Factors Determining Enterprise Shift Behavior among Smallholder Cocoa Farmers in the Mpohor-Wassa East District in the Western Region of Ghana

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Abstract

Recent cutting of cocoa trees and the shifting of farm resources to only rubber cultivation among smallholder cocoa farmers particularly in the Western Region of Ghana has raised great concern. It is important to examine factors influencing enterprise-shift behavior among smallholder cocoa farmers. Interview schedules were administered to all smallholders of rubber plantation famers registered under the Ghana Rubber Estates Limited (GREL)'s out-grower scheme at Mpohor. 150 smallholder cocoa farmers (except 35 absent) were interviewed for the study. Data were analyzed using descriptive statistics and logit regression. About 73% of smallholder cocoa farmers were found to be shifting from cocoa to only rubber cultivation while the remaining 27% engage in both cocoa and rubber cultivation. The logit model reveals that family size and perception of investment outcome of their cocoa farms have a significant effect on their enterprise-shift behavior and decisions (P<0.01). It is recommended that government should address specific issues such as inadequate credit supply and low producer prices that affect the investment outcome of cocoa farm enterprise.
Keywords: Enterprise shift, smallholder cocoa farmers, rubber cultivation, socio-economic determinants.

1.0 Introduction

Cocoa is the most important agricultural commodity in and one of the major contributors to Ghana's economy. Generally, the cocoa industry has been and continues to be the backbone of the Ghanaian economy as it contributes substantially to the general economic development of the country. Almost one-third of the Ghanaian population depends on cocoa for their livelihood (Laven, 2010). Cocoa has historically been a key economic sector in Ghana and a major source of export and fiscal earnings (McKay & Arytee, 2005). Cocoa production and marketing accounted for 32.2 % of export earnings (Laven, 2010; Institute of Statistical, Social and Economic Research, 2007) and 8.5% of Gross Domestic Product in 2006, up from 4.9% in 1998, with the European Community being the main export destination for cocoa produced in Ghana (International Monetary Fund, 2007). In Ghana, cocoa is grown in the forested areas of Asante, Brong Ahafo, Central, Eastern, Western and Volta Regions with the Western Region being the leading contributor (Food and Agriculture Sector Development Policy Sector, 2002). Although there is an increasing demand for Ghana's cocoa beans by manufacturing industries both locally and internationally, the cocoa sector is dwindling in productivity especially in the Western Region. Although Ghana was the world's largest producer of cocoa in the early 1960s, its production had dwindled almost to the point of insignificance (an average of more than 450,000 metric tonnes per year) to as low as 159,000 metric tonnes in the early 1980s. The tremendous decline over the years is partly attributed to inadequate credit supply, bad weather, low producer prices, inappropriate control of disease and pests, and poor macroeconomic policy (Abekoe et al., 2002; Opoku & Appiah, 1999). These production challenges have resulted in low farm yield and income that cannot guarantee farm families' basic needs (Abekoe et al., 2002),

There has been a recent increase in the number of cocoa farmers shifting from cocoa to rubber cultivation in Ghana. Most cocoa farmers, especially in the Western Region, are shifting to rubber cultivation although the cocoa sector continues to be the backbone of the country. Ghana's rubber production increased from 9,300 metric tonnes in 2000 to 19,134 metric tonnes in 2009, recording an increase of 74 % over the period. The country's rubber production is estimated to reach 52,000 metric tonnes by 2020 and 70,000 metric tonnes by 2030 (Ministry of Food and Agriculture, 2011). Currently, the main rubber growing regions in Ghana are the Western and Central Regions. The Mpohor-Wassa East District is one of the major cocoa growing districts in the Western Region where many cocoa farmers are diverting their resources to rubber production.

Natural rubber (*Hevea brasiliensis*) is a perennial crop that is capable of being harvested for 35 years (Aitchison, 2011; Campbell, 2000). The plant thrives in rainforest regions of the lowland tropics with temperatures between 21-35 degrees C and a well-distributed rainfall of 2,000mm per year or more (Aitchison, 2011). Natural rubber takes its origin from the tropical rainforest of South America, specifically from the Amazon forest in what is now Brazil. According to Campbell (2000), natural rubber became popular after the invention of Pneumatic tyres for bicycles and cars. The discovery of waterproof garments also promoted the foundation for the development of the rubber industry. Rubber has the ability to renew its bark and thus ensure a

sustainable harvest. While cocoa farmers could adopt cocoa and rubber diversification, many farmers are noted to be shifting their resources to only rubber plantations. In the context of agriculture, shifting from one enterprise to another implies the re-allocation of a farm's productive resources including land, capital, labor, and equipment into a new farm enterprise or activities. Thus, farmers tend to move resources from less profitable crops to newer and more profitable crops (Ashfaq et al., 2008). A farmer's decision to shift from one particular crop to another could be considered to be economic behavior. Currently, the author has found no study on the determinants of decision or behavior of smallholder cocoa farmers shifting from cocoa to rubber plantation in Ghana. Thus, the aim of this study is to identify the major determinants that influence farmers' attitudes and decisions to shift from cocoa to rubber plantations in the Mpohor area in the Western Region of Ghana.

2.0 Literature Review

2.1 Factors Associated With Farmers' Enterprise Shift Behavior

The literature on farm enterprise choice has outlined a number of factors that influence farmers' enterprise shift decisions and behaviors. The shifting to a more profitable and comparatively advantaged enterprise is a rational economic behavior or choice among many farmers. Many profitable agricultural enterprises do engage in entrepreneurial shift (Achoja, 2013). According to Bowman and Zilberman (2013), a farmer's preference in a particular farm enterprise can be classified into individual and household characteristics, farm characteristics, economics and production risk factors, biological, and geophysical factors.

2.1.1 Individual and Household Characteristics

Individual and household characteristics do affect both the farmer and the farm household's abilities and motivation to invest in a particular farm enterprise or to practice a particular farming system. In particular, the farmer's age, human capital or previous experience, education and household size are critical influences on a farmer's decision to invest in a particular farm enterprise or innovation (Bowman & Zilberman. 2013; Chaplin, 2000). The farmer's educational level is known to affect his decision to invest in a particular farm venture or technology. The higher the farmer's educational level the greater his ability to analysis the pros and cons of a given enterprise and to make his investment decision. According to Shivery (2001), the farmer's lack of knowledge and ability to analyze information about the cost and benefit of a particular farm enterprise or technology could negatively affect his willingness to invest in that enterprise. Chaplin (2000) notes a positive relationship between a person's work experience and his likelihood to engage in a similar enterprise or to adopt a related innovation. An individual who has been brought up on a farm and received on-the-job training would have more experience. Chaplin (2000) argues that a farmer's experience of entering a new market through a new investment is more likely to decrease his uncertainty over the profitability of the activity and the expected output price. Thus, a farmer's lack of knowledge or previous experience could serve as barriers into a new venture, while his previous experience with a particular farm enterprise is more likely to increase his probability to engage in similar ventures. The lifecycle of the farmer is quadratic in nature. The age of the farmer is important on his investment decision and adoption of a new technology. The probability of the farmers to undertake a new venture increases for younger farmers, and then decreases for older ones. This trend could be attributed to the fact that capital accumulation over time increases a farmer's investment with time. However, as individuals approach retirement, there is less propensity and motivation to undertake or adopt new ventures. The farmer's age is an indication of the age of his children such that older farmers tend to have older children and younger farmers will more likely have younger children. Thus, older farmers may have children who are ready to assist in new enterprise businesses.

