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Robustness of food security and policy trust on smallholder participation in Ghana's planting for food and jobs programme

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The Planting for Food and Jobs programme was initiated in 2017 as a strategy to create jobs, promote food production and enhance food security in Ghana, especially among smallholder farmers. This research applies mixed research approach to explore the robustness of policy trust and food security risk on smallholder participation in the programme. Using multistage sampling, a total of 164 respondents were selected for the study. Food availability and income enhancement have been identified as the most important reason for participating in the programme. The results also show that policy trust and vulnerability to food security risk increase probability of participation by at least 10.2 and 11.2%, respectively. Moreover, the findings are robust to varying estimation assumptions. It is therefore recommended for the programme to deepen trust with vulnerable individuals to enhance participation.

Key words: Food security, policy trust, planting, food, jobs.

INTRODUCTION

The importance of agriculture to food and nutrition security in developing countries is largely outlined in the Sustainable Development Goals (SDGs 1&2) of the United Nations (UNDP, 2016). The Food and Agriculture Organization (FAO) suggests that over 60% of the world's food insecure population live in developing countries (FAO et al., 2019). For the most part, developing countries face high levels of food insecurity arising from the combined effects of policy failures, climate change, poverty, low agricultural productivity and disruptions in global food supply chains. This, coupled with rising unemployment and anticipated food shortages in most developing countries by 2050, has created the need to strengthen agriculture to create sustainable jobs and ensure food security (FAO, 2009; Baldos and Hertel, 2014).

In Ghana, agriculture and agrifood systems have major implications for food security. Agriculture constitutes about 18% of Ghana's Gross Domestic Product (GDP) and provides employment to over 30% of the labour force (World Bank, 2020). In rural areas of the country where farming is the main economic activity, agriculture offers a

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direct source of income to more than 80% of the rural folks (Ghana Statistical Service, 2012). Nevertheless, Ghana's agricultural sector growth has declined over the years; falling from 8.0% in 2007 to 4.5% in 2016 (Pauw, 2018). Food insecurity has also remained a major challenge for some estimated 1.6 million people in the country, representing 5% of the population (FAO et al., 2019). These, coupled with recent global food crises have created the need to initiate special programmes to enhance agriculture and food security.

It is in line with these that the Government of Ghana introduced the Planting for Food and Jobs (PFJ) programme. The PFJ programme, which began in 2017, is a subsidy incentive to improve smallholder productivity, promote food production, create jobs, and enhance food and nutrition security in the country. Smallholder farmers form an integral part of the programme because they dominate Ghana's agriculture and food systems. The programme is expected to increase yields of staple crops such as corn, rice, soybean and sorghum by 30, 49, 25 and 28%, respectively, and create some estimated 750,000 jobs within the agrifood sector (MoFA, 2017). The PFJ programmes, together with *Rearing for Food and Jobs* and *Planting for Export and Rural Development,* are part of government's wide-ranging strategies to modernise agriculture, eradicate hunger and enhance food and nutrition security, and in line with Ghana's commitment under the United Nations' Sustainable Development Goals.

The PFJ programme has been widely publicised in the country as one of the government's leading interventions in agriculture. The Ministry of Food and Agriculture, in particular, mobilizes farmers by creating awareness through mass media, local information meetings, district offices and agriculture extension agents. Awareness is also carried through private sector, non-governmental organisations and registered Farmer-Based Organizations that coordinate farmer-based activities. Nonetheless, farmers' participation has been relatively low. The Minister of State in charge of Agriculture expressed concern that close to 70% of the target farmers were not registering for the PFJ programme (Awuni, 2017). In view of this, factors influencing participation in the PFJ programme became important research questions (Mabe et al., 2018; Ansah et al., 2018; Tanko et al., 2019; Lambongang et al., 2019; Nurideen, 2019). However, farmers' trust in the policy as a measure to address food insecurity - which could potentially drive participation - were limited in these studies. This research primarily explores the effects of *policy trust* and farmers own *food insecurity risk* as drivers of participation in the PFJ programme.

Some preliminary studies relating to policy trust, citizen participation and food security have been done. For example, research shows that *trust* explains citizen participation in political processes, agricultural programmes, and marketing channels (Barraud-Didier et al., 2012; Donkor et al., 2021; Belay 2020; Lee and Schachter, 2018). It is hypothesised that individuals that have trust in the PFJ policy to address food security are likely to participate. A number of studies also examined the effects of farmer participation in agricultural interventions on household food security (Beyuo and Anyidoho, 2021; Manda et al., 2020; Montalbano et al., 2018). Nevertheless, little is known about the effects of food security on participation. This paper argues that farmer's vulnerability to food security risk can influence participation. To address this, vulnerability to food security is measured using two indicators: income level; and, access to food at all times. We argue that high income earners, and individuals with access to food at all times are less vulnerable to food security risk, and, hence, less likely to participate in the PFJ programme. We test these propositions using data from smallholder corn farmers in Berekum Municipality of the Bono Region of Ghana.

METHODOLOGY

Study area

This research was conducted in the Berekum Municipality in the Bono Region of Ghana. The municipality is situated in the forest zone, and lies within longitudes 2'25' East and 2'50' West and latitude 7'15' South and 8'00' North. Commerce, agriculture and agroforestry are the main livelihood activities in the area. In terms of land size, the municipal covers about 955 km^2, of which 373.35 km^2 is under agriculture (MOFA, 2020). The study area's agro-ecological zone is characterised by two cropping seasons: the major and minor seasons ranging from April to August, and September to December respectively. In general, farmers mostly intercrop corn, plantain, vegetables, cocoa and cashew with forest resources. Nevertheless, the study focus on corn since it is the dominant crop being supported by the PFJ programme in the municipality. The research was conducted at Jinijini, Kato, Berekum and Kutre communities where corn is largely cultivated.

Research design

Both qualitative and quantitative research designs were employed in a cross-sectional survey. Data was collected using semi-structured questionnaires, and validated using Key Informant interviews, Personal Observations and Focus Group discussions.

Sampling techniques and sample size

Registration for PFJ programme starts from February to March of every year before the commencement of the major cropping season. Farmers register with the local offices of the Ministry of Food and Agriculture in their respective districts. The data is then used to estimate total quantities of seeds and fertilizer to be supplied in each district. For this research, data collection was done in June of 2020 after farmers had registered for the programme. A multistage sampling technique was used to draw a representative sample of 164 respondents for the analysis, based on Slovin's criteria (Ryan, 2013). Slovin's sample size determination is specified as:

$$n = \frac{N}{1+Ne^2} \quad (1)$$

Where, n=sample size, N=sample population, *e*= margin of error. Based on a population of 840 smallholder corn farmers in the district (MOFA, 2020), the sample size of 164 was determined using 7% margin of error. To draw the respondents, four dominant corn growing communities were first selected using purposive sampling technique. Secondly, simple random sampling technique was used to select representative samples of 82 participants and non-participants each. Non-participants were also sampled to serve as the treatment's control group.

Model specification

The random utility theory was employed to analyse farmers' participation in the PFJ programme. The theory postulates that individuals will participate in a given course if it maximizes their satisfaction relative to the alternative. The theory has been extensively applied to analyse participation where respondents are faced with two options (Nahayo et al., 2017; Etwire et al., 2013; Jamilu et al., 2015). It is assumed that farmers have the option to participate or not participate in the PFJ programme. The paper postulates that participation is influenced by a set of socio-economic factors (X) including *policy trust* and *vulnerability to food security risk*. To analyze this, participation is measured as a binary variable (Y) that assumes a value of 1 for participants, and 0 otherwise. Consequently, the conditional probability of participation ($\Pr(Y_i = 1|X_i)$) is specified as:

$$\Pr(Y_i = 1|X_i) = F(\beta' X) = \beta_o + X_i'\beta + \mu_i \quad (2)$$

Where, $F(\beta' X)$ is the underlying probability function; X is a vector of explanatory variables; β_o is the constant term; β is a vector of coefficients; and, μ is the *identical and independently distributed* error term (Greene, 2012). Nonetheless, the functional form of the underlying probability ($F(\beta' X)$) is undefined leading to the emergence of three models, namely: *Linear probability (LP), logit* and *probit*. The LP model assumes a linear functional form to predict options. It is easy to interpret since the estimated coefficients and marginal effects are equal. The LP model does have some weaknesses though. In addition to predicted probabilities exceeding 0 and 1, standard errors of the LP model are heteroskedastic and inversely affect hypothesis testing. In response, the *logit* model restricts predicted probabilities between 0 and 1 by imposing a logistic function. The derived logit and marginal effects models are specified in Equations 3 and 4 respectively:

$$\Pr(Y_i = 1|X_i) = \frac{\exp(X'\beta)}{1+\exp(X'\beta)} = \ln\left(\frac{Y_i}{1-Y_i}\right) = \beta_o + X_i'\beta + \mu_i \quad (3)$$

$$\text{Marginal effect of variable } X_j = \frac{\partial F(X'\beta)}{\partial X_j} = \frac{\exp(X'\beta)}{(1+\exp(X'\beta))^2} * \beta_j \quad (4)$$

Unlike logit, the probit model assumes a cumulative normal probability density function, $m(X'\beta)$, that restricts predicted probabilities between 0 and 1. The associated probit and marginal effects models are specified in Equations 5 and 6, respectively:

$$\Pr(Y_i = 1|X_i) = \Phi(X'\beta) = \int_{-\infty}^{X'\beta} \emptyset(z)\,dz = \beta_0 + X_i'\beta + \mu_i \quad (5)$$

$$\text{Marginal effect of variable } X_j = \frac{\partial \Phi(X'\beta)}{\partial X} = \emptyset(z) * \beta_j \quad (6)$$

In this paper, we estimate all the three models to check the robustness of the results. A variable is robust if it is significant under all three models.

Policy trust assumes a value of 1 for individuals who have trust in the PFJ programme to address food insecurity, and 0 otherwise. Furthermore, *vulnerability to food security risk* is defined using: *income level;* and, *access to food at all times*. Income is justified as a food security indicator as it provides the individual with the ability to purchase his/her food needs. To quantify its effect, income was measured using the revised World Bank 2015 poverty line of US$1.9 per day. This was, however, approximated to US$2 for numerical convenience. Annual income was divided by 365 to obtain income per day, and converted to US dollars using the Bank of Ghana's average exchange rate of US$1 to Gh₵5 for the 2020 fiscal year. The paper argues that individuals earning below US$2 per day are vulnerable to food security risk and, hence, more likely to participate in the programme to alleviate that risk. Similarly, *access to food at all times* is a strong measure of food security risk. Individuals who have *access to food at all times* face a reduced risk, and, hence, less likely to participate in the programme. Therefore, a respondent is assigned the value of 1 if s/he has *access to food at all times*, and 0 otherwise. In addition, age, gender, household size, educational level and farm are the other socio-economic variables included in the model. The full description of variables used in the model is presented in Table 1. Nonetheless, readers should be cautious in comparing the scale of estimated coefficients as the models are structurally different.

Data analysis

Hejase et al. (2012) contend that informed objective decisions are based on facts and numbers, real, realistic and timely information. Furthermore, according to Hejase and Hejase (2013), "descriptive statistics deals with describing a collection of data by condensing the amounts of data into simple representative numerical quantities or plots that can provide a better understanding of the collected data" (p. 272). Therefore, this study analyzed data collected with descriptive statistics such as means and standard deviations (in percentage) supported with tables for clarity. Accordingly, Table 1 depicts the demographic results. Any possible violations of homogeneity assumption were controlled for using heteroscedasticity robust standard errors. Besides, the tolerance levels of Variance Inflation Factor (VIF) were checked for possible violations of multicollinearity. The models goodness-of-fit and overall significance were checked from the corresponding R^2/Pseudo R^2, and F-test/Wald Chi-square tests, respectively. The data were analyzed using STATA version 14 software programme.

Factors influencing participation in PFJ programme

The regression results of factors influencing participation in the PFJ programme are presented in Table 2. The F-statistic and Wald chi-square tests are statistically significant, meaning that the estimated models are valid. On the goodness-of-fit, the *linear probability*, *logit* and *probit* models explain approximately 78.63, 90.83 and 90.44% of the variation in smallholder participation in PFJ, respectively (Table 2). Further, the estimated models are free from multicollinearity since the Variance Inflation Factor (VIF) values are less than 10 in each case. In general, the results indicate that age,

Table 1. Variable description, summary statistics and effects (N=164).

Variable	Variable measurement	Mean	Std. dev.	Effect
Dependent variable:				
Participation	Binary; Participation in PFJ 1=participant; 0=otherwise	0.5	0.51	
Independent variables:				
Age	Ordinal; age of respondent. 1=below 20 years 2=20 to 29 years 3=30 to 39 years 4=40 to 49 years 5=50 to 59 years 6=60 years and above	3.46	1.78	-
Gender	Binary; sex of respondent. 1=Male; 0=Female	0.55	0.49	+
Household size	Continuous; number of household members	5.55	1.72	+
Educational level	Ordinal; educational level. 1=No formal education 2=Primary education 3=JHS education 4=Secondary education 5=College	3.19	1.78	+
Farm size	Continuous; number of acres.	7.40	5.37	-
Years of farming experience	Continuous; years of farming.	10.47	8.15	-
Vulnerability to food security risk:				
Income level	Binary: income level of respondent 1=below US$2/day 0=otherwise	0.44	0.49	+
Access to food at all times	Binary; respondent has access to food at all times. 1=Yes, 0=otherwise	0.52	0.50	-
Policy trust	Binary; do you trust in PFJ to address food insecurity? 1=Yes; 0=otherwise.	0.48	0.50	+

