclusion, access to financial services by key demographics and across regions remains low.

Savings mechanisms can consist in storing cash at home, with bank accounts, traditional practices such as Susu collectors and savings clubs, or mobile money, also often referred to as digital finance or mobile financial services (MFS). Regarding the latter, promising studies in Eastern Africa (Sekabira & Qaim, 2017; Suri et al., 2021; Suri & Jack, 2016) show, how MFS help smoothing consumption, increase resilience and lift marginalized households out of poverty. While Kenya was Africa's mobile money pioneer and its neighboring countries, for instance Uganda or Tanzania, soon followed the trend, Western African countries have been slower to pick up on this new technology: In 2019, 53% of registered mobile money accounts were located in Eastern Africa in comparison to Western Africa with only 35% of registered accounts (GSMA, 2020). Countries, such as Ghana and Nigeria, are now following the movement in an accelerated pace and governments, as well as private banks and fintech companies, are currently expanding their digital financing portfolio. The Ghanaian government understood the relevance of MFS: In May 2020, they collaborated with international organizations and issued policies aimed at promoting financial inclusion and accelerating the development towards digitization of the banking sector. This dynamic development makes Ghana an interesting study area. Apart from current proceedings in policy making and the need to financially include marginalized groups, there are other reasons that make Ghana an interesting study area: The country has a relatively stable economy and, according to the Consultative Group to Assist the Poor (CGAP, 2016), fulfills the conditions to upscale mobile money. Ghana counts with a high percentage of adults with a required ID, mobile phones and basic numeracy skills. Furthermore, it has a long informal savings history through Rotating Savings and Credit Associations (ROSCAs), also known as Savings and Internal Lending Communities (SILC) or Village Savings and Loan Associations (VSLA), as well as

Susu collectors (Aker & Wilson, 2013).

According to van Vliet et al. (2021) 30% of Ghanaian cocoa producers fall below the World Bank's definition of extreme poverty and almost three quarters (73%) stay below the living income benchmark. Waarts and Kiewisch (2021) estimate that slightly above two-thirds of West African cocoa producers earn an income that does not allow them to live above the poverty line. As a consequence, smallholder farmers can become trapped in a vicious cycle: Their low incomes reinforce low productivity due to the inability to invest in additional inputs needed for cocoa farming. These circumstances call for action to improve Ghanaian cocoa farmers working and living conditions by e.g. allowing them to access affordable credits or formal savings tools.

Although there are publications that deal with determinants of savings in Ghana (Aidoo-Mensah, 2020; Amoah et al., 2020; Baidoo et al., 2018), cocoa smallholder farmers in the more marginalized areas have been left out. Up to now it is not clear, whether Ghanaian smallholder farmers save more when they use digital tools compared to traditional methods or storing cash at home. This research's objective is to examine the determinants of domestic saving in Ghana with special emphasis on MFS and other savings tools. Our aim is to understand whether different savings tools can promote rural savings. We contribute to the literature by providing new evidence derived from household-level data that we collected via telephone interviews during the COVID-19 pandemic. As the Ghanaian government launched a new set of policies in May 2020 to accelerate the digital finance sector growth, our insights into financial behavior of Ghanaian Cocoa farmers are of enhanced interest to policy makers as well as the fintech industry. To our knowledge, we are the first to investigate the effect of MFS usage on the amount of Ghanaian cocoa farmers' savings in Eastern Region.

We structure our paper as follows: A general background on Ghana's savings tradition as well as it's formal financial services sector is provided in Section 2. Section 3 presents our materials and methods, starting with the sampling and data collection process and our variables and then moving on to presenting the descriptive statistics. Section 4 is dedicated to the empirical framework and section 5 provides the results and reflects our findings on the basis of existing literature. Section 6 briefly summarizes and concludes.

2. Background

There can be several reasons why an individual wants to save, ranking from life-cycle motives such as saving for education, marriage, retirement or funeral expenses to precautionary, risk-reduction strategies such as saving for illness, unemployment or natural disasters. Also, there is a common misconception: Being poor does not mean that an individual is lacking self-control or not being able to save. Banerjee and Duflo (2007) conducted detailed household surveys in 13 countries. They find that even extremely poor households do not use all of their income to afford basic goods and services but save substantial amounts. Other studies (Ashraf et al., 2006; Dupas & Robinson, 2013) show that observed low saving rates should not be mistaken with the assumption that the poor are simply too poor to save: Dupas and Robinson (2013), for instance, find that social pressure and the provision of a safe place to store money increases savings from rural Kenyans.

Households that rely on cash have informal saving mechanisms such as storing money at home or accumulating assets in the form of livestock or jewelry. Yet, these mechanisms carry the risk of theft by others or liquidation by the owners themselves (Aron, 2018) and are subject to inflation. Following the standard consumption theory, we assume that individuals value flexibility (Amador et al., 2006): being able to withdraw a part of their savings at any moment is theoretically a plus, especially when income flows are seasonal due to agricultural production cycles and the household is vulnerable to shocks. Contrarily, assuming hyperbolic discounting and preferences, the poor, like everyone else, are often exposed to temptation and suffer from over-consumption and self-control issues (Amador et al., 2006; Frederick et al., 2002). Another reason to spend money at hand is to help others (Banerjee & Duflo, 2007). In the absence of formal safety nets, family and community based informal support networks are crucial. However, the social pressure, especially on women, to share with kin is inhibiting an accumulation of larger savings (Carranza et al., 2022; McNeill & Pierotti, 2021). People who want to save would thus benefit from ways to conceal their savings.

In Ghana, group saving methods are common: either via Susu collectors or credit and savings associations, often known as VSLA, ROSCA or SILC. Susu collectors are service providers who charge a fee for holding their client's savings for a fixed period of time (Osei-Assibey, 2015). In a savings association, a group deposits their money on a weekly basis. Depending

on the concept and purpose of the group, the members receive the accumulated amount after a previously determined time period or they lend their savings to each other on a rotating basis (ROSCA). While savings associations and collectors can encourage putting aside larger amounts and provide more security than saving e.g. under the mattress, the individual group member can not access their savings in an emergency (Aker & Wilson, 2013).