2.1.2 Farm Characteristics

Farm enterprise characteristics do influence a farmer's decision to invest in a given farm enterprise (Bowman & Zilberman. 2013; Chaplin, 2000). The characteristics of a farm enterprise have important effects on its profitability. The farm business structure such as co-operative, partnership or membership in farmer-based organizations may be associated with certain integral strengths. The type of agricultural enterprise may have a positive or negative effect on its success and a farmer's decision to invest in the enterprise. The debt-to-asset ratio of a farm can affect its profitability and the farmer's interest n a particular enterprise. Farm households with higher a debt-to-asset ratio will not invest in a new venture or adopt a new technology. Thus, an increasing debt-to-asset ratio could reduce a farmer's interest in new investment.

2.1.3 Economics and Production Risk Factors

According to Stoorvogel et al (2004), the profitability of a farm economic enterprise is often dependent on a number of factors including price risk production constraints and asset endowment. Production constraints such as availability of labour, inputs, financial and credit often are known to influence the farmer's decision to engage in a particular farm enterprise. The farmer's income base and his ability to easily access credit facility do influence his choice of farming system and willingness to engage in new farm enterprises (Knowler and Bradshaw, 2007; Shively, 2001; Sunding and Zilberman, 2001). According to Hanson et al. (2004) and Nerlove et al. (1996), an income constraint to risk-averse farmers may less likely motivate the adoption of new

technologies or to engage in new ventures even if they are more likely to increase productivity over time. This attitude is more common in developing countries. The farmer's credit constraints may not encourage him to sacrifice current profit or income for a long term venture.

2.1.4 Biological and Geophysical Factors
Machmound and Shively (2004) and Feder et al. (1985) underscore biological and geophysical constraints that may affect a farmer's decision to engage in a particular farm enterprise or adopt a new technology. Constraints such as pest or disease infestation, water scarcity, risk of flood or drought, and soil infertility may cause the farmer to avoid a particular farm enterprise. Pests, disease, and bad weather are noted to cause production or yield risk. Pests and disuse conditions can reduce yield drastically (Chaplin, 2000). However, the risks caused by pests and diseases can be reduced by using pesticides or a resistant variety of planting materials. The prevalence of particular pests and diseases can force farmers to divert farm resources to a different enterprise.

3.0 Methods and Procedures
3.1 Study Area and Data Collection
The study was conducted in the Mpohor-Wassa East District in the Western Region of Ghana. Mpohor-Wassa East District is located at the South-Eastern end of the Western Region. The district falls within the tropical climate zone. The mean annual rainfall is1500mm and ranges from 1300 to 2000mm, with an average annual temperature of 30^0C. The rainfall pattern has been favorably supportive of agricultural activities but makes it difficult to physically have access to farming areas especially during the rainy seasons (Ghana Statistical Service, 2010). The predominant cash crops cultivated are cocoa, oil palm, rubber, and coffee in some cases. Cocoa is usually cultivated in small- to medium-sized plantations. The Ghana Rubber Estates Limited (GREL) is promoting the cultivation of rubber in the district. A number of smallholder cocoa farmers have registered under the Ghana Rubber Estates Limited (GREL)'s out-grower scheme (Ghana Statistical Service, 2010).

In order to study the enterprise shift behavior among smallholder cocoa famers, a cross-sectional survey was employed. A cross-sectional research design accurately measures respondents' attitudes or behaviors toward a specific farm enterprise preference at a specific point in time (Monette, Sullivan, and Dejong, 2002). A quantitative survey is an appropriate choice of research design since it has the ability to describe and observe attributes of a study population, such as smallholder cocoa farmers in the Mpohor-Wassa East District (Monette, Sullivan, and Dejong, 2002). A structured intervener schedule was used to collect information on variables relating to farmer and household demographic characteristics, farm characteristics, economics and production risk factors, biological, and geophysical factors. Interview schedules were administered to the listing of all smallholders of rubber plantation famers who have registered with the Ghana Rubber Estates Limited (GREL)'s out-grower scheme at Mpohor area. Mpohor was selected in the district for the study because many of the cocoa farmers had been found to have cut down cocoa trees and/or shifted to rubber production. A total of 150 registered famers out of 185 responded to the questionnaire. The remaining 35 farmers were not available in their communities during the period of the data collection.

3.2 Variables and Hypotheses
The dependent variable is enterprise-shift behavior or decision among smallholder cocoa farmers. Farmers who indicated shifting completely from cocoa to rubber plantation are coded 1, otherwise 0.
3.2.1 Explanatory Variables and Hypotheses
Based on a review of the literature on enterprise-shift behavior or decisions, the following explanatory variables are expected to determine a farmer's probability of shifting completely from cocoa farming to rubber cultivation. Table 1 present a summary of the explanatory variables.
Sex: This is a dummy variable that takes a value of 1 if the respondent is male and 0 if female. The nature of the relationship of sex to the decision to shift from one enterprise to the other is ambiguous. Male or female cocoa farmers can choose to shift from a given farm enterprise to another depending on different factors such as access to land and production resources.
Education: This is an important factor that influences individual's attitude or decision to engage in a new enterprise. Farmers with some form of formal education are more likely to shift from a less profitable to a more profitable farm venture. Respondent response categories to his/her educational attainment were no formal education, middle/junior high, senior high, and tertiary. A dummy variable was set up for the response categories, with some form of formal education recoded 1 and those with no formal education recoded 0.
Age: Age is found to show a curvilinear relationship with farmer decisions to embark on a new venture. Younger farmers are more likely to undertake a new venture than older farmers nearing retirement age. Age is an ordinal scale ranging from <21; 21-30, 31-40, 41-50, > 50. It is assumed that individual farmers with more than 50 years approach retirement. A dummy variable is set for age: farmers with under 50 years are coded 1, and those older than 50 years are coded 0.
Farm Size: This is a continuous variable. It refers to the total farmland under cultivation. A smallholder farmer

may find it difficult to convert existing large farmland to a new one. However farms of small sizes are more likely to be converted to new ventures.

Household Size: This is a continuous variable. The larger the household size, the higher the availability of labor to invest in a new enterprise and the more likely the farmer may be to shift from a less profitable enterprise to a more profitable enterprise.

Years of related experience: This is a continuous variable and is expected to be positively related to a farmer's decision to undertake a new venture. The number of years of experience is more likely to increase the positive attitude of the farmer towards a new venture.

Investment outcome: Low or poor investment outcome is known to negatively affect the farmer's continuity of an existing venture. Respondents were asked to indicate whether the investment outcome of cocoa production was able to meet household basic needs. This variable is ordinal scales ranging from 1-4 (strongly disagree to strongly agree). Both the strongly agree and agree are merged and coded as 1, indicating the problem of financial constraint. The responses strongly disagree and disagree are both merged and coded 0.

Pest and Disease Presence: The presence of pest and disease affecting particular farm crops can discourage a farmer to continue to produce that crop and prefer a shift to a disease-resistant crop. Respondents were asked to indicate whether pest and disease affect cocoa production. The responses are ordinal scale ranging from 1-4 (strongly disagree to strongly agree).

Table 1: A Summary of Explanatory Variables

Variable	Type	Description	Expected sign
Sex	Dummy	Sex of the farmer	Ambiguous
Education	Dummy	Whether the farmer had some form of formal schooling	+
Age	Ordinal, on a scale of 1 to 5, but transformed into dummy variable	The age of the farmer expressed in years.	Ambiguous
Farm Size	Continuous	Total number of farm plot or field under cultivation	-
Household size	Continuous	Number of people in the household (proxy for labour supply)	+
Years of related experience	Continuous	Number of years of related farm experience	+
Investment outcome	Ordinal, on a scale of 1 to 5, but transformed into dummy variable	Farmer's assessment of investment outcome of cocoa farm to meet household basic needs	Ambiguous
Pest and Disease Presence:	Ordinal, on a scale of 1 to 5, but transformed into dummy variable	Cocoa pests and diseases including black pod disease.	-

3.3 Data Analysis and Model Specification

An initial analysis to determine the association between the explanatory variables and a farmer's enterprise-shift decisions or behavior was performed. The bivariate relationship among the explanatory variables was conducted to determine their tolerance levels. To determine the relative contribution of significant factors influencing the probability of cocoa farmers' decisions or behavior to shift to only rubber cultivation, a multivariate logistic analysis was utilized. The logistic model is useful to determine the likelihood of enterprise-shift behavior, and also the analysis helps to overcome most of problems associated with multiple linear regression (Pallant, 2013). According to the logistic model the probability, P, of a smallholder farmer shifting from cocoa to only rubber cultivation is given by

$$P_i = \exp^Z / 1 - \exp^Z \quad \text{...(1)}$$

where Z = a random variable (i.e the stimulus index) that predicts the probability of ith farmer shifting from cocoa to only rubber cultivation. The final form of the model therefore becomes

$$Z_i = \beta_o + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \text{..........} \beta_n X_n \text{......} (2)$$

where B is an unknown parameter, and X is the identified factor contributing to farmer's behavior or decision to shift to rubber cultivation. The unknown parameter associated with each contributing factor X is determined by standard logistic analysis, where $X_1 + \text{......} + X_6$ were the predictor variables (Pallant, 2013).

4.0 Results and Discussion

4.1 Distribution of Enterprise Shift Behavior by Cocoa Farmers

The distribution of enterprise-shift behavior among smallholder cocoa farmers is presented in Figure 1. The

distribution shows that the majority (74.7%) of the smallholder cocoa farmers exhibited a shift from cocoa cultivation to only rubber. Although crop diversification is a cropping system that ensures risk aversion, only 25.3% of the smallholder the farmers cultivate both cocoa and rubber.
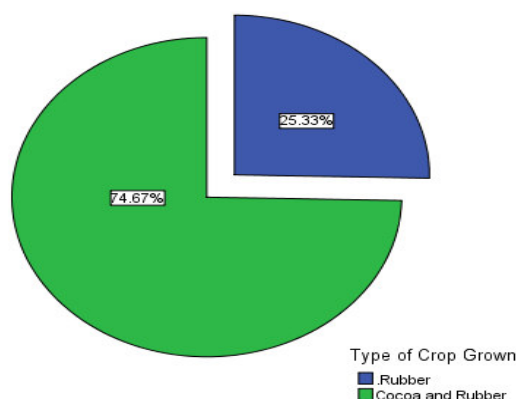
Figure 1: The distribution of enterprise-shift behavior among smallholder cocoa farmers

4.2 Bivariate Analysis

Table 2 summarizes the Spearman correlation analysis of the main factors likely to be associated with the smallholder cocoa farmer's decision to shift to only rubber cultivation. Two factors were significantly correlated (P<.01) with the dependent variable, the decision or behavior to shift to only rubber cultivation. Household size and investment outcome of cocoa were found to be significantly corrected with the dependent variable. In contrast, a farmer's sex, age, level of education, and years of related experience showed no significant relationship with the decision of whether or not to shift to only rubber cultivation.

Table 2: Summary of Factors Associated with Farmers Shifting to Only Rubber Plantation

Factor	Rho	Significant
Sex	.138	n.s
Education	.050	n.s
Age	.059	n.s
Farm Size	-.016	n.s
Household Size	.346	P < 0.01
Years of related experience	.154	n.s
Investment outcome	.302	P < 0.01
Pest and disease presence	-.149	n.s

The bivariate correlation matrixes of the explanatory variables indicated no multicollinearity between the variables. Most (97%) of the correlations are less than or very close to 0.20 indicating a general weak association among the explanatory variables. The presence of multicollinearity could make it difficult to separate the effect of each parameter estimate on the dependent variable.

