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Examining the Influence of Commercialisation and Postharvest Losses on the Choice of Marketing Outlet among Poultry Farmers

Richard Kwasi Bannor*
Department of Agricultural Economics, Agribusiness and Extension, University of Energy and Natural Resources, Sunyani- Ghana.
**Corresponding Author Email: richard.bannor@uenr.edu.gh*

Najeeb Ibrahim
Department of Agricultural Economics, Agribusiness and Extension, University of Energy and Natural Resources, Sunyani- Ghana.
Email: ibra.najeeb@gmail.com.gh

Ernest Christlieb Amrago
Department of Agricultural Economics, Agribusiness and Extension, University of Energy and Natural Resources, Sunyani- Ghana.
Email: ernestchristliebamrago@yahoo.com

Abstract

The paper examines the effect of the extent of commercialisation and postharvest losses on the choice of marketing outlets among poultry farmers in the Bono Region of Ghana. The Commercialisation Index (CI) and the bivariate probit regression model were used to examine the extent of commercialisation and the factors influencing marketing outlet choice, respectively. The results revealed that the respective extent of commercialisation for layers and eggs were 0.974 and 1. Demographic, institutional and agribusiness factors such as expertise rate, FBO membership, access to credit, trip cost, postharvest losