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Agricultural value chain participation and farmers' access to credit in northern Ghana

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Abstract

Purpose – Promoted for its inclusivity, agricultural value chain (AVC) financing leverages social capital and mechanisms such as off-take agreements and forward contracts to reduce borrowing and lending costs and risks for both farmers and lending institutions. AVC financing has been defined as the flow of financial products and services to and among the various actors within the AVC to address constraints of production and distribution and fulfill the needs of those involved in the chain by reducing risk and improving efficiency. This paper investigates how farmers' involvement in AVC affects their access to credit.

Design/methodology/approach – The authors collected primary data from 400 crop farmers in northern Ghana through a semi-structured questionnaire and analyzed the data, using the multinomial endogenous switching regression model.

Findings – Joint participation in AVC increased the amount of formal and informal credit received by 64 and 78%, respectively, compared to nonparticipation. Similarly, participation in AVC horizontal linkage and AVC vertical linkage increased the amount of formal and informal credit received by 40 and 47% and 46 and 74%, respectively, compared to nonparticipation. Irrigation farming, extension visits, knowledge of AVC in the community, access to a storage facility and trust in contract farming significantly influenced farmers' participation in AVC.

Originality/value – The authors' work offers valuable insights into how different dimensions of value chain participation can impact smallholder farmers' access to credit. This work also underscores the importance of considering both formal and informal credit sources when analyzing the outcomes of value chain participation. The findings could enable formal financial providers to identify, liaise and/or resource informal financial players such as value chain actors to supply both formal and informal credit to farmers in AVCs.

Keywords Agricultural value chain participation, Credit access, Multinomial endogenous switching regression model, Northern Ghana

Paper type Research paper

1. Introduction

Agriculture is still an important economic sector of many developing countries. In rural Ghana, where most poor people live, agriculture employs more than 70% of the workforce (GSS, 2019). While it has been argued that agricultural growth through increased productivity has a larger impact on poverty reduction than the nonagricultural sector, mechanisms for fostering agricultural productivity growth are still problematic. For instance,

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agricultural productivity growth is associated with the use of modern inputs, which often requires a substantial capital outlay for the optimal application of inputs in production (Khanal and Omobitan, 2020; Mani and Joshi, 2017). To overcome capital constraints, farmers need sufficient credit for their farming operations (Dicken, 2007; Awotide *et al.*, 2015; Saqib *et al.*, 2018). Credit access can significantly increase the ability of households with little or no income and savings to meet their production, social and financial needs. For instance, farmers with credit have capital to buy inputs and adopt improved technology and hire services, including mechanization and labor, to increase production (Moahid and Maharjan 2020). It also helps farmers diversify into new areas of farm and nonfarm enterprises (Ahma *et al.*, 2010; Alhassan *et al.*, 2020).

Agricultural credit takes several forms, such as cash, inputs and services (including mechanization and labor), given to farmers by financial institutions, with particular agreement on when and how much credit is received and subsequently paid (Kosgey, 2013). Credit that takes the form of input (trader credit or in-kind credit) is mostly provided by agricultural input suppliers, processors and buyers. However, it is increasingly becoming evident that farmers can gain less cumbersome access to those credits once they participate in agricultural value chains (AVCs). Financing agriculture through the AVC is called AVC financing and has been defined as the flow of financial products and services to and among the various actors within the AVC to address constraints of production and distribution and fulfill the needs of those involved in the chain by reducing risk and improving efficiency (Miller and Jones, 2010). In AVC financing, actors provide credit based on good relationships and trust instead of collateral (Ninh and Kieu, 2019). Participation in AVCs also helps farmers to escape most of the stringent terms and conditions of formal financial institutions and gain access to cash credit with flexible terms (Miller and Jones, 2010). Despite the potential of AVCs in enhancing farmers' access to credit, little is known about the processes and effects of farmer participation in AVCs. This paper examines how farmers' participation in horizontal and vertical AVC links affects their access to both formal credit and informal credits. The need to achieve higher agricultural growth continues to attract the attention of the government and development partners, since it is inextricably linked to economic growth and poverty alleviation. Critically, to achieve higher agricultural growth, farmers need to have agricultural credit. However, their access to credit can only be sustained when they are well integrated in input and output markets that produce and stimulate higher farm incomes and loan repayment. This study has significant implications for the development of smallholder agriculture. In practice, it brings to light the channels or links by which agricultural credit can be made available and easily flows to farmers. The study is unique in that it deciphers farmers' participation in AVC into horizontal linkage (AVC-HL), vertical linkage (AVC-VL and joint participation) and examines their individual effect on credit access. Empirical studies have not yet analyzed how these dimensions of farmers' participation in AVCs relate to credit access.

Section 2 discusses the trends and problems of agricultural financing in Ghana, while Section 3 describes the research methodology. Section 4 presents the results and discussion, while Section 6 concludes with some policy implications.

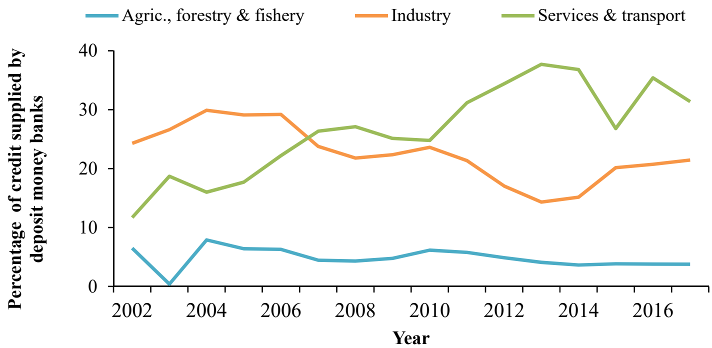
2. Agricultural financing in Ghana: trends, problems and empirics

Over the years, the Government of Ghana (GoG), through the Bank of Ghana (BoG), has played a facilitating role in agriculture financing (Nkegbe, 2018). With the governments' focus on developing and modernizing agriculture in Ghana, the need to set up a specialized bank to supply credit to farmers was a priority. Hence, in 1965, the Agricultural Development Bank (ADB) was established. This led to the rapid expansion of agricultural credit, where farmers were granted larger loans for the purchase of farm equipment such as tractors and combined harvesters as well as modern inputs such as improved seeds, fertilizers and agrochemicals. Development partners, such as the Africa Development Bank (AfDB), provided funds to the BoG to refinance the ADB at subsidized interest rates under projects such as the Food Crop Development Project (FCDP), Lowland Rice Development Project – LRDP (1997–2007) and Livestock Development Project – LDP (2003–2010), with the broad aim of increasing farmers' productivity and reducing poverty.

In 1976, the BoG introduced the rural banking concept, which allowed members of rural communities to obtain licenses, purchase shares and open and operate rural banks as alternative channels for providing financial services to rural people (Steel and Andah, 2004). To ensure that farmers obtained credit for agricultural production, the BoG further introduced the quota system that mandated all rural and community banks to allocate 50% of their loan portfolios to agriculture. Commercial banks were also mandated to allocate 20% of their entire loan portfolio to agriculture (Awunyo-Vitor, 2012). Furthermore, in the mid-1980s–1990s, the Central Bank liberalized the financial market, which paved the way for massive expansion of financial services to the majority of the rural population through the establishment of the microfinance industry (Awunyo-Vitor, 2012; Kyere, 2014). Even though the expansion of financial services to the majority of rural people resulted in increased farm outputs, those credit policies and programmes were not sustainable due to the inability of farmers to repay their loans. Consequently, credit flow to agriculture by financial institutions and donors declined, limiting farmers' access to credit (Abdallah, 2016; Appiah-Twumasi *et al.*, 2019) and prohibiting the right investments in new and more profitable crops, inputs and nonfarm businesses.

Figure 1 shows the percentage of credit provided to agriculture, industry and services by deposit money banks between 2002 and 2017. As evidenced in Figure 1, the share of agriculture in deposit money banks outstanding credit balance fell from 6.5% in 2002 to 3.8% in 2017, while the share of services in deposit money banks outstanding credit balance increased from 11.7% in 2002 to 31.37% in 2017. Furthermore, credit flow to agriculture was smaller compared to what the industry and services sectors received.

There are several reasons why credit flow to agriculture is low and declining. First, financial institutions view agricultural lending as risky, costly and unprofitable (Casuga *et al.*, 2008; Mani and Joshi, 2017). For example, the high tendency for farmers' production to fail due to diseases, pests and extreme weather events (such as droughts and floods) coupled with the high cost of financing widely dispersed farmers across large geographical regions may prevent financial institutions from lending to agriculture (Casuga *et al.*, 2008; Mani and Joshi, 2017). Recently, most financial institutions have been reluctant to do business with poor and



Source(s): Bank of Ghana (2002-2017)

Figure 1.
The trend of credit supplied to economic sectors by deposit money banks in Ghana

small-scale farmers due to their poor repayment behavior, which managers of financial institutions believe is deliberate. To reduce the risk of lending, financial institutions rely on proof of address, viable business plans, lengthy documentations and collateral (guarantor) as part of their screening processes to solve the selection problem, but this is discouraging to farmers.

Most lenders also set minimum requirements and higher interest on loans to cover up their administrative costs and increase their returns. Tang (1995) argues that some financial institutions ration borrowers using restrictive covenants, such as market interlinkage, which increases lenders' ability to monitor borrowers' behaviors and motivates borrowers to repay loans by making other transactions contingent upon loan repayment. In the absence of registered assets coupled with high illiteracy and lack of market interlinkages, most farmers rely on informal sources of credit (Chandio *et al.*, 2017; Chen *et al.*, 2015a, b; Cowan *et al.*, 2015; Luan and Kingsbury, 2019; Swamy and Dharani, 2016). However, informal credit is somehow expensive, short-term and often small in size to merit intensive farming (Dong *et al.*, 2012; Lin *et al.*, 2019). Hence, it appears not a good substitute for formal credit (Chen, 2004) and borrowers can be abused due to a lack of legal protection (Lin *et al.*, 2019).

The foregoing approach to agricultural financing is described in this paper as the traditional approach. The traditional approach is that the potential farmer seeking credit is appraised as a separate or independent entity, without any coordination, collaboration or linkages between farmers and other AVC actors. Lenders' criteria for advancing credit are mainly tied to the educational level, nature (size) of the farm business, cash flow, account turnovers, familiarity with the potential borrower and how the loan affects farmers' outputs, among others. The approach does not consider contractual arrangements between farmers and off-takers to buy farm produce, which negatively affects farmers' loan repayment (Köhn, 2014; Luan and Kingsbury, 2019).

To overcome the weaknesses of the traditional approach, financing through the AVC has recently been encouraged to increase farmers' access to credit, as there are groups and contracting mechanisms within the chain that help mitigate the costs and risks of borrowing. The AVC consists of several interlinked agents and markets involved in transforming inputs and services into products with attributes that consumers are prepared to purchase (Horton *et al.*, 2016) or the full range of activities involved in getting a product or service from conception through the different distribution channels to the final consumer (Kaplinsky and Morris, 2000). AVCs are broadly characterized by two main forms of linkages, which are vertical and horizontal.

The vertical link (AVC-VL) refers to the relationship among actors performing different activities. This type of relationship is strengthened through input and product market contracts (Herrmann *et al.*, 2018). Examples are the relationships between input suppliers and producers, input dealers and traders, producers and traders, producers and processors, producers and exporters and producers and consumers. The horizontal link (AVC-HL), on the other hand, refers to relationships among members of the same enterprise performing similar functions. The AVC-HL involves group formation and networking.

In AVCs, farmers can obtain credit from within the chain (direct/internal financing) and outside the chain (indirect/external financing). Financiers may provide credit more readily to farmers based on social collateral or the guarantee that farmers have a link with buyers (Cowan *et al.*, 2015; Hartarska and Nadolnyak, 2012) and the assured market that helps them sell their produce in bulk and receive ready incomes (Mani and Joshi, 2017; Swamy and Dharani, 2016). According to Devaux *et al.* (2018), AVC financing is an effective and efficient method of agricultural financing. Booker *et al.* (2015) argue that AVC appraises and satisfies the credit needs as well as builds the repayment capacity of each actor along the entire chain. Caniato *et al.* (2016) also argue that AVC improves credit access to smallholder farmers, since it is an important route to reach out to large numbers of smallholders at reduced costs and risks (Miller and Jones, 2010).

In Zambia, Middelberg (2017) found evidence that financing through the value chain improves farmers' access to credit. In South Africa, Oberholster *et al.* (2015) examined the factors that promote the success of financial flows through the value chain, while Köhn (2014) assessed farmers' motivation for participating in AVCs. All these studies did not account for selection bias and treatment effects that are very likely to be associated with these variables. This is the gap in the literature relative to using quantitative techniques to estimate the effects of AVC participation on access to credit, which this paper attempts to fill.

3. Methodology

3.1 Survey design and data

A cross-sectional survey was conducted to collect primary data from maize farmers in northern Ghana. Primary data were collected using a structured questionnaire. The questionnaire for the data collection was pretested for quality and reliability. Around five field assistants, including the researcher, took part in the data collection. During the period from January to 2017/2018 farming season, when the data for this study were collected, northern Ghana comprised the Northern region (NR), Upper East region (UER) and Upper West region (UWR). It now includes the North-East and Savannah regions increasing the total number of regions in the Savannah agroecology to five (Ampim *et al.*, 2021). Figure 2 is the map of the study area, encompassing the districts under study. The use of northern Ghana in this study refers exclusively to three regions (NR, UER and UWR), which accounted for nearly 41 and 17% of the total landmass and population in Ghana, respectively (see Figure 2).

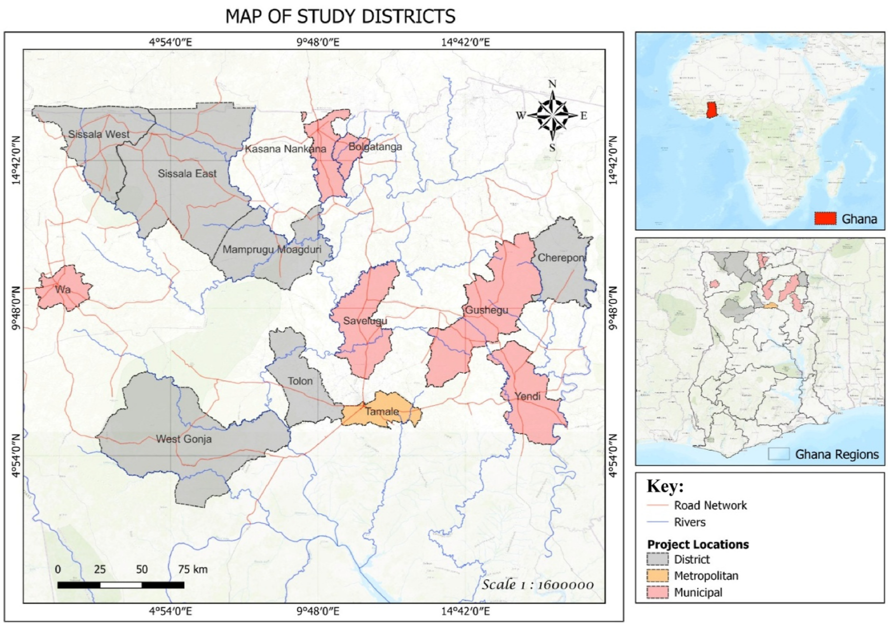


Figure 2.
Map of the study area

Source(s): Author's construct

We employed a multi-stage sampling procedure to select farmers in northern Ghana. In the first stage, we purposively selected 16 districts in Northern Ghana. The clustering was done to cover all the formal financial institutions in the study area (mainly commercial banks, rural and community banks and microfinance institutions). Around 8 of 13 districts were in the NR, to were in the UER and three were in the UWR. In the second stage, the stratified sampling approach was employed to select the five communities with AVC and 15 communities without AVC. In each AVC community, 35 farmers were randomly sampled. In each non-AVC community, 15 farmers were randomly selected. Our dataset included 175 AVC participants and 225 non-AVC participants, totaling 400 farmers. Yamane's (Yamane, 1967) formula was used to estimate the sample size:

$$n = \frac{N}{1 + N(e^2)} = \frac{1,132,765}{1 + 1,132,765\left(0.05^2\right)} = \frac{1,132,765}{2,832.9125} = 399.8588 \tag{1}$$

where n is the sample size, N is the population size in the Savannah agroecology taken from the Ghana Living Standard Survey (GLSS) 6 report (GSS, 2014) and margin of error of 5%. According to GSS (2014), the total number of maize and rice farmers in the Savannah agroecology was 1,132,765. Farmers and farmer groups involved in contractual arrangements with input dealers, processors and buyers were identified with the help of secondary information from key organizations and programs (such as the USAID-Agricultural Development and Value Chain Enhancement (ADVANCE), Ghana Commercial Agricultural Project and Northern Rural Growth Program (NRGP), Integrated Water Management and Agricultural Development (IWAD) and Association of Church Development Project (ACDEP)) and contact tracing of farmer leaders in some communities. Non-AVC participants were also selected with the help of secondary information from the Ministry of Food and Agriculture (MoFA) district office.

3.2 Analytical strategy

AVC participation is assumed to be correlated with the error term or endogenous. The decision to participate in AVC is not fully determined by observable factors. Rather, it is also affected by unobservable factors such as knowledge/perceptions, experience, trust, risk preference and entrepreneurial ability, which introduces some correlation between the error term and AVC participation. This problem leads to endogeneity bias or inconsistent estimates of credit access if ordinary least squares (OLS) or propensity score matching (PSM) is used. Following Di Falco and Veronesi (2013), this study specifies the MESR model into two equations: a first-stage multinomial selection equation (AVC participation) and a second-stage outcome equation (odds of credit access). AVC participation is an unordered categorical variable containing AVC-VL, AVC-HL and joint participation. AVC participation is estimated first to derive the inverse Mill's ratios (IMRs) using the multinomial logit model.

3.2.1 Multinomial logit (MNL) model. The MNL framework is built on the assumption that each farmer chooses one category from the set of mutually exclusive choices. The choice of one category over another is based on utility, which can be decomposed into observed and unobserved components. Let U denote the indirect utility associated with the mth choice, $m = 1, 2, 3$ and 4 for farmer i such that:

$$U^{*}_{im} = X_i\beta_m + \varepsilon_{im} \tag{2}$$

where X_i is a the vector of exogenous factors associated with unknown parameters and ε_{ij} is the idiosyncratic unobserved stochastic component. The observed utility (U) function of a farmer participating in m linkage over any other linkage k is expressed as follows:

$$U = \begin{cases} 1 if\, U^{*}_{im} > \max_{k\neq 1}\left(U^{*}_{ik}\right) \text{or } \omega_{i1} < 0 \\ \vdots \quad \vdots \quad \vdots \qquad\qquad\qquad\qquad \text{for all } k \neq m \\ M if\, U^{*}_{im} > \max_{k\neq M}\left(U^{*}_{ik}\right) \text{or } \omega_{iM} < 0 \end{cases} \tag{3}$$

where $\omega_{iM} = \max_{k\neq M}(U^{*}_{ik} - U^{*}_{im}) < 0$. Assuming ε_{im} meet the independence of irrelevant alternatives (IIA) assumption, then Equation [3] leads to the MNL model, as shown by following Cameron and Trivedi (2005), the conditional probability of the MNL model is specified as:

$$p_{im} = \Pr(\omega_{im} < 0|X_i) = \frac{\exp(X_i\beta_m)}{\sum_{k\neq 1}^{j}\exp(X_i\beta_k)} \tag{4}$$

The base category is used to compare other choices by restricting the base category's parameters to all zero ($\beta = 0$). The estimation of the MNL model is done by the maximum likelihood estimation (MLE) method. The log-likelihood function is expressed as follows:

$$\ln L = \sum_{i=1}^{n}\sum_{j=1}^{k} Y_{ij} \log\left(p_{im}\right) \tag{5}$$

3.2.2 Multinomial endogenous switching regression (MESR) model. We employed the MESR model developed by Bourguignon *et al.* (2007), as the selection bias correction model to analyze the relationship between AVC participation and farmers' credit access. In our model, a farmer faces four regimes, the base category of which is nonparticipation (H_0V_0). The amount of formal and informal credit equation for each possible regime (m) can be expressed as follows:

$$\begin{cases} Regime\, 1 : y_{i1} = B_1 Z_{i1} + u_{i1}\, if\ U = 1 \\ \vdots \quad \vdots \quad \vdots \qquad\qquad\qquad\qquad m = 2, 3, 4 \\ Regime\, M : y_{im} = B_m Z_{im} + u_{im}\, if\ U = M \end{cases} \tag{6}$$

where y_{im} is the amount of formal and informal credit received by the ith farmer in regime m, Z is the vector of exogenous explanatory variables, B_{im} represents a vector of unknown parameters to be estimated and u_{im} are the error terms distribution with $E(\varepsilon_{im}|X, Z) = 0$ and $\text{var}(\varepsilon_{im}|X, Z) = \sigma^2_m$. y_{im} is observed if and only if one of the possible AVC participation combinations is used. Given this, some unobserved factors that influence AVC participation could also influence the amount of formal and informal credit received by farmers, thereby leading to non-zero covariances between the error terms of AVC participation (ε_{im}) and the amount of formal and informal credit received by farmers (u_{im}). Using OLS would lead to inconsistent estimates of the outcome variables because the error terms, conditional on the AVC participation decision criteria, have non-zero expected values. To obtain consistent of B_{im}, we include the selection correction terms of the AVC participation choices in the outcome equations, as expressed in Equation (7).

$$\begin{cases} Regime\,1: y_{i1} = B_1 Z_{i1} + \sigma_1 \lambda_{i1} + v_{i1}\; if\; U = 1 \\ \qquad \vdots \quad \vdots \quad \vdots \qquad\qquad\qquad m = 2, 3, 4 \\ Regime\,M: y_{im} = B_m Z_{im} + \sigma_m \lambda_{im} + v_{im}\; if\; U = M \end{cases} \tag{7}$$

where λ is the IMR and α is the unknown parameter relating to IMR. As a rule, the IMRs from the MNL model are included in the second-stage OLS model to control endogeneity bias in the outcome equation. Following Teklewold *et al.* (2013), the IMR can be defined as follows:

$$\lambda_{im} = \sum_{k \neq m}^{j} \rho_m \left[\frac{\widehat{p}_{ki} \ln\left(\widehat{p}_{ki}\right)}{1 - \widehat{p}_{ki}} + \ln\left(\widehat{p}_{mi}\right) \right] \tag{8}$$

where ρ is the correlation between ε_{im} and u_{im}. In the multinomial choice setting, there are $m-1$ selection correction terms. σ in Equation [7] is the covariance between ε_{im}, u_{im} and v_{im} is the error term with an expected value of zero. The MESR model is estimated using the full information maximum likelihood (FIML). We use a restriction criterion, where requires that there must be identification or instrumental variables (knowledge of AVC in the community, trust in contract farming and main market source). The restriction criteria means that at least one variable that affects selection decisions must not directly affect any of the outcome variables. In addition to controlling selection bias, the MESR also helps in constructing counterfactuals based on returns to the characteristics of AVC participants and nonparticipants. The counterfactual amount is then compared to the actual amount to derive the average treatment effects on the treated. Following Manda *et al.* (2021), the expected amount of formal and informal credit under the actual scenario for each AVC participation decision is expressed as:

$$E\left(y_{im} \middle| U = m, Z_{im}, \widehat{\lambda}_{im}\right) = \beta_m Z_{im} + \sigma_m \widehat{\lambda}_{im} \tag{9}$$

The expected amount of formal and informal credit received by farmers had he or she chooses not to participate is expressed as:

$$E\left(y_{i1} \middle| U = m, Z_{im}, \widehat{\lambda}_{im}\right) = \beta_1 Z_{im} + \sigma_1 \widehat{\lambda}_{im} \tag{10}$$

The difference between Equation [9] and Equation [10] is the average treatment effect (ATT) on the treated, which measures the effect of AVC participation on the amount of formal and informal credit received by farmers.

$$\begin{aligned} ATT &= E\left(y_{im} \middle| U = m, Z_{im}, \widehat{\lambda}_{im}\right) = \beta_m Z_{im} + \sigma_m \widehat{\lambda}_{im} - E\left(y_{i1} \middle| U = m, Z_{im}, \widehat{\lambda}_{im}\right) = \beta_1 Z_{im} + \sigma_1 \widehat{\lambda}_{im} \\ &= Z_{im}(\beta_m - \beta_1) + \widehat{\lambda}_{im}(\sigma_m - \sigma_1) \end{aligned} \tag{11}$$

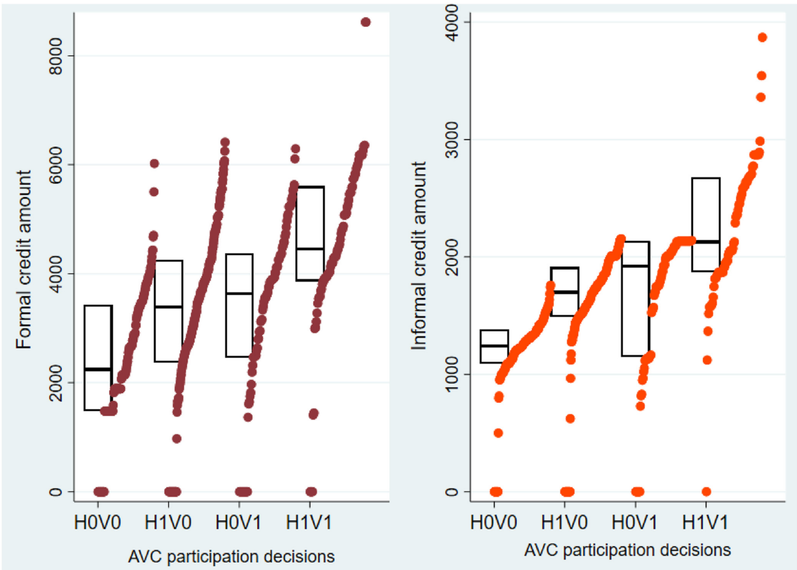
3.2.3 Measuring AVC participation and access to credit. AVC participation yields four distinct categories in the study: nonparticipation (H_0V_0), participation in the horizontal linkage of AVC (H_1V_0) only, participation in the vertical linkage of AVC (H_0V_1) only and joint participation (H_1V_1). Table 2 shows that 30.5% of the farmers did not participate in any of the AVC linkages, whereas 30.25% participated in the horizontal linkage, 20.75% in the vertical linkage and 18.5% in both linkages. Participating in both linkages implies that the farmer joined farmer group (farmer-to-farmer relationship) and engaged in contractual arrangements with input dealers (farmer-to-input market actor relationship) and buyers (farmer-to-output market actor relationship). Joint participation may have the greatest impact on credit access if farmers receive financing within (internal) and outside (external) the AVC.

More than half (65.38%) of the farmers had access to credits. Of these credits, 71.52% were from informal financial institutions and 28.48% were from formal financial institutions. This result is consistent with Birthal *et al.* (2017), who found that a considerable proportion of smallholder farmers borrow from informal sources because of their more flexible and less cumbersome procedures. AVC actors also have access to credit more internal finance more than external finance from commercial banks and other financial institutions (Chen *et al.*, 2015a, b). Commercial banks predominately use conventional lending approaches heavily dependent on collateral which typically results in a shortage of credit available to the chain actors (Luan and Kingsbury, 2019). Informal financial institutions were nucleus farmers, traders, input suppliers, aggregators, farmers, relatives, friends and moneylenders and formal financial institutions were commercial banks, rural and community banks and microfinance institutions. Before explaining the econometric results, we use a strip plot to depict the distributions of credit access by AVC participation decisions. Figure 3 is the strip plot, which shows the mean credit amount with the associated cumulative probabilities of each AVC participation decision. Farmers who participated in AVCs reported a higher mean credit amount than nonparticipants. Farmers who participated in both linkages (H_1V_1) received the highest credit amount, followed by farmers who participated in H_0V_1 and H_1V_0 (Figure 3).

4. Results and discussions

4.1 Data description

Table 1 presents the descriptive results of variables used in the study. Most farmers (63%) interviewed were men. Also, we found more men in maize and rice value chains (H_1V_0 and H_1V_1) because they have greater access and control in determining farm input requirements and



Source(s): Author's own creation

Figure 3. Distribution of credit amount by participation in AVCs

utilization, compared to women who manage less resource-demanding crops such as vegetables on smaller plots to supplement the household's food security and income (Lambrecht, 2016). The mean age of farmers was 42.55 years, indicating that they have passed their youth, yet are economically active. Farmers in their middle age are older. Older farmers may be risk averse and non-receptive to contract farming arrangements because sometimes they have difficulty in understanding complicated contract provisions and following instructions regarding new production practices than younger farmers (Zheng *et al.*, 2008). Farmers had spent an average of 3.60 years in school, which corresponds to basic (primary) school education in Ghana's educational system. Educated farmers are unlikely to seek information about the risks and benefits of contract farming arrangement and formal credit application processes (Adnan *et al.*, 2020). Most farmers were natives (79%) and married (75%). The results indicate that marriage is common among farmers. The results also imply that farming is also an indigenous activity in northern Ghana, as indigenes are mostly involved in the industry.

The mean household size was roughly ten people. Households with more active members can obtain sufficient family labor for farm, off-farm and non-farm jobs (Kumar *et al.*, 2019). Few farmers did off-farm work (23%) and irrigation farming (28%). The average cropland of farmers was 22.30 acres (or 8.99 ha). Farmers cultivated an average of 2 of the following crops: maize, rice, soybean, millet, sorghum, groundnuts, beans, cassava and leafy greens on the same or different plots. Farmers received an average of two extension visits to their farms. Contact with extension agents were the main sources of information on farming practices, credits and markets. Most farmers had access to marketing information (74%) and knowledge of AVC (76%) in their community. Over half of the farmers owned a vehicle (53%) and high trust in contract farming arrangement (56%). About 41, 44 and 7% of the farmers had bank (from commercial and noncommercial financial entities), mobile money and informal savings ("Susu") accounts. Farmers traveled an average 6.39 km and 8.46 km to access markets and credit facilities. Less than half (49.2%) of the farmers market their produce outside their community.

4.2 Determinants of farmers' participation in AVCs

Table 2 presents the MNL model results of factors influencing AVC participation. Irrigation farming, extension visits, knowledge of AVC in the community, the main market source and trust in contract farming all had positive and significant effect on farmers' participation in AVCs (H_1V_0, H_0V_1 and H_1V_1). Irrigated farmers were more likely to participate in AVCs because irrigation helps farmers apply water at the most beneficial times of the year, increasing productivity and marketable surplus (Schoengold and Zilberman, 2007). Farmers who had extension visits were more likely to participate in AVCs. This finding is consistent with Mossie *et al.* (2020), who found that the frequency of extension contacts per year had a significant positive effect on apple producers' participation in value chains. Extension agents often mobilize and connect value chain actors to smallholder farmers when they visit. During extension, farmers get to know the importance of AVCs, which increases their chances of participating.

Participation choice set	Combustion	Horizontal (H)		Vertical (V)		Frequency	Percentage
		H_0	H_1	V_0	V_1		
1	H_0V_0	√		√		122	30.50
2	H_1V_0		√	√		121	30.25
3	H_0V_1	√			√	83	20.75
4	H_1V_1		√		√	74	18.50

Source(s): Field data, 2018

Table 1.
AVC participation decisions

Table 2.
Descriptive statistics of continuous variables used in the study

Variable		Full sample Means	H_0V_0 Means	H_1V_0 Means	H_0V_1 Means	H_1V_1 Means	*F*-stat
Sex	1 = if the gender of the farmer is a male	0.63 (0.48)	0.64 (0.48)	0.68 (0.47)	0.49 (0.50)	0.65 (0.48)	3.14**
Age	Age of farmers in years	42.55 (13.21)	40.90 (13.20)	43.27 (12.86)	42.79 (14.11)	43.57 (12.99)	1.09
Education	Farmer years of years of schooling	3.60 (4.70)	3.415 (5.03)	3.31 (4.56)	3.55 (4.78)	4.72 (4.19)	1.74
Marital status	1 = if the farmer is married	0.75 (0.27)	0.78 (0.33)	0.73 (0.25)	0.72 (0.28)	0.76 (0.20)	1.66
Resident status	1 if the farmer is native in the community	0.79 (0.41)	0.80 (0.41)	0.74 (0.44)	0.76 (0.43)	0.91 (0.29)	3.06**
Household size	No. of people eating from the same pot	10.18 (6.42)	9.53 (6.01)	11.29 (6.80)	9.91 (6.504)	8.87 (5.72)	3.55**
Off-farm job	1 = if the farmer is doing off-farm work	0.23 (0.42)	0.24 (0.43)	0.20 (0.40)	0.23 (0.43)	0.24 (0.43)	0.25
Cropland	Total acreage of farmer land under cultivation	22.47 (39.72)	27.77 (42.61)	19.28 (29.64)	26.28 (61.53)	16.19 (17.58)	2.16*
Irrigation farming	1 = if the farmer is doing irrigation farming	0.28 (0.41)	0.07 (0.32)	0.23 (0.41)	0.33 (0.41)	0.47 (0.48)	7.37***
Extension visits	No. of extension visits to the farm	1.01 (1.19)	0.44 (0.93)	1.14 (1.13)	1.61 (1.25)	1.07 (1.25)	21.23***
Crop diversification	No. of crops cultivated by the farmer	1.97 (0.94)	2.01 (0.88)	1.95 (1.02)	2.05 (1.05)	1.83 (0.70)	0.9
Distance to market	Total distance traveled to access a market in Km	6.39 (6.67)	6.69 (7.53)	7.04 (7.58)	5.98 (5.35)	4.63 (1.95)	2.57*
Distance to bank	Total distance traveled to access a bank in Km	8.46 (6.42)	8.08 (6.48)	8.51 (6.56)	8.86 (6.15)	8.61 (6.32)	0.29
Vehicle	1 = if the farmer owned a vehicle	0.53 (0.41)	0.51 (0.50)	0.63 (0.49)	0.57 (0.49)	0.25 (0.44)	11.03***
Marketing information	1 = if the farmer had access to marketing info	0.74 (0.29)	0.77 (0.19)	0.70 (0.30)	0.78 (0.42)	0.79 (0.12)	10.21***
Knowledge of AVC	1 = if the farmer is aware of AVCs in his or her community	0.76 (0.43)	0.52 (0.50)	0.80 (0.07)	0.85 (0.50)	0.80 (0.06)	91.57***
Market source	1 = if the farmer's main market is outside the community	0.49 (0.50)	0.13 (0.50)	0.54 (0.50)	0.68 (0.49)	0.61 (0.49)	4.20***
Trust	1 = if the farmer has a high trust in contracting	0.56 (0.50)	0.29 (0.455)	0.61 (0.39)	0.55 (0.40)	0.59 (0.37)	78.99***
Collateral	1 = if the farmer has collateral	0.45 (0.50)	0.58 (0.50)	0.41 (0.49)	0.43 (0.50)	0.56 (0.50)	3.88***
Bank account	1 = if the farmer has a bank account	0.18 (0.41)	0.193 (0.257)	0.17 (0.48)	0.18 (0.40)	0.18 (0.37)	14.39***
MoMo account	1 = if the farmer has a mobile money account	0.44 (0.50)	0.35 (0.48)	0.49 (0.50)	0.61 (0.49)	0.33 (0.48)	6.81***
ISA	1 = if the farmer has an informal saving account (ISA)	0.07 (0.25)	0.07 (0.26)	0.06 (0.25)	0.09 (0.29)	0.03 (0.16)	0.97

Note(s): No savings account is set as base category. ***, 1% significance level; **, 5%; significance level and *, 10% significance
Source(s): Field data, 2018

Knowledge of AVCs in the community increased farmers' likelihood of AVC participation. Farmers who were aware of AVC activities in their community already have market information. Being aware is the starting for farmers to contact or locate other AVC actors to engage with. The process of introducing a new technology or concept usually involves several stages, including awareness. The farmer will produce commodities using prior market knowledge (demand and price) and interact with other AVC actors if he or she knows where they are (Eaton and Shepherd, 2001). In the awareness stage, the investor or information provider (herein called extension agent) conveys the risks and prospects of the concept (AVCs) to the farmer and for that increases their chances of participating. Farmers who had a high trust in contract farming are more likely to participate in AVCs than those with a low trust in contract farming. Trust is the foundation of all transactions, agreements and collaboration; without it AVC actors cannot work together or collaborate (Han *et al.*, 2021; Porras *et al.*, 2004). Rugema *et al.* (2018) also discovered that value chain actors interact or collaborate with one another as a result of trust. The main market source was also found to increase farmers' chances of participating in AVCs. Farmers join AVCs to minimize their market risks and costs if they were looking for markets outside of their community. Knowledge of AVCs in the community, trust in contract farming and the main market source were used as exclusion restrictions or instruments for a more robust identification of the MESR model. These instrumental variables (IV) have a strong significant effect on AVC participation, but not on credit access, conditional on participation. Following Di Falco and Veronesi (2013), we also conducted a falsification test to assess the validity of our instruments. An instrument is valid if it influences the decision to participate in AVC, but it has no effect on credit access for farmers who did not participate in AVC. The results revealed that the instruments are valid since they are significant in the AVC participation models (Table 3) but not in the credit access model among the non-market participants (Table A1 in Appendix).

	H_1V_0		H_0V_1		H_1V_1	
Variable	Coeff.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
Gender	0.011	0.423	−1.097**	0.436	−0.409	0.437
Age	0.007	0.015	0.003	0.016	0.027*	0.016
Education	−0.016	0.043	0.024	0.046	0.038	0.043
Household size	0.312	0.574	0.338	0.554	0.250	0.604
Off-farm job	−0.331	0.470	−1.348**	0.588	0.323	0.447
Cropland	−0.013**	0.006	−0.002	0.003	−0.010	0.008
Crop diversification	−0.432**	0.190	−0.181	0.200	−0.051	0.234
Irrigation farming	0.958**	0.469	0.805**	0.357	0.988***	0.310
Extension contacts	0.573***	0.175	0.874***	0.172	0.543***	0.177
Vehicle	0.223	0.414	−0.288	0.425	−0.668	0.451
Marketing information	−1.434	0.823	−2.196***	0.730	0.223	1.441
Distance to market	−0.111	0.267	−0.320	0.305	−1.569	0.661
Knowledge of AVC	2.595***	0.842	2.393**	1.144	3.703***	0.808
Market source	4.492***	0.471	3.684***	0.482	4.223***	0.755
Trust	2.157***	0.447	0.887*	0.502	2.269***	0.451
Constant	−2.077	1.306	0.690	1.228	−3.367*	1.780
Joint significance of instruments (χ^2)	108.63***		58.79***		45.74***	

Note(s): ***, 1% significance level; **, 5%; significance level and *,10% significance level
Source(s): Field data, 2018

Table 3. First-stage MESR regression results showing the determinants of farmers' participation in agricultural value chain

Female farmers were more likely to participate in H_0V_1 than males. Women play a significant role in agriculture marketing and are more likely to collaborate with other AVC actors. Farmers who had off-farm jobs were less likely to participate in H_0V_1. Age increased joint participation in AVC (H_1V_1). This finding is congruent with Ndlovu *et al.* (2021) and Ola (2020), who found a positive relationship between age of male and female farmers and AVC participation. Older farmers have greater farming networks and experience, and hence, have a wealth of information to participate in AVC. Total cropland reduced farmers' participation in H_0V_1. In most remote areas, smallholder farmers often lack access to ready inputs to grow a wide range of crops on a commercial basis and hence are likely to participate in AVCs to acquire inputs and other services from contractors or value chain actors. Farmers who had access to marketing information were less likely to participate in H_0V_1. This finding disagrees with Islam (2021) and Mossie *et al.* (2020), who found that access to marketing (price) information had a significant positive effect on apple producers' participation in value chains. Contrary to our expectation, growing more crops per season reduced farmers' participation in H_1V_0.

4.3 Effect of AVC participation on farmers' credit access

Table 4 presents the effect of AVC participation on credit access. According the results, participation in single and joint AVC linkages significantly increased farmers' credit access. Specifically, participation in AVC horizontal linkage (H_1V_0) increased the amount of formal and informal credit received by 40 and 47%, respectively, compared to nonparticipation, whereas participation in AVC vertical linkage (H_0V_1) increased the amount of formal and informal credit received by 46 and 74%, respectively, compared to nonparticipation. More importantly, joint participation (H_1V_1) increased the amount of formal and informal credit received by 64 and 78%, respectively, compared to nonparticipation. The results imply that farmers who participated in both links have bigger credit amount, compared to nonparticipation.

A number of reasons can be attributed to the positive effect of participation in AVCs on credit access. First, farmers who are in AVCs benefit from market contracts and collective actions, which they use as social collateral for loans from both within (internal finance) and outside (external finance) the value chain (Birthal *et al.*, 2017). Chain actors obtained external finance from banks and non-AVC actors such as friends and family and internal finance from their co-workers and other chain actors such as input dealers, processors and traders. Chain actors provided input, mechanization (technology) and services credit to farmers in exchange for the farmer's produce (Adjognon *et al.*, 2017). To prevent diversion of cash and ensure full utilization of funds for intended purposes, chain actors often purchased and delivered the inputs to farmers.

Outcome	Participants	Nonparticipants	ATT	Change in outcome
Formal credit				
H_1V_0	7.624	5.441	2.183 (0.723)***	40%
H_0V_1	6.956	5.456	2.500 (0.664)***	46%
H_1V_1	8.980	5.468	3.516 (0.811)***	64%
Informal credit				
H_1V_0	6.738	4.632	2.106 (0.830)***	47%
H_0V_1	7.841	4.496	3.345 (0.736)***	74%
H_1V_1	8.759	4.913	3.846 (0.774)***	78%

Note(s): ***, 1% significance level; **, 5%; significance level and *,10% significance level
Source(s): Field data, 2018

Table 4.
Average treatment effect of AVC participation on farmers' credit access based on MESR

Second, farmers who are in AVCs are easier to identify and finance by financial institutions because they are organized and united than their nonparticipant counterparts who operate independently in scattered or remote locations (Birthal *et al.*, 2017). Financing the AVC helps financial institutions to reduce transaction costs and lending risks associated with short-term loans. In some cases, the loan is issued to a cooperative, which is open to reliable members and does not need collateral to apply (Middleberg, 2017). This finding is consistent with Linh *et al.* (2020), who revealed that group membership or farmer-to-farmer relationships increase the probability of accessing formal credit. Ma *et al.* (2018) also reported that smallholder farmers have enhanced access to credit when they form groups or enter into contracts with input dealers and buyers.

Third, a farmer's commitment to sell produce to a buyer demonstrates that he or she is potentially creditworthy or has a higher ability to satisfy his repayment obligations if granted a bigger loan amount (Birthal *et al.*, 2017). Farmers in AVC horizontal linkage (H_1V_0) or farmer groups monitor credit use to ensure timely repayment by their members (Luan and Kingsbury, 2019). Technology transfer and pre-harvest contracts within the chain increase agricultural productivity and incomes, making the farmer's business more appealing to financial institutions for larger funding. When there is a tripartite agreement among the financing institutions, lead firms and farmers, the former (financing institutions) can rely on the intermediary (lead firm) to recover and deposit sale proceeds (loans) in the bank account on behalf of the latter (farmers) to avoid breach of contract with the financial institutions (Birthal *et al.*, 2017; Middleberg, 2017). Financial institutions can increase the supply of credit to smallholder farmers if buyers bear some or all of the risk and burden for loan recovery (Kopparthi and Kagabo, 2012).

The MESR results used to estimate ATT are presented in Tables A2 and A3 as appendix. Sex of farmer had a negative significant effect on the amount of formal and informal credit received by nonparticipants, but a positive effect on the amount of formal and informal credit received by joint participation. Age had a significant positive effect on the amount of formal credit received by nonparticipants and all AVC participants. This result is consistent with Barslund and Tarp (2008), who found that age reduces the probability of informal credit access. The results imply that older farmers who participated in AVCs had bigger formal credit amounts. Marital status had a positive effect on the amount of formal and informal credit received by nonparticipants. Marital status was also found to be positive associated with the amount of formal credit received by all AVC participants. Collateral was found to positively influence the amount of formal credit received by non-participants and all AVC participants. Collateral also had a positive effect on the amount of informal credit received by H_0V_1 participants. Cropland and ownership of bank account exhibited positive effect on formal credit amount for nonparticipants and all AVC participants. However, ownership of bank account was negatively associated with the amount of informal credit received by H_1V_0 participants. Larger landholdings can serve as an input for commercial agriculture and collateral for securing formal credit. This result is consistent with Chandio *et al.* (2020), who found that formal credit demand was positively affected by landholding. Banks prefer lending credits to borrowers with an account with them so that they can better monitor their cash flows (Luan and Kingsbury, 2019). This finding is consistent with Dzadze *et al.* (2012), who reported a positive relationship between possession of savings accounts and access to formal credit by farmers. Ownership of mobile money account had a positive effect on formal credit amounts for all AVC participants, but a negative effect on informal credit amount for H_0V_1 participants. Off-farm job and ownership of informal savings account (ISA) were found to positively influence formal credit amounts for H_0V_1 participants. Off-farm job had a negative effect on informal credit amounts for joint participation.

Residential status was positively associated with informal credit amounts for all AVC participants. Natives have more relations, which increases their social networks and consequently their chances of accessing informal credit. Networking helps firms reduce credit obstacles and asymmetric information in the credit market (Nguyen and Luu, 2013). Furthermore, extension contact increased informal credit amounts for joint participation. Farmers that have access to agricultural extension agents (AEAs) are more likely to be introduced to credit information as well credit application processes. Fortunate farmers may even obtain AEAs guaranteeing their credit applications from formal financial institutions. This finding ties in with those of Moahid and Maharjan (2020) and Chandio *et al.* (2017). Distance from home to the nearest bank was found to be positively associated with informal credit amounts for nonparticipants and joint participation.

5. Conclusion

The potential of AVC participation to facilitate farmers' access to credit is examined in this study. Since participation in AVCs is potentially endogenous in credit access models, we adopt the MESR model to accounts for endogeneity bias arising from self-selection. The analytical approach we used lead to interesting findings. Within the agricultural value chain, there are vertical and horizontal linkages, where farmers acquire production and marketing services through contractual arrangements and collective actions, respectively. Participation in AVCs played a significant role in increasing the amount of formal and informal credit received by farmers. Joint participation in AVCs exhibited the largest effect on credit access. Farmers participating in both linkages can access credit from within and outside the value chain because they enjoy social collateral and contracts. Irrigation farming, extension visits, knowledge of AVC in the community, access to a storage facility and trust in contract farming significantly influenced farmers' participation in AVCs. The key implication of our findings is that the concept of AVC financing is laudable and should be formalized and extended. AVC financing tends to ensure a win–win outcome for both farmers and financiers because while farmers are assured of ready access to farm inputs (including cash credit), financiers are confident of prompt loan repayment. Our work offers valuable insights into how different dimensions of value chain participation can impact smallholder farmers' access to credit. This work also underscores the importance of considering both formal and informal credit sources when analyzing the outcomes of value chain participation. We suggest that to enhance farmers' access to credit, financial institutions, development partners and other stakeholders should strictly channel credit support through AVCs and encourage farmers to participate in AVCs. Formal financial providers should identify, liaise and or resource informal financial players such as value chain actors (e.g. nucleus farmers, aggregators and processors) to supply both formal and informal credit to farmers in agricultural value chains. Extension agents (EAs) can provide farmers with information about AVC to enhance their participation.