4.3 The Logistic Model

Even though there is increasing demand for Ghana's cocoa, smallholder cocoa famers are currently shifting to only rubber cultivation especially in the Mpohor area in Western Region.

The probability of a smallholder cocoa farmer shifting from cocoa cultivation to only rubber cultivation is predicted by the logistic model equation in Table 3. Table 3 shows the results of the effect of the farmer's socio-economic factors on the enterprise shift behavior or decisions.

The model contained eight explanatory variables. The full model containing all the explanatory variables was statistically significant X2 (8, N=150) = 25.2, *P*<.001, indicating that the model was able to distinguish between respondents who exhibited enterprise-shift behavior and those who did not. The model as whole explained between 15.5% (Cox and Shell R Square) and 22.2% (Negelkerke R Square) of the variance in enterprise-shift behavior and correctly classified 74% of the cases. The value of the Hosmer and Lemeshow test (*P*>0.05) indicates the model is well fit and confirms that smallholder cocoa farmers' behavior or decisions to shift completely to only rubber cultivation is basically based on the two identified factors (Pallant, 2013). In

explaining the variability in the likelihood of shifting from cocoa to rubber cultivation, household size of the respondent has a positive effect on enterprise shift behavior. This suggests that larger family size serves as a source of labor to influence the farmer likelihood to shift to rubber cultivation. A larger farm family may also decrease risk aversion through the increased labor force and will increase the earning capacity of the farm family. Respondents' perceptions and assessment of the investment outcome of cocoa farm to meet household basic need also had a negative effect of leaving the cocoa cultivation to a more profitable crop, rubber. The majority of the smallholder cocoa farmers expressed their concerns about low investment outcomes of their cocoa farms to meet basic household needs, including the inability to pay basic for utility fees, school fees, and nourishment. Bowman and Zilberman (2013) note that farmers tend to leave a less profitable to a more profitable farm enterprise that has been seen to increase income and reduce financial risk.

Table 3: *Logit Regression Predicting likelihood of Shifting from cocoa to Rubber Cultivation*

Variable	Estimated Parameter	Standard Error	Wald	Significant
Sex	.741	.453	2,678	.102
Education	-.060	.519	.013	.903
Age	-.141	.552	.066	.868
Farm Size	-.097	.083	1.364	.243
Household Size	.427	.142	8.990	.003
Years of related experience	.041	.130	.099	.753
Investment outcome	-.847	.412	4.232	.040
Pest and Disease Presence:	-.627	1.036	.366	.545
Constant	-.614	1.318	.217	..641

Sig $p > 0.05$, Hosmer and Lemeshow test 0.87.

The problems of cocoa pests and disease appear to be less important factors in determining farmers' behavior or decisions to shift from cocoa to only rubber cultivation. This observation could be partly explained by the fact that interventions by government and the Cocoa Board in recent years have provided free mass spraying of major cocoa pests and disease, including black pod disease. Thus, farmers might not currently be considering cocoa pests and disease as production threats. In addition, age, level of education, and sex were not significantly found to determine a farmer's behavior or decisions to shift to only rubber cultivation. Literature on the effects of age, level of education, and sex on farm enterprise shift behavior are found to be mixed or ambiguous. It is not therefore surprising to find these variables insignificant in determining a farmer's enterprise shift behavior.

5.0 Conclusion

The aim of this study is to examine the determinants of enterprise shift behavior or decisions among smallholder cocoa farmers in Mpohor in the Western Region of Ghana. The findings of the study indicate that two main socio-economic factors, household size and cocoa farm investment, outcome may combine to affect the likelihood of the farmer's decision to shift to only rubber cultivation. The potential usefulness of the model is that it provides a method for predicting the likelihood of the smallholder cocoa farmer shifting to only rubber cultivation while there is a high demand for Ghana cocoa beans. It is recommended that government and agricultural extension services should make cocoa production more profitable for the smallholder farmers by addressing specific issues affecting their investment outcome.

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