Journal of Agricultural Science; Vol. 13, No. 5; 2021
ISSN 1916-9752 E-ISSN 1916-9760
Published by Canadian Center of Science and Education

Impact of Recapitalisation and Development Programme on Performance of Land Reform Beneficiary Farmers in KwaZulu-Natal, South Africa

T. Shabangu[1,†], M. S. C. Ngidi[1,2,†], T. O. Ojo[3,4,†] & S. C. Babu[5,†]

[1] School of Agricultural, Earth and Environmental Sciences, Department of Agricultural Extension and Rural Resource Management, University of KwaZulu-Natal, Pietermaritzburg, South Africa

[2] Sustainable and Healthy Food Systems, School of Agricultural, Earth and Environmental Sciences, University of KwaZulu-Natal, Pietermaritzburg, South Africa

[3] Department of Agricultural Economics, Obafemi Awolowo University, Ile-Ife, Nigeria

[4] Disaster Management Training and Education Centre for Africa, University of the Free State, Bloemfontein, South Africa

[5] International Food Policy Research Institute, Washington DC, USA

Correspondence: T. O. Ojo, Department of Agricultural Economics, Obafemi Awolowo University, Ile-Ife, Nigeria. E-mail: ojotemitope70@yahoo.com

Received: January 2, 2021 Accepted: February 15, 2021 Online Published: April 15, 2021

doi:10.5539/jas.v13n5p91 URL: https://doi.org/10.5539/jas.v13n5p91

† *These authors contributed equally to organizing the special issue, to editorial work, and to write this article.*

Abstract

Providing appropriate post-settlement support to farmers is crucial for sustainable development of smallholder agriculture in South Africa. In unravelling this, the South Africa's Recapitalization and Development Programme (RADP) was initiated. Hence, this study analysed the impact of RADP on performance of land reform beneficiary farmers in KwaZulu-Natal, South Africa. A multistage sampling procedure was used to select (n = 264) respondents for the study. Accounting for endogeneity issues in RADP assessments and its impact on the performance of land reform farmers, an endogenous switching regression model (ESRM) was employed. In the same vein, a doubly-robust inverse probability weighted regression adjustment was used as credible remedy for potentially biased estimates of ATT and POM of endogenous treatment model. The main findings revealed that tax compliance, secondary organization, legal entity, farm potential income at acquisition, farmers receiving third party assistance and strategic partnership were statistically significant in influencing the participation of farmers in RADP. Mentorship remains an extremely challenging element in post-settlement. However, through the strategic partnership of RADP farmers had likelihood to improve the farm and increase farm income. The results of the suggest that the RADP can contribute to a deep process of change and empowerment of farmers. In the same vein, strategic partnership of RADP is likely to improve the farmers' performance. Therefore, there is a need to strongly improve mentorship and strategic partnership programme to encourage participation of land reform farmers in the support programmes.

Keywords: land reform, RADP, ESRM, IPWRA, South Africa

1. Introduction

Effective use of land reforms as a tool for poverty alleviation crucially depends on how the beneficiaries are guided through for efficient use of the land they have acquired for productive purposes (Zhang et al., 2019; van Noordwijk, 2019). Continued support through engaging them by developing an enabling environment, institutional and individual capcities are important. In the absence of susch support the full benefits of the land reform programs may not be realized. The case of South Africa is typical.

Post-settlement support in South Africa is a programme of improving and broadening post-settlement support services to land reform farms (Anseeuw et al., 2015; Nthai, 2020). There is a necessity to strengthen farmer

support to ensure cohesion function of government organization. Hence, it must be explicitly facilitated that post-settlement must not remain the duties of government, but numerous interested organizations in land reform are critical in playing a role in farmer support development. The mandate of post-settlement is to ensure beneficiaries make use of economic development through sustainable livelihood and poverty eradication (Mafora, 2014).

Existing post-settlement programmes in land reform in were replaced with (RADP) in 2013, including settlement support grants for beneficiaries of land restitution (Anseeuw et al., 2015). The significance of Recapitalization and Development Programme (RADP) is premised on the fact that most of land reforms have been failing because of insufficient and ineffective post-settlement support and are in 'distress', and consequently in need of additional recap funds (University of the Western Cape, 2016; Staal, 2019). Therefore, the Department of Rural Development and Land Reform (DRDLR) initiated a farmer support programme, RADP, to enhance the involvement of a range of institutions, especially local government, in the post settlement stage of land reform to assist farmers with RADP (DRDLR, 2014).

RADP is the programme implemented after Comprehensive Agricultural Support Programme (CASP) with an aim to revive under-performing farms by supporting with; capital to improve farm production, machineries, infrastructure and access to mentorship in order to gain skills and knowledge on how to sustainably manage the farm. DRDLR (2013) suggested that the programme also aims to increase farm income, enhance food security and improve livelihoods of the beneficiaries. Additionally, RADP found to replace all previous forms of funding for land reform in 2013, including settlement support grants for beneficiaries awarded land through restitution, claimed by the University of the Western Cape (2016).

In the spectrum of land redistribution across countries, interested stakeholders in land reform in Southern Africa revised land reform against the experiences of the recent land crisis in the region. This led to initiation of negotiated transfer land redistribution program pursued in the foundation of four questions: What has been the experience with land redistribution in the region over the last decade or so? What has been the impact on people's livelihoods? How are redistribution programmes expected to develop in future? What might be the role of donors in the process (Adams & Howell, 2001)? Byamugisha (2014) argued that land reform is an imperative aspect of social and economic transformation in South Africa, as a means of both redressing past injustices and alleviating the pressing problems of poverty and inequality. Hence, given the significance of the agricultural sector in economic growth, poverty alleviation and employment, Weideman (2003) suggested that it is crucial that land reform contributes to increased (or at least sustained) levels of agricultural production.

Martin (2000) revealed that a paradigm shift from the initial poverty-reduction objective of land restitution programme and towards land redistribution for 'productive' objective brought a heavy criticism on the grounds of Zimbabwe that farms were being compulsorily acquired and distributed to politicians, military employees and officials and used as a pillar to underpin political support. However, the stakeholders recommended that infrastructure and settler support, particularly in the form of 'starter packs' must be provided for proposed beneficiaries. This approach of establishing commercial native farmers was once observed in Chile, in 1967 the government invested land reform with the major goal of increasing farm production and productivity of the agricultural industry and also established polices promoting production at farm level (Binswanger-Mkhize, 2014; Tilley, 2008; Janvry & Sadoulet, 2002; Heit, 2003) in Sibisi (2015).

The large-scale farmer model in land reform is a very efficient model around the world and is the fundamental of land reform success and with great contribution to agricultural growth. Global experience shows that this model is successful from very small and labour-intensive operations to very large, mechanized operations. Rogier et al. (2006) emphasized that larger farmers generally have easier access to cheaper credit. This enables them to quickly respond to the market, especially when the market demands agricultural products with high investment costs. According to Kahn (2007) in Sibisi (2015) suggested that repossession of land is meaningless without appropriate post-settlement support. The problem remains in that in across countries land reform is failing because of insufficiency and late delivery of farmer support/post-settlement services, argued by Hans and Mkhize (2014). Across the world, land and post-settlement support are provided by different stakeholders, which proves impossible to coordinate. As indicated above, the stakeholder arrangements for the delivery of farmer support services to proposed land reform farmers are largely dysfunctional and the services provided have been neither adequate nor appropriate (Byamugisha, 2014). Sibisi (2015) criticized the collaboration of stakeholders and lack of scope of post-settlement support required to be implemented which results in poor after-care support. Locally and internationally, poor post-settlement support has appeared to be a hindrance to achieving success.

As a result, Sibisi (2015) finds the RADP to be the best programme because it focuses on the whole farm development but not limited to farmer capacity development. Maka and Aliber (2019) supported that one outstanding characteristic of the RADP is that it connects proposed farmers with mentors or strategic partners, significantly as a condition of receiving financial support. Phatudi-Mphahlele (2016) proposed that the mention link of stakeholders is with an aim to invest infrastructure and provide with mentorship and strategic partners as to ensure the growth and development of the farmer and farm. However, there is dearth of information on impact of RADP on net farm income of land reform beneficiaries in KwaZulu-Natal (KZN) Province of South Africa. It is against this backdrop that this study sought to unravel the impact of RADP participation on net farm income of beneficiaries of the land reform to support the public policy makers' job and informing the society in KZN.

3. Materials and Methods

3.1 Study Region and Data

The study was conducted in KwaZulu-Natal to analyze the impact of RADP on performance of land reform farmers. In the study area, respondents (n = 264) successfully participated in the study both non-benefited and benefited RADP beneficiaries. The factors being assessed were adopted from the literature, seeing as the elements required and increases the likelihood to participate in RADP and also contribute in farm income generation. Probability sampling was adopted with an aim to estimate the probability of a participant's being included in the sample (Taherdoost, 2016). A survey was conducted using a structured questionnaire that was directed to land reform beneficiaries in the study sites. Multistage sample tool was employed to guarantee that non-RADP and RADP beneficiaries are given each adequately represented within the entire sample (Crossman, 2020). Hence, it was done to remove bias from selection procedure and result in representative of sample (Dudovskiy, 2018).

The use of structured interview was independently during one-on-one interviews because respondents were segregated and in-order to acquire in-depth data relevant to factors contribute in participating in RADP and improving farm income which is examined to be contributing to farm development and sustainable livelihood. It was this also this reason the research study employed probability sampling to assess factors influencing participation of farmers in RADP and factors contribute in increase farm income. The interview was conducted using isiZulu so that farmers can best respondent with an understanding. Data collection was conducted to a total of 264 questionnaires (n = 264) and were successfully completed.

During primary data collection, the letter of consent was read clearly, attached to each survey for land reform farmers, to encourage that the respondent fully comprehended the nature of the research. This was done and signed by the respondents prior to their involvement to make sure that participants agreed to the condition of the research study. Hence, a mentioned letter of consent informed respondent prior that the participant true identification would not be presented, but indication using numbers and class name like land reform farmer were used to ensure protection of their identification. An inferential analysis was employed with an aim to analyze the data to show the relationship between multiple variables to generalize results and make predictions (Lutabingwa, 2007). An Endogenous switching regression model was adopted to show the level of significance of variables or the relationship between two variables influencing participation of farmers in RADP and the variables that contribute in the likelihood of farm income of RADP farmers and non-RADP farmers to find the impact of recapitalization and development programme on performance of land reform farmers. The data was captured in a computerized manner using STATA.

3.2 Econometric Estimation Strategy

Following Lokshin and Sajaia (2004), Khanal et al. (2018), and Aravindakshan et al. (2018), an endogenous switching regression model (ESRM) was employed for this study. This approach, however, estimated the impact of RADP participation on the net farm income of farmers using RADP participation as a dummy variable, which might yield biased and inconsistent estimates because participation is potentially endogenous (Ojo & Baiyegunhi, 2020a). This model consists of two parts; endogeneity due to self-selection using a probit selection model (Note 1) was corrected for in the first part of the model, in which farmers were partitioned (divided) into participants and non-participants of RADP programme. Following Abdulai and Huffman (2014), a RADP participation is normally chosen by a farmer if the net benefits derived by participating in it are higher than the benefits derived by not participating in it ($P_{Y1} \geq P_{Y2}$), where, P_{Y1} is the net benefit that farmer i derives from RADP participation and P_{Y2} is the net benefit of not participating in it. The net benefits derived by RADP participation were not known to the researcher. However, the characteristics of farmers were observed during the survey period, with Y_i^* representing the net benefits derived from RADP participation that was not observed, but could be expressed as a function of the observed attributes.

$$Y_i^* = \beta F_i + \varepsilon_i \tag{1}$$

$$Y_i = 1 \text{ if } Y_i^* > 0 \text{ and 0 if otherwise}$$

where, Y_i^* is a variable that was not observed (or latent) for RADP participation, while Y is the observable counterpart (equal to 1 if the farmer participated it, and 0 if otherwise).

In the second stage, the outcome equations on the impact of the RADP participation on net farm income was estimated using a production function, expressed in Equation (2) as:

$$P = f(Y, \beta, F) + \varepsilon \tag{2}$$

where, P is the log form of net farm income; Y is the RADP participation; β is a vector of parameters to be estimated; and F is a set of covariates used in the model.

$$\text{Regime 1 (participants): } P_{1i} = \lambda_1 H_i + v_{1i} \tag{3a}$$

$$\text{Regime 2 (non-participants): } P_{2i} = \lambda_2 H_i + v_{2i} \tag{3b}$$

where, P_{1i} and P_{2i} are the logs of the rice yields in regimes 1 and 2, respectively; H_i is a matrix of covariates that are, hypothetically, the determinants of net farm income and v_{1i} and v_{2i} are the stochastic error terms. The stochastic error terms were assumed to have a trivariate normal distribution, with a zero mean and non-singular covariance matrix, as expressed in Equation (4):

$$\text{cov}(\varepsilon_i v_1 v_2) \begin{vmatrix} \sigma_1^2 & \sigma_{12} & \sigma_{1\varepsilon} \\ \sigma_{12} & \sigma_2^2 & \sigma_{2\varepsilon} \\ \sigma_{1\varepsilon} & \sigma_{2\varepsilon} & \sigma^2 \end{vmatrix} \tag{4}$$

where, $\sigma_1^2 = \text{var}(v_1)$; $\sigma_2^2 = \text{var}(v_2)$; $\sigma^2 = \text{var}(\varepsilon_1)$; $\sigma_{12} = \text{cov}(v_1, v_2)$; $\sigma_{1\varepsilon} = \text{cov}(v_1, \varepsilon_i)$; $\sigma_{2\varepsilon} = \text{cov}(v_2, \varepsilon_i)$; σ^2 represents the variance of the error term in the selection equation; while σ_1^2, σ_2^2 indicate the variance of the stochastic error term in the generated equation.

According to Maddala (1983), when latent characteristics are related to selection bias, the structure of the error might arise because the error term, ε_i, of the selection Equation (2) is correlated with the error terms, v_{1i} and v_{2i}, of the generated Equations (3a) and (3b), with the expected values of v_{1i} and v_{2i} being conditional on sample selection being non-zero.

$$E(v_{1i} \mid Y_i = 1) = E(v_{1i} \mid \varepsilon_i > -F_i\beta) = \sigma_{1\varepsilon}\left[\frac{\theta(F_i\beta/\sigma)}{\phi(F_i\beta/\sigma)}\right] \equiv \beta_{1\varepsilon}\gamma_1 \tag{5a}$$

$$E(v_{2i} \mid Y_i = 0) = E(v_{2i} \mid \varepsilon_i \le -F_i\beta) = \sigma_{2\varepsilon}\left[\frac{-\theta(F_i\beta/\sigma)}{1-\phi(F_i\beta/\sigma)}\right] \equiv \beta_{2\varepsilon}\gamma_2 \tag{5b}$$

where, θ and φ are the PDF and CDF of the standard normal distribution, respectively. The ratio of θ and φ were evaluated at βF_i, as represented by γ_1 and γ_2 in Equations (5a) and (5b). This ratio is the inverse mills ratio (IMR), which indicates the selection bias terms. The IMR shows the correlation between the RADP participation and net farm income of smallholder farmers. Previous studies used the two-stage endogenous switching model (Fuglie & Bosch, 1995). A probit model of the selection equation was estimated in the first stage, and the IMRs γ_1 and γ_2 were predicted as indicated in Equations (5a) and (5b). The second stage involved adding the derived IMRs to Equations (3a) and (3b), respectively, with the following sets of equations being formed:

$$P_{1i} = \lambda_1 H_i + \beta_{1\varepsilon}\gamma_1 + \varphi_i Y_{1i} + \psi_1 \tag{6a}$$

$$P_{2i} = \lambda_2 H_i + \beta_{2\varepsilon}\gamma_2 + \varphi_{2i} Y_{2i} + \psi_2 \tag{6b}$$

The coefficient of the variables γ_1 and γ_2 gave parameter estimates of the covariance terms $\beta_{1\varepsilon}$ and $\beta_{2\varepsilon}$, respectively. Through estimating variables γ_1 and γ_2, the standard errors of the two-stage estimates could not be calculated using the residuals ψ_1 and ψ_2. Heteroskedastic errors are always confounded with methods where IMRs are manually inserted from probit equations into the generated equations. A full information maximum likelihood (FIML), as proposed by Lokshin and Sajaia (2004), represents an efficient method for analysing endogenous switching regression models. The FIML simultaneously fits the selection equation and the generated equations (Equation (1) and Equations (3a) and (3b), respectively) to yield consistent standard errors. In turn, this makesγ_1 and γ_2 in Equations (6a) and (6b), respectively, homoscedastic. The log likelihood function of the FIML for the switching regression model employed in this study followed that proposed by Lokshin and Sajaia (2004):

$$LnY_i = \sum_{i=1}^{N} \left\| \begin{array}{l} Y_i t_i \left[\ln Q\left(\frac{F_i\beta + \sigma_{1\varepsilon}(P_{1i} - H_{1i}\lambda/\varphi_1)}{\sqrt{1-\alpha_{1i}^2}}\right) + \ln(q(P_{1i} - H_{1i}\lambda/\varphi_1)) \right] + \\ (1-Y_1)t_i \left[\frac{\ln(1-Q(F_i\beta + \sigma_{2\varepsilon}(P_{2i} - H_{2i}\lambda/\varphi_2)))}{\sqrt{1-\alpha_{2\varepsilon}^2}} + \ln(q(P_{2i} - H_{2i}\lambda/\varphi_2)) \right] \end{array} \right\| \quad (7)$$

According to Fuglie and Bosch (1995), the signs of the correlation coefficients $\alpha_{i\varepsilon}$ and $\alpha_{2\varepsilon}$ have economic meanings. If $\alpha_{i\varepsilon}$ and $\alpha_{2\varepsilon}$ have alternate signs, RADP participation based on their comparative advantages. For instance, farmers who participated would have above-average net farm income, while those who did not participate would have below-average net farm income. However, if the coefficient has the same sign, participants would have above-average net farm income whether they participated or not but would be better off if they participated. In comparison, non- participant would have below-average net farm income in either case but would be better off if they decided not to participate. As posited by Khanal et al. (2018), and Ojo et al. (2019) the current study shows how an endogenous switching treatment regression model determines counterfactual effects and the effects of participation. The counterfactual effect is the net farm income by the participants that would have been derived if the characteristics of the net farm income had been the same as the characteristics of the net farm income of non-participants, and vice versa. The change to the net farm income of farmers as a result of participation in RADP was estimated as the difference between Equations 3a and 3b, which were termed the average treatment effects on the treated (ATT):

$$ATT = E(P_{1i} - P_{2i} \mid Y_i = 1) = H_i(\lambda_1 - \lambda_2) + (\sigma_{1\pi} - \sigma_{2\pi})\gamma_1 \quad (8)$$

In Equation (3), $E(P_{1i} \mid Y_i = 1) = \lambda_1 H_i - \sigma_{1\mu}\gamma_1$ represents the expected outcome for the participants, had they participated, while $E(P_{2i} \mid Y_i = 1) = \lambda_2 H_i - \sigma_{2\mu}\gamma_1$ represents the expected net farm income for farming households that participated had they chosen not to participate in RADP programme.

4. Results and Discussion

4.1 Descriptive Statistics

Table 1 presents the description of variables and their units of measurement. A thorough search from pieces of literature shows that farmers' socioeconomic, farm-specific and policy or institutional variables influence participation in RADP programme among smallholder farmers. For instance, it is expected that a farmer with a higher educational level understands farm management practices and that can enhance productivity and efficiency of resource use. As posited by Myeni et al. (2019), Ojo and Baiyegunhi (2020b) farmers with satisfactory level of education are capable to process, interpret, analyze and respond to innovations for adoptions for sustainable agricultural management practices. Hence, this is line with the study of Ukhanal et al. (2018) who stated that farmers with a higher level of education are more likely to have better access to information to implement better farming strategies. Hence, the study hypothesized a positive effect of the number of years in formal education on participation in RADP programme.

Table 1. Descriptive statistics of the sampled farmers

Variable	Description	Mean	SD
Ln Income	Log of Income of the farmers (Rands)	12.23	1.76
Gender	1 = if farmer is male	0.58	0.50
Age	Age of the farmer in years	49.72	12.71
Marital status	1 = if farmer is married	0.81	0.68
Formal education	1 = if farmer had access to formal education	0.69	0.67
Off-farm income	1 = if farmer engaged in off-farm economic activities	0.64	0.47
Household size	The number of persons in a household (count)	4.65	1.24
Farming experience	Number of years in farming	10.9	3.87
Access to extension	1 = if farmer had access to extension services	0.58	0.47
Access to credit	1 = if farmer had access to credit	0.58	0.49
Legal entity	1 = if farmer had access to legal entity	0.48	0.40
Farm potential income at acquisition	Amount of income at acquisition (Rands)	14.24	1.13
Tax compliance	1 = if farmer is tax compliant	0.37	0.48
Mentorship	1 = if farmer had access to mentorship	0.17	0.37
Strategic partnership	1 = if farmer had access to partnership	0.54	0.50
Project contract signed	1 = If farmer signed the contract	0.69	0.50
Farm- based organizations (FBO)	1 = if farmer belongs to FBO	0.34	0.47

Generally, the average age of respondents is about 49 years and about 80% of the sampled farmers are married. While about 64% of farmers were engaged in off-farm economic activities, the average number of persons in a household is about five. Similarly, the number of years in crop farming (proxied for experience) is expected to have positive effects on participation in RADP programme and its impact on net farm income. This is because, with more years of farming, farmers understand the agricultural production environment and process market information, which subsequently increases the likelihood of participating in on participation in RADP programme. About 70% of the respondents had a signed contractual agreement. These findings confirmed that the majority of South African PLAS land reform farmers do have readily available market with contract agreements but have no command or bargaining power since that the majority do not grade produce before selling. Therefore, a crucial role needs to be played by key stakeholders in agricultural development is to capacitate farming in marketing.

Table 2. Full information maximum likelihood (FIML) estimates of the endogenous switching regression model (ESRM)

Variables	Participation in RADP Programme			Farm income					
				RADP Beneficiaries			Non-RADP Beneficiaries		
	Coef.	Std. Err.	P-value	Coef.	Std. Err.	P-value	Coef.	Std. Err.	P-value
Age	0.060	0.027	**0.029****	0.026	0.023	0.251	0.010	0.015	0.496
Farm potential income at acquisition	0.391	0.229	**0.088***	0.307	0.226	0.175	0.118	0.196	0.547
Access to non-farm income	-0.064	0.535	0.905	0.185	0.487	0.703	-0.587	0.410	0.152
Strategic partnership	1.243	0.631	**0.049****	1.534	0.666	**0.021****	1.700	0.899	**0.059***
Secondary education	-0.052	0.446	0.907	0.324	0.428	0.449	0.450	0.394	0.254
Legal entity	0.127	0.868	0.883	0.560	1.473	0.704	1.097	0.469	**0.019****
Mentorship	0.188	0.580	0.746	0.741	0.492	0.132	-0.533	0.787	0.498
Farmer's receiving 3rd party assistance	0.321	0.643	0.618	-0.928	0.839	0.269	1.253	0.750	**0.095***
Tax compliance	1.655	0.527	**0.002*****	1.881	0.735	**0.010****	0.726	0.613	0.236
Gender	0.381	0.494	0.441						
Project contract signed	0.466	0.462	0.313						
Farming experience	-0.020	0.022	0.354						
Farmers organizations/Associations	1.006	0.454	**0.027****						
Constants	-11.165	4.152	**0.007*****	5.031	4.205	0.232	8.788	3.087	**0.004*****
/lns1	**0.234**	**0.107**							
/lns2	**0.280**	**0.109**							
/r1	**0.167**	**0.465**							
/r2	**0.576**	**0.552**							
sigma_1	**1.263**	**0.135**							
sigma_2	**1.324**	**0.144**							
rho_1	**0.165**	**0.452**							
rho_2	**0.520**	**0.403**							
LR test of indep	**10.80**								
Prob > chi2	**0.001**								
Loglikelihood	**-202.364**								
Wald chi2 (14)	**15.74**								
Prob > chi2	**0.072**								

Note. ***, **, and * represent significance level at 1%, 5%, and 10%, respectively.

4.2 Results From Full Information Maximum Likelihood (FIML) Estimation of the Endogenous Switching Regression Model (ESRM)

The result is subjected to a more rigorous estimation method by employing the full information maximum likelihood (FIML) ESRM (Table 2). The FIML ESR model involves a selection equation and separate outcome equations for RADP beneficiaries and non-RADP beneficiaries, which are estimated simultaneously with factors influencing participation in RADP

The results are based on the factors influencing the participation of land reform beneficiaries in RADP and farm income estimates for both participating RADP beneficiaries and non-RADP beneficiaries using the endogenous switching regression model (ESR), and the results are presented in Table 2 above. The covariance terms (Constants) for RADP Participation and non-RADP beneficiaries equations are both statistically significant at the 1% level. The statistical significance of the covariance terms implies that the application of the ESR in the empirical estimation is suitable. The results of the ESRM estimation are presented in Table 2, with the second column showing the factors influencing participation of farmers in RADP. The results showed that the coefficients of age, farm potential income at acquisition, strategic partnership, and tax compliance were statistically significant in influencing the participation in RADP.

The age variable had a significantly positive influence on the participation in RADP. These results show that there was 6% of probability of "middle age" beneficiaries are significant to influence the participation in RADP. The result implies that participation in RADP increase the likelihood of older beneficiaries. The mean beneficiaries are getting older as indicated by their mean age of 50 years which is below 62, the average age of farmers in south Africa, (Sihlobo, 2015; Thinda et al., 2020). Hence, the more farmers get old the less is the production, workforce and income. This is in line with the study of Mahembe (2001) who also found a strong

correlation between the age of an enterprise and its risk profile in their study on literature review on small and medium enterprises' access to credit and support in South Africa.

The coefficient of farm potential income at acquisition had a significantly positive influence on participation of beneficiaries in RADP. This implies that the participation on RADP increase the likelihood of the farm potential income at acquisition. This is not unconnected with the regulations of Department Rural Development and Land Reform (DRDLR) (2014), with an aim to revitalize poor performing and with a low farm potential income at acquisition through RADP programme. Hence, this is in line with the study of Nenngwekhulu (2019) who also found a positive relationship between RADP and farm income in their study on financial analysis of the RADP in South Africa.

The coefficient of strategic partnership had a significantly positive influence on the participation of land reform beneficiaries in RADP. The result implies that participation of land reform beneficiaries in RADP increase the likelihood of working with strategic partners. This is not unconnected with the regulations of Department Rural Development and Land Reform (DRDLR) (2014), that farmers must be in profit & risk sharing based shareholding mechanisms with strategic partner(s) for farm sustainability. This is in line with the study of Sibisi, (2015) who also a positive relationship between strategic partners and land reform farmers in their study on importance and role of stakeholders involved in support services of land reform in South Africa.

The coefficient of tax compliance had a significantly positive influence on participation of beneficiaries in RADP. The result implies that the participation in RECAP programme increases the likelihood of being tax compliant. This is not unconnected with the regulations of Department Rural Development and Land Reform (DRDLR) (2014), that all beneficiaries must comply with South African Revenue Services (SARS) requirements and a tax clearance certificate must be provided to the DRDLR on an annual basis. This is in line with the study of De Janvry et al., (2015) who also found a positive relationship between tax compliance and migration in their study on delinking land rights from land use in Mexico.

4.3 Impact of RADP on Performance of Land Reform Farmers on Farmers' Net Farm Income

The estimates of the second stage of the ESRM on the impact of recapitalization and development programme on performance of land reform farmers of participation on RADP on the net farm income of beneficiaries (RADP and non-RADP) are presented in the third and fourth columns of Table 2. The coefficients of strategic partnership, legal entity, farmer receiving third party assistance and tax compliance were statistically significant in explaining differences in the net farm income of RADP and non-RADP beneficiaries in land reform. For the non-RADP beneficiaries, the coefficients of strategic partnership, legal entity and farmer's receiving third party assistance were statistically significant in explaining differences in the net farm income of land reform farmers.

The strategic partnership had a significantly positive influence in explaining variation in the net farm income of both RADP and non-RADP beneficiaries of land reform. Thus, this is not unconnected with the regulations of Department Rural Development and Land Reform (DRDLR) (2014), that farmers must be in profit & risk sharing based shareholding mechanisms with strategic partner(s) for farm sustainability. The result on both RADP Beneficiaries and Non-RADP Beneficiaries implies that the net farm income increases the likelihood for intervention of strategic partners. Furthermore, indicates that on Non-RADP beneficiaries the farm income is more likely to be increased by the engagement with strategic partners since never benefited from RADP. This is in line with the study of Sibisi (2015) who also a positive relationship between strategic partners and land reform farmers in their study on Agricultural extension and post-settlement support of land reform beneficiaries in South Africa: the case of Ixopo in the province of KwaZulu-Natal.

The establishment legal entities (co-operatives, CPA, and private companies) had a significantly positive influence in explaining variation in the net farm income of just the non-RADP beneficiaries of land reform. The result implies that Non-RADP beneficiaries increases the likelihood of possessing legal entities in other to increase farm income as a result of structured entities with roles and responsibilities. This is in line with the study of Ojo and Baiyegunhi, (2020a) who found that rice farmers being in cooperatives had a significantly positive influence in explaining the variation in net farm income in the study of perception and economic impact of climate change on rice production in South-West, Nigeria. Furthermore, Ntlou (2016) stated that the group formation of beneficiaries should be taken into deliberation that group members' interests may differ, even though they all want to farm.

The farmer's receiving third party assistance through farmer-to-farmer approach and consultations had a significantly positive influence in explaining variation in the net farm income of just the non-RADP beneficiaries of land reform. The result implies that Non-RADP beneficiaries since RADP is not made available to them the likelihood to increase the net farm income is seen on the engagement with other farmers and consultants. This is

in line with the study of Abdulai and Huffman (2014) who also found a positive relationship between extension agents and access technology in their study on the adoption and impact of soil and water conservation technology in USA.

The tax compliance had a significantly positive influence in explaining variation in the net farm income of just the RADP beneficiaries of land reform. The result implies that the participation in RADP increases the likelihood of being tax compliant and increase the likelihood of positive net farm income. This is not unconnected with the regulations of Department Rural Development and Land Reform (DRDLR) (2014), that all beneficiaries must comply with South African Revenue Services (SARS) requirements and a tax clearance certificate must be provided to the DRDLR on an annual basis. This is in line with the study of De Janvry et al. (2015) who also found a positive relationship between tax compliance and migration in their study on delinking land rights from land use in Mexico.

4.3.1 Treatment Effects for the RADP Participation—Endogenous Switching Regression Treatment Effect

This study estimated endogenous switching regression with the inclusion of RADP beneficiary among the smallholder farmers for treating the endogeneity problem as presented in Table 3.

Table 3. Treatment effects for the RADP participation—endogenous switching regression treatment effect

Treatment effects	Coefficient	Std.
Average treatment effect (ATE)	18.24***	4.71
Average treatment on the treated (ATT)	14.66***	1.71

The results show a positive and significant effect on participation in RADP . A simple considerable difference in the average income between the participants and non-participants of participation in RADP in impact evaluation studies is misleading as they usually fail to control for potential differences in the characteristics between the two groups. The estimate from the endogenous switching regression model can also be inadequate even if not misleading though it accounts for endogeneity. This is because direct coefficients from the model cannot be considered as ATT since the issue of missing data (counterfactual scenario) has not been accounted for. To account for this, the study turned to the results of the causal effects of the participation in RADP on farmers' net income using ATE and ATT, where the switching regression with endogenous treatment was used and then complement it with IPWRA as a robustness check. Hence, the estimates from the endogenous switching regression are discussed first. ATE and ATT were estimated after fitting the endogenous regression with endogenous treatment effects (Note 2). As indicated in Table 3, the estimated potential outcome means (ATE) of participation in RADP programme on net farm income by farm households is about 18.24 and statistically significant at 1%. The ATE estimate suggests that an average farm household in the study area will make about R18 more net farmincome if he participates in RADP programme. In the same vein, the conditional treatment effects which measure the ATT of participating in RADP on the net farm income adopted is about 14.66 and also statistically significant at 1%. Thus, the average farm household participating in RADP would realize about R15 more of net farm income than it would if it did not participate in RADP programme.

4.3.2 Treatment Effects for the RADP Participation—Doubly-Robust Inverse Probability Weighted Regression Adjustment

The ex-post estimates of the causal effects of the adoption of SWC on rice productivity of smallholder farmers from the IPWRA are presented in Table 4.

Table 4. Treatment effects for RADP participation—inverse-probability-weighted regression adjustment

Treatment effects	Coefficient	Std. Err.
Average treatment effect (ATE)	1.641***	0.556
Average treatment on the treated (ATT)	5.708***	1.247
Potential-outcome mean (POM)	17.304***	0.766

Note. The bootstrap replications were changed from 100-1,000 but no significant change occurred, hence 500 replications were used to bootstrap the standard errors.

From Table 4, the ATE and POM are approximately two (2) and seventeen (17), respectively. Thus, the average net farm income if all of our sampled farmers were to participate in RADP would be two times more the average of seventeen that would occur if none of the farmers had participated in RADP. Likewise, RADP participants treated group realized 5.7 more net farm income than they would have if they did not participate RADP programme.

The results from the two estimation techniques indicate that participation in RADP programme significantly increases the net farm income. The results of the average causal effects reported in Tables 3 and 4 indicate that the magnitudes of the estimates of the outcome variables are divergent between endogenous switching regression and IPWRA. This divergence in the results of both may be due to differences in unobserved heterogeneity among smallholder farmers (Danso-Abbeam & Baiyegunhi, 2018). The positive impact of RADP participation on performance of smallholder farmers agrees with the studies of Worku et al. (2020), and Martey et al. (2020) in Eastern Africa and Ghana, respectively. The results of the study suggest that the participation of smallholder farmers in RADP programme increases the propensity of improved net farm income as compared to those who did not participate in RADP programme (Ojo et al., 2019, 2020a). The implication of these results reflects the important role of RADP for improved agricultural production.

5. Conclusion

Based on the results reported above we find that the factors such as age of the farmer, farm potential income at acquisition, strategic partnership, and tax compliance significantly influence on the participation of farmers in RADP. Programmatic interventions to increase the participation of the farmers - benefiting from land reforms- in the RADP needs to identify opportunities that can increase income farmers. Strategic partnership is significant factor in explaining differences in the net farm income of RADP and non-RADP beneficiaries in land reform. For the non-RADP beneficiaries, the factors—strategic partnership, legal entity and farmer's receiving third party assistance were statistically significant in explaining differences in the net farm income. And for RADP beneficiaries, strategic partnership and tax compliance were statistically significant in explaining differences in the net farm income. This indicates that the magnitudes of the estimates of the outcome variables are divergent between endogenous switching regression and IPWRA. This divergence in the results of both may be due to differences in unobserved heterogeneity among land reform beneficiaries. However, there are still more interventions required both from private and public sector to enhance the performance of post-settlement support to improve farmers livelihood and farm development. Hence, through the strategic partnership of RADP farmers had likelihood to improve the farm and increase farm income. The study's results suggest that the RADP can contribute to a deep process of change and empowerment of farmers. In the same vein, strategic partnership of RADP is likely to improve the farmers' performance. Therefore, there is a need to strongly improve mentorship and strategic partnership programme to encourage participation of land reform farmers in the support programmes.

Acknowledgements

This research was funded in whole, or in part, by the Sustainable and Healthy Food Systems (SHEFS) programme supported by the Wellcome Trust's Our Planet, Our Health programme [grant number: 205200/Z/16/Z], and SIM, ATM and TM are supported by this grant.

References

Abdulai, A., & Huffman, W. (2014). The Adoption and Impact of Soil and Water Conservation Technology: An Endogenous Switching Regression Application. *Board of Regents of the University of Wisconsin System, 90*(1), 26-43. https://doi.org/10.3368/le.90.1.26

Adams, M. & Howell, J. (2001). Redistributive Land Reform in Southern Africa. In J. Farrington & A. Wyles (Eds.), *Natural Resource Perspective*. London: Overseas Development Institute. Retrieved from http://dlc.dlib.indiana.edu/dlc/bitstream/handle/10535/3779/64-redistributive-land-reform-southern-africa.pdf?sequence=1

Anseeuw, W., Liebenberg, F., & Kirsten, J. (2015). Agrarian reform in South Africa: Objectives, evolutions and results at national level. *South Africa's Agrarian Question*, 28-51. Retrieved from https://hal.archives-ouvertes.fr/hal-01376094/file/South_Africa%27s_Agrarian_Question_-_eBook.pdf#page=55

Aravindakshan, S., Rossi, F., Amjath-Babu, T. S., Veettil, P. C., & Krupnik, T. J. (2018). Application of a bias-corrected meta-frontier approach and an endogenous switching regression to analyze the technical efficiency of conservation tillage for wheat in South Asia. *Journal of Productivity Analysis, 49*(2-3), 153-171. https://doi.org/10.1007/s11123-018-0525-y

Byamugisha, F. (2014). *Agricultural Land Redistribution and Land Administration in Sub-Saharan Africa: Case Studies of Recent Reforms*. Washington, DC: The World Bank. https://doi.org/10.1596/978-1-4648-0188-4

Crossman, A. (2020). *Understanding stratified samples and how to make them*. Retrieved January 29, 2021, from https://www.thoughco.com/stratified-sampling-3026731

De Janvry, Alian, Emerick, K., Gonzalez-Navarro, M., & Sadoulet, E. (2015). Delinking Land Rights from Use: Certification and Migration in Mexico. *American Economic Review, 105*(10), 3125-49. https://doi.org/10.1257/aer.20130853

DRDLR. (2013). *Three Years Review of Recapitalization and Development Programme: September 2013*. Pretoria: Department of Rural Development and Land Reform.

DRDLR. (2014). *Revised Policy for the Recapitalisation and Development Programme of the Department of Rural Development and Land Reform*. Pretoria: Department of Rural Development and Land Reform.

Dudovskiy, J. (2018). *The Ultimate Guide to Writing a Dissertation in Business Studies: A Step-by-Step Assistance*. Retrieved December 16, 2019, from https://research-methodology.net/about-us/ebook

Fuglie, K. O., & Bosch, D. J. (1995). Economic and environmental implications of soil nitrogen testing: A switching-regression analysis. *American Journal of Agricultural Economics, 77*(4), 891-900. https://doi.org/10.2307/1243812

Khanal, P., Wagle, B. H., Upadhaya, S., Ghimire, P., & Acharya, S. (2019). Perceived Climate Change Impacts and Adaptation Strategy of Indigenous Community (Chepangs) in Rural Mid-hills of Nepal. *Forestry: Journal of Institute of Forestry, 16*, 48-61. https://doi.org/10.3126/forestry.v16i0.28353

Lokshin, M., & Sajaia, Z. (2004). Maximum likelihood estimation of endogenous switching regression models. *The Stata Journal, 4*(3), 282-289. https://doi.org/10.1177/1536867X0400400306

Lutabingwa, J. (2007). Data Analysis in Quantitative Research. *Journal of Public Administration, 42*(6), 528-548.

Maddala, G. S. (1983). Methods of estimation for models of markets with bounded price variation. *International Economic Review*, 361-378. https://doi.org/10.2307/2648751

Mafora, M. (2014). *Socio-economic Analysis of Land Reform Projects at Elias Motsoaledi Local Municipality in the Limpopo Province of South Africa: Comparing the degree of contribution to food security* (Masters Dissertation, University of South Africa, South Africa).

Mahembe, E. (2001). *Literature review on small and medium enterprises' access to credit and support in South Africa*. South Africa, Pretoria: National Credit Regulator. Retrieved from https://www.smallbusinessinstitute.co.za/wp-content/uploads/2019/12/NCRLiterature-Review-on-SME-Access-to-Credit-in-South-Africa_Final-Report_NCR_Dec-2011.pdf

Maka, L., & Aliber, M. (2019). The role of mentors in land reform projects supported through the recapitalisation and development programme: findings from Buffalo city metropolitan municipality, South Africa. *South Africa Journal Agricultural Extension, 47*(2), 37-45. https://doi.org/10.17159/2413-3221/2019/v47n2a501

Martey, E., Etwire, P. M., & Kuwornu, J. K. (2020). Economic impacts of smallholder farmers' adoption of drought-tolerant maize varieties. *Land Use Policy, 94*, 104524. https://doi.org/10.1016/j.landusepol.2020.104524

Martin, A. (2000). *Breaking Ground: Development Aid for Land Reform*. London, UK: Overseas Development Institute.

Nenngwekhulu, N. (2019). *Financial analysis of the Recapitalisation and Development Programme in South Africa* (Doctoral Dissertation, University of Pretoria, South Africa).

Nenngwekhulu, N. (2019). *Financial analysis of the Recapitalisation and Development Programme in South Africa* (Masters Dissertation, University of Pretoria, South Africa).

Nthai, M. M. (2020). Funding Rural Development in Post-Apartheid South Africa's Land Reform Programme. *African Perspectives on Reshaping Rural Development* (pp. 118-139). IGI Global. https://doi.org/10.4018/978-1-7998-2306-3.ch006

Ntlou, T. (2016). *Potential for economic sustainability of land reform projects benefiting from the Recapitalisation and Development Programme in South Africa* (Masters Dissertation, University of Pretoria, South Africa).

Ojo, T. O., & Baiyegunhi, L. J. S. (2020). Determinants of climate change adaptation strategies and its impact on the net farm income of rice farmers in south-west Nigeria. *Land Use Policy*, 103946. https://doi.org/10.1016/j.landusepol.2019.04.007

Ojo, T. O., Baiyegunhi, L. J. S., & Salami, A. O. (2019). Impact of Credit Demand on the Productivity of Rice Farmers in South West Nigeria. *Journal of Economics and Behavioral Studies, 11*(1), 166-180. https://doi.org/10.22610/jebs.v11i1(J).2757

Phatudi-Mphahlele, M. (2016). *Analysis of Socio-economic Impact of Comprehensive Agricultural Support Programme on Agrarian Reform Farmers of Sedibeng District Municipality in Gauteng Province South Africa* (Masters Dissertation, University of South Africa, South Africa).

Sibisi, N. (2015). *Agricultural Extension and Post-Settlement Support of Land Reform Beneficiaries in South Africa: The Case of Ixopo in the province of Kwazulu-Natal* (Masters Dissertation, University of Kwazulu-Natal, South Africa).

Sihlobo, W. (2015). *The youth are the agriculture's future*. Retrieved December 16, 2019, from https://mg.co.za/article/2015-06-18-the-youth-are-agricultures-future/?amp=1

Staal, B. M. (2019). *Land reform in South Africa: A case study of the Witzenberg pals initiative* (Doctoral Dissertation, Stellenbosch University, Stellenbosch, South Africa).

Taherdoost, H. (2016). Sampling Methods in Research Methodology; How to Choose a Sampling Technique for Research. *International Journal of Academic Research in Management, 5*(2), 18-27. https://doi.org/10.2139/ssrn.3205035

Thinda, K. T., Ogundeji, A. A., Belle, J. A., & Ojo, T. O. (2020). Understanding the adoption of climate change adaptation strategies among smallholder farmers: Evidence from land reform beneficiaries in South Africa. *Land Use Policy, 99*, 104858. https://doi.org/10.1016/j.landusepol.2020.104858

University of the Western Cape. (2016). *Diagnostic Report on Land Reform in South Africa: Commissioned Report for High Level Panel on the Assessment of Key Legislation and the Acceleration of Fundamental Change, an Initiative of the Parliament of South Africa*. University of the Western Cape, South Africa.

Uzunoz, M., & Akcay, Y. (2012). A Case Study of Probit Model Analysis of Factors Affecting Consumption of Packed and Unpacked Milk in Turkey. *Economics Research International, 2012*, Article ID 732583. https://doi.org/10.1155/2012/732583

Van den Brink, R., Glen, T., Hans, B., Bruce, J., & Byamugisha, F. (2006). *Consensus, Confusion, and Controversy: Selected Land Reform Issues in Sub-saharan Africa*. Washington, DC: The World Bank. https://doi.org/10.1596/978-0-8213-6440-6

van Noordwijk, M. (2019). Integrated natural resource management as pathway to poverty reduction: Innovating practices, institutions and policies. *Agricultural Systems, 172*, 60-71. https://doi.org/10.1016/j.agsy.2017.10.008

Weideman, M. (2003). *Land reform, Equity and Growth in South Africa: A Comparative Analysis* (PhD Thesis, University of Witwatersrand, Johannesburg, South Africa).

Worku, M., De Groote, H., Munyua, B., Makumbi, D., Owino, F., Crossa, J., … Mutinda, C. (2020). On-farm performance and farmers' participatory assessment of new stress-tolerant maize hybrids in Eastern Africa. *Field Crops Research, 246*, 107693. https://doi.org/10.1016/j.fcr.2019.107693

Zhang, J., Brown, C., Qiao, G., & Zhang, B. (2019). Effect of eco-compensation schemes on household income structures and herder satisfaction: lessons from the grassland Ecosystem Subsidy and Award Scheme in Inner Mongolia. *Ecological Economics, 159*, 46-53. https://doi.org/10.1016/j.ecolecon.2019.01.006

Notes

Note 1. For this study, the decision of farmers to RADP participation in response to an improved net farm income was a dummy variable, taking the value 1 as a participant and 0 as a non-participant.

Note 2. ATE and ATT were estimated as a post-estimation after fitting the Stata command teffects for endogenous switching regression with endogenous treatment. The ATE estimated after teffects is the potential outcome means while ATT is the conditional treatment effect.