Increasing rice productivity in Ghana: Do savings with rural and community banks matter?

Enoch Yao Vukey and Irene S. Egyir
Department of Agricultural Economics and Agribusiness, University of Ghana, Legon, Ghana
Edward Asiedu
Department of Finance, University of Ghana Business School, Legon, Ghana, and
Nana Afranaa Kwapong
Department of Agricultural Extension, University of Ghana, Legon, Ghana

Received 11 December 2020
Revised 5 April 2021
9 June 2021
Accepted 10 June 2021

Abstract

Purpose – This paper analysed the motives behind farmers' savings with Rural and Community Banks (RCBs) and the effect of these savings on rice yield in the Hohoe Municipality of the Volta region of Ghana.
Design/methodology/approach – A multi-stage sampling approach was used to draw a random sample of 222 rice farmers, and a structured questionnaire was employed to collect cross-sectional data. A Likert scale was used to rank the motive behind farmers' savings while the endogenous switching regression model was used to estimate the effect of savings on rice yield.
Findings – The results of the study showed that most farmers mobilise savings to enhance farm investment which is critical to increasing rice productivity. Improved labour and fertiliser use had a positive influence on rice yield, while farm size had an inverse relation with rice yield. Further, the findings show that savings with RCBs help mobilise the necessary finance to enhance rice productivity. In terms of the treatment effect of savings, the results indicate that farmers who patronise saving products of RCBs recorded a statistically significant average yield of 1.41 Mt/ha more than those not patronising saving products from any bank.
Practical implications – While the literature on agricultural finance focuses largely on credit, this study demonstrates that savings hold significant benefits for the development of agriculture through productivity gains. The importance of this demonstration is further shown by the fact that credit access depends on the ability to save in most developing countries.
Social implications – There is a need to educate farmers about the essence of patronising formal savings products.
Originality/value – This study represents the first attempt at linking farmers' savings to agricultural productivity using an econometric methodology in Ghana. The study serves as a foundation paper and for that matter will serve as a guide to future research on savings mobilisation and agricultural productivity nexus.

Keywords Saving, Rural and community banks (RCBs), Rice farmers, Yields, Ghana
Paper type Research paper

1. Introduction

Saving is seen as a major source of finance for agricultural activities in sub-Saharan Africa (Brune *et al.*, 2016). Savings among the farming households in a developing economy like Ghana is of crucial significance as the degree of progress of farmers depend largely upon what farmers do with the additional incomes generated seasonally from agricultural activities (Anyawale and Bamire, 2000). Moreover, credit services are strongly linked to holding a positive saving balance or deposit account (Awunyo-Vitor and Al-hassan, 2014). Advancement in the agricultural economy largely hinges on the stock of capital built through savings mobilisation by farmers and the re-investment of such stock for further improvement

The authors are grateful to William F. Steel and DPK Amegashie of the University of Ghana for their comments on this paper and Raphael Latsey who assisted with the data collection.

Agricultural Finance Review

0002-1466
DOI 10.1108/AFR-12-2020-0179

of farm operations (Nwibo and Mbam, 2013). In other words, savings is closely related to investment. It is the most likely resource to be invested to enhance agricultural productivity (Nwibo and Mbam, 2013).

It is quite unfortunate that formal financial intermediation has not gained ground in rural farming communities compared to the urban centres in Ghana (Demirgüç-Kunt and Klapper, 2012; Ksoll *et al.*, 2016). Also, credit market imperfections make it difficult for poor farm households to get the needed capital required for massive agricultural investments. In light of the challenges associated with access to conventional financial services, the rural and community banking concept was initiated in most developing countries including Ghana to provide formal financial and banking services to the people dwelling in the rural areas (Danquah *et al.*, 2017). These banks focused on facilitating the activities of smallholder farmers and traders in rural communities (Owusu-Frimpong, 2008). It is important to note that access to a transaction account is the first step toward broader financial inclusion since it allows people to save money, send and receive payments (Peprah *et al.*, 2020). In Ghana, before the advent of Rural and Community Banks (RCBs), physical cash was usually tucked into boxes, buried in the Earth, rolled inside hollowed-out bamboo or thrust into clay piggy banks, which can be lost or stolen, blown away or maybe rotten (Rutherford, 1999).

Modern Ghana has witnessed a new trend of savings where banks collaborated with mobile telephony companies to design mobile banking applications to assist some elite farmers to deposit monies from their homes. These farmers need not travel long distances from their villages to the banking centres to save. Karlan *et al.* (2014) noted that even without the existence of RCBs, farmers do save, however, the main purpose behind farmers' savings is unknown. The poor output of farmers can be linked directly to inadequate financial mobilisation. This is because most farmers do not patronise savings products with these RCBs to mobilise and secure funds for investment. However, Nwibo and Mbam (2013) argued that saving constitutes the basis for capital formation which is an essential instrument of livelihood improvement (see also, Peprah *et al.*, 2020).

In Ghana, grain agriculture is dominated by rural peasant farmers (Donkor *et al.*, 2016). These farmers produce cereals such as maize, rice, sorghum and millet. One of the crops many farmers in Ghana invest in is rice. The crop plays a crucial role in boosting the economy in terms of domestic consumption, investments, government spending and export revenues (Ragasa *et al.*, 2013). Rice serves as a staple food to promote food security (see Onyango, 2014). Its consumption has risen above 35% because of increased urbanisation and changes in food demand patterns, which make the cereal an important staple for many households (Asuming-Brempong and Osei-Asare, 2007; Onyango, 2014; Ragasa *et al.*, 2013). The country's rice production units have been incapable of meeting the huge local consumption. This is because the domestic rice farmers produce only 33% of the nation's demand of 1.8 m metric tonnes per annum (Donkor *et al.*, 2016). Kavi (2015) observed that rice contributes about 4% of the total crop output annually, although it occupied about 45% of the total cereal farmland in Ghana, suggesting low rice productivity and insufficiency to facilitate poverty reduction initiatives (Issahaku *et al.*, 2017).

Ghana has an average rice yield of 2.91 Mt/ha (MoFA, 2016) out of an achievable target of 6–8 Mt/ha, and this attests to the poor performance of the rice industry (Donkor and Owusu, 2014). Comparing the nation's rice yield to other countries such as Mali (3.36 Mt/ha), Benin (4.07 Mt/ha), Senegal (4.10 Mt/ha), Japan and Vietnam (4 Mt/ha), the USA (7 Mt/ha) and Egypt (9.8 Mt/ha), it is obvious that the climatic conditions are favourable for rice production, rice productivity is low in the country (see Donkor and Owusu, 2014; Tripathi *et al.*, 2014). Ghana's rice sector requires massive capital investment to drive production and productivity, yet it has attracted less investments. Modern agriculture has advanced in the use of technology, but many peasant rice farmers still practise the traditional (hoe and cutlass) systems of production. They tend to over-rely on unpredicted rainfall patterns

and inefficient processing systems that eventually result in low rice yield (Quartey *et al.*, 2012). These have all culminated in low rice output and productivity (Osanyinlusi and Adenegan, 2016).

Previous literature about savings examined the saving behaviour of rural households and its relation to agriculture. Studies are focussing on household saving motives without specific reference to farm households (Banerjee and Duflo, 2007; Devaney *et al.*, 2007; Lee and Hanna, 2015; Pg Md Salleh, 2015; Satsios *et al.*, 2020; Xiao and Noring, 1994). For instance, Satsios *et al.* (2020) shed light on the relationship between individuals' saving motives and their intention towards saving. Danquah *et al.* (2017) examined the access of financial services with RCBs on poverty reduction. Another branch of the literature explores the determinants of rural household saving and credit behaviour (Amedi, 2014; Awunyo-vitor and Al-hassan, 2014; Bime, 2008; Chen and Chivakul, 2008; Ike and Umuedafe, 2013). Further, some other studies (Donkor and Anane, 2016; Nwibo and Mbam, 2013; Obasi *et al.*, 2013) provided empirical evidence on the impact of saving on investment and household business income. Other studies have outlined factors that directly or indirectly affect farm productivity, farm technology (Donkor *et al.*, 2016), education (Paltasingh and Goyari, 2018; Panda, 2015), credit access (Awotide *et al.*, 2015; Chandio *et al.*, 2018), farm inputs (Donkor and Owusu, 2014; Tanko and Amikuzuno, 2015) and financial inclusion (Peprah *et al.*, 2020). However, these did not consider savings as the main exogenous variable that influences crop yield.

