

EFFECT OF OFF-FARM INCOME ON SMALLHOLDER COMMERCIALISATION: EVIDENCE FROM RURAL FARMERS IN RWANDA

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Abstract

This paper examines the effect of off-farm income on smallholder commercialisation in rural Rwanda using the Households survey (EICV 4) data from the National Institute of Statistics, Rwanda. The logit model was used to determine the influence of off-farm income on the probability of rural smallholder farmers commercialisation. The study found that off-farm income positively and significantly affects smallholder commercialisation and hence, compensates for missing or imperfect credit markets. This indicates that farmers use earnings from off-farm sources for liquidity purpose and to invest in agricultural production to increase marketable surplus rather than to smooth out consumption. Thus, the policy implications are that expanding higher earning rural enterprises through financial support, capacity building and human capital investment are vital. This could also improve the returns to labour for off-farm work participating land-poor households and quickens the process of smallholder agricultural commercialisation in Rwanda.

Keywords: Off-farm income, smallholder, commercialisation, farmland, liquidity.

JEL Classification: D13, Q12, Q14

INTRODUCTION

Smallholder farmers' commercialisation is an indispensable pathway towards economic growth and development for most low-income countries relying on the agricultural sector (von Braun, 1995; Pingali and Rosegrant, 1995; Timmer, 1997) as subsistence production maybe infeasible to sustainable household food security and welfare in the long run (Pingali, 1997). Smallholder commercialisation will increase productivity and production of

marketable surplus of staple food crops to link farmers up with output market and it is the most common form of agricultural commercialisation at the early stage of economic transformation (Gebreab, 2006; Pingali and Rosegrant, 1995). This is because it is likely to lead to welfare gains through the realization of comparative advantages, economies of scale, and from dynamic technological, organizational and institutional change; effects that arise from flows of ideas due to exchange-based interactions (Romer,

1993; 1994). Sharp et al. (2007) note that enhancing the degree of smallholder commercialisation can have more impact on poverty reduction than promotion of few large commercialised ventures.

In Rwanda, 90% of the farm households practice subsistence agriculture as their main livelihood (CIALCA, 2009) and they constitute the highest proportion of poor rural households. In addition, Rwanda aims at fundamentally transforming into a middle-income economy (with a per capita income of 900 USD), reduce the number of people living below poverty line to 30%, and raise the average life expectancy to 55 years by the year 2020 and it key strategy for stimulating economic growth and reducing poverty puts more emphasis on intensification of smallholder agriculture using new technologies, infrastructure development and better access to service institutions. Like in other developing countries, the agricultural sector continues to be the leading employer and the basis of daily livelihoods for most of the country's population, with more than 80% living in rural areas and holding subsistence small-scale farms with an average land size of 0.59 ha (MINAGRI, 2013). However, Cantore (2011) reports that the crop intensification pursued in Rwanda is not economically and ecologically sustainable, confirming Reardon et al. (1999) assertion that many African farmers are intensifying

in ways that are economically or ecologically unsustainable.

This is shocking given the massive investment by the government and its development partners in improving domestic staple food production and value addition, strengthening rural financial systems, and re-structuring extension services in agriculture. Furthermore, improving the livelihoods of resource-poor farmers with the smallest parcels of land remains a challenge for policy-makers and practitioners in Rwanda. Poverty and food insecurity remain concentrated in rural areas among low-income agriculturalists, those who work on other people's farms (agro-labourers) and marginal livelihood groups. The 2015 Comprehensive Food Security and Vulnerability Analysis (CFSVA) further shows that 19 per cent of Rwandan households are food insecure with peaks in the northern (46.2 per cent) and western (45.3 per cent) provinces. Thus, there is urgent need to increase farmers productivity through commercialisation of smallholder rural farmers in Rwanda. Market participation impacts farmers' supply responses and hence is important for agricultural policy analysis (Key et al., 2000). This is why the issue of farm commercialisation in emerging economies received some, although not sufficient, attention in the literature (Kan et al, 2006).

Despite the Rwandan government and its development partners providing

some credit services through different microfinance institutions, it is not easily accessible to all farmers and the poor smallholder farmers are often constrained by lack of liquidity to finance the inputs typically needed to increase productivity (Carter et al., 2004). Several programs initiated in the country to improve food security and market access have had limited success. Musabanganji et al. (2015) opine that access by smallholders to formal financial services in rural Rwanda is still limited and this prevents resource-poor smallholders from having enough financial resources to invest in agriculture-related activities and, as stressed by Willoughby and Forsythe (2011), also prevents them from joining marshland cooperatives due to high fees. This shows that working capital constraints are still a concern for the smallholders commercialisation as it hampers any attempt to increase agricultural production due to lack of resources to invest.

While literature on determinants of smallholder commercialisation is vast globally (Woldeyohanes et al., 2015; Okezie et al., 2012; Omiti et al., 2009; Kim et al. 2006; Kan et al, 2006; Key et al., 2000), few are done on Rwanda. Moreover, all the available literature on Rwanda are either descriptive in nature (Musabanganji et al., 2016) or crops specific (Ochieng et al., 2015 for Banana and legumes). Commercialisation of

agriculture has long been considered an important means of enhancing food security, nutrition and incomes particularly when market access barriers are reduced (Gabremadhin et al, 2009). However, there is no study examining the effect of off farm income on smallholder commercialisation in rural Rwanda. Still, the implications of off farm income on smallholder commercialisation and household food security are not yet fully understood and the findings not always in consensus (Maertens et al., 2012; Ochieng, et al. 2015), which is likely due to inability to empirically identify the causal relationship. Given the nature of the dataset, this study used the binary logit model to estimate the impact of off-farm income on smallholder commercialisation in rural Rwanda. This study addresses two research questions: (1) what socio-economic factors influence smallholder commercialisation in Rural Rwanda? and (2) what is the effect of off farm income on smallholder commercialisation in Rural Rwanda?

The rest of the paper is structured as follows. The literature review is presented in section 2. Section 3 presents the data and research methodology. Results and discussions of findings are presented in section 4, while section 5 presents conclusions and policy implications.

LITERATURE REVIEW

Evidence shows that the major challenge to food production and smallholder commercialisation in developing countries is financial exclusion to the resource poor rural farmers (World Bank, 2008; Hernandez et al., 2010; Oseni and Winters, 2009). There are strands of literature that shows off-farm income can be a crucial means to overcome working capital constraints to invest in agriculture particularly if credit markets are thin or missing whereas off-farm options can be accessed easily (Barrett et al., 2001; Hernandez et al., 2010; Oseni and Winters, 2009; Reardon et al., 1994; Woldehanna, 2000).

Some theoretical reasoning suggests that off-farm income could have both positive and negative effects on smallholder commercialisation. For instance, according to Woldehanna (2000), off-farm income can enhance smallholder commercialisation if used as a liquidity source for farm investment that will increase productivity and production of marketable surplus. This in turn may increase the proportion of crops sold by smallholder farmers. This is more likely if household engages in higher earning wage or self-employment activities and saving rate is higher (Woldehanna, 2000; Woldehanna and Oskam, 2001). Oseni and Winters (2009) found a positive effect of off-farm income on farm investment by compensating missing or imperfect credit

markets. Ochieng et al. (2015) state that off farm income access has a positive effect on smallholder commercialisation in the Great Lakes region of Rwanda and DRC. World Bank (2008) reported that in Sub-Saharan Africa, imperfect input and output markets continue to persist because of high transaction costs, risks and diseconomies of scale thus delaying achievement of food security goals.

Off-farm income may also assist farmers in consumption smoothing when there is production and market related risks following agricultural commercialisation (Holden et al., 2004; Evans and Ngau, 1991; Reardon et al., 1994). This may help them to develop a willingness to move from “safety first” food cropping to risky but high value cropping with a buffer of cash from nonfarm activities. In this way, off-farm income can have a negative effect on smallholder commercialisation as it leads to increased household’s demand for both agricultural and non-agricultural consumption goods (Kan et al., 2006; Woldehanna, 2000). In this case, farmers that have previously used income from product sales to purchase non-agricultural consumption goods may replace this with cash income from off-farm employment and now consume what they produce and become self-sufficient. Hence, the marketed surplus might be lower than what it would be otherwise.

At the macro level, the linkage between agricultural commercialisation and off-farm employment have been explained through growth linkages. That means advancement in agricultural commercialisation creates rural off-farm employment opportunity for the poor (Binswanger and von Braun, 1991; von Braun, 1995). Although this is very crucial for rural development, information on the nature of interaction that could exist at the household level is more beneficial for the design of pro-poor public policies. Thus, this study looks at factors affecting smallholder farmers' decision to participate in crop output market and how much they sell focusing on role of off-farm income.

Even though agriculture is the main source of livelihoods in rural Rwanda, households also engage in various forms of off-farm employment driven by different push and pull factors. There is, however, no literature on how off-farm work participation and income from this source interacts with smallholder commercialisation at household level in rural Rwanda. Globally, evidence suggest that subsistence farming in any form is not a viable activity for safeguarding household food security and welfare (Pingali, 1997). As rural households gradually commercialise, household incomes are increased, improving household welfare, food security and nutritional status (Von Braun 1994). Von

Braun (1994; 1995) found that a 10 percent increase in the income of the poor had a positive influence on the nutritional status of children below the ages of 5 years in Rwanda, Zambia and Malawi. Most common studies touching food crops have been done by Govereh et al (1999) in Kenya, Zimbabwe and Mozambique and Strasberg et al. (1999) in Kenya and found that commercialisation positively influences fertilizer use and food crops productivity among rural households.

From the foregoing, it is glaring that many previous studies on the determinants of smallholder commercialisation considered level of commercialisation exogenously. However, smallholder commercialisation could be seen as a dynamic process, as the decision to participate in the crop market and amount to sell could change due to changing circumstances. To model this relationship, this study adopted the binary logit model sourcing data from the Integrated Household Living Condition Survey (EICV 4) 2013/14 conducted by the National Institute of Statistics, Rwanda to analyze determinants of smallholder commercialisation.

METHOD, DATA, AND ANALYSIS

Data, Sample and Sources

This study is based on the Integrated Household Living Condition Survey (EICV) IV conducted in 2013/2014

by the National Institute of Statistics. The EICV IV contains information on households' consumption expenditure for poverty and other living standards of population (Education, agriculture, environment, economic activity, ICT, Transport, water, sanitation, etc.). This enables the survey to comprehensively capture socio-economic information on household demographics, health, employment and welfare.

The EICV IV Sample size is about 12,310 HHs (cross-sectional), 2,000 HHs (panel) and 2,500 HHs (VUP). The survey is conducted over 12 months in every 3 years since the first survey in 2000/1 at households' level, enabling it to provide district level statistics also. The agriculture module is divided into many subgroups, among them subsistence farming and commercial farming. Since more than 80% of farmers in Rwanda are smallholders, this study focuses on the subsistence farming. Secondly, commercial farmers are mostly non-indigenes and have a relatively larger access to various means of credit, making off-farm income insignificant for their market participation. Finally, as the name implies these farmers are purposively producing for the market and thus, need no stimulus to partake in their core commercial activities.

Methodology

Following Adong (2015) and Matiku (2014) studies on smallholder farmers commercialisation, this study model smallholder commercialisation as a binary choice variable taking the value of 1 for market participation and 0 for non-market participation. The logit model was used to analyse the effect of off-farm income on the probability of being market oriented in Rural Rwanda.

The basic setup is that a decision maker, labeled i , faces a choice among j alternatives. The decision maker obtains a certain level of utility from each alternative. The utility that decision maker i obtains from any alternative j is U_{ij} ($j = 1 \dots J$). Given two alternatives x and y , the decision maker chooses the alternative with the highest utility: choose alternative x if and only if $U_{ix} > U_{iy}$ for y being different from x .

The binary outcomes for individual i can be represented as:

$$Y_i = \begin{cases} 1 & \text{if the rural smallholder commercialises} \\ 0 & \text{if the rural smallholder does not commercialises} \end{cases}$$

Given P_i , the probability of commercialising ($1 - P_i$), the probability of not commercialising, is

$$(1) \quad (1 - P_i) = \frac{1}{1 + e^{Z_i}}$$

Also, we can rewrite Equation (1) as:

$$(2) \quad \frac{P_i}{(1 - P_i)} = \frac{1 + e^{Z_i}}{1 + e^{-Z_i}}$$

The left-hand side $\frac{P_i}{(1 - P_i)}$ is simply the odds ratio in favor of smallholder commercialization- the ratio of the probability that a rural smallholder farmer will commercialise her agricultural production to the probability that she will not.

Now if we take the natural log of (2), we obtain a very interesting result namely

$$(3) \quad L_i = \ln \frac{P_i}{1 - P_i} = Z_i$$

that is, L, the log of the odds ratio, is not nonlinear in X, but also (from the estimation view of point) linear in parameters. L is called the logit, and hence the name logit model for this model.

For estimation purpose, we write (3) as:

$$(4) \quad L_i = \ln \frac{P_i}{(1 - P_i)} = Z_i$$

To estimate the model, we need, apart from X_i , the values of the logit L_i (taking binary response of 1 if commercialises and 0 if not). To incorporate our variables of interest in this study (by splitting X_i s into continuous variables part and the dummy variable's part), the cumulative logistic probability model (Gujarati, 1995) is econometrically expressed as:

$$(5) \quad L_i = \ln \left[\frac{P_i}{(1 - P_i)} \right] = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \alpha_4 X_4 + \alpha_5 X_5 + \alpha_6 X_6 + \alpha_7 X_7 + \alpha_8 X_8 + \alpha_9 X_9 + \alpha_{10} X_{10} + \beta_1 D_1 + \beta_2 D_2 + \beta_3 D_3 + \beta_4 D_4 + \beta_5 D_5 + \beta_6 D_6 + \varepsilon_i$$

Where:

i = individual 1, 2, 3, ..., n

L_i = log of the odds ratio which is linear in X_i and in parameters

P_i = Probability that an individual participates in food crops market, proxy for commercialisation

$(1 - P_i)$ = Probability that an individual does not participate in food crops market

α_0 = Intercept or constant term, that implies that combined impact of these fixed factors on household market participation

$\alpha_1, \dots, \alpha_7$ = Coefficients of the log continuous explanatory variables ($X_1, \dots, X_7$). These variables include off farm income (sum of incomes from public works and other nonagricultural labour), food crops output (in RWF), HHH age, HH size, Farmland (in acres), distance (in Km), and income from livestock respectively

α_{8-10} = Coefficients of the categorical explanatory variables (X_8, X_9, X_{10}), denoting Rural West, Rural East, and Rural South with Rural North as reference point (It was chosen due to its high incidence of food insecurity).

$\beta_1, \dots, \beta_6$ = Coefficients of the explanatory dummy variables ($D_1, \dots, D_6$). These

variables are off farm employment, regionalisation, technology, HHH gender, HHH education level, and market information respectively.

More detail on the explanatory variables as well as their expected signs are shown in Table 1 below. The expected effect of a certain variable is either positive or negative depending on whether it is likely to increase or decrease market participation and thus commercialisation. After the model specification, the parameters were estimated using the maximum likelihood regression method in accordance with other studies (Adong, 2015 and Gebremedhin & Jaleta, 2010). Additionally, the marginal effects of the explanatory variables on the dependent variable are calculated in order to estimate the impact of these variables on the household market participation. Household characteristics (family size, HHH education level, gender, age, and location, income from livestock, if any), transaction costs (proxy by distance), and structural challenges (technology and regionalisation) greatly influence smallholder commercialisation. However, previous studies used either Heckman's (1979) sample selection (Alene et al., 2008; Bellemare and Barrett, 2006; Boughton et al., 2007; Ehui et al., 2003; Gebremedhin et al., 2009) or double hurdle and switching regression models (Goetz, 1992; Omiti, 2009) to estimate smallholder market participation. Some

other considered it as a single decision process and used a more restrictive Tobit model (Holloway et al., 2000). To make the most out of the data set available, the logit model was applied, and we believed that logit model is more appropriate to estimate the probability of household market participation, which suggests their commercialisation level than the other methods.

Additionally, this study adopts Singh et al. (1986) basic non-separable farm household model to drive household market supply. This means that not only the production decision affects the consumption decisions but also the consumption decision affects the household production and ultimately output market supply decisions. The key variable of interest, off-farm income is the sum of income from public works and income from other non-agricultural jobs, is represented by X1 in the model. It is expected to have positive effect on smallholder commercialisation in rural Rwanda and it is based on related previous works on the determinants of smallholder commercialisation (Gebremedhin et al., 2009; Jaleta et al., 2009; Alene et al., 2008; Von Braun, 1994). While smallholder commercialisation could be affected by off-farm earnings, increased income as a result of higher commercialisation could also help farmers to overcome capital constraint and engage in own off-farm

business that would increase off-farm income in turn (Wooldridge, 2010).

RESULT AND DISCUSSION

Descriptive Results

Descriptive statistics of variables used in the logistic regression analysis are given in Table 2. From the table, only 21.54% of the rural smallholders sell crops in the market, with an average sale value

of 11,579 RWF per month. This indicates that there is a low market participation and thus commercialisation by rural smallholder farmers in Rwanda. The average farmland size of household is 13.45 acres (approximately 5 ha) with 45% female headed household. However, it is above the national average of 0.59ha per household.

Table 1. List of explanatory variables and their expected signs

Code	Variables	Expected Signs
X ₁	Off-farm Income (in Rwanda Franc)	+
X ₂	Output (in Rwanda Franc)	+
X ₃	Age of household head (years)	+
X ₄	Family size (number of adult equivalent members)	+
X ₅	Farm land size owned (acres)	+
X ₆	Distance to Market (in Km)	-
X ₇	Participation in off-farm employment (=1 if participated)	-
X ₈	Household head Gender (=1 if head is male)	+
X ₉	Household head highest Education level (= 1 if household head attended primary school at least)	+
X ₁₀	Regionalization (=1 if benefited from land consolidation)	+
X ₁₁	Technology (Irrigation) (=1 if farmland is irrigated)	+
X ₁₂	Regions (Rural South is the reference region)	+
X ₁₃	Livestock Income (in Rwanda Franc)	+
X ₁₄	Information (=1 if owns a mobile phone)	+

Source: Researchers' Design (2022).

Table 2. Descriptive Summary Statistics

Variables	N	Mean	Std. Dev.	Min	Max
Smallholder commercialisation (=1 if sold food crops in the market)	277,482	21.54	41080.24	0	5746000
Off-farm Income (in Rwanda Franc)	1283	8363.246	21847.02	0	336000
Output (in Rwanda Franc)	277452	11579.92	41888.01	0	5746000
Age of household head (years)	242120	30.9625	25.98299	0	110
Family size (number of household members)	26291	2.013275	.2385744	1	14
Farm land size owned (acres)	277482	13.45983	24.58057	.01	5000
Distance to Market (in Km)	162071	4.245287	5.730326	0	150
Participation in off-farm employment (=1 if participated)	242,120	24.19	.4282602	1	2
Gender (=1 if head of household is male)	242,120	55.74	.4966923	1	2
Education (= 1 if household head completed primary school at least)	242,120	31.80	.3226129	1	2
Regionalization (=1 if benefited from land consolidation)	275,330	14.05	.347525	1	2
Technology (Irrigation)(=1 if farmland is irrigated)	277,482	7.41	.2618671	1	2
Livestock Income (Rwanda Franc)	1284	9135.548	9135.548	0	336000
Information (=1 if (s)he owns mobile phone, 0 otherwise)	15,656	33.10	.471779	1	2
Rural Western	193,347	21.77	.093424	1	5
Rural Northern	122,828	16.54	.043563	1	6
Rural Eastern	209,220	22.95	.083422	1	10
Rural Southern	254,341	26.30	.34562	1	13

Source: Researchers' Computation(2022).

Table 3. Regression Results for Smallholder Commercialisation in Rural Rwanda

Variables	Logistic Reg		Marginal Effects	
	Coeff.	Z-Stat	Coeff.	Z-Stat
Off farm Income	1.156439	10.01	.0115639	9.86
Output	0.1306742	6.54	0.0137249	6.65
HHHage	-0.011831	-4.11	-0.011463	-4.14
FamilySize	0.0304472	2.13	0.0022977	5.13
Farmland	0.0210784	11.1	0.0459609	5.76
Distance	-0.125514	1.97	-0.0255453	6.59
Offfarmemployment	-0.026204	-7.14	-0.0280247	-4.14
HHHgender	0.0057836	0.03	0.0044733	1.03
HHHEducationLevel	-0.018619	-1.79	-0.0278083	-1.71
Regionalisation	-0.03796	-0.71	-0.0339791	-0.75
Technology	0.0044436	3.19	0.0733408	2.71
LivestockIncome	1.297093	1.99	0.0363264	1.73
Information	0.2189279	1.66	0.0491986	1.65
Province:				
RuralSouth	0.0818806	4.18	0.0872181	3.57
RuralWest	0.0600197	1.32	0.053996	1.09
RuralNorth	0.034198	5.28	0.0103609	4.34
RuralEast	0.041012	3.02	0.0434455	3.98
Statistics				
LR chi2(27)		439.16		
Prob > chi2		0		
Pseudo R2		0.5803		

Source: Researchers' Computation(2022).

The low commercialisation maybe due to the relatively higher nonfarm market participation (24.19%) yielding 8,363 RWF per month, which is very close to the average value of crops sold. Another factor may be the high transaction costs caused by the long distance to market (about 4 Km, on average) and the lower educational background as almost 70% of rural farmers are illiterate (only 31% completed primary school at least). Table 2 also shows that most households heads are younger and

thus inexperience in farming (average of 31 years). Also, the result indicates that only 7.41% of households have irrigated farmland and very few households benefited from the government regionalization programme (14.05%) aimed at increasing food crops production not only for home consumption (to reduce food insecurity) but about increased smallholder farmers commercialisation in the country. On average households earn RWF 9135.548 from sale of livestock and its products. In terms of region, Rural

South is the most populated region (26.30%), and Rural North is the least populated smallholders' region in Rwanda. Lastly, the results in Table 2 above shows that only about a quarter of the rural farmers (33%) own mobile phones to access market information. This may like increase their transaction costs and further alienate them from commercialising.

Econometric Analysis and Discussion

Table 3 presents the results of the Logit Estimation and the Marginal Effects of the econometric model. All the expected and actual signs for the variables are the same except for age of household heads, the government programme of regionalization of crops, and household education level. As shown in the Table 3, the coefficient of off-farm income is positive and statistically significant at 5% level and meets our apriori expectation. This implies, holding other factors constant, an increase in off-farm earning has a positive influence on the probability of smallholder commercialisation in rural Rwanda. The economic effect shown by the Marginal effect indicates that on average, a 1% increase in off farm income increases smallholder commercialisation in rural Rwanda by 0.12%- that is for every RWF1,000 earn off farm, RWF120 is spent on commercialisation.

The positive influence of off-farm income on rural smallholder household commercialisation is consistent with the notion that off-farm income accelerates smallholder commercialisation due to its investment effect. Our empirical finding thus supports the hypothesis that off-farm income promotes smallholder commercialisation through capital investment in agriculture and risk diversification. Perhaps participation in off-farm activities does help smallholder farmers to overcome liquidity constraints. Particularly when agricultural growth is hampered by credit constraints, the additional resources can be used by farmers for the adoption of innovations and the purchase of input. Such positive effect of off-farm income in providing liquidity to agriculture was recently shown by Oseni and Winters (2009), Woldehanna, (2000) and Woldehanna and Oskam (2001), but against the findings of Alene et al. (2008) and Omiti et al (2009). The negative effect may be due to off-farm income geared toward consumption instead of investing in farm capital, and the off-farm work ends up competing with agriculture for labor and other resources rather than being a complement.

With respect to other determinants of smallholder commercialisation, the results show that degree of rural smallholder farmers commercialisation is influenced by the value of crop produced, distance to market, farmland size, HHH

gender, and off farm market participation, all with expected signs. However, regionalization of food crops, HHH gender, and market information do not significantly influence the level of smallholder commercialisation. The probability of rural smallholder commercialisation increase with the increase in output and it is statistically significant at 5%. The marginal effect results in Table 4 shows that each additional Rwf1,000 earned from crops sold increase farmers commercialisation by 1.3 percentage point. However, education reduces the probability of farmers market participation, which is in consonance with Kan et al. (2006). Numerous earlier studies showed that the effect of education on farm output is negligible relative to its effect on non-farm income. This may be due to farm employment and off farm employment competing for labour and people preferring nonagricultural jobs as their skills increase. For instance, participation in off farm work reduces market participation by an 2.8% percentage point.

Farmland size and livestock income, which can be considered as household's wealth, have positive and statistically significant (5% and 10% significance level respectively) influence smallholder commercialisation. On average, each additional acreage of land increases the level of smallholder commercialisation by a percentage point

of 4.5%. This result confirms that land is a key constraint input for rural household and land holding per capita is declining mainly because of rapidly growing population. Moreover, land market for smallholder farmers is nonexistent in Rwanda as land is state property and farmers have only usufruct right. Our result is also consistent with what others found elsewhere in developing countries (see Alene et al., 2008; Woldeyohanes et al., 2015). Crops regionalization has higher negative probability of commercialisation among rural farmers, however. This may be due to the low acceptability of the program and cultural constraints. Indeed, Kathiresan (2012) stated that there are major disenchantments amongst small farm holders about the regionalization, and hence requires to be addressed by strengthening the horizontal and vertical linkages and by improving communications amongst the key actors of implementation. Gender of household head (HHH) indicates that probability of commercialisation is higher by 7 percentage points if the household is male-headed rather than female headed. This might be due to the cultural influence that male farmers have better access to information and well networked within the community that helps them to trade at lower cost and participate more in output market than their female counterpart. This finding may suggest that

any policy actions designed to strengthen smallholder market integration has to bring the gender aspect into the center of discussion so that equal participation of female farmers is ensured.

Key constraint to smallholder commercialisation is technology. Table 4 shows that households with irrigation services increase their market participation by 7.3% compared to those without irrigation. Furthermore, market information though positively influence market participation, is non-significant. This might be due to the fact that only a quarter of the sample have access to market information and the higher market transaction costs. The coefficient of distance to nearby markets, which is included to control for the effect of transactions costs, is not significant. The negative influence of distance from market also makes sense and supports the idea that infrastructure development strengthens smallholder's market integration by reducing marketing cost. This finding of negative effect of high transaction costs to rural small holder agriculture commercialisation is in consonance with Woldeyohanes et al., (2015) finding in Ethiopia. Finally, the results also show wider regional disparities in market participation. Being in all the regions rather than in the North increases the probability of market participation for smallholders. Based on results, there is a higher chance (8.7%) for

smallholders in Rural West to commercialise than for those in the Rural North. But only West and South have positively significant impact on smallholder commercialisation at 5% significance level. Indeed, the 2015 Comprehensive Food Security and Vulnerability Analysis (CFSVA) affirms to this result by showing that 46.2 per cent of Northern region households are food insecure (market participation is necessary for food availability, accessibility and stability), with the rural area being the most affected due to large market imperfections.

CONCLUSION

Using the EIVC IV 2013/14, we test empirically the effect of off-farm income on smallholder commercialisation in rural Rwanda. The results show that off-farm income has significant influence on rural farmers agricultural commercialisation in Rwanda. Although the magnitude of economic effect on commercialisation is small, it seems consistent with the notion that off-farm income increases smallholder commercialisation due to its investment capital effect. Indeed, our empirical finding indicates there is evidence to support the hypothesis that off-farm income promotes smallholder commercialisation by relaxing liquidity constraint to invest and raise productivity and marketable surplus. The policy implication of our finding is that expanding higher earning rural enterprises

through financial support, capacity building and human capital investment is vital. This may help to improve the returns to labor for off-farm work participating land-poor households and fasten Rwandan smallholder commercialise. Thus, the government financial support programmes and individual remittances to rural relatives could help accelerate smallholder farmers commercialisation.

The results also show among other things, that farmland size, income from livestock sale, value of output, technology, market information and gender positively increase the level of commercialisation. On the other hand, distance to the nearest market, regionalization, education, age and off farm employment negatively affect the participation decision of rural farmers. Also, the results show higher advantage to commercialise for rural farmers living in particular regions over others. This indicates household's access to rural infrastructure is quite critical to link them up with crop output markets by reducing market imperfections (marketing cost) and that female farmers empowerment programmes should be extended to agriculture. Similarly, our result indicates land holding and technology have significant and positive influence on household commercialisation. Given the current small land holding system and high population growth in Rwanda, the

policy implications are for the government to strengthen the institutional support services to female headed farmers and improve the infrastructural facilities in rural farming communities to reduce transaction costs. Since income from livestock and its by-products sale is statistically significantly and positively impact on smallholder's commercialisation, the government Girinka programme (One Cow per Family) should be continued and extended to especially Rural Northern farmers who are the most food insecure and least commercialised in the country. Finally, the government should continue with its policies aimed at transforming smallholder agriculture from subsistence production system to more market-oriented production system as it is considered indispensable to food security and sustained economic growth in Rwanda.

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