Formal accounts, either from a bank or a mobile money provider, allow safer and more private cash storage, thanks to password-protected accounts. A drawback is that these mechanisms come with a cost. However, evidence in the literature suggests that, despite the cost associated with formal saving methods, individuals, employing one of these rather formal instruments, tend to save more. Dupas and Robinson (2013) show that the use of commitment savings accounts encourages poor Kenyans to accumulate savings and Prina (2015) reports that Nepalese households with access to bank saving accounts with zero fees increased their coping ability and stated that their overall financial situation had improved. In a study conducted in rural Kenya, Jakiela and Ozier (2016) demonstrate that women prefer investment strategies that conceal the amount of their capital, even knowing that, with this strategy, they would forgo expected earnings.

Thanks to an expansion of non-bank financial institutions (such as mobile money providers), rural access to financial accounts with formal institutions almost doubled from 2011 to 2017. Increased mobile phone penetration has paved the way for financial service expansion and made Ghana the fastest thriving among African growing mobile money markets. This dynamic growth becomes evident when looking at the expanding agent network: The number of active agents increased 25-fold within five years from 6,000 in 2012 to 150,000 in 2017 (Geiger et al., 2019). Due to the high cost associated with establishing brick and mortar branches, alongside with typically lower levels of economic activity in rural areas, traditional banks see less incentives for improving financial access to geographically marginalized communities. Setting up an agent outlet is much cheaper and allows for physical proximity, even in remote areas. In a World Bank Report, Geiger et al. (2019) criticize that banks have not done enough recently to contribute to financial inclusion in Ghana. Instead of focusing on offering financial solutions to lower net worth individuals they prioritized corporate banking and high net worth customers. In the last two decades this gap was filled successfully by mobile

money providers and fintech companies. Yet, although large banks have not been a driving force in the development towards financial inclusion in rural areas, they start to recognize the potential of mass market banking (Geiger et al., 2019).

In May 2020, amidst the start of the COVID-19 pandemic, the Ghanaian government issued policies, aimed at deepening of financial inclusion and accelerating the development towards digital payments (Ghana Ministry of Finance, 2020). Along with the public sector, the private sector is on the move: Naghavi et al. (2019) report that one of Ghana's largest telecommunication providers MTN has released mAgric, a mobile-based tool, aimed at digitizing the procurement process in the last steps of the agricultural production process of e.g. Ghanaian cocoa. Agribusinesses can record crop procurement from producers digitally and then pay them via mobile money. Among other benefits, farmers have reported improved financial stability or reduced travel time (Naghavi et al., 2019).

3. Materials and Methods

3.1. Sampling and data collection

The data collection took place in the Eastern region of Ghana from April to August 2021. In collaboration with the data collection company Esoko Ghana we collected data via computer assisted telephone interviews (CATI) on household information, knowledge on mobile money and digital credit and savings tools. Relying on telephone interviews to collect primary data is a method that several researchers adopted during the COVID-19 pandemic 2020 and 2021. Using CATI, Alvi et al. (2021) collect data in India and Nepal, investigating women's access to agricultural extension. Durizzo et al. (2021) conduct telephone interviews to understand the urban poor's experience and coping mechanisms during COVID-19 related lockdowns in Accra, Ghana and Johannesburg, South Africa. Ahmed et al. (2021) use results from telephone interviews in rural Bangladesh to examine the food insecurity situation during the pandemic.

As smallholder cocoa producers are among the poorest groups in Ghanaian society (van Vliet et al., 2021; Waarts & Kiewisch, 2021), they are also particularly vulnerable to income shocks related to climate change or market-disrupting pandemics such as COVID-19. Due to low capital endowment, the poorer households, among them especially female headed households (Smith & Sarpong, 2018), cannot afford to make sufficient investments into hired

labor, machinery or fertilizers. The reason why we chose to focus our data collection on Eastern region is that (1) it is one of the major Ghanaian cocoa production regions and (2) for data collection, we focus on English (the official lingua franca) and Twi, also known as Akan kasa, a dialect of the Akan language. About 80% of the Ghanaian population speak Twi as a first or second language and in Eastern region the majority of the population speaks either Twi or English (Garry et al., 2001). As we had a company in Accra conduct telephone interviews for us, the language was an important criterion that allowed us to run a quality check with the recorded phone calls.

We collected data from survey participants located in the following districts in Eastern Region: Nkawkaw, Oda, Fanteakwa, New Abirem, Tafo and Oyoko. For the sampling, Esoko Ghana allowed us access to their database for Eastern Region (N = 2445), from which we sampled 405 respondents. When selecting respondents, we employed a simple random sampling technique. As we realized that more men than women answered the phone, we over sampled women to achieve a more balanced composition of respondents. We are aware that, due to the physical labor requirements, cocoa is traditionally a men's crop, yet women increasingly become involved in cocoa farming and nowadays gendered cropping patterns are less pronounced than some decades ago (Doss, 2002; Lambrecht et al., 2018; Williams & Taron, 2020). Further, we were cautious to avoid the peak labour demand season, typically from November through January (Mull & Kirkhorn, 2005). We thoroughly trained the enumerators in several video chat sessions to ensure there were no questions and misunderstandings standing in the way of a successful data collection. After a pretest with 50 randomly selected participants we adjusted the questionnaire and conducted a second pretest with 25 participants. When we were sure that all the instructions were understood, the data collection started in April 2021. Because we paused the data collection four times (after 50, 100, 200 and 300 observations) in order to listen to randomly selected recordings and conduct quality checks, the entire data collection process took until the first week of August.

3.2. Variables

Table 1 shows the description of the selected variables for the analysis. Our dependent variable reveals, how much savings a household has accumulated. In the first design, we had it as an open question but in the pretest, we realized that respondents considered it too sensitive information and were hesitant to report the exact amount of their savings. In order to not lose too many data points or to avoid false information, we resorted to pre-defined intervals. When designing the intervals, we followed Yu et al. (2014): In lower amount ranges, the intervals are smaller than in upper ranges. As expected, the majority of the respondents reported to have accumulated 500 GHS (Ghanaian Cedi, 6.75 GHS = 1€, as of April 2021) or less, so designing intervals with the same range would have been a) inaccurate because we would not be able to depict the variation in lower savings levels or b) obsolete in case of the upper amount ranges because few respondents have reported to have saved 5,000 GHS or more.

We organize the independent variables in four groups: general household information, information about savings instruments, access to services, and the impact of COVID-19 on the household. We include gender, because disparities in the uptake of formal financing instruments and especially the adoption of mobile financial services are an issue in many SSA economies The same holds true for education and age, with the early adopter of new financial technologies typical being a young, educated, urban male (Arestoff & Venet, 2017; Kaffenberger et al., 2018; Molinier & Quan, 2019). Further, it is interesting to look at the land size the respondent cultivates as an indicator for their wealth, other than monetary savings. Because the concept of land ownership is not always understood in the same manner by different cultures, we opt to ask for the acres of land cultivated. Further, shared land ownership between husband and wife is not customary and often women are allocated smaller and lower quality land (Goldstein & Udry, 2008; Lambrecht et al., 2018). Thus, we expect this variable to be an indicator of the person's wealth i.e. savings amount. Household size is an important variable to control for as the number of household members strongly influence economic performance. On the one hand, additional household members might contribute to the income, on the other, every additional member, especially children and elderly people, might consume more than they can contribute, with basic requirements

Table 1: Description of the variables considered for the analysis

Variables	Description	Units
Dependent variable		
Savings	Respondent's reported amount of savings	Intervals (GHS): [1, 500], [500, 1,000], [1,000, 5,000], [5,000, 10,000], >10,000
Independent variables		
Household characteristics		
Age	Respondent's age in years	Years
Education	Respondent's years of formal education	Years
Gender	Respondent's gender	1=male 2=female
Household size	Number of people (including the respondent) living in the household	Individuals
Land size	Total land size that the respondent's household cultivates/keeps livestock on	Acres
Marital status	Respondent's marital status	1=Single, 2=Married, 3=Divorced, 4=Widowed
Savings instrument		
Bank	Respondent's current savings instruments	0=no 1=yes
Mobile phone	Respondent's current savings instruments	0=no 1=yes
Susu	Respondent's current savings instruments	0=no 1=yes
Access to services		
Distance agent	Walking time to reach the next mobile money agent	1= < 20 min, 2= < 60 min, 3= > 60 min
Distance bank	Travel time to reach the next bank branch	1= < 20 min, 2= < 60 min, 3= > 60 min
Network quality	Network/mobile phone connectivity at respondent's place of residence	1=very good, 2=good, 3=very bad
Negative shocks COVID-19		
Household	The COVID-19 pandemic affected the respondent's household negatively	0=no 1=yes
Market access	The COVID-19 pandemic affected the respondent's farm activities negatively	0=no 1=yes

for food, education, clothing, medicine and housing. Following Aidoo-Mensah (2020), we include household size into the equation, expecting that it will influence the savings amount negatively. Marital status is an interesting variable because, as the literature suggests, female household heads, who are often single, divorced or widowed, are among the most vulnerable groups in Sub-Saharan Africa (van Campenhout et al., 2016) and thus less able to put aside money for investments or emergencies.

The variables mobile phone, Susu and bank are dummy variables, indicating whether the respondent employs the respective saving instrument. Following existing literature on formal and traditional savings instruments (Dupas & Robinson, 2013; Jakiela & Ozier, 2016; Prina, 2015), we expect all of these instruments to increase the respondent's savings, compared to non-usage and storing cash at home. In the questionnaire we also ask whether the person is engaged in a VSLA, however, we decided not to include this variable into the regression, because only very few respondents answered, that they were part of such an association.

Further, we include network quality, as it is a prerequisite for mobile money usage, as well as a proxy for area's general infrastructure, comparable to distance to and quality of roads. However, in a study on mobile money adoption in Uganda, Sekabira and Qaim (2017) find that typically adoption constraining factors such as physical infrastructure have a lower relevance when it comes to mobile money. The variable distance agent inquires the distance, a respondent has to walk in order to reach the next mobile money agent in order to cash in or cash out. The variable distance bank is similar but refers to the travelling distance to the next bank branch for transactions. We defined the variables differently because in rural areas we expect bank branches to be less prevalent than mobile money agents and thus assume the distances to be larger for bank clients (Geiger et al., 2019; Naghavi et al., 2019; Sarfo et al., 2021). Therefore, we assume a walking distance in order to reach the next mobile money agent, contrary to a travel distance where the respondent is expected to take public transport or a car to get to the next bank branch or ATM. The two variables are crucial, as convenience of use and the reduction of transaction costs are vital for the decision to employ any formal or semi-formal savings instrument. We expect the amount of savings to decrease, the further the respondent has to travel in order to make transactions with either a bank employee or mobile money agent.

The last group includes variables that might have a rather short-term effect on the respondent's savings amount. We first ask the respondent whether the COVID-19 pandemic affected their households negatively. Then we also inquire about the effect of COVID-19 on their access to markets, translating into their economic basis for savings. Durizzo et al. (2021) provide evidence that the pandemic has had more severe economic than health consequences for the urban poor in Accra. For India, Alvi et al. (2021) show how COVID-19 induced lockdowns negatively affected female farmer's access to extension services. We thus expect the COVID-19 pandemic to have a rather negative effect on the savings amount.

3.3. Descriptive statistics

Table 2 shows the descriptive statistics for the pooled sample and the subsample. In total, 405 cocoa farmers participated in the survey, yet 42 preferred not to provide information on their savings. Thus, we verified whether the two groups are similar, before removing these farmers from the analysis. We run a Pearson's Chi-squared Test for categorical variables and Equal means in a One-Way Layout for continuous variables. We cannot reject the null hypothesis of different between group at 5% significant level for all variables (see Table 2). Following Strazzera et al. (2003), it is possible to exclude a sub-group that refused to give information without affecting the estimation, given that there is no difference between the two sub-groups. After verifying that the two groups are similar we remove these farmers from the analysis. Likewise, in the subsample where farmers give information of savings, 207 cocoa farmers reported having savings and 156 not. Table 2 shows the p-values from the test which suggest that both groups are different. Thus, we use this subsample in our analysis. In the remaining sample, 57.3% reported to have saved between 0 and 500 GHS. 10.7% have saved between 501 and 1,000 GHS, 18.5% have saved between 1,001 and 5,000 GHS, 9.6% have saved 5,001 and 10,000 GHS and 3.9% of the sample state to have a total current savings amount of more than 10,000 GHS. 38,8% of the respondents are female . The average farmer in our sample has an education of 8.82 years corresponding with the World Bank (2020) stating that 78% of Ghanaians were enrolled secondary school. According to UNESCO (2020), the net enrolment rate in secondary education is 57%. Primary education in Ghana lasts 6 years and lower secondary education 3 years. The average respondent is 52.13 years old and lives in a household with 5.82 members. The household size is slightly above the