The theoretical literature has also emphasised, relying on the life-cycle model, the link between individual characteristics and savings behaviour (see for example Corneo and Jeanne, 1998; Devaney, 2006; Heng-fu, 1995; Loayza *et al.*, 2000). Beck *et al.* (2017) expanded on the theoretical link between savings and reinvestments in small businesses using the life-time utility maximization framework, whereas others have explored the theoretical association between credit constraints and productivity (Adeyemo and Bamire, 2005; Dong *et al.*, 2012; Irz and Roe, 2005). The findings from these studies considered saving as an undeniable strategic instrument of economic growth for both individuals and nations. Individuals save for various reasons, including household consumption, children's education, asset accumulation, investment, paying debts and security. Households who save with financial institutions were encouraged to save more, thereby increasing their total savings for investments. Saving and Credit Cooperative Societies' (SACCOs) beneficiaries were provided with entrepreneurial training meant to create members' awareness of terms and conditions of loans and savings. Saving groups were opportune to have access to microcredit compared to the control group who remain credit constrained. Many of the studies failed to bring out the motives behind farmers' savings and the relation between farmers' savings and crop yield/output.

The current study aims to provide empirical responses to the following questions; (1) what are the main motives behind savings by rice farmers, and (2) do savings with RCBs influence rice yields? The study is significant in two principal ways. First, it is necessary to analyse household saving motives because it provides a better understanding of the saving behaviour of farm households. It also gives further clarification on the continuous trends and changes in household saving rates and determinants of household savings. Saving motives would help address other saving-related issues especially among rural households who have been excluded from the formal financial system. This is because financial exclusion is one of the most critical elements that underlie persistent income inequalities that limit the economic empowerment and capacity of farmers (Peprah *et al.*, 2020). Understanding the saving motive of farmers would inform policymakers to prioritise the initiatives of farmers in rural development agendas. For example, knowing the saving motives of farmers can assist financial institutions to develop and tailor financial products that meet the demand-driven needs of farmers resulting in a mutually beneficial business relationship.

Second, the enhancement of formal savings products among rural farmers has become an important means of promoting financial inclusion in developing countries

(Baidoo and Akoto, 2019). Perhaps, saving mobilisation with RCBs provides a cushion to manage agricultural risks. This would go a long way to promote farming activities and increase agricultural yield. The efficient collaboration between the agricultural and financial sectors would eliminate the hindrances of farmers from patronising banking services. This partnership would increase food production to alleviate food insecurity and hunger in developing nations. The above objectives correspond with the aim of the Sustainable Development Goals (SDGs) and Ghana's Ministry of Food and Agriculture (MoFA), which emphasised increasing agricultural productivity. The rest of the paper is structured as follows; Section 2 presents the data and the empirical strategy adopted for our empirical estimation. Section 3 presents and discusses the empirical results. Finally, section 4 provides a summary of our key findings, conclusions and recommendations.

2. Research methodology

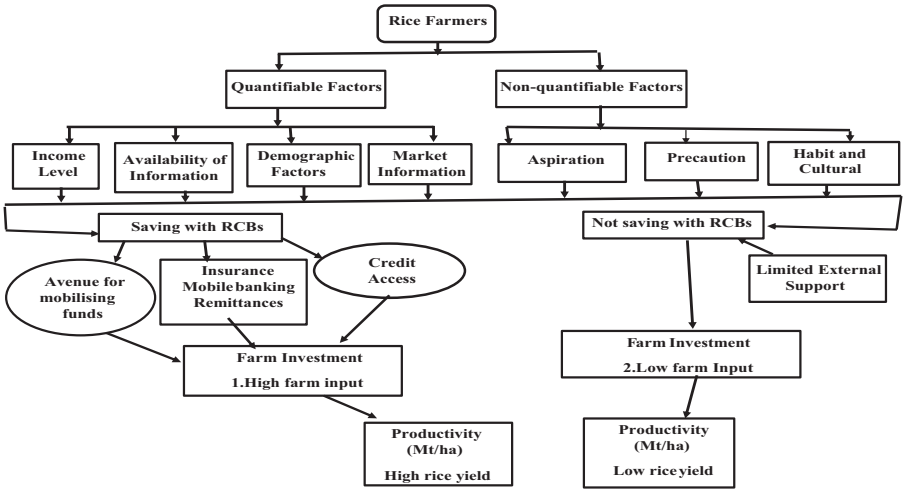
2.1 Data

This study relied solely on primary data of 222 farmers randomly sampled from the population of rice farmers in the Hohoe Municipality, Ghana. This was done after the cluster sampling technique was employed to select farmers from major rice-producing communities within the municipality, namely Santrokofi, Akpafu, Gbi Wegbe, Likpe and Godenu. These communities are extensively known for rain-fed valley bottom rice production. The area produces about 21,759 metric tons of rice per year, representing about 35% of the total yield in the Volta Region (MoFA, 2016). Rice farming is the predominant occupation for many households in the area. The municipality is among the top rice-producing district in Ghana and houses RCBs (namely Agricultural Development Banks (ADB) and Gbi Rural Banks). These banks provide financial services to farmers. The area is endowed with low-lying areas conservatively over 10,000 ha. These lands are swampy and suitable for rice production. Therefore, the municipality has a comparative advantage over all the other districts in rice production in the country (MoFA, 2016). The primary data were solicited from rice farmers using a structured questionnaire which was pretested to check its validity to capture relevant datasets.

2.2 Conceptual considerations

The two relevant concepts in this paper are saving with RCBs and rice yield (productivity). Impact studies, assessing the treatment effect of saving with RCBs on rice yield, implies that saving with RCBs in the treatment variable and rice yield is the outcome variable. This study conceptualized the interrelation between farmers' savings with RCBs and its influence on rice yields. In Figure 1, saving is seen as an essential source of finance for most agricultural activities, mainly among smallholder rice producers. Factors that are quantifiable and non-quantifiable influence the decision of farmers to save with RCBs. The level of income, access to information, demographic factors and market frictions were classified as quantifiable factors. On the other hand, precaution, aspiration, habit and socio-cultural practices were categorised under non-quantifiable factors. These factors affect a farmer's decision to save with RCBs or use the traditional means of saving (in a pot, under a mattress, etc.).

Hence, farmers' decision is a discrete variable comprising two values for each indicator, 0 and 1 representing a farmer who saves with RCBs and those who do not save with RCBs, respectively. Farmers who patronised savings products from RCBs may have access to a well-secured avenue to mobilise funds. They were better positioned to get credit facilities, enjoy insurance, mobile banking and remittance services. These financial services help farmers to mobilise funds that could be readily available to be invested in agricultural operations, such as procuring fertilisers, pesticides, farmlands, high-grade seeds and farm



Source(s): Authors' computation

Figure1. The interrelation between saving with RCBs, investment and rice productivity

machinery (Banerjee and Duflo, 2007). The acquisition of these farm inputs could improve rice productivity (Karlan *et al.*, 2017).

On the other hand, farmers who do not save with RCBs (control group) lack a well-secured avenue to mobilise savings into an adequate investable fund with limited external financial support from stakeholders. From the framework, farmers who were unable to save with RCBs subsequently fail to mobilise financial resources adequately to acquire the farm inputs (investment) to enhance rice yield. Moreover, Girabi and Mwakaje (2013) emphasised that an increase in farm productivity was a result of the change in inputs and the level of technology used. Farmers who deposit money with RCBs were opportune to benefit from financial transactions such as secure funds, credit assistance, insurance and mobile money services. These services help farmers to mobilise adequate financial resources to purchase farm inputs and services to enhance rice yield. The difference in the yield (productivity) between the treatment and control group was resulting from the investable funds to acquire farm inputs which were made available to farmers through their engagement with RCBs.

2.3 Methods of analysis

The first objective of this paper sought to determine the motive behind rice farmers' savings. A pilot survey was conducted to analyse the motives of saving among the rice farmers in the study area. We adopted the Likert scale to rank the saving motivation among rice farmers. Second, we assess the effect of saving with RCBs on rice yield. The decision to save with RCBs is a discrete outcome: either a farmer saves with RCBs or otherwise. In economic parlance, a farmer decides to save with RCBs if the expected marginal utility is greater. This decision is dependent on socioeconomic, institutional and technological factors surrounding a farmer. We assumed that mobilising capital through savings creates an opportunity that influences rice yield.

$$Yield_i = \beta_0 + \beta_1 Savings_i + \vartheta X_i + \epsilon_i \quad (1)$$

Where *Yield* is a continuous variable which denotes output per hectare, *Savings* takes on a value of 1 if the farmer saves with RCB and 0 otherwise. X denotes other individual and household characteristics' age, household size, marital status, land ownership, etc. ϵ is the

error term. For simplicity, in the next sections, we denote *Yield* with "*Y*", and *Savings* with "*G*".

This paper considered various models such as the Heckman selection, double difference and the instrumental variable (IV) models suggested in the literature. Ordinary least square (OLS) is used in the second stage of the Heckman model and imposes a restraining postulation of normally distributed errors which is prone to suffer from conventional OLS problems. Khandker *et al.* (2010) and Ogutu *et al.* (2014) also claimed that the double difference method has a limiting assumption of time-invariant selection bias which is difficult to substantiate. The difficulty in finding a suitable instrument is the caution for estimating the IV approach. Specifically, the endogenous switching regression (ESR) and propensity score matching (PSM) models are preferred in this case. Moreover, it is argued that the ESR accounts for both observable and unobservable factors, while PSM addresses only observable factors (Rosenbaum and Rubin, 1983).

In this case, the ESR model becomes the appropriate model for estimating the causal effect of saving with RCBs' decision on rice productivity. This model solves the two econometric problems of endogeneity and sample selection bias (Paltasingh and Goyari, 2018). Assessing the effect of saving with RCB on rice productivity may pose the problem of endogeneity (Hausman, 1978). This is because there is a two-sided relationship between saving with RCB and rice productivity (Alene and Manyong, 2007). Saving with RCBs may influence rice productivity. On the other hand, rice productivity may also affect saving with RCBs. In an endogenous switching regression model, the first stage involves modelling the saving decision with the limited-dependent variable method. In the second stage, another variable (productivity) is estimated separately for each group (saving and non-saving with RCBs), conditional on the saving decision. A binary probit model is used in the first stage to model the saving behaviour of farmers. A separate regression model is used in the second stage to model the function of rice productivity conditional on a defined criterion function.

In the context of utility maximization theory, the decision to save with RCB can be modelled after Ali and Abdulai (2010) and Paltasingh and Goyari (2018). The difference between the utilities from saving with banks (US_i) and not saving UN_i of rice farmers may be denoted as G^*, such that the ith farmer would decide to save with RCBs if US_i is greater than UN_i. In other words, the ith household will save when $G^* = US_i - UN_i > 0$, but G^* is unobservable. Therefore, we can express it as a function of observable factors in this latent variable model (probit model) as follows:

$$G_i^* = \beta X_i + \mu_i \text{ with } G_i = \begin{cases} 1 & \text{if } G_i^* > 0 \\ 0 & \text{if } G_i^* \leq 0 \end{cases} \tag{2}$$

where G is the dichotomous variable that takes the value 1 if the farmer decides to save with RCBs and 0 otherwise; β is the vector of unknown parameters to be estimated, and X is the vector of explanatory variables comprising farmer, farm, institutional and technology-specific characteristics; and μ is the random error term with 0 mean and variance as σ^2. A maximum likelihood estimation procedure is employed to estimate the vector of probit coefficients β.

Now, saving with RCBs also affects farm productivity (Y). Let the rice productivity (Y) be a function of conventional and non-conventional factors then J_i is the vector of those exogenous factors. In the switching regression model, as rice productivity (Y) is conditional on saving with RCB status, we use two separate productivity functions for saving and not saving as follows:

$$Y_{1i} = \rho_1 J_{1i} + \in_{1i} \text{ if } G_i = 1$$

$$Y_{0i} = \rho_0 J_{0i} + \in_{0i} \text{ if } G_0 = 0 \tag{3}$$

The variables Y_1 and Y_0 are the rice productivity (paddy yield) for saving with RCB and not saving with RCB, respectively. For a given household, Y_1 or Y_0 is observable relying on the values of the criterion function in Eq. (1). Therefore, the ordinary least squares (OLS) estimates of the parameter vector J_1 or J_0 will be biased as they suffer from sample selection bias. The errors $\in_1$ and $\in_0$, conditional on sample selection criterion will have non-zero expected values (Lee and Trost, 1978; Maddala, 1983). The error terms u, ϵ_1, and ϵ_0 are assumed to have a trivariate normal distribution with 0 mean and non-singular covariance matrix expressed as follows:

$$Cov(\in_{1i}, \in_{0i}, \mu_i) = \begin{pmatrix} \sigma^2_{\in 1} & \sigma_{\epsilon 1 \epsilon 0} & \sigma_{\in 1 \mu} \\ \sigma_{\epsilon 1 \epsilon 0} & \sigma^2_{\epsilon 0} & \sigma_{\in 0 \mu} \\ \sigma_{\in 1 \mu} & \sigma_{\in 0 \mu} & \sigma^2_{\mu} \end{pmatrix} \tag{4}$$

where σ^2_μ is the variance of the error in the criterion eqn. (1); $\sigma^2_{\epsilon 1}$ and $\sigma^2_{\epsilon 0}$ are the variances of the errors ϵ_1 and ϵ_0, respectively, in productivity outcome functions in Eqn. (2); and $\sigma_{\epsilon 1 \mu}$ and $\sigma_{\epsilon 0 \mu}$ are the covariance of error terms μ, ϵ_1, and ϵ_0. The outcome functions in Eqn. (3) are not observed simultaneously. So, the covariance between ϵ_1 and ϵ_0 is not defined (Maddala, 1983). However, a significant inference of the error structure is that the error μ of criterion function is correlated with the error terms of the productivity functions in Eqn. (3), the expected values of the error terms are non-zero, conditional on the sample selection, and expressed as:

$$E(\in_{1i} | G_1 = 1) = \sigma_{\epsilon 1 \mu} \frac{\varphi(\beta X_i | \sigma)}{\varnothing(\beta X_i | \sigma)} \equiv \sigma_{\epsilon 1 \mu} \lambda_{1i} \tag{5}$$

$$E(\in_{0i} | G_1 = 0) = -\sigma_{\epsilon 0 \mu} \frac{\varphi(\beta X_i | \sigma)}{1 - \varnothing(\beta X_i | \sigma)} \equiv \sigma_{\epsilon 0 \mu} \lambda_{0i} \tag{6}$$

where $\varphi(.)$ and $\varnothing(.)$ are the standard normal probability density function and standard normal cumulative density function respectively. λ_{1i} and λ_{0i}, i.e. the estimated ratio of $\varphi(.)$, and $\varnothing(.)$ evaluated at βX_i is the inverse Mills ratio. If the estimated covariance $\sigma_{\in 1 \mu}$ and $\sigma_{\in 0 \mu}$ are statistically significant, it implies that adoption decision and productivity outcome variables are correlated. Therefore, we find the evidence of endogenous switching and reject the null hypothesis of no sample selection bias (Maddala and Nelson, 1975). The full information maximum likelihood (FIML) estimation method is considered to be the most efficient one to estimate the endogenous switching regression model (Lokshin and Sajaia, 2004). It estimates simultaneously the criterion equation (probit model) and the productivity outcome functions to give consistent standard errors. Centred on the normal distribution of trivariate for the error terms, the logarithmic likelihood function for the system of Eqns. (2) and (3) can be expressed as:

$$\begin{aligned} \ln L = \sum_{i=1}^{N} G_i [\ln \varphi \left(\frac{\epsilon_{1i}}{\sigma_{\epsilon 1}} \right) - \ln \sigma_{\epsilon 1} + \ln \phi(\varphi_{1i})] \\ + (1 - G_i) [\ln \varphi \left(\frac{\epsilon_{1i}}{\sigma_{\epsilon 1}} \right) - \ln \sigma_{\epsilon 0} + \ln(1 - \phi(\varphi_{0i})] \end{aligned} \tag{7}$$

where $\varphi_{1i} = \frac{(\beta X_i + \gamma_i \epsilon_{ji} / \sigma_j)}{\sqrt{1 - \gamma_i^2}}, j = 0,1$ with γ_i denoting the correlation coefficient between the error term of criterion function, i.e. μ_i and the errors of outcome functions, i.e. ϵ_{1i}. The entire system of the equations is jointly estimated by the full information likelihood method. For the effect of

saving with RCBs on rice yield of rural farm households, the average treatment effect on treated (ATT) is computed as:

$$\mathrm{ATT} = E(Y_{1i}|G_i > 0) - E(Y_{0i}|G_i > 0) = X_{1i}(\alpha_1 - \alpha_0) + X_{1i}(\sigma_{\epsilon 0\mu} - \sigma_{\epsilon 1\mu}) \tag{8}$$

where $E(Y_{1i}|G_i > 0) = \sum \alpha_{1i} J_{1i} + \sigma_{\epsilon 0\mu}\lambda_{1i}$ is the observed, $E(Y_{0i}|G_i > 0) = \sum \alpha_{0i} J_{0i} + \sigma_{\epsilon 1\mu}\lambda_{1i}$ is the counterfactual, $\sum \alpha_{1i} J_{1i}$ represents measured independent variables, $\sigma_{\epsilon 0\mu}$ is the covariance between outcome and position i, and λ_{1i} is the probability of assignment to position 1.

To check for the robustness of the ESR model, the study employed the PSM approach to complement the results of the ESR approach. PSM reduces the estimation bias in measuring the impact of a treatment with observational data. Khandker *et al.* (2010) proposed the mimicking of randomisation by constructing an observational analogue of the randomised experiment to avoid biased estimation of the impact of the treatment, which in our case is the non-random assignment of savings. Thus, to correct for endogeneity and address some of the problems raised and strengthen the ESR estimates, this study applies PSM estimators as a robustness check. Applying nearest neighbour matching means that one comparison unit is chosen as a match for a treatment unit that is closest in terms of propensity score or the probability to save. Kernel matching is a nonparametric matching estimator that uses propensity score to calculate the weighted averages of all comparison units and thereby construct the counterfactual outcome (Dehejia and Wahba, 2002). We report estimates from both nearest-neighbour and Kernel matching.

3. Result and discussion

3.1 Descriptive results

A total of 103 respondents representing 46% save with RCBs out of a sample of 222 rice farmers (see Table 1). About 54% of the farmers do not save with any bank. This group of farmers claimed that they were reluctant to patronise formal savings products due to the recent closure of certain unaccredited banks. It was noted that these unlicensed banks have intruded financial sector and running away with huge savings. These banks are characterised by poor record-keeping, inability to meet the capital requirement and maladministration (Danquah *et al.*, 2017). Some of the farmers revealed that if caution had not been taken, they might have lost their deposits with those unauthorised banking institutions (see also Dupas and Robinson, 2013). As a result of this challenge, most rice growers decided to save their income in their homes to avoid any financial malfeasance. Rice farming is mostly done by people within the working population (average age less than 50 years). This supports Ghana's Ministry of Food and Agriculture annual report which claimed that most active farmers are adults and agriculture remains the main source of livelihood for the rural dwellers in Ghana (MoFA-SRID, 2016). Grain agriculture is female-dominated in the Hohoe Municipality, this is because most men are engaged in tree cash crop farming such as cocoa and coffee and that the involvement of men is mainly to assist their wives during the cultivation and harvesting periods (see Amedi, 2014).

Both savers and non-savers had about 12 years of rice farming experience. This level of farming experience has enabled farmers to gain skills and knowledge about how they can manage their farm business. Obasi *et al.* (2013) elaborated that whenever farmers spend several years cultivating a specified crop over time, they become more productive than a new grower. Farmers who patronise savings products with RCBs are 1.6 km distant from the banks. However, those who do not save with any banks are 4 km away from the banking institutions. This indicated that distance was one of the crucial factors that hinder farmers from patronising saving products with banks.

Table 1.
Descriptive statistics

Variables	Description of variable	Saver (n = 103)		Non-saver (n = 119)		T-value	*A priori* expectation
		Mean	Std Dev	Mean	Std Dev		
Age	Age of household heads in years	41.95	11.19	47.77	13.29	3.50***	+
Agesquared	Age squared of household heads in years	1883.83	943.11	2457.35	1294.1	3.722***	−
Gender	Sex of farmer: 1 = Male, 0 = Female	0.46	0.49	0.40	0.50	−0.79	+
Household Size	Number of household members	5.28	0.24	5.19	0.23	−0.28	−
Marital status	Marital status: 1 = married, 0 = Otherwise	0.71	0.46	0.74	0.44	1.42	+/−
Years of education	Years of formal education of the respondent	8.99	3.31	7.96	3.91	−2.10**	+
Distance to bank	Distance to the bank in kilometres	1.62	2.18	4.00	2.07	8.33***	−
Distfisquared	Distance squared to the bank in kilometres	7.33	13.22	20.23	16.99	6.24***	−
Experience	Number of years in rice farming	12.27	9.49	14.98	12.57	1.79*	+
Farm shock	Access extension service: 1 = Yes, 0 = Otherwise	0.56	0.50	0.50	0.50	−0.99	−
Extension	Access extension service: 1 = Yes, 0 = Otherwise	0.65	0.48	0.47	0.50	−2.78***	+
FBO membership	Farmer group membership: 1 = member, 0 = Otherwise	0.30	0.46	0.18	0.38	−2.19**	+
Farm size	Farm size under cultivation in hectare (ha)	1.02	1.18	0.73	0.52	−2.39**	+
Land ownership	Land Ownership: 1 = Self-owned, 0 = Otherwise	0.63	0.48	0.79	0.41	2.64***	+
Credit access	Access to credit: 1 = Yes, 0 = otherwise	0.62	0.48	0.15	0.36	−8.24***	+
Household income	Total household income in Ghana Cedi (GHS)	4622	7,357	2,184	2,711	−3.36***	+
Seed	Quantity of hybrid seed used in cultivation in kilogrammes	68.95	64.74	46.65	28.34	−3.35***	+
Fertiliser	Quantity of inorganic fertilisers used in cultivation in kilogrammes	233.33	712.57	81.74	147.03	−2.26**	+
Labour	Number of labours used in farming	25.76	15.61	20.77	10.57	−2.82***	+

Note(s): *, **, *** denote 10, 5 and 1% significant levels respectively

The saving group (treatment) used more farm inputs, on average 68.95 kg of hybrid seeds, 233.33 kg of inorganic fertilizers and 25 labourers during the preceding agricultural season. The non-saving group (control) cultivated with an average of 46 kg of hybrid seeds, 81.74 kg of fertilizer and 20 hired labour force. This implied that farmers who open a savings account and do save regularly were better able to mobilise adequate capital to be directly channelled into farm investment (also observed by Nwibo and Mbam, 2013).

3.2 Saving motives among farmers

Satsios *et al.* (2020) noted that household saving motives vary from geographical and occupational settings, implying that socio-cultural and economic environments influence the saving motives of individuals. Saving is an active action, and individuals are motivated to save for a particular goal (Devaney *et al.*, 2007). Comparatively, people with a saving motive and those without are likely to save based on their saving behaviour. In the field of agriculture, farmers also have motives that "fuel" their intention to save money. The findings of the study revealed that rice farmers prioritised, farm investment, education of children, household consumption, medication, household properties and funeral arrangement as the main reason they save (Table 2). The coefficient of the Cronbach's alpha was 0.628 and this confirmed that the Likert scale was statistically significant since the value of the Cronbach's alpha is more than 0.5. This emphasised that larger proportion of farmers save purposely to reinvest into their farm businesses.