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Appendix

Variable	Formal credit Coef.	Std. Err.	Informal credit Coef.	Std. Err.
Sex of farmer	−0.489*	0.261	−0.090	0.206
Age of farmer	−0.084***	0.009	0.005	0.007
Education of farmer	0.010	0.027	0.019	0.022
Distance from house-to-bank	−0.222	0.202	−0.441***	0.153
Total cropland	0.468*	0.268	−0.470*	0.268
Off-farm job	0.543**	0.268	−0.526**	0.232
Extension visits	−0.345	0.254	−0.558***	0.200
Informal saving account	−0.852*	0.485	0.758**	0.382
Marital status	0.998***	0.370	0.794**	0.372
Mobile money account	0.909***	0.335	−0.722***	0.245
Bank account	0.590***	0.206	−0.223*	0.124
Resident status	−0.023	0.296	1.219***	0.245
Collateral	0.857***	0.244	0.290*	0.195
Trust in contract farming	−0.365	0.260	0.006	0.219
Knowledge of AVC	0.300	0.300	0.346	0.234
The main market source	0.030	0.250	−0.089	0.199
_cons	−1.701	0.788	−0.634	0.613

Table A1. Test of validity of instruments

Variable	H_0V_0 Coeff.	Std. Err.	H_1V_0 Coeff.	Std. Err.	H_0V_1 Coeff.	Std. Err.	H_1V_1 Coeff.	Std. Err.
Gender	−0.032*	0.018	0.019	0.019	−0.015	0.037	0.076*	0.045
Age	0.003***	0.001	0.002***	0.001	0.002*	0.001	0.0004**	0.002
Education	−0.001	0.002	−0.001	0.002	−0.001	0.004	0.010	0.006
Marital status	0.255***	0.024	0.197***	0.027	−0.014	0.135	0.352*	0.192
Resident status	−0.005	0.296	−0.056	0.139	0.219	0.245	0.192	0.210
Cropland	0.051**	0.024	0.068**	0.028	0.073**	0.030	0.373**	0.163
Collateral	0.043**	0.018	0.045***	0.016	0.098***	0.037	−0.197	0.044***
Distance to bank	0.010	0.015	−0.009	0.012	−0.026	0.033	0.069	0.179
Off-farm job	0.005	0.020	−0.015	0.021	−0.116**	0.052	−0.026	0.052
Extension contact	−0.020	0.044	−0.002	0.027	0.115	0.087	0.060	0.083
Bank account	0.095**	0.045	0.168***	0.015	0.138***	0.018	0.243***	0.049
MoMo account	0.056	0.047	0.134***	0.019	0.169***	0.022	0.168**	0.067
ISA	0.011	0.049	−0.025	0.029	−0.073**	0.033	−0.055	0.191
Constant	−0.039	0.051	0.194	0.046	0.418	0.181	−0.102	0.247
Selection correction terms								
_m0			0.032	0.064	−0.020	0.096	0.138	0.116
_m1	0.096	0.058			−0.134	0.090	−0.134	0.151
_m2	−0.033	0.067	0.058	0.043			−0.016	0.213
_m3	−0.104	0.039	−0.106	0.062	0.137	0.154		
Ancillary								
Sigma2	0.0171	0.007	0.015	0.006	0.035	0.027	0.043	0.047
rho0			0.331	0.588	−0.140	0.631	0.8563	0.523
rho1	0.938**	0.489			−0.917**	0.426	−0.833	0.671
rho2	−0.321	0.614	0.597	0.375			−0.099	0.983
rho3	−1.024***	0.361	−1.101**	0.527	0.938	0.905		

Note(s): ***, 1% significance level; **, 5%; significance level and *,10% significance level
Source(s): Field data, 2017

Table A2. Second stage parameter estimates of the determinants of formal credit access

Table A3.
Second stage parameter estimates of the determinants of informal credit access

Variable	H_0V_0 Coeff.	H_0V_0 Std. Err.	H_1V_0 Coeff.	H_1V_0 Std. Err.	H_0V_1 Coeff.	H_0V_1 Std. Err.	H_1V_1 Coeff.	H_1V_1 Std. Err.
Gender	0.066	0.096	−0.018	0.077	0.086	0.123	−0.026	0.156
Age	0.000	0.003	0.001	0.003	0.001	0.004	0.005	0.005
Education	−0.001	0.010	0.007	0.008	0.009	0.011	0.004	0.018
Marital status	0.232**	0.111	0.193	0.123	−0.262	0.202	0.332	0.363
Resident status	0.083	0.108	0.383***	0.083	0.430***	0.094	0.622***	0.148
Cropland	0.096	0.120	−0.163	0.144	−0.138	0.209	−0.584*	0.345
Collateral	0.004	0.090	−0.116	0.080	0.212***	0.101	−0.119	0.135
Distance to bank	0.013	0.065	0.096**	0.040	0.030	0.107	0.972**	0.413
Off-farm job	−0.080	0.083	0.041	0.089	0.077	0.135	−0.336**	0.151
Extension contact	−0.271	0.167	−0.103	0.120	−0.206	0.244	−0.690***	0.190
Bank account	−0.140	0.094	−0.121*	0.070	−0.022	0.125	0.021	0.141
MoMo account	0.081	0.169	−0.049	0.085	−0.390***	0.123	0.071	0.188
ISA	0.095	0.212	−0.129	0.169	−0.190	0.125	0.286	0.599
Constant	0.216	0.281	0.482	0.237	1.225	0.382	−0.224	0.665
Selection correction terms								
_m0			−0.106	0.303	0.163	0.345	0.187	0.282
_m1	0.371	0.269			0.262	0.263	0.863*	0.453
_m2	−0.270	0.275	−0.037	0.190			−1.206**	0.591
_m3	−0.058	0.198	0.077	0.257	−0.318	0.523		
Ancillary								
Sigma2	0.285	0.151	0.216	0.069	0.219	0.235	0.915	0.566
rho0			−0.293	0.687	0.448	0.698	0.251	0.484
rho1	0.892*	0.481			0.717	0.521	1.157**	0.534
rho2	−0.648	0.519	−0.103	0.453			−1.616**	0.677
rho3	−0.140	0.433	0.214	0.596	−0.870	1.011		

Note(s): ***, 1% significance level; **, 5%; significance level and *,10% significance level
Source(s): Field data, 2017

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