number of household members other studies reported in Ghana: Among 3,000 Ghanaian cocoa farming households across five regions, including the Eastern region, Hainmueller et al. (2011) report a median household size of five. The farmers in our sample report to cultivate on average 8.64 acres. According to Hainmueller et al. (2011) the average farm size is 5 acres. However, they also observe a discrepancy in reported and measured farm size: Farmers in their sample overestimated the actual size of their farms by 40-60% on average. The majority of the respondents (65%) describe their network connection as very good, 25.6% say it is good and 9.4% state that it is very bad. More than three quarters (81.8%) state that the next mobile money agent to cash in and out is less than a 20-minute walk away. 11.3% of the sample have to walk more than 20 but less than 60 minutes and 6.9% have to walk more than an hour to reach the next mobile money agent. The bank infrastructure is not as pronounced as the mobile money infrastructure: while almost half of the sample (47.1%) have to travel more than 60 minutes to reach the next bank branch, only 38.8% and 14% have to undertake a journey of less than 60 minutes or less than 20 minutes respectively. This mirrors the reality in Sub Saharan African rural regions reported by Geiger et al. (2019) and Naghavi et al. (2019). In our sample 30.3% of the respondents save with their mobile phone, 12.1% with a Susu collector and 51.8% have a formal bank account to save with. As of 2017, 39% of the Ghanaian population had a mobile money account, the prerequisite to save on the phone and engage in digital financing. While the numbers most likely have increased since 2017, there is a discrepancy between urban and rural areas when it comes to adoption of mobile money or digital finance: the typical early adopter of digital finance is an urban, well-educated, young man (Kaffenberger et al., 2018).

Table 2: Descriptive statistics of the Ghanaian Cocoa Farmers

Variable	Answer (n=207)	No answer (n=156)	Pooled sample (n=363)
Dependent variable			
0	-	-	43.00 %
[1, 500]	-	-	14.33 %
[500 1000]	-	-	10.74 %
[1000, 5000]	-	-	18.46 %
[5000, 10000]	-	-	9.64 %
>10000	-	-	3.86 %
Household characteristics			
Age	49.88 (11.84)	55.13 (12.90)	52.13 (12.56)
Education	9.64 (2.82)	7.74 (4.32)	8.82 (3.66)
Gender = female	29.47 %	51.28 %	38.84 %
Household size	5.77 (2.39)	5.89 (2.75)	5.82 (2.55)
Land size	9.45 (6.36)	7.57 (5.79)	8.64 (6.18)
Marital status: divorced	5.31 %	3.21 %	4.41 %
Marital status: married	81.64 %	71.79 %	77.41 %
Marital status: single	3.38 %	7.05 %	4.96 %
Marital Status: widowed	9.66 %	17.95 %	13.22 %
Savings instrument			
Bank = yes	81.64 %	12.18 %	51.79 %
Mobile phone = yes	43.48 %	12.82 %	30.30 %
Susu = yes	20.29 %	1.28 %	12.12 %
Access to services			
Network quality			
Very good	27.05 %	23.72 %	25.62 %
Good	14.49 %	2.56 %	9.37 %
Very bad	58.45 %	73.72 %	65.01 %
Dist. agent			
less 20 min	6.28 %	7.69 %	6.89 %
less 60 min	82.13 %	81.41 %	81.82 %
> 60 min	11.59 %	10.90 %	11.29 %
Dist. bank			
less 20 min	43.48 %	51.92 %	47.11 %
less 60 min	16.91 %	10.26 %	14.05 %
> 60 min	39.61 %	37.82 %	38.84 %
Negative shocks-Covid-19			
Household = Yes	43.96 %	58.33 %	50.14 %
Market access = Yes	53.62 %	73.72 %	62.26 %

Note: Percentages, means (standard deviations in parentheses)

4. Empirical model

In our sample, the dependent variables (household savings) contain a considerable number of zero values; 43% of households reported having no savings. If we drop these observations or omit them from the analysis, it may be possible that the population sample is not random since it does not consider potential savers. Besides, statistically, significant differences are observed between savers and non-savers (see appendix, Table A.1). Therefore, applying a model that considers the potential sample selection problem is reasonable. Many approaches have been developed to deal with sample selection bias (e.g., Tobit, Poisson, Heckman 2-Steps). However, the Tobit model is considered too restrictive, as it requires the same

variables to affect the probability of observing a non-zero value and the level of a positive observation (Verbeek, 2017). A more flexible specification, relaxing this assumption, is the 2-step Heckman.

Nevertheless, since our dependent variable is an interval proxy, it would require a nonlinear estimation in the second stage (Freedman & Sekhon, 2010; Petersen, 2017); therefore, it is not possible to use the standard two-step Heckman model. In this paper, to address the sample selection bias problem, we estimate an interval regression with sample selection bias that follows the approach of Heckman (1979). In the first step, we estimate the sample equation modeling the farmer's choice to save or not to save any amount of money. In the second step, the outcome equation (i.e., the interval regression) models how much farmers save after they have decided to save. Selection bias is handled by joint estimation of the two equations by maximum likelihood under the assumption that the errors respond to a bivariate normal distribution as proposed by Henningsen et al. (2020).

Sample equation: To model whether a farmer decides to save or not, we use a binary (i.e., Probit) model. The latent variable represents the probability of observing saving or not, for which we follow the observation rule:

$$y_i^{s*} = \beta^{s'} x_i^s + \varepsilon_i^s \tag{1}$$

$$y_i^s = \begin{cases} 1 & if \quad y_i^{s*} > 0 \\ 0 & Otherwise \end{cases} \tag{2}$$

Where y_i^{s*} is a dummy variable that takes values equal to one when $y_i^{s*} > 0$, that is, savings are reported ($y_i^s = y_i^{s*}$), and values equal to zero when $y_i^{s*} = 0$, in other words, the level of savings is not reported ($y_i^s = unknown$). β^s are the parameters of the selection equation, and i indicates a farmer's observation. Furthermore, since selection bias affects the estimation savings intensity but does not influence the savings decision, we can independently estimate a Probit model. Then, we calculate the marginal effect of each covariate on the savings decision and explain its possible policy implications.