Concerning the results from Table 2, it was indicated that farmers prioritised farm investment, as the most important motive for saving while household properties and funeral arrangements are considered the least important of all. Out of the 222 respondents who participated in the survey, 87% of them strongly agreed to have been saving purposely to finance farm investment. This implies that farmers acknowledged savings as an integral component of financial resource which is needed to enhance agricultural production. Farmers professed to have been saving to reinvest to keep business going. This finding is inconsistent with that of Satsios *et al.* (2020) who claimed education as the most essential background characteristic, influencing the saving intention among households in Greece, which is a developed country than Ghana. However, in Nigeria, Odoemenem and Akerele (2013) recognised agriculture as the main source of livelihood henceforth, it has become the prime motive why farmers save. Therefore, rice farmers save part of their income generated seasonally to sustain their agricultural livelihoods. Farmers save deliberately to hire more labour force (by-day workers) during the harvesting period, to help harvest since they lack the necessary harvesting machines. This contradicted the report by Banerjee and Duflo

Table 2. Responses on the purpose of saving among rice farmers

Motive	Response scale				Position
	Strongly agree	Agree	Averagely agree	Weekly agree	
Farm investment	193	20	5	4	1st
Children's education	125	71	16	10	2nd
Domestic consumption	43	110	61	8	3rd
Medication	36	116	64	6	4th
Household properties	59	34	92	37	5th
Funerals	37	27	66	93	6th
Reliability statistics					
Number of respondents	222				
Cronbach's alpha	0.628				
Number of motives	6				

Source(s): Authors' computation

(2007), which claimed that rural farming households use a large portion of their savings for unnecessary expenditures such as ceremonies.

Aside from farm investments, farmers also save to cater for other family obligations such as their children's education, domestic consumption, medical bills, household asset and funeral arrangements (see Table 2). Among these motives, peculiar essence is attached to the education of children (S. A. Devaney *et al.*, 2007; Pg Md Salleh, 2015). In total, 125 farmers strongly agreed to have been saving intending to provide for the academic needs of their children. For instance, buying all the necessary materials needed at school for their children. In Africa, household heads contribute family functions, family caregiving and other social activities that build upon the socialisation of people living in their community (Devaney *et al.*, 2007; Lee and Hanna, 2015; Xiao and Noring, 1994). Therefore, farmers save with the motive of paying the medical bills for their relatives, buying properties and organising befitting funeral arrangements when death occurs.

3.3 Determinants of savings and rice yields

The results of the estimates are presented in Table 3. Column 3 showed estimates of farmers' decision to save with RCBs while columns 1 and 2 are the estimates of savers and non-savers yield. Marital status, distance to FIs and the square of the distance to FIs were considered

	Yield (1) Saver (1)	Yield (2) Non-saver (0)	(3) Saving with RCBs (1/0)
Variables	Coefficient	Coefficient	Coefficient
Age	−136.70 (130.30)	70.01 (55.78)	0.05 (0.06)
Agesquared	1.68 (1.57)	−0.86 (0.56)	−0.00 (0.00)
Gender	−282.20 (480.00)	20.30 (258.10)	0.11 (0.26)
Household size	−110.70 (95.45)	−42.78 (52.87)	−0.06 (0.05)
Education	−143.80** (72.27)	−24.05 (34.00)	0.02 (0.03)
Farming experience	−4.13 (28.28)	0.82 (11.83)	−0.02 (0.01)
Extension	27.04 (509.80)	120.10 (261.90)	0.14 (0.25)
Land acquisition	1,012** (497.60)	22.01 (299.70)	−0.17 (0.27)
Credit access	2,114*** (697.90)	613.7* (363.30)	1.24*** (0.25)
Farm size	−2,080*** (271.00)	−1,141*** (332.10)	−0.14 (0.22)
Seed	−3.38 (5.71)	15.96** (6.30)	0.01*** (0.00)
Fertiliser	8.79*** (0.41)	0.39 (0.87)	−0.00 (0.00)
Labour	−5.05 (15.66)	20.86* (12.05)	0.01 (0.01)
Marital status			−0.24 (0.19)
Distance to_FIs			−0.56*** (0.16)
Dstfissquared			0.05** (0.02)
Farm shock			0.07 (0.247)
FBO			0.14 (0.29)
Income			2.98e-05 (4.83e-05)
Constant	9,463*** (3,220)	710.60 (1,402)	−0.57 (1.39)
Observations	217	217	217
/lns1	7.66*** (0.08)	sigma_1	2,123 (186.77)
/lns2	7.09*** (0.07)	sigma_2	1208.08 (85.80)
/r1	−0.57 (0.34)	rho_1	−0.51 (0.25)
/r2	0.31 (0.22)	rho_2	0.30 (0.20)
Wald $\chi^2(16)$	658.93	Log-likelihood	−1982.22
Prob > χ^2	0.00		

LR test of indep. eqns. : $\chi^2(1) = 3.96$. Prob > $\chi^2 = 0.04$

Note(s): *, ** *** denote 10, 5 and 1% significant levels, respectively

Table 3. Result of ESR model: showing the factors influencing rice yield

exclusion restriction variables to identify the model. These variables affect the exogenous variable (savings with RCBs) without having any effect on the endogenous variable (yield) in context. The *F*-statistics is significant and indicates a good fit for the estimated model. Also, the significance of the correlation between saving with RCBs and rice yield in all the models provides evidence of the endogeneity of rice yield. Findings from the survey revealed that credit access, seed, and distance to banks, and distance to bank squared influenced farmers' decision to patronise savings products with RCBs.

The multiplier of distance to RCBs was negative, implying that an extra kilometre to the banking centre limits farmers' chances of saving with banks that are far away from the remote farming communities. This was expected because the time spent waiting and travelling couple with the high transportation cost discourage farmers from depositing their income with banks. Moreover, the time spent travelling to the urban centre to save could be used to engage in an economic activity that would enhance the livelihood conditions of farmers. This finding was consistent with literature. In Nigeria, Nwibo and Mbam (2013) emphasised that inadequate agents for the collection of saving cash from farmers who resides in rural areas have greatly been a limitation for savings and investments. It would be difficult to travel far distances to save money in organised banks located in the cities. Also, Donkor and Anane (2016) noted that long-distance and higher transport costs and congestion at financial institutions also discourage farmers from saving with monetary institutions in Ghana. This implies rural people would be more likely to deposit with banks when it is located closer to their communities. However, the coefficient of the distance to the bank squared had a positive effect on farmers' potential to save with RCBs. This is because rural banks have set initiatives to bring financial services to the doorstep of those who are geographically cut off from formal financial services. The banks have set up collection centres in some distanced farming areas. Also, banks have extended their services through mobile telephony services. These initiatives encourage farmers who are far from banking centre to save with banks. This means that the introduction of dispatch banking agents and mobile banking services have high tendency of increasing the saving decision of farmers.

Credit access plays an instrumental role in influencing farmers' decisions to continue savings with banks. This affirmed the *a priori* expectation which suggested that credit availability enthuses farmers to save with RCBs. Credit services are made available to farmers who have good performing saving records or positive saving balances. Loans become a necessary financial supplement to enhance agricultural investment (Chandio *et al.*, 2018). This corresponded with the findings of Chen and Chivakul (2008) and Awunyo-vitor and Al-hassan (2014) who claimed that credit opportunities are made to households with good saving standing with financial institutions in Bosnia and Ghana, respectively. Therefore, farmers are motivated to have good savings records with RCBs because it may serve as a guarantee for loans in times of financial need. The highlights of the results show that improved seed has a positive influence on farmers' decision to save with RCBs. This finding agreed with the *a priori* expectation. Peasant rice farmers considered hybrid seed as a substantial variable the persuade farmers to save. This is because hybrid seed can sustain hash weather conditions and resistance to pest and diseases attacks. This decision position farmers in the right direction to maximise crops yield.

