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<https://doi.org/10.3390/su13095047>

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Determinants of Rice Farmer Participation in the Direct Marketing Channel in Ghana

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Abstract: Enhancing smallholder farmers' access to reliable, ready, and direct marketing channels is a prerequisite for sustainable food supply and poverty reduction in the developing countries including Ghana. However, it is a great challenge for smallholder farmers to access direct marketing channels in Ghana. This paper analyzes the factors that influence smallholder rice farmers' participation, and the intensity of participation, in direct marketing channels using primary data from 199 farmers in three rice-growing districts in the Northern Region of Ghana. A double hurdle model was used in the empirical analysis. The study findings show that a lower percentage of farmers sold their rice output to processors (direct marketing). Farm size, the price of rice output per 85 kg bag, access to market information, and access to credit increased farmers' participation in direct marketing channels, whereas payment period and ownership of a bicycle reduced their participation. The study concludes that improving farmers' access to market information and credit availability would enhance participation in direct marketing channels.

Keywords: rice marketing; rice farmers; Ghana; double hurdle model; transaction cost theory; random maximization theory



Citation: Donkor, E.A.; Garnevska, E.; Siddique, M.I.; Donkor, E. Determinants of Rice Farmer Participation in the Direct Marketing Channel in Ghana. *Sustainability* **2021**, *13*, 5047. <https://doi.org/10.3390/su13095047>

Academic Editor: Mario D'Amico

Received: 24 March 2021

Accepted: 27 April 2021

Published: 30 April 2021

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1. Introduction

In many developing countries, a large number of people directly or indirectly rely on agriculture for their livelihoods. The development of the agricultural sector can reduce poverty and food insecurity in rural areas [1]. Most of these people are smallholder farmers who operate on parcels of land that are, on an average, smaller than 2 ha [2]. The smallholder farmers account for about 80% of the food supply in sub-Saharan Africa (SSA) [2]. One of the key food commodities widely consumed in SSA is rice. The demand for rice has increased considerably in SSA since 1995 [3]. The driving forces for this high rice consumption include population growth, increasing rate of urbanization, changing consumer preferences, and economic development [4]. Although rice production in SSA has risen significantly over the past 50 years, demand has outweighed domestic supply, resulting in increasing imports. The share of imports in African rice consumption has increased by 2% per year over the past 50 years, and reached 43% in 2009 [5]. Almost 33% (11.8 million tonnes) of the total rice traded on the global market in 2011 was imported by African countries, where West African countries were the largest importers [5]. For example, in Ghana, 60% of the total supply of rice comes from imports, which amounts to over USD 600 million per annum [6]. This shows that there are huge market opportunities for rice; however, smallholder farmers' access to these markets remains a great challenge in African countries, including Ghana.

In Ghana, agriculture accounts for 19.7% of gross domestic product (GDP), contributes to over 30% of export earnings, and is a major source of inputs for the manufacturing sector [7]. It employs 33.5% of the total labor force in the country. Rice is the second most important grain food staple consumed in Ghana [7]. The rice sector provides employment opportunities through input supply, production, processing, marketing, and logistics for about 10% of Ghanaian households [1]. The northern part of Ghana is an important hub of rice production, and makes the largest contribution to the national rice output [1]. Rice is an important cash crop for many farmers in Northern Ghana. The majority of rice supply in Northern Ghana emanates from smallholder farmers with farm sizes of less than 2 hectares, located in rural areas characterized by poor infrastructure [6]. These smallholder rice producers encounter numerous marketing challenges, such as limited access to reliable market information, poor road networks, poor storage facilities, and limited access to transportation [1,8,9]. These problems contribute to high transaction costs, which hamper the farmers' participation in agrifood markets. Research evidence shows that farmers' participation in agrifood markets can improve their livelihoods by increasing incomes and food security, and reducing poverty in rural areas [8,9]. In the marketing of agricultural goods, the decision on the choice of channel is critical to farmers. Marketing channel choice is one of the critical components to successful marketing for rural producers, because different channels are characterized by different costs, profit margins, and risks [10,11]. Selling to middlemen or brokers or collectors at the farm gate is often less remunerative [12].

Although there is growing body of literature on the rice industry in SSA, most of the studies focus on addressing production issues, such as technology adoption [13–15] and productivity and efficiency of rice production [16–23]. However, there is limited empirical studies on the marketing of rice in Ghana. Hence, little information is available on rice farmers' choice of marketing channel in Ghana. Therefore, the present paper aims to analyze the factors that influence rice farmers' participation and intensity of participation in the direct marketing channel in the Northern region of Ghana.

This paper contributes to providing relevant information to promote farmers' access to direct and higher-value markets, which would stimulate them to increase their investments in productive inputs and, in turn, trigger higher yields. This would accordingly raise their income levels to promote their standard of living, in addition to transforming the rural economy in Northern Ghana. With increased incomes, farmers can access better health care in urban areas and provide better quality education for their children. In addition, this study is closely aligned to the One District One Factory (1D1F) Presidential Initiatives and Planting for Food and Jobs, which seek to promote agro-industrialization in Ghana [7]. Hence, findings from the study will provide key policy directions for the promotion of rice farmers' participation in direct marketing channels in the rice value chain. The remainder of this paper is structured as follow. Section 2 provides a literature review of the choice of marketing channel. Section 3 explains the methodology used, and the results and a discussion are presented in Sections 4 and 5, respectively. The final section concludes the paper.

2. Literature Review

Marketing of agricultural commodities is an important component in the agrifood supply chain in sub-Saharan Africa (SSA) [8,24,25]. One of the critical decisions that farmers need to make is the choice of marketing channel. Different market channels offer different prices and services, which eventually have an impact on farmers' incomes and welfare [8,26]. Therefore, the choice of marketing channel is a key consideration for smallholder farmers because different channels affect their profit margins. Smallholder farmers can improve their profitability by choosing to sell through a profitable channel, which enhances their investment in productive assets and new agricultural technologies, and improves the welfare of the household [11,27]. Farmers' understanding of each channel, including its benefits, requirements, and limitations, is an important starting point for

channel selection [28]. It is also important to know the volume of production required and the average prices paid to assess the potential returns of a channel [28].

The marketing literature categorizes marketing channels into two main groups: direct and indirect marketing channels [29]. The direct marketing channel has no levels of intermediaries [29]. From the producers' perspective, a greater number of channel levels implies less control and increased channel complexity. The direct marketing channel tends to be attractive to producers because producers receive all of the profit which would otherwise be shared with intermediaries [30]. In contrast, producers bear the risk of transaction costs to deliver the product directly to the end users and, in most cases, the transaction costs are higher for smallholder farmers [8]. Many smallholder farmers avoid this type of marketing channel because they do not want to incur extra transaction costs associated with selling to final users [8]. The indirect marketing channel is associated with more than one intermediary [29,30] and the marketing margins are shared among the intermediaries [31]. In addition, producers may not have the capacity to add more value to their products, so they cannot trade directly with final users.

Most smallholder farmers in SSA make a decision regarding the marketing channel based on their judgement and past experiences because they lack inadequate information to make rational decisions [10]. This means that most of the farmers sell their farm outputs through channels that offer them low prices because they either have little knowledge regarding the market or they face difficulty in accessing profitable markets [32]. Middlemen may take advantage of the farmers' ignorance of the market price and purchase agricultural output from producers at lower prices, and sell at a higher price to cover their transaction costs and profits [32,33]. Despite the personal and economic benefits associated with participating in the market, smallholder farmers in Ghana and other developing countries are faced with challenges that constrain their participation in the market [8,34–36]. There are many challenges that have an effect on smallholder farmers' choices of a marketing channel for their produce, such as limited access to reliable market information, poor basic infrastructure, inefficient and weak institutional factors (e.g., farmer association, agricultural extension services), limited access to credit, and the subsistence nature of farming [32,37,38].

In the rice value chain in Ghana, farmers can sell different rice products, namely milled and paddy. Milling of rice paddy involves a series of value-adding activities such as drying and parboiling [39]. Hence, most farmers prefer to sell paddy rice to avoid these numerous activities and transaction costs. There are two main marketing channels for paddy rice: indirect marketing (thus, selling to middlemen or collectors) and direct marketing (selling to processors). Farmers can use both of these marketing channels to sell their rice outputs. Most of the rice outputs are sold just after harvest to enable the farmers to repay their loans, but some farmers store their rice output and sell at a later date. In indirect (middlemen) marketing, farmers sell paddy rice to middlemen at the farm gate. These middlemen are mostly women who live in the farmers' community or nearby communities. The middlemen aggregate all of the paddy rice purchased and transport it to processing firms, which are located in the local district or nearby districts. The middlemen or collectors can sell their rice to processors or either mill it and sell it to other channel members (wholesalers, retailers, consumers). They do not buy rice by weight but rather use a volume, such as bags, as a means of measurement. The average weight of these bags is 85 kg; however, because they are not weighed, the weight could vary. This mode of measurement is inaccurate and could lead to exploitation of farmers. Farmers receive less income when rice outputs are sold in volumes compared to the same quantity sold by weight. Middlemen offer instant cash payment after buying rice but a few can sometimes delay payment by a week. The buyers make regular visits to the communities to buy rice, normally at the peak of harvest. For direct (processor) marketing, farmers sell paddy rice directly to processing firms without allowing the middlemen to perform the marketing function. Processors also buy rice from middlemen or collectors. Processors mill the purchased rice and distribute it to wholesalers, retailers, institutions, and consumers.

After selling their rice to processors, farmers have to wait for weeks, and in some cases months, for payment.

There is a growing body of empirical literature on the determinants of farmers' participation in different agricultural markets in SSA. For instance, in Ghana, Zanello, Srinivasan [40] found that distance to market, bike ownership, trust in the buyer, quality of products, and receiving market information via extension officers were key significant determinants of farmers' choice of marketing channels, which notably involved community, district, or regional markets. Arinloye, Pascucci [41] concluded that farmer age, farm size, the number of varieties (of pineapples, in this case), product quality, bargaining power, and the physical distance from the market significantly influenced pineapple farmers' decision to participate either in export or processing marketing channels in Benin. In Tanzania, Mmbando, Wale [26] revealed that transaction costs, household wealth, access to credit and access to extension services, social capital (membership of farmer group), household characteristics (age and education), and the price of the products affected the farmers' choices of marketing channels. Mmbando, Wale [42] observed that gender negatively influenced maize farmers' decision to sell to traders in local markets, rather than to brokers at the farmgate, whereas education showed a positive effect in Tanzania. Musara, Musemwa [43] showed that price, distance to market, and access to extension services positively influenced sorghum farmers' decision to sell to traders rather than local markets in Tanzania. Evidence from Donkor, Onakuse [9] suggests that improving road networks in rural areas, enhancing farmers' access to market information, and membership of associations could promote cassava farmers' active participation in direct marketing channels in Nigeria. Nxumalo, Oduniyi [44] showed that access to extension services, farm experience, gender, marital status, and education had positive effects on maize farmers' decision to participate in informal markets in South Africa. Chikuni and Kilima [45] found that the price of maize and access to extension services negatively correlated with maize farmers' participation in the market, whereas gender showed a negative effect in Malawi. Mgale and Yunxian [46] found that education, access to credit, access to price information, own transport, and perceived trust in buyers showed a positive effect on farmers' choice of selling to millers or wholesalers rather than village collectors, whereas distance to market showed a negative effect in Tanzania. Kaimba, Muendo [47] showed that gender, age, marital status, experience, product price, distance to market, transport, and access to credit affected baobab collectors' choices of marketing channels in Kenya. In summary, the literature review suggests that demographic characteristics (age, gender education, farm experience, and marital status), transactional factors (bargaining power, distance to the market, output price, and access to market information), institutional factors (access to credit and access to extension services), and asset endowment (ownership of transport assets and mobile phones) are key determinants of farmers' decisions to participate in different markets in SSA. The literature review also shows that little empirical evidence exists regarding rice farmers' decisions to participate in different markets in SSA. Hence, factors affecting farmers' participation in different agricultural markets were included in the current empirical analysis, to examine how these factors influence rice farmers' choice of marketing channel in Ghana.

3. Materials and Methods

3.1. A Case Study and Data

The study was conducted in the Northern region, which is one of the most important regions known for rice production in Ghana. The Northern region occupies an area of about 70,383 km², which constitutes about two-fifths of the area of Ghana, making it the largest region in term of land size [48]. The target population for the study comprises all smallholder farmers who grow rice as their main source of income in the Northern region of Ghana. A purposive sampling technique was used to select three districts, namely Tolon, Savelugu, and Kumbungu, from Northern Ghana. These districts were purposively selected because they contribute a larger proportion to the total output of the region. In

total, 200 rice farmers were selected, comprising 63 farmers from Tolon, 74 from Savelugu, and 63 from Kumbungu. One of the 200 participants withdrew during the interview, resulting in a sample size of 199. The response rate was therefore 99.5%.

The study used a structured questionnaire to solicit relevant information from the respondents. The questionnaire was first pre-tested to evaluate its suitability for the relevant research questions. The data generated from the pre-test was analyzed and necessary adjustments were made to ensure that all of the important information required to answer the relevant research questions was captured in the questionnaire. Generally, pre-testing of questionnaires tends to increase the reliability of the final questionnaire and ensure that the questions being asked are relevant and understood by the respondent. The questionnaire was first tested with three extension officers and one agricultural district director to identify if the questionnaire was lacking any information. Clarification and extra information gathered were used to modify the questionnaire a second time. Thirteen rice farmers who were not included in the final survey were interviewed and, taking their feedback into consideration, the final questionnaire was designed.

3.2. Empirical Estimation Strategy

The study applied the random utility maximization theory and transaction cost theory to explain farmers' decision process regarding the choice of marketing channel. The random utility maximization theory indicates that farmers as economic agents seek to make a choice that maximizes their marginal utility [49]. The transaction cost theory postulates that an organization, firm, or economic agent aims to minimize the costs of exchanging resources in the business environment [50]. Based on these theories, the study conceptualizes that a rice farmer's decision to sell to middlemen or processors is based on the net utility and transaction costs associated with the choice. Rice farmers are more likely to sell to processors and increase the quantity of rice output sold to processors if the associated net utility is greater than the net utility from selling to middlemen, and the associated transaction costs are less. A farmer's decision to sell via a direct marketing channel (to a processor) and quantity sold is expressed as a function of transactional factors, institutional factors, demographic characteristics, farm characteristics, and asset endowment. In this study, the binary choice problem of the farmer and the quantity sold were analyzed using Cragg's double hurdle model, which combines Probit and Tobit regression models in a single framework [51]:

$$y_{i1}^* = \omega x'_i + v_i, \text{ Direct market participation decision} \quad (1)$$

$$y_{i2}^* = \theta z'_i + \zeta_i, \text{ Quantity sold decision} \quad (2)$$

where y_{i1}^* denotes latent direct market participation, 1 equals participation in direct marketing channel and 0 otherwise. y_{i2}^* represents the quantity of rice output sold through direct marketing channel. x_i and z_i represent the explanatory variables. ω and θ denote the parameters to be estimated. v_i and ζ_i represent the error terms, which are assumed to be independent and distributed as $v_i \sim N(0, 1)$ and $\zeta_i \sim N(0, \sigma^2)$. If y_{i1}^* and y_{i2}^* are positive, then a positive quantity sold y_i can be observed [51]. The parameters in the model were simultaneously estimated using the maximum likelihood approach.

Empirically, a farmer's decision to participate in a direct marketing channel is specified as:

$$MC_i = \alpha_0 + \sum_{k=1}^6 \alpha_k \text{FarmerDemo}_{ik} + \sum_{k=7}^{10} \alpha_k \text{Farmxters}_{ik} + \sum_{k=11}^{13} \alpha_k \text{Transactional}_{ik} + \sum_{k=14}^{16} \alpha_k \text{Institutional}_{ik} + \zeta_i \quad (3)$$

$$\text{Quantity}_i = \omega_0 + \sum_{k=1}^6 \omega_k \text{FarmerDemo}_{ik} + \sum_{k=7}^{10} \omega_k \text{Farmxters}_{ik} + \sum_{k=11}^{13} \omega_k \text{Transactional}_{ik} + \sum_{k=14}^{16} \omega_k \text{Institutional}_{ik} + v_i \quad (4)$$

where MC_{ij} refers to the different rice market channels (namely, direct and indirect marketing channels). MC_j equals 1 if the farmer participates in the direct channel and 0 if the farmer participates in the indirect market channel. In this study, direct marketing channel refers to sales of rice directly to processors, whereas in the indirect marketing channel, the farmer sells to middlemen who then trade directly with processors. $Quantity_i$ represents the quantity of rice paddy rice in kg sold through the direct marketing channel. $\alpha_0, \omega_0, \alpha_k, \omega_k$ are a vector of parameters to be estimated; v_i and ζ_i represent the error terms. $FarmerDemo_{ik}$ represents a set of farmer demographic characteristics related to the rice farmer, and include farmer gender, age, household size, and educational level, farmers experience, and off-farm employment. $Farmxters_{ik}$ represents the farm characteristics and asset endowment factors, such as farm size, ownership of a mobile phone, and ownership of transport assets, specifically, a motorbike and a bicycle. $Transactional_{ik}$ denotes transactional factors which include the average product price, payment period, and farmer access to market information. $Institution_{ik}$ refers to a set of institutional factors, which includes membership of a farmer association, farmer access to extension services, and access to credit. The definitions of the various variables to be included in the models are presented in Table 1. Stata software (version 16) (StataCorp, College Station, TX, USA) was used to estimate the models.

Table 1. Summary statistics of the variables included in the model.

Variable	Description	Direct Market Participants N = 77 (39%)		Indirect Market Participant N = 122 (61%)		MD	t-Value
		Mean	SD	Mean	SD		
Farmer demographic characteristics							
Gender	1 = male	0.987	0.113	0.909	0.287	0.077 **	2.244
Age	Years	38.662	10.106	37.066	11.201	1.597	1.017
Education	Number of years of formal schooling	3.494	0.912	3.549	0.854	−0.056	−0.436
Household size	Number of persons in household	9.675	4.532	8.566	4.096	1.110 *	1.786
Experience in rice farming	Number of years in rice farming	11.961	8.492	10.754	7.935	1.207	1.017
Off-farm employment	1 = off-farm employment	0.403	0.494	0.303	0.462	0.099	1.439
Farm characteristics and asset endowment							
Farm size	Hectares	8.351	8.812	2.361	1.438	5.990 ***	7.365
Mobile phone	1 = ownership of mobile phone	0.987	0.114	0.926	0.262	0.061 *	1.918
Motorbike	1 = ownership of motorbike	0.662	0.476	0.467	0.500	0.195 ***	2.728
Bicycle	1 = ownership of bicycle	0.883	0.323	0.869	0.339	0.014	0.294
Institutional factors							
Farmer association	1 = member of farmer association	0.247	0.434	0.262	0.442	−0.016	−0.243
Extension services	1 = access to extension services	0.429	0.498	0.492	0.502	−0.063	−0.868
Credit	1 = access to credit	0.130	0.338	0.148	0.356	−0.018	−0.348

Table 1. Cont.

Variable	Description	Direct Market Participants N = 77 (39%)		Indirect Market Participant N = 122 (61%)		MD	t-Value
		Mean	SD	Mean	SD		
Transactional factors							
Price of paddy rice	GhC/kg	116.419	13.125	92.704	12.165	23.714 ***	12.839
Instant payment	1 = receive instant payment	0.506	0.503	0.869	0.339	−0.362 ***	−6.069
Market information	1 = access to market information	0.784	0.414	0.115	0.320	0.669 ***	12.665

Note: *, **, and *** denote 10%, 5%, and 1% statistical significance, respectively. SD denotes standard deviation. MD denotes mean difference. Source: Authors' computations (2021).

4. Results

4.1. Descriptive Results

Table 1 shows the distribution of the marketing channels used by the farmers. The result shows that 61% of the farmers sold their paddy rice to middlemen at the farm gate, whereas the remaining 39% sold directly to processing firms. This result suggests that about two-thirds of the farmers depend on middlemen to perform their marketing functions for them. Some farmers also expressed their interest in dealing directly with processors, but they were discontented with the bureaucracy associated with dealing with processors and delays in payment. Most of the participants in direct and indirect marketing channels were males. This result shows that males dominate rice production in Northern Ghana. Women were more involved in farm activities such as planting, weeding, threshing, the winnowing of harvested rice, and the processing and marketing of rice. A higher proportion of males participated in the direct marketing channel than indirect marketing channels, as demonstrated by the statistical significance of the t-value of the mean difference. However, the mean differences in age and education of the participants in direct and indirect marketing channels were not statistically significant at 10%, indicating that age and education are unlikely to influence farmers' decisions regarding the marketing channel. The mean household sizes for the farmers were generally large but the participants in the direct marketing channel had a larger household size. This result gives an indication of the prevailing family system in the Northern region. The extended family system is more popular than the nucleus type, and is coupled with polygamous nature of marriage in the region. This large household size is an important labor source needed to perform the relevant farming operations, such as land preparation, weeding, disease and pest control, harvesting, bagging, threshing, and marketing of rice. The mean differences in experience in rice farming and engagement in off-farm activity showed no statistical significance at 10%. This result suggests that the participants in direct and indirect marketing channels have a similar level of experience in rice farming and engagement in off-farm activity. The average farm size of the farmers was small. However, the participants of direct marketing channels had larger rice farms. The mean rice farm size is consistent with the national average farm size of less than 2 ha (Table 1).

Table 1 also shows that a higher proportion of the farmers owned mobile phones, motorbikes, and bicycles. Nonetheless, the mean differences in ownership of mobile phone and motorbike were positive and statistically significant. This demonstrates that ownership of mobile phones and motorbikes is likely to influence farmers' decision to participate in the direct marketing channel. Interestingly, the mean differences in membership of farmer-based organizations, access to agricultural extension services, and access to credit showed no statistical significance, which indicates that these factors are unlikely to affect a farmer's decision regarding marketing channels. On the contrary, on average, the payment of the direct marketing channel per kg of paddy rice was GhC24 higher than that of the indirect marketing channel. The mean difference in instant payment at delivery

was highly significant at 1%, implying that delays in payment discourage farmers from participating in indirect marketing channels. In addition, a higher proportion of direct marketing participants had access to market information compared to indirect marketing channel participants.

4.2. Determinants of Farmer Participation in Direct Marketing Channel

Table 2 shows the results of the double hurdle model. The variance inflation factor (VIF) and Breusch Pagan test were used to check for the presence of multicollinearity and heteroskedasticity in models, respectively. The mean VIF was far less than 10, which is the threshold for the presence of multicollinearity. This shows that multicollinearity is not problematic in the model. In addition, the chi-square statistics from the Breusch Pagan test showed statistical significance ($p > 0.05$), indicating the presence of heteroskedasticity in the model (Table 2). This econometric problem was rectified by estimating the standard errors using the robust estimation approach.

4.2.1. Transactional Factors

The coefficient of price shows a significant positive effect ($p > 0.01$) on rice farmers' participation in the direct marketing channel, but does not have a significant effect on the quantity of rice sold through the direct marketing channel. This finding shows that, as price per kg of paddy rice increases, rice farmers are more likely to participate in the direct marketing channel. A positive significant relationship ($p > 0.01$) was observed between access to market information and participation in the direct marketing channel. This result implies that rice farmers who have access to market information have a higher probability of participating in the direct marketing channel compared to those who do not have access to market information. However, market information does not have a significant effect ($p > 0.10$) on the quantity sold to processors (direct marketing channel). Although payment period has a negative effect on direct marketing channel participation, it is not statistically significant ($p > 0.10$); nonetheless, it has a significant negative effect ($p > 0.05$) on the quantity of paddy rice sold to processors. This empirical finding shows that delay in payment of sales tends to discourage farmers from selling more rice paddy to processors compared to middlemen.

4.2.2. Farmer Demographic Characteristics

Farmers' age does not show a significant effect ($p > 0.10$) on participation in the direct marketing channel but shows a significant negative effect ($p > 0.01$) on quantity of paddy rice sold to processors. This result implies that, as farmers' age increases, they decrease the quantity of paddy rice sold to processors. Education, farming experience, and household size do not show significant effects ($p > 0.10$) on farmers' participation in the direct marketing channel and the quantity of paddy rice sold. Off-farm activity does not have a significant effect ($p > 0.10$) on direct marketing participation. However, it is statistically significant ($p > 0.05$) and negatively related to the quantity of paddy sold, indicating that farmers who engage in off-farm activity tend to decrease the quantity of paddy rice sold to processors.

4.2.3. Institutional Factors

Membership of a farmer group does not significantly influence farmers' participation and intensity of participation in the direct marketing channel. Access to credit shows a positive significant effect ($p > 0.10$) on farmers' participation in the direct marketing channel but not on the intensity of participation in the direct marketing channel. This result indicates that farmers who have access to credit are more likely to participate in the direct marketing channel compared to those who do not have access to credit.

Table 2. Double hurdle results regarding the determinants of farmers' participation and intensity of participation in the direct marketing channel.

Variables	Direct Marketing Channel Participation		Intensity of Participation in Direct Marketing Channel (Quantity of Paddy Sold to Processors)	
	Coefficient	SE	Coefficient	SE
Transactional factors				
Log (price)	7.007 ***	2.445	0.398	0.657
Access to market information	1.843 ***	0.328	0.033	0.149
Instant payment	−0.348	0.311	−0.272 **	0.135
Farmer demographic characteristics				
Age	−0.009	0.018	−0.0176 ***	0.007
Education	0.026	0.028	0.011	0.013
Farming experience	0.002	0.019	0.003	0.009
Household size	−0.020	0.033	0.005	0.014
Off-farm activity	−0.278	0.350	−0.321 **	0.128
Farm characteristics and Asset endowment				
Farm size	0.390 ***	0.090	0.066 ***	0.013
Ownership of motorbike	0.161	0.334	0.396 ***	0.133
Ownership of bicycle	−0.639	0.429	0.246	0.154
Ownership of mobile phone	0.465	0.578	−0.866 ***	0.262
Institutional factors				
Membership of farmer group	0.172	0.343	−0.013	0.208
Access to extension services	−0.119	0.363	0.070	0.120
Access to credit	0.616 *	0.374	−0.171	0.290
Constant	−34.273 ***	10.919	2.422	3.045
Diagnostic statistics				
Variance inflation factor	1.34		1.33	
Breusch Pagan test of heteroskedasticity	4.71 **		8.52 ***	

Note: *, **, and *** denote 10%, 5%, and 1% statistical significance levels. Log refers to natural logarithm. SE denotes standard errors. Source: Authors' computations (2021).

4.2.4. Farm Characteristics and Asset Endowment

Farm size shows a significant positive effect ($p > 0.01$) on participation in the direct marketing channel and the quantity of paddy rice sold to processor. This result indicates that as farmers' increase their farm size, they are more likely to participate in the direct marketing channel and intensify their participation. Ownership of transport assets, such as bicycles, does not significantly influence ($p > 0.10$) farmers' participation and intensity of participation in the direct marketing channel. However, ownership of a motorbike shows a significant positive effect ($p > 0.01$) on intensity of participation in the direct marketing channel. Although ownership of a mobile phone shows a positive insignificant effect ($p > 0.10$) on direct marketing participation, it is statistically significant ($p > 0.01$) and negatively associated with the intensity of participation in the direct marketing channel. This result implies ownership of a mobile phone decreases farmers' intensity of participation in the direct marketing channel.

5. Discussion

The empirical results from the double hurdle model show that transaction factors, such as price of paddy rice per 85 kg bag and access to market information, positively influence farmers' participation in the direct marketing channel but not intensity of participation. However, delayed payment discourages farmers from intensifying their participation in the direct marketing channel. An increase in the price of rice output per 85 kg bag motivates farmers to increase their participation in the direct marketing channel. Taking into consideration the associated transportation costs, farmers are more likely to benefit from an increase in the price of rice when sold to processors than when sold to middlemen. Mostly, middlemen offer farmers a lower price when compared to the price paid by processors. The study's findings are consistent with those of existing studies [26,43,45] that found a positive relationship between farm output price and farmers' marketing channel choices (traders and wholesalers). On the contrary, Barrett [8] and Maspaitella, Garnevska [11] argued that price is not the only determinant of farmers' participation in a marketing channel, but non-price factors are equally important in affecting their marketing decisions.

Access to market information is considered an important input in making important production, marketing, and finance decisions in agribusiness [52]. Farmers' access to market information enables them to understand the existing market conditions, such as price, transaction costs, and available buyers. This information assists farmers to make an informed decision regarding the marketing channel that offers the highest margin. Access to market information reduces the risk associated with perception. In the context of this study, processors offer farmers a higher price than middlemen, taking into consideration the associated transaction costs. With this market information, farmers are persuaded that they will receive a higher price when selling to processors, reflected in a higher preference for the direct marketing channel. The study's finding is consistent with those of previous studies [9,46,52] that show access to market information enhanced farmers' market participation in Africa.

Furthermore, the current study indicates that the delayed payment of sales is a disincentive for farmers to intensify their participation in the direct marketing channel. Farmers who sell to processors (milling companies) usually have to wait for a week before they receive payment for their products. This condition deters farmers from trading directly with the processors. Farmers sell their rice output to raise capital for the next production and cater for domestic expenditures, thereby compelling farmers to sell their rice output to middlemen who offer ready cash, even though the price might be lower. Therefore, farmers are highly motivated by the instant payment to sell a greater quantity of paddy rice to middlemen. This result is consistent with the finding of Boger [53], which revealed that farmers generally enjoy prompt payment and any effort by a particular marketing channel to delay payment leads to low patronage by farmers. Boger [53] found that farmers were risk averse and preferred instant payment. Therefore, farmers tend to prefer a marketing channel that assures them of instant payment. In the same study, itinerant buyers offered farmers prompt payment; hence, farmers chose them over other buyers who delayed payment.

As farmers become older, they tend to decrease the quantity of paddy rice sold to processors. As widely acknowledged in the literature, as people become older, their risk aversion increases. Hence, older farmers may attempt to avoid the risk associated with direct marketing participation. The risks may include delayed payment and high transport costs. The empirical evidence is consistent with previous studies [26,41] that show farmers' age affects their choice of marketing channel. The empirical finding further shows that farmers' engagement in off-farm activity is less likely to intensify their participation in the direct marketing channel. Other demographic characteristics, such as education, household size, and farming experience, are not important factors that affect farmers' participation and intensity of participation in the direct marketing channel. This finding is contrary to the extant studies, which have observed that the aforementioned farmer demographic

characteristics influence farmers' marketing channel decision in developing countries, including Ghana [26,42,44,46].