Outcome equation: The second part of the model describes the expected savings of those farmers who opted to have savings. Given the sensitivity of answering questions related to amounts of money, we could not collect precise values of savings. So, we created different intervals and asked farmers to indicate to us, in which of the intervals their savings lie. The savings interval regression is defined as follows:

$$y_i^{o*} = \beta^{o'} x_i^0 + \varepsilon_i^o \tag{3}$$

$$y_i^o = \begin{cases} unknown \quad if \quad y_i^{s*} = 0 \\ 1 \;\; if \;\; \alpha_1 < y_i^o \leq \alpha_2 \; and \;\; y_i^s = 1 \\ 2 \;\; if \;\; \alpha_2 < y_i^o \leq \alpha_3 \; and \;\; y_i^s = 1 \\ \vdots \\ M \;\; if \;\; \alpha_M < y_i^o \leq \alpha_{M+1} \; and \;\; y_i^s = 1 \end{cases} \tag{4}$$

Where y_i^{o*} is a latent outcome variable and y_i^o is a categorical variable containing the intervals in which the expected savings of each farmer are found. M represents the total number of intervals defined by $\alpha_1, \ldots, \alpha_{M+1}$. x_i^0 is a vector of observed farmer characteristics, β^0 are the parameters of the outcome equation, and ϵ_i^0 is the error term. The assumption of correlated errors is addressed by a joint bivariate normal distribution in which the values of ρ and σ^2 are unknown scalars to be estimated:

$$\begin{pmatrix} \varepsilon_i^s \\ \varepsilon_i^o \end{pmatrix} \sim \left(\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho\sigma_2 \\ \rho\sigma_2 & \sigma_2^2 \end{pmatrix} \right) \tag{5}$$

The estimation of the sample selection model usually requires a exclusion restriction for a more robust identification. The constraint is that at least one of the regressors can affect the decision to save (or not) but have no direct effect on the amount that is saved; however, in empirical work, it is difficult to find such a variable (Cameron & Trivedi, 2010). In our context, we select two variables: marital status and adverse COVID-19 shocks.

Married people, for example, have a greater sense of responsibility and a higher sense of long-term plans (Andre & Carvalho, 2019; Rader, 2009). Thus, we expect that being married

would positively affect the decision to save, but not necessarily the size of savings, which in turn may depend on other factors, such as household size (Aidoo-Mensah, 2020). Regarding the COVID-19 related variables, we expect that when a household suffers from a shock or loses market access due to the pandemic, it would positively affect the willingness (or ability) to save.

5. Results and Discussion

We apply a logarithmic transformation to the interval of the dependent variable (savings) because the model does not converge on the original values. It has the advantage of increasing the model performance and the coefficients can be interpreted as log-level model specification (Bellemare & Wichman, 2020; Petersen, 2017). We use a probit model to estimate the farmer's saving decision since it is not affected by the sample selection problem. For reasons of space, the reader can find the probit model with marginal effects in the appendix Table A.2. Figure 1 illustrates the direction and magnitude of the mean marginal effects. Table 3 shows the results for the selection and outcome model with sample selection as well as the interval regression when not accounting for sample selection.

5.1. Probit regression: Farmer's decision to save

Figure 1 presents the marginal effects of the probit model for the farmer's decision to save. Information about savings instruments is not included, as they are dependent on the respondents' saving decision and only become relevant in the outcome stage.
Gender(*) and household size(*) have a negative association with the savings probability. Being a woman, reduces the probability of saving by 12%, while having an extra member in the household reduces it by 2%. This is in line with our expectations derived from the literature: women are less equipped with productive resources such as land (Lambrecht et al., 2018) and are time- and capital restricted, due to being over proportionally responsible for nonsalaried domestic duties, such as cooking, cleaning or caring for children and other household members (Boone et al., 2011; Doss et al., 2011). Additional household members may or may not contribute to household income and thus wealth. With our results, we follow Aidoo-Mensah (2020), stating that additional household members have to be income earners in order to contribute to a higher income. Otherwise every additional person in the household

consumes more than they contribute. In our case extra members negatively affect the savings amount. Further, divorced household heads are less likely to have savings (33%) compared to married household heads(*). Single respondents have a slightly negative probability to save, while widowed respondents display a slightly positive effect. Yet, both are not statistically significant at conventional significance levels. This, especially the outcome for the divorce variable, is in line with van Campenhout et al. (2016), describing single, widowed or divorced female household heads as particularly vulnerable. Also, we expect male and female headed households alike, to benefit from a constellation where they are in a stable relationship such as a marital status where duties (e.g. income earning, domestic duties, farm work) are allocated to the respective partners. In the situation of a divorce or separation, an ex-partner might have to pay alimony, thereby reducing their chances to save. The fact that we observe a slightly positive effect on savings when looking at widowed respondents, might be explained by increased support from the community in the case of the partner's decease or by the fact that they inherited money or commodities. The respondent's education level and age are positively associated to the savings decision: One extra year of education will increase the probability of having savings by 9% (***). Likewise, an additional life year increases the probability of saving by 6% (**). However, as the reader can observe in the results in the appendix Table A.2, age^2(**) has a negative sign: we thus expect diminishing effects over time. We explain this by assuming that in younger years, the household can generate and accumulate savings, older respondents might rather live off their savings and be less likely to generate new savings. When the respondent's cultivated land size increases by one acre, the savings probability will increase by 1%(**). This is in line with the literature on land rights in Ghana, suggesting that individuals who own and cultivate more land are usually more powerful and wealthy (Goldstein & Udry, 2008) and thus, more likely to have savings.

When the quality of the (self-reported) mobile phone connectivity improves in comparison to the benchmark level very bad quality, the likelihood to save decreases. Respondents reporting good connectivity decrease their savings probability by 33% (**), when their connectivity is very good, savings probability decreases by 42% (***). This may sound counter-intuitive at first, because, on the one hand, mobile phone connectivity is a necessary prerequisite for saving on the phone. On the other hand, good or very good network also

means, that money can be sent easily to relatives or friends who urge the respondent to send them remittances. Further, the respondent might be tempted to spend money via phone by talking and messaging or using mobile data. Increasing the distance to the next bank agency decreases the savings probability. However, this effect is not statistically significant at common levels.

Overall, the COVID-19 pandemic is negatively associated with the probability of saving. Households that were negatively affected by COVID-19 are less likely to save by about 7%. Yet, this effect is not statistically significant. COVID-19 induced problems with access to markets reduces the savings probability by 16.32% (**). These results are unsurprising, as shocks, such as a worldwide pandemic in the case of COVID-19, are likely to affect a households' economic activity in a negative way (Alvi et al., 2021; Durizzo et al., 2021)

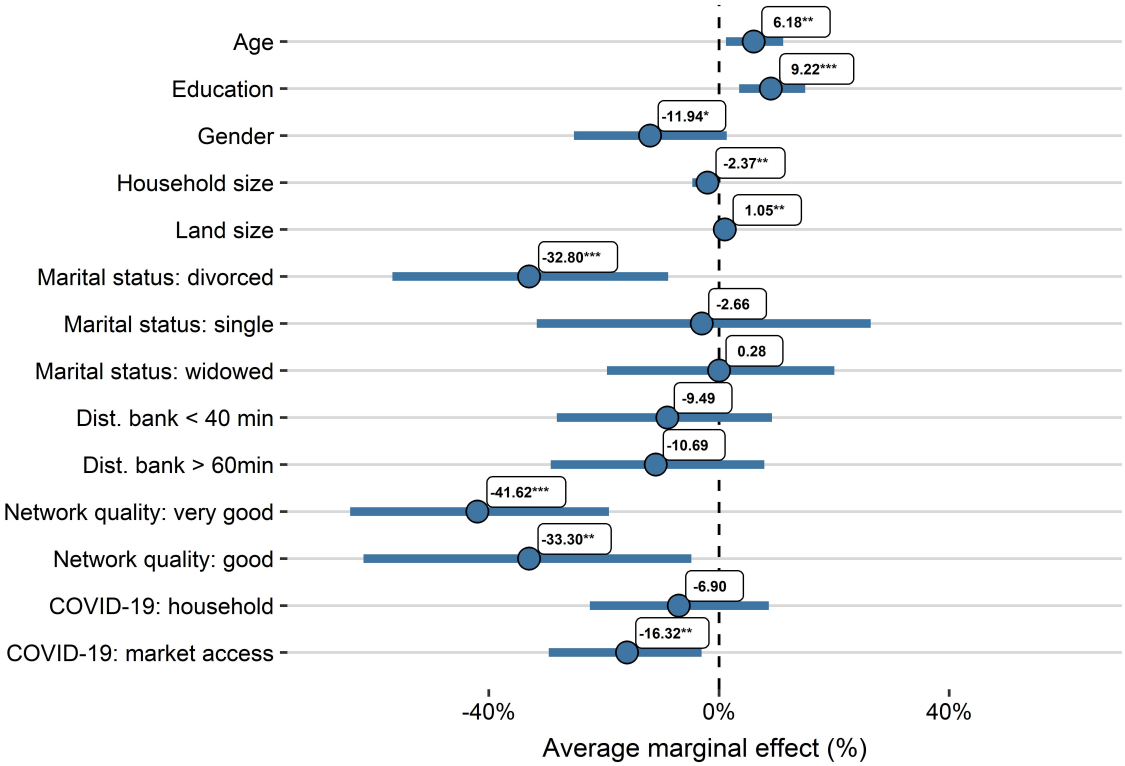

Figure 1: Marginal effects of the probit model for farmer's decision (or ability) to save

Note: *p<0.1; **p<0.05; ***p<0.01. N = 363 observations.

5.2. Interval regression accounting for sample selection bias

Column (2) and (3) in Table 3 present the results of the interval regression, with column (2) accounting for sample selection bias. The results of the selection equation (column (1)) and the probit model are similar in terms of signs, magnitude and significance, except for gender (*). Therefore, in this section, we do not repeat the discussion of the selection equation outcomes. The selection model estimates the Rho coefficient that captures the selection effect (see Table 3). Rho is statistically significant at 5%, indicating that there is a sample selection, so we chose an interval regression model accounting for sample selection bias.

Looking at the outcome equation, we see that the gender variable has a negative sign(*). As expected and discussed in the previous subsection, female respondents have not only a lower probability of saving but also save less than their male counterparts: female respondents in our sample save 27%[1] less than male respondents. While the savings probability increases with higher education, the number of years of a respondent's education are negatively associated with the amount of savings(*): An increase of one year of education will thus decrease savings by 28%, albeit with a decreasing effect as we can see from education^2. This means that with a certain level of education, the effect will turn around and better educated respondents will increase their amount of savings. We thus interpret education as an investment that pays off later in life via e.g. the opportunity of getting higher paid jobs or better farm management. Further, our results suggest that, while age is strongly and statistically significantly associated with the probability of saving, there is no statistically significant relationship with the amount. We use land size and land size^2 to model a possible curved relationship. By increasing the cultivated land size by one acre, the respondent's savings amount will increase by 11%, ceteris paribus (**). As discussed in the previous subsection, this is consistent with the suggestions made in the literature (Goldstein & Udry, 2008). The squared coefficient of land size has a positive sign (*), hence, the relationship between savings and land size reflects an U-shape. However, this effect is vanishingly small. Since the respondent's marital status and the COVID-19 related variables do not play a

[1]To avoid misleading interpretation of the coefficient of the dummy variables from the Table 3, column (2), we apply the correction suggested by Kennedy (1981)

statistically significant role in the outcome equation, we use the likelihood ratio test to examine whether these variables could improve the explanatory power of our model. The test fails to reject the null hypothesis at conventional significant levels; we exclude them from the outcome equation.

Farmers who use their mobile phone to save, accumulate 44% less than farmers who do not use it. Savings amounts from farmers using a bank account and Susu are higher by 109%(**) and 15%, respectively. Yet, while the effect for saving with a bank account is statistically significant at 5%, the coefficients for the savings instruments Susu and mobile phone are not statistically significant at conventional levels. Results for Susu and bank accounts are in line with literature suggesting that savings instruments generally help individuals to increase their savings amounts (Dupas & Robinson, 2013; Jakiela & Ozier, 2016; Prina, 2015). Only the negative effect of mobile phone usage on savings amount is contradicting the existing literature. As already mentioned in connection with the network quality in the previous subsection, we assume that having a mobile phone allows the user to interact with others. This results in them being subject to requests for money transfers and also to temptations to communicate and consume more than before. Mobile money usage might thus be a double-edged sword, allowing the user to store money and hiding it from others while at the same time exposing them to opportunities to spend that money or give it to others in need. Our explanation is in line with Gurbuz (2017), hypothesizing that as a storage mechanism mobile financial services might reduce the cost of saving and even create savings incentives. Yet, by simultaneously being a money transfer mechanism, it can reduce the incentive to accumulate money. The coefficient of interaction of the combined saving instruments, mobile phone and bank, is -0.82. This means that households who use mobile phone and bank will reduce their savings by 62% . However, this observation is not statistically significant. Although the effect of mobile saving is counterproductive for increasing the savings amount, we find that when interacting mobile saving with gender, the effect turns out to be positive for female respondents: Women who use a phone to save increase their savings amount by 113%(*). The above mentioned negative effect for both genders might thus be outweighed be the opportunity for women to have an affordable and relatively secure way to store money and hide it from others. The literature suggests that for women, it is particularly difficult to

save larger amounts because of their lower social standing they are more frequently subject to requests from others and expected to share their income. Refusing to share money can have undesirable social consequences.Therefore, the option to store money out of sight and credibly denying transfer requests might be very attractive, especially for women (Carranza et al., 2022; Jakiela & Ozier, 2016; McNeill & Pierotti, 2021).

For network quality, we use very bad quality as the comparison level. Farmers who report having a good network quality instead of a very bad one, reduce their savings amount. Farmers with a reportedly very good network quality increase their savings. Yet, these effects are not statistically significant. In addition, having to walk more than 60 minutes to reach the nearest mobile money agency reduces the amount of savings by 61% (**), compared to farmers who live less than 20 minutes walking time from the next mobile money agent (comparison level). Having to overcome larger distances is associated with higher transaction costs, thus the amount saved in the end decreases.

Table 3: Determinants of saving estimated via interval regression accounting for sample selection (selection and outcome stage) and interval regression

	Interval regression accounting for sample selection					
	Selection (1)		Outcome (2)		Interval regression (3)	
	Estimate	Std Error	Estimate	Std Error	Estimate	Std Error
Intercept	−27.21*	14.59	−3.43	26.77	−10.96	18.26
Household characteristics						
Log Age	15.72**	7.64	7.10	14.06	11.12	9.64
Log Age^2	−2.17**	1.00	−1.04	1.84	−1.62	1.26
Education	0.25***	0.09	−0.28*	0.16	−0.16	0.13
Education^2	−0.01*	0.01	0.01	0.01	0.01	0.01
Gender	−0.30	0.19	−0.56*	0.30	−0.69**	0.32
Household size	−0.07*	0.04	−0.04	0.05	−0.06	0.05
Land size	0.03**	0.01	0.11**	0.06	0.13**	0.06
Land size^2	–	–	0.00*	0.00	0.00**	0.00
Marital status: divorced	−0.78**	0.36	–	–	0.40	0.57
Marital status: single	−0.12	0.50	–	–	−0.11	0.49
Marital status: widowed	−0.03	0.30	–	–	−0.05	0.40
Savings instrument						
Bank=yes	–	–	0.80**	0.36	0.75**	0.36
Mobile phone=yes	–	–	−0.44	0.53	−0.59	0.49
Susu=yes	–	–	0.19	0.32	0.12	0.27
Mobile phone x gender	–	–	0.88*	0.50	0.90**	0.44
Mobile phone x bank	–	–	−0.82	0.55	−0.66	0.52
Access to services						
Dist. agent -60 min	−0.32	0.24	–	–	–	–
Dist. agent +60min	−0.43	0.28	–	–	–	–
Dist. bank -60 min	–	–	0.08	0.30	0.02	0.30
Dist. bank +60min	–	–	−0.85**	0.42	−1.00**	0.44
Network quality: very good	−1.16***	0.33	0.21	0.44	−0.11	0.31
Network quality: good	−0.84**	0.34	−0.20	0.43	−0.44	0.33
Negative shocks COVID-19						
Household=yes	−0.06	0.23	–	–	0.07	0.24
Market access=yes	−0.45**	0.20	–	–	−0.36	0.22
Log-Sigma	0.31**	0.12			0.21***	0.07
Sigma	1.36***	0.17			–	–
sigma^2	1.86***	0.46			–	–
Rho	−0.59**	0.27			–	–
Observations	363				156	

Note: *p<0.1; **p<0.05; ***p<0.01

Additionally, as robustness check, we estimate the interval regression without controlling for sample selection. There are some slight differences: When employing the interval regression accounting for sample selection, education is statistically significant at 10% but the outcome in column (3) for the simple interval regression is not statistically significant at conventional levels. However, the direction of the effect is the same and the magnitude is similar to education in column (2). While the variable age is not statistically significant in both cases it has a lower magnitude for the interval regression accounting for sample selection bias (7.10), compared to the simple interval regression (11.12). The same holds true for age^2. Some effects estimated in the simple interval regression model, such as marital status or negative effects of COVID-19 are only used for the selection equation because of the exclusion restriction.

6. Conclusion and Policy Implications

Rural households in SSA often depend on farming for their livelihoods and are particularly vulnerable to unforeseen shocks and income fluctuations, a characteristic of agricultural production. Providing smallholder farmers with tools to facilitate and increase savings has proven to be a pathway towards higher resilience, especially for females. In our paper we analyze the determinants of savings for Ghanaian cocoa farmers, putting special attention on savings tools and MFS. We employ a Heckman-2step model, to identify the factors influencing a respondent's probability to save, as well as the accumulated amount. Our approach extends existing empirical studies by focusing on the marginalized group of smallholder cocoa farmers in Eastern Region and their use of MFS, among other savings instruments.

The results reveal that bank saving and the traditional method Susu increase a respondent's savings amount, however, only the effect for the bank account is statistically significant. Surprisingly, mobile phone usage seems to have a negative effect on a respondent's savings amount (although not statistically significant at conventional levels). While this seems to be counter intuitive at first, there are logical explanations for this result, such as the usage of the mobile phone for savings purposes but also as a remittance tool. When we look at the interaction of gender and MFS usage, we see that for females the effect turns out to be positive and statistically significant: Saving on the mobile phone seems to be particularly beneficial for women in the Ghanaian cocoa sector. Further, we find that education plays an

important role and we see that women and divorced respondents seem to face more obstacles to accumulating money in comparison to men and married respondents.

The role of MFS usage on women's savings amounts suggests the need for strengthening MFS providers outreach to extend their focus on female smallholder farmers and accelerate technology adoption. The marginalized situation of many smallholder farmers in SSA calls for improving access to formal financial services as they have proven to contribute to women empowerment and pro-poor development. Yet, MFS usage should not be seen as a panacea for financial inclusion. Adverse effects, as also seen in our results, should always be considered in the implementation and extension of such services. Our results, along with findings from previous research, suggest the important role of education. Thus, investments in rural public education with a special focus on women is a promising approach to allow for conscious and responsible use of such a technology.

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Appendix

Table A.1: Comparison of means between farmers responding to the question on the amount of savings and those who have savings.

	Pooled sample			Sub sample responded		
Variable	Answer	No answer	p-values	Saving	No saving	p-values
n	363	42		207	156	
Dependent variable						
Savings (%)		–	–	–	–	–
0	156 (43.0)	–	–	–	–	–
[1, 500]	52 (14.3)	–	–	–	–	–
[500, 1000]	39 (10.7)	–	–	–	–	–
[1000, 5000]	67 (18.5)	–	–	–	–	–
[5000, 10000]	35 (9.6)	–	–	–	–	–
>10000	14 (3.9)	–	–	–	–	–
Household characteristics						
Age (mean (SD))	52.13 (12.56)	54.29 (13.16)	0.296	49.88 (11.84)	55.13 (12.90)	0.001
Education (mean (SD))	8.82 (3.66)	8.10 (4.20)	0.232	9.64 (2.82)	7.74 (4.32)	0.001
Gender = female (%)	141 (38.8)	17 (40.5)	0.969	61 (29.5)	80 (51.3)	0.001
Household size (mean (SD))	5.82 (2.55)	5.76 (2.76)	0.888	5.77 (2.39)	5.89 (2.75)	0.650
Land size (mean (SD))	8.64 (6.18)	9.62 (6.24)	0.333	9.45 (6.36)	7.57 (5.79)	0.004
Marital status (%)			0.429			0.029
Divorced	18 (5.0)	3 (7.1)		7 (3.4)	11 (7.1)	
Married	281 (77.4)	35 (83.3)		169 (81.6)	112 (71.8)	
Single	16 (4.4)	0 (0.0)		11 (5.3)	5 (3.2)	
Widowed	48 (13.2)	4 (9.5)		20 (9.7)	28 (17.9)	
Savings instrument						
Bank = yes (%)	188 (51.8)	26 (61.9)	0.280	169 (81.6)	19 (12.2)	0.001
Mobile phone = yes (%)	110 (30.3)	8 (19.0)	0.180	90 (43.5)	20 (12.8)	0.001
Susu = yes (%)	44 (12.1)	1 (2.4)	0.101	42 (20.3)	2 (1.3)	0.001
Access to services						
Dist. agent (%)			0.806			0.860
< 20 min	297 (81.8)	36 (85.7)		170 (82.1)	127 (81.4)	
< 60 min	41 (11.3)	4 (9.5)		24 (11.6)	17 (10.9)	
> 60 min	25 (6.9)	2 (4.8)		13 (6.3)	12 (7.7)	
Dist. bank (%)			0.159			0.121
< 20 min	51 (14.0)	2 (4.8)		35 (16.9)	16 (10.3)	
< 60 min	141 (38.8)	21 (50.0)		82 (39.6)	59 (37.8)	
> 60 min	171 (47.1)	19 (45.2)		90 (43.5)	81 (51.9)	
Network quality (%)			0.226			0.001
Very good	236 (65.0)	27 (64.3)		121 (58.5)	115 (73.7)	
Good	93 (25.6)	14 (33.3)		56 (27.1)	37 (23.7)	
Very bad	34 (9.4)	1 (2.4)		30 (14.5)	4 (2.6)	
Negative shocks-COVID-19						
Household = Yes (%)	182 (50.1)	24 (57.1)	0.486	91 (44.0)	91 (58.3)	0.009
Market access = Yes (%)	226 (62.3)	32 (76.2)	0.108	111 (53.6)	115 (73.7)	0.001

Table A.2: Determinants of saving and marginal effects of the probit model

	Probit model (1)		Marginal effects (2)	
	Estimate	Std Error	Estimate	Std Error
Intercept	−27.57**	(12.87)	–	–
Household characteristics				
Log Age	15.81**	6.76	6.18**	2.53
Log Age^2	−2.18**	0.88	−0.85**	0.33
Education	0.24***	0.07	0.09***	0.03
Education^2	−0.01*	0.00	0.00*	0.00
Gender	−0.30*	0.18	−0.12*	0.07
Household size	−0.06*	0.03	−0.02**	0.01
Land size	0.03**	0.01	0.01**	0.01
Marital status: divorced	−0.86**	0.37	−0.33***	0.12
Marital status: single	−0.07	0.42	−0.03	0.15
Marital status: widowed	0.01	0.27	0.00	(0.10)
Access to services				
Network quality: very good	−1.18***	(0.34)	−0.42***	(0.11)
Network quality: good	−0.86**	(0.35)	−0.33**	(0.14)
Dist. bank -60 min	−0.24	(0.24)	−0.09	(0.09)
Dist. bank +60min	−0.27	(0.26)	−0.11	(0.09)
Negative shocks Covid-19				
Household=yes	−0.18	(0.21)	−0.07	(0.08)
Market access=yes	−0.43**	(0.18)	−0.16**	(0.07)

Note: *p<0.1; **p<0.05; ***p<0.01