Our *a priori* expectation assumed that education has a positive influence on a farmer to enhance rice productivity. However, the findings of the survey rejected the null hypothesis. This is because farmers had approximately 9 years of formal education. This is equivalent to junior high graduate status at an old age. This level of formal education is insufficient to make a meaningful impact on crop yield. Therefore, education has a negative effect on rice productivity for farmers who patronise savings products with RCBs. Panda (2015) argued that farmers' education has an indirect relationship between the household agricultural income, the land area cultivated and crop productivity in India. However, Paltasingh and

Goyari (2018) also held the view that education help farmers to vary technology that has a positive influence on crop yield. It has therefore been realised that, in order for young farmers to have a significant impact on their farm yield, it is necessary to increase their level of formal education beyond junior high school.

Previous literature claimed that agricultural credit in general has a positive and highly significant effect on farm productivity (Awotide *et al.*, 2015; Awunyo-vitor and Al-hassan, 2014; Chandio *et al.*, 2018; Ike and Umuedafe, 2013). It was elaborated that credit access has a direct influence on agricultural productivity through a positive effect on agricultural technological adoption, labour employment and enhance welfare. From the first-stage results (column 3, Table 3), we find savings with RCBs correlates with access to credit. For both yield models as presented in columns 1 and 2, we find a positive association between access to credit and yield. However, we find the effect much stronger for those who save compared to those who do not save (1% level and 10% level, respectively)

Land ownership is an important element in farming in developing countries, which influences the yield of farmers. On this basis, farmers who save with banks are able to mobilise sufficient funds to explore other tenures of farmland acquisition, instead of depending on inherited lands. Farmers who cultivate their own lands are able to go into long-term investments to improve land and soil quality, without the fear that the owners will take over the land after the soil improvement. And therefore this finding is consistent with our *a priori* expectation (see Table 1). Specifically, land ownership positively impacts the productivity of smallholder rice farmers, implying that access to the cultivation of other farmland would increase rice productivity. Farm output is maximized when farmers take the initiative to acquire and cultivate other farmlands and when policies are introduced to improve farmland acquisition by smallholder farmers. This result corresponded with the findings of Donkor and Owusu (2014) which emphasised the positive effect of land acquisition on the productivity and efficiency of rice farms in the northern part of Ghana.

Farm inputs such as fertiliser use have a direct influence on rice yield for savers while labour and improved seed also have a significant positive effect on rice yield for non-saver. The use of inorganic fertilisers has become a necessity, and farmers who save with banks use savings to purchase these chemicals to influence their crop yields. It is because farmers cultivate every season on the same land without practising any natural soil fertility initiative. These inorganic fertilisers have provided crops with much-needed nutrients to grow and maintain plant health. Farmers who do not save with banks considered it important to cultivate hybrid seeds because of its benefits. Hybrid seeds are highly resistant to harsh weather conditions, diseases, pests and have a high capacity to grow. Farmers hired labour to complement family workers and provided sufficient energy for ploughing, broadcasting, sowing and rice harvesting to boost rice productivity. The finding concorded with Donkor and Owusu (2014) and Tanko and Amikuzuno (2015) who argued that these farm inputs have a positive effect on agricultural yield.

Attention is now turned to discuss farm size which had a negative influence on rice yield for both savers and non-savers. This finding even though unexpected, implying that an increase in hectares of land under cultivation would cause productivity to decline, is plausible, particularly in smallholder farmer settings in developing countries. An additional land under rice cultivation should be accompanied by the use of more labour/farm machinery including other agricultural inputs, to help obtain optimal tonnes of rice. Our evidence comparing farm acquisition with farm size, shows that while land acquisition improves confidence and nudges long-term land investment which drives productivity, just clearing more land without the ability to acquire and invest in them hampers productivity. Thus, clearing additional land without resources to invest in smallholder farm settings will have detrimental impacts on productivity. An additional land under rice should be accompanied by more inputs to help improve yield. This study, therefore, shows that unlike the study by

Rada and Fuglie (2019) in the United States, expanding land under cultivation does not necessarily translate into higher productivity but owning land does.

3.4 Effect of savings on rice yields

Peprah *et al.* (2020) noted that saving is a crucial factor that enhances the adoption of farm inputs which increases crop yield. In the current study, the outcome of the ESR model revealed that savings with RCBs have a positive influence on rice productivity. We estimated the potential average yield of a farmer who chose to patronise saving products at 3.309 Mt/ha compared to a yield level of 1.90 Mt/ha if a particular farmer decides not to save with any bank (see Table 4). Therefore, the mean ATT was 1.409 Mt/ha, which is statistically significant at 1%. This implies that farmers are better off in terms of crop yield when they decide to save with RCBs. Saving with RCBs has an indirect influence on the yield of farmers. Farmers who patronise savings products have a secure avenue to raise financial capital to enhance farm investment. These groups of farmers are opportune to engage in another mode of land acquisition aside from self-owned plots and use inorganic fertiliser for rice farming. The farmland acquisition and use of inorganic fertiliser usage have a multiplier effect on the yield of farmers.

To test for the robustness of the ESR model, the PSM was used to estimate the ATT for farmers who save with RCBs (see Appendix). The nearest neighbour matching (NNM) and the kernel-based matching (KBM) were used. The result from the NNM and KBM algorithms indicates that saving with RCBs has a significant positive impact on rice yield. These estimates were significant at 1% significance level. Specifically, the estimate of NNM and the KBM showed that a farmer would have an average yield of 1.24 Mt/ha and 1.04 Mt/ha, respectively, if the farmer chose to save with RCBs than otherwise. The significant positive effects from the PSM estimates using the two algorithms confirm the baseline impact estimates from the ESR model.

3.5 Conclusion and policy implications

A deep understanding of formal financial savings and its impact on rice productivity is critical for food security and poverty alleviation in sub-Saharan Africa. In this paper, we identified and ranked the motives behind farmers' saving and examined the effect of saving with RCBs on rice yield. Primary data were collected from rice farming communities in Ghana. We deployed the Likert scale and ESR model as the analytical tool for analysis. The results of the study showed that farm investment is the main motive behind farmers' savings. It was revealed that saving to increase farm investment could have an overwhelming effect on crop yield. Improved labour and fertiliser use had a positive influence on rice yield, while farm size had an inverse relation with rice yield. Farmers who patronise saving products with RCBs recorded an average yield of 1.41 Mt/ha higher compared to not patronising saving products by RCBs. Our findings show that saving with RCBs help mobilise the necessary finance to enhance rice productivity. We realised that savings mobilization has become an

Table 4.
Estimates of the ATT

Estimate	Coefficient	Std. Error	*p*-value
Not saving	1.89***	0.11	0.00
Saving	3.30***	0.56	0.00
ATT (saving vs not saving)	1.41***	0.57	0.01

Note(s): *, ** *** denote 10, 5 and 1% significant levels, respectively

integral component of development endeavours as it is the simplest way of organising financial resources to boost agricultural productivity.

This paper recommended the following essential policies based on these findings. It was suggested that government through the Ministry of Finance and the central bank create the enabling financial environment for financial institutions to settle in rural agrarian communities. This initiative would encourage farmers to open accounts with RCBs to benefit from financial intermediaries to improve crop yields. RCBs should open collection centres in rural farming communities to enhance the patronage of formal saving products. Farmers should use mobile banking to improve their formal savings to raise the needed funds to improve rice yield. Agricultural extension agencies should educate farmers about the essence of patronising formal saving products by organising financial programmes for rural farmers. RCBs should ensure that agricultural loans given to farmers are used for their intended purposes. On the other hand, farmers should also use agricultural procured loans to facilitate farm businesses. Financial institutions should repackage their saving products to be more attractive to the farmers to enhance agricultural activities. This study was only conducted on a small group of farmers over a short period. Further research should determine a long-time effect on RCBs services on a large group of farmers.

References

Adeyemo, R. and Bamire, A.S. (2005), "Saving and investment patterns of cooperative farmers in Southwestern Nigeria", *Journal of Social Sciences*, Vol. 11 No. 3, pp. 183-192, doi: 10.1080/09718923.2005.11892512.

Alene, A.D. and Manyong, V.M. (2007), "The effects of education on agricultural productivity under traditional and improved technology in northern Nigeria: an endogenous switching regression analysis", *Empirical Economics*, Vol. 32 No. 1, pp. 141-159, doi: 10.1007/s00181-006-0076-3.

Ali, A. and Abdulai, A. (2010), "The adoption of genetically modified cotton and poverty reduction in Pakistan", *Journal of Agricultural Economics*, Vol. 61 No. 1, pp. 175-192, doi: 10.1111/j.1477-9552.2009.00227.x.

Amedi, M. (2014), "Constraints among rice farmers under the MiDA agricultural credit programme in the Hohoe municipality", *International Journal of Novel Research in Marketing Management and Economics*, Vol. 1 No. 1, pp. 1-9.

Anyawale, A. and Bamire, A.S. (2000), "Rural income, savings and investment behaviour among farmers in Osun State of Nigeria", *Indian Journal of Economics*, Vol. 320, pp. 49-60.

Asuming-Brempong, S. and Osei-Asare, Y.B. (2007), "Has imported rice crowded-out domestic rice production in Ghana ? What has been the role of Policy ?", *AAAE Conference Proceedings*, pp. 91-97.

Awotide, B.A., Fashogbon, A. and Awoyemi, T.T. (2015), "Impact of access to credit on agricultural productivity: evidence from smallholder cassava farmers in Nigeria", *Conference of Agricultural Economists*, pp. 1-34.

Awunyo-vitor, D. and Al-hassan, R.M. (2014), "Drivers of demand for formal financial services by farmers in Ghana", *International Journal of Agriculture and Forestry*, Vol. 4 No. 4, pp. 261-268, doi: 10.5923/j.ijaf.20140404.01.

Baidoo, S.T. and Akoto, L. (2019), "Does trust in financial institutions drive formal saving? Empirical evidence from Ghana", *International Social Science Journal*, Vol. 69 No. 231, pp. 63-78, doi: 10.1111/issj.12200.

Banerjee, A.V. and Duflo, E. (2007), "The economic lives of the poor", *Journal of Economic Perspectives*, Vol. 21 No. 1, pp. 141-167, doi: 10.1257/jep.21.1.141.

Beck, T., Pamuk, H. and Uras, B.R. (2017), "Entrepreneurial saving practices and reinvestment: theory and evidence", *Review of Development Economics*, Vol. 21 No. 4, pp. 1205-1228, doi: 10.1111/rode.12300.

Bime, M.J. (2008), "Savings mobilization and rural credit markets performance in the North West Province, Cameroon", Ph.D Thesis submitted to the Department of Agricultural Economics, Michael Okpara University of Agriculture, Abia State Nigeria.

Brune, L., Giné, X., Goldberg, J. and Yang, D. (2016), "Facilitating savings for agriculture: field experimental evidence from Malawi", *Economic Development and Cultural Change*, Vol. 64 No. 2, pp. 187-220, doi: 10.1086/684014.

Chandio, A.A., Jiang, Y., Wei, F. and Guangshun, X. (2018), "Effects of agricultural credit on wheat productivity of small farms in Sindh, Pakistan: are short-term loans better?", *Agricultural Finance Review*, Vol. 78 No. 5, pp. 592-610, doi: 10.1108/AFR-02-2017-0010.

Chen, K.C. and Chivakul, M. (2008), "What drives household borrowing and credit constraints? Evidence from Bosnia and Herzegovina", In IMF Working Papers, Vol. 08, 202, doi: 10.5089/9781451870602.001.

Corneo, G. and Jeanne, O. (1998), "Social organization, status, and savings behavior", *Journal of Public Economics*, Vol. 70 No. 1, pp. 37-51, doi: 10.1016/S0047-2727(98)00059-0.

Danquah, M., Quartey, P. and Iddrisu, A.M. (2017), "Access to financial services via rural and community banks and poverty reduction in rural households in Ghana", *Journal of African Development*, Vol. 19 No. 2017, pp. 67-76.

Dehejia, R.H. and Wahba, S. (2002), "Propensity score-matching methods for nonexperimental causal studies", *The Review of Economics and Statistics*, Vol. 84 No. 1, pp. 151-161.

Demirgüç-Kunt, A. and Klapper, L. (2012), "Measuring financial inclusion: the global findex Database", World Bank Policy Research Working Paper, Vol. 6025, April, pp. 1-61, doi: 10.1596/978-0-8213-9509-7.

Devaney, P.L. (2006), *Microsavings Programs: Assessing Demand and Impact A Critical Review of the Literature*, Afminetwork.Org, IRIS Center, Washington, DC (Issue June).

Devaney, S.A., Anong, S.T. and Whirl, S.E. (2007), "Household savings motives", *Journal of Consumer Affairs*, Vol. 41 No. 1, pp. 174-186, doi: 10.1111/j.1745-6606.2006.00073.x.

Dong, F., Lu, J. and Featherstone, A.M. (2012), "Effects of credit constraints on household productivity in rural China", *Agricultural Finance Review*, Vol. 72 No. 3, pp. 402-415, doi: 10.1108/00021461211277259.

Donkor, E. and Anane, E. (2016), "Saving behaviour of citrus farmers in Ghana: implications for rural enterprise development", *Development in Practice*, Vol. 26 No. 8, pp. 1037-1046, doi: 10.1080/09614524.2016.1225671.

Donkor, E. and Owusu, V. (2014), "Effects of land tenure systems on resource-use productivity and efficiency in Ghana's rice industry", *African Journal of Agricultural and Resource Economics*, Vol. 9 No. 4, pp. 286-299.

Donkor, E., Owusu-sekyere, E., Owusu, V. and Jordaan, H. (2016), "Impact of row-planting adoption on productivity of rice farming in Northern Ghana", *Review of Agricultural and Applied Economics*, Vol. XIX No. 2, pp. 19-28, doi: 10.15414/raae/2016.19.02.19-28.

Dupas, P. and Robinson, J. (2013), "Why don't the poor save more?", Vol. 71 No. 2, pp. 215-222, doi: 10.1257/aer.103.4.1138.

Girabi, F. and Mwakaje, A. (2013), "Impact of microfinance on smallholder farm productivity in Tanzania: the case of Iramba district", *Asian Economic and Financial Review*, Vol. 3 No. 2, p. 227.

Hausman, J.A. (1978), "Specification tests in econometrics", *Econometrica*, Vol. 46 No. 46, pp. 1251-1271, doi: 10.2307/1913827.

Heng-fu, Z. (1995), "The spirit of capitalism and savings behavior", *Journal of Economic Behavior and Organization*, Vol. 28 No. 1, pp. 131-143, doi: 10.1016/0167-2681(95)00024-2.

Ike, P.C. and Umuedafe, D.E. (2013), "Determinants of savings and capital formation among rural farmers in Isoko North local government area of delta state, Nigeria", *Asian Economic and*

Financial Review, Vol. 3 No. 10, pp. 1289-1297, available at: http://www.aessweb.com/journals/5002/info/ci.

Irz, X. and Roe, T. (2005), "Seeds of growth? Agricultural productivity and the transitional dynamics of the Ramsey model", *European Review of Agricultural Economics*, Vol. 32 No. 2, pp. 143-165, doi: 10.1093/eurrag/jbi007.

Issahaku, H., Abu, B.M. and Nkegbe, P.K. (2017), "Does the use of mobile phones by smallholder maize farmers affect productivity in Ghana?", *Journal of African Business*, Vol. 3, pp. 1-21, doi: 10.1080/15228916.2017.1416215.

Karlan, D., Ratan, A.L. and Zinman, J. (2014), "Savings by and for the Poor: a research review and agenda", *Review of Income and Wealth*, Vol. 60 No. 1, pp. 36-78, doi: 10.1111/roiw.12101.

Karlan, D., Savonitto, B., Thuysbaert, B. and Udry, C. (2017), "Impact of savings groups on the lives of the poor", *Proceedings of the National Academy of Sciences*, Vol. 114 No. 12, pp. 3079-3084, doi: 10.1073/pnas.1611520114.

Kavi, F.K. (2015), "Technical efficiency in rice production on the Weta irrigation scheme in the Ketu North district of the Volta region, Ghana", Doctoral Dissertation, University of Cape Coast.

Khandker, S.R., Koolwal, G.B. and Samad, H.A. (2010), *Handbook on Impact Evaluation Quantitative Methods and Practices*, The International Bank for Reconstruction and Development, World Bank, Washington, DC, 978-0-8213-8028-4.

Ksoll, C., Lilleør, H.B., Lønborg, J.H. and Rasmussen, O.D. (2016), "Impact of village savings and loan associations: evidence from a cluster randomized trial", *Journal of Development Economics*, Vol. 120, pp. 70-85, doi: 10.1016/j.jdeveco.2015.12.003.

Lee, J.M. and Hanna, S.D. (2015), "Savings goals and saving behavior from a perspective of Maslow's hierarchy of needs", *Journal of Financial Counseling and Planning*, Vol. 26 No. 2, pp. 129-147, doi: 10.1891/1052-3073.26.2.129.

Lee, L.-F. and Trost, R.P. (1978), "Estimation of some limited dependent variable models with application to housing demand", *Journal of Econometrics*, Vol. 8 No. 3, pp. 357-382.

Loayza, N., Schmidt-Hebbel, K. and Servén, L. (2000), "Saving in developing countries: an overview", *World Bank Economic Review*, Vol. 14 No. 3, pp. 393-414, doi: 10.1093/wber/14.3.393.

Lokshin, M. and Sajaia, Z. (2004), "Maximum likelihood estimation of endogenous switching regression models", *STATA Journal: Promoting Communications on Statistics and Stata*, Vol. 4 No. 3, pp. 282-289, doi: 10.1177/1536867x0400400306.

Maddala, G. and Nelson, F. (1975), "Switching regression models with exogenous and endogenous switching", in *Proceeding of the American Statistical Association (Business and Economics Section.*

Maddala, G. (1983), *Limited Dependent and Qualitative Variables in Econometrics*, Cambridge University Press, Cambridge.

MoFA (2016), "Hohoe municipal – Ministry of food & agriculture", available at: http://mofa.gov.gh/site/?page_id=1707.

MOFA-SRID (2016), "Facts and figures (2016)", available at: http://mofa.gov.gh/site/wp-content/uploads/2018/05/Agric in Ghana F&F 2016_Final.pdf.

Nwibo, S.U. and Mbam, B.N. (2013), "Determinants of savings and investment capacities of farming households in udi local government area of Enugu state", *Research Journal of Finance and Accounting*, Vol. 4 No. 15, pp. 59-69, available at: http://www.iiste.org.

Obasi, P., Henri-Ukoha, A., Ukewuihe, I.S. and Chidiebere-Mar, N.M. (2013), "Factors affecting agricultural productivity among arable crop farmers in Imo state, Nigeria", *American Journal of Experimental Agriculture*, Vol. 3 No. 2, pp. 443-454, doi: 10.9734/ajea/2013/2030.

Odoemenem, I.U. and Akerele, S.O. (2013), "Saving and investment pattern of small-scale farmers of benue state, Nigeria", *Global Journal of Human Social Science Sociology and Culture*, Vol. 13 No. 1, pp. 1-7.

Ogutu, S.O., Okello, J.J. and Otienoc, D.J. (2014), "Impact of information and communication technology-based market information services on smallholder farm input use and productivity: the case of Kenya", *World Development*, Vol. 64, pp. 311-321.

Onyango, A.O. (2014), "Exploring for improving rice production to reduce hunger poverty in Kenya", *World Environment*, Vol. 4 No. 4, pp. 172-179, doi: 10.5923/j.env.20140404.03.

Osanyinlusi, O.I. and Adenegan, K.O. (2016), "The determinants of rice farmers' productivity in Ekiti state, Nigeria", (February), *Greener Journal of Agricultural Sciences*, Vol. 6 No. 2, pp. 049-058, doi: 10.15580/GJAS.2016.2.122615174.

Owusu-Frimpong, N. (2008), "An evaluation of customers' perception and usage of rural community banks (RCBs) in Ghana", *International Journal of Emerging Markets*, Vol. 3 No. 2, pp. 181-196, doi: 10.1108/17468800810862632.

Paltasingh, K.R. and Goyari, P. (2018), "Impact of farmer education on farm productivity under varying technologies: case of paddy growers in India", *Agricultural and Food Economics*, Vol. 6 No. 1, doi: 10.1186/s40100-018-0101-9.

Panda, S. (2015), "Farmer education and household agricultural income in rural India", *International Journal of Social Economics*, Vol. 42 No. 6, pp. 514-529, doi: 10.1108/IJSE-12-2013-0278.

Peprah, J.A., Koomson, I., Sebu, J. and Chei, B. (2020), "Improving productivity among smallholder farmers in Ghana: does financial inclusion matter?", *Agricultural Finance Review*, December, doi: 10.1108/AFR-12-2019-0132.

Pg Md Salleh, A.M.H.A. (2015), "Integrating financial inclusion and saving motives into institutional zakat practices: a case study on Brunei", *International Journal of Islamic and Middle Eastern Finance and Management*, Vol. 8 No. 2, pp. 150-170, doi: 10.1108/IMEFM-12-2013-0126.

Quartey, P., Udry, C., Al-Hassan, S., Seshie, H. and Udry, C. (2012), *Agricultural Financing and Credit Constraints*, International Growth Centre, London (Issue March).

Rada, N.E. and Fuglie, K.O. (2019), "New perspectives on farm size and productivity", *Food Policy*, Vol. 84, March, pp. 147-152, doi: 10.1016/j.foodpol.2018.03.015.

Ragasa, C., Dankyi, A., Acheampong, P., Wiredu, A.N., Chapoto, A., Asamoah, M. and Tripp, R. (2013), "Patterns of adoption of improved rice technologies in Ghana. *Ghana Strategy Support Program*", (GSSP) Working Paper, Vol. 36, July, pp. 1-33, doi: 10.13140/2.1.5093.4727.

Rosenbaum, P.R. and Rubin, D.B. (1983), "The central role of the propensity score in observational studies for causal effects", Paul R. Rosenbaum, Donald B. Rubin, *Biometrika*, Vol. 70 No. 1, pp. 41-55.

Rutherford, S. (1999), *The Poor and Their Money an Essay about Financial Services for Poor People*, Vol. 121, Stuart Rutherford Institute for Development Policy and Management University of Manchester, Management, January, available at: http://www.amazon.com/Their-Money-Oxford-India-paperbacks/dp/019565790X.

Satsios, N., Karamanis, K., Galanou, A. and Sotiropoulos, I. (2020), "Saving motives and intention towards saving of Bulgarian pomaks", *International Journal of Economics and Financial Issues*, Vol. 10 No. 3, pp. 97-101, doi: 10.32479/ijefi.9633.

Tanko, M. and Amikuzuno, J. (2015), "Effects of rice importation on the pricing of domestic rice in Northern region of Ghana", *ABC Resarch Alert*, Vol. 3 No. 2, pp. 23-36.

Tripathi, R., Nayak, A.K., Raja, R., Shahid, M., Kumar, A., Mohanty, S., Panda, B.B., Lal, B. and Gautam, P. (2014), "Forecasting rice productivity and production of Odisha, India, using autoregressive integrated moving average models", *Advances in Agriculture*, Vol. 1 No. 1, pp. 1-9, doi: 10.1155/2014/621313.

Xiao, J.J. and Noring, F.E. (1994), "Perceived saving motives and hierarchical financial needs", *Financial Counseling and Planning*, Vol. 5 No. 1, pp. 25-44.

Further reading

Maddala, G.S. (1992), *Introduction to Econometrics*, Macmillan International, New York, pp. 1-637.

Prina, S. (2011), "Do simple savings accounts help the poor to save? Evidence from a field experiment in Nepal", available at: http://agecon.ucdavis.edu/research/seminars/files/prina-do-simple-savings-accounts-help-the-poor-to-save.pdf.

Appendix

Table A1. Treatment effect using the propensity score matching

Estimate	Average treatment on the treated (ATT)		
	Coefficient	Std. Error	*p*-value
Nearest neighbour matching (NNM)	1.24***	0.24	0.00
Kernel-based matching (KBM)	1.04***	0.33	0.00

Note(s): *, **, *** denote 10, 5 and 1% significant levels respectively

Corresponding author
Enoch Yao Vukey can be contacted at: vukenoch@gmail.com