The present study further reveals that farm size has a positive influence on farmers' participation and intensity of participation in the direct marketing channel. The size of the farm plays a crucial role in the production process. It is usually a proxy to the scale of production, which suggests that farmers with a larger farm have higher production and are therefore able to sell directly to processors [9]. The transaction costs incurred by farmers in transporting a larger volume of rice output to processors are usually less than those associated with smaller quantities. This indicates that farmers with large rice farms can easily take advantage of economies of scale and transport their rice output to processors at minimum cost. In addition, farmers with a large farm have higher bargaining power when dealing with processors than those with a smaller farm. Other empirical studies [11,54,55] also established a positive relationship between farm size and farmers' choice of marketing channel. Ownership of a motorbike encourages farmers to intensify their participation in the direct marketing channel. In the study area, we observed long distances between farming communities and the processing sites. Due to these far distances, farmers with motorbikes can transport more bags of paddy rice to processors compared to those who do not have motorbikes. The study's finding supports the empirical evidence observed by Zanello, Srinivasan [40], that suggested that ownership of bicycles increased farmers' probability of participating in distant markets rather than selling to middlemen at farm gates in the Northern region of Ghana.

The study shows that among the three institutional variables included in the double hurdle model, only one—access to credit—shows a significant positive effect on farmers' participation in the direct marketing channel, suggesting that farmers' access to credit increases their probability to trade directly with processors instead of allowing middlemen to assume the marketing function. In rural Northern Ghana, most rice farmers are poor; therefore, their access to credit enables them to invest in productive inputs such as agro-inputs and improved rice seed varieties. This kind of investment helps the farmers to increase their rice output level. It is acknowledged in the economics literature that it is cheaper to transport a large quantity of farm output to the market than a small quantity [56]. In addition, farmers can use some of the loans to pay for the transportation costs associated with the participation in the direct channel. The study's finding agrees with extant empirical studies that suggest that access to credit exerts a positive effect on farmers' participation in markets [26,46].

6. Conclusions and Policy Implications

The study has improved our understanding regarding farmers' participation and intensity of participation in the direct marketing channel in the rice value chain in the Northern region of Ghana. Two main marketing channels, notably direct (processors) and indirect (middlemen), were identified in the study area. Rice farmers expressed a lower preference for the direct marketing channel, suggesting that the farmers allowed middlemen to market their paddy rice for them. The price of paddy price per 85 kg, access to market information, farm size, and access to credit enhanced farmers' participation in the direct marketing channel. Farm size and ownership of a motorbike were positively related to farmers' intensity of participation in the direct marketing channel, whereas delayed payment, age, off-farm activity, and ownership of a mobile phone were negatively correlated with farmers' intensity of participation in direct marketing. Surprisingly, transactional factors, such as price and access to market information, also showed a positive sign, but were not statistically significant.

Based on these key findings, the study proposes the following policy recommendations. First, any price increases, particularly from processors, will stimulate farmers to sell their rice paddy to them. Second, agricultural policy should incorporate the promotion of farmers' access to reliable market information regarding direct markets and prices in peri-urban and urban marketing centers. This could be achieved with the assistance of the

extension officers in the districts and the non-governmental organizations. The Statistics, Research and Information Directorate (SRID) of Ministry of Food and Agriculture (MoFA) in Ghana should provide agricultural market information to farmers. Access to reliable information regarding prices will enable farmers to bargain for a better price with the buyers, including middlemen at the farm gate. In addition, processors in the districts should pay farmers promptly when they purchase paddy rice. Instant payment incentivizes farmers to increase the supply of paddy rice to processors in peri-urban and urban centers. Processors can also travel to rice growing communities to purchase rice from farmers directly. We anticipate that these policy implications could enhance rice farmers' participation in direct marketing, thus helping to enhance farmers' sustainable livelihoods by improving their incomes, and stimulate rural agricultural development in Ghana. This study did not incorporate external determinants, such as existing government policies, into the modeling of farmers' participation in direct marketing; hence, future research can consider this issue.

Author Contributions: Conceptualization, E.A.D., M.I.S. and E.D.; formal analysis, E.D., E.A.D.; Investigation, E.A.D.; methodology, E.A.D. and E.D.; Supervision, E.G. and M.I.S.; writing—original draft, E.A.D.; writing—review & editing, E.G., M.I.S. and E.D. All authors have read and agreed to the published version of the manuscript.

Funding: This research was supported by the New Zealand Government through the Ministry of Foreign and Trade under the New Zealand Commonwealth Scholarship Programme.

Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Human Ethics Committee of Massey University (protocol code 4000018749 and 1 December 2017).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The authors and funders declare no conflict of interest.

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