educational level, farm size, years of farming experience, vulnerability to food insecurity risk and policy trust significantly influence participation in the PFJ programme. However, farm size and years of farming experience are not robust to varying estimation assumptions. The estimated marginal effects values are shown in Table 3.

Age has a significant negative effect on participation, implying that aged farmers are less likely to participate in the PFJ programme. Specifically, a year increase in age reduces the probability of participation by 11.7, 216.1 and 204.7% under the LP, Logit and Probit models, respectively (Table 3). The result is consistent with Etwire et al. (2013)'s conclusion that aged farmers are more skeptical about interventions in agriculture. As one farmer indicated: *"I'm 66 years now. I have been farming for over*

Table 2. Factors influencing participation in PFJ programme.

Variable	Linear probability	Logit	Probit
Constant	0.839(0.131)***	39.930(20.710)*	23.828(14.470)**
Age	-0.117(0.017)***	-8.660(3.68)***	-5.132(2.591)**
Gender	0.141(0.040)***	11.013(4.730)**	6.349(3.035)**
Household size	0.000(0.011)	-1.190(1.180)	-1.146(0.806)
Educational level	0.077(0.019)***	3.847(1.677)**	2.287(1.164)**
Farm size	-0.016(0.004)***	-0.947(0.526)*	-0.542(0.382)
Years of farming experience	-0.004(0.003)	-0.842(0.382)**	-0.515(0.245)**
Vulnerability to food security risk:			
Income level of respondent	0.112(0.050)**	2.591(1.491)*	1.459(0.866)*
Access to food at all times	0.146(0.041)***	11.843(4.538)***	7.030(3.188)**
Trust in PFJ to address food insecurity	0.102(0.048)**	11.425(4.134)***	6.855(2.653)***
R^2	0.7910		
F-statistic (9,154)	140.73***		
Pseudo R^2		0.9340	0.9337
Wald chi^2 (9)		27.82***	35.85***
VIF	1.61	4.56	4.56
Sample Size, N	164	164	164

Note: Statistical significance at *** 1% level, ** 5% level and *10% level. Heteroscedasticity robust standard errors are reported in parentheses.

Table 3. Marginal effects of significant variables.

Variable	Linear probability(LP)	Logit	Probit
Age	-0.117***	-2.161**	-2.047**
Gender	0.141***	0.990***	-0.997***
Household size	-	-	-
Educational level	0.077***	0.960***	0.912**
Farm size	-0.016***	-0.236*	-
Years of farm experience	-	-0.210**	-0.205**
Income level	0.112**	0.563**	0.533**
Access to food at all times	0.146***	0.994***	0.999***
Trust in PFJ to achieve food security	-0.102**	0.993***	-0.999***

Statistical significance at *** 1% level, ** 5% level and *10% level.

40 years. For all this while, I realised that government interventions in agriculture are usually rushed, ill-planned and don't work. That is why I'm not participating". Also, gender has a significant positive effect on participation, inferring that males are more likely to participate in the programme. Males participate more in farming related interventions because they have better access to farmlands (Azumah et al., 2018). The effects of gender on participation are robust under changing estimation models. The probability of participation is 14.1, 99.0 and 99.7% higher for males under the LP, Logit and Probit, respectively.

Moreover, education has a significant positive effect on participation. This suggests that educated farmers are more likely to participate in the PFJ programme. A possible explanation is that education broadens people's knowledge and analytical capabilities to take informed decisions (Ntshangase et al., 2018). As one farmer indicated: *"I'm educated. I have a university degree. After carefully analysing the policy document, I saw that the programme will reduce my cost of production by almost 10%. That is why I joined".*

The effect of education on participation is robust under varying estimation assumptions. The results indicate that a unit rise in educational level raises the probability of participation by 7.5, 96.0 and 91.2% under the LP, Logit

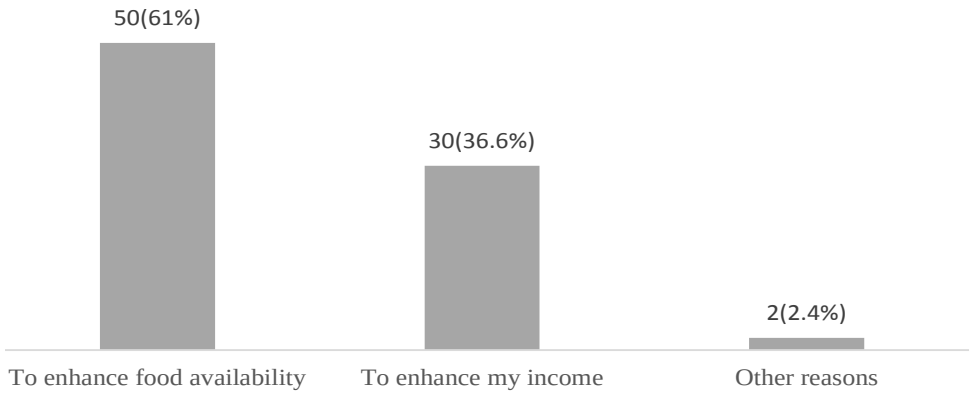

Figure 1. Most important reason for participating in the PFJ programme.
Source: Author's computation from field survey (2020).

and Probit models, respectively.

Besides, farm size has a significant negative effect on participation, indicating that large farm owners are less likely to participate in the PFJ programme. This is attributable to the limit on acreage. The PFJ subsidizes 20% of fertiliser and seeds for up to five acres. The limit on acreage tends to discourage large scale farmers from participating in the programme. A unit increase in farm size reduces the probability of participation by 1.4% and 7.6% under the LP and Logit, respectively. The result is contrary to the findings of Jamilu et al. (2015) who observed a positive relationship between farm size and participation in IFAD programmes. However, farm size is not significant under the probit model, and thus, not robust to varying estimation assumptions.

Vulnerability to food security is measured using income level and access to food at all times. Income has significant positive effect on participation, suggesting that farmers earning below US$2 per day are more likely to participate in the programme. A possible explanation is that farmers earning below US$2 per day are food insecure and want to participate in the programme to alleviate that risk. As one farmer indicated: "My income is too low. I earn below one US$1 per day. I couldn't afford fertiliser and certified seeds. This inversely affected my output, income and ability to feed. That's why I'm participating in this programme to have access to subsidized inputs". The probability of participation increase by 11.2, 56.3 and 53.3% under LP, Logit and Probit, respectively for individuals earning below US$2 per day. Thus, income has a robust effect on smallholder participation under varying estimation assumptions. Also, *access to food at all times* has a robust and significant negative effect on participation. A possible explanation is that people who have *access to food at all times* face a reduced food security risk and, hence, less likely to participle in the programme. Access to food decrease the probability of participation by 14.6, 99.4 and 99.9% under the LP, logit and Probit models, respectively. As one farmer indicated: *"I think the programme is designed to help people struggling to feed their families. I don't have enough to feed. That is why I am participating"*. In general, the results indicate that food insecure individuals are more likely to participate in the programme. This finding is consistent with the PFJ's objective of addressing food insecurity among vulnerable individuals.

Policy trust has significant positive effects on participation. Thus, farmers are more likely to participate if they trust PFJ to address food security challenges. For instance, a farmer indicated that: *"I participated in the PFJ because I believe it will help increase food production and feed my household. The inputs provided are high yielding".* On the contrary, participation is less likely when farmers do not have trust in the programme. As a farmer indicated: *"I do not participate in the programme because I don't believe it will help me address my food production challenges"*. This suggests that trust is an important factor in farmers' participation decisions. The probability of participation is 10.2, 99.3 and 99.9% higher under LP, Logit and Probit, respectively when farmers trust the programme to address food security. The finding is consistent with Belay (2020) conclusion that trust influence farmers' participation in dairy cooperatives. In addition, 61% of the respondents participated in the PFJ programme to enhance food availability while 36.6% wanted to enhance their income (Figure 1). This implies that the most important reason for participating in the programme is related to food security.

Conclusion

In conclusion, policy trust and farmers' vulnerability to food security risk drives participation in the PFJ programme. Moreover, most farmers (over 90%) participate in the programme with the primary aim of enhancing income and food availability. This implies that food security is the primary reason for participating in PFJ programme. On the other hand, lack of trust in the policy

negatively affects participation. The programme should, therefore, deepen trust with food security vulnerable individuals to enhance their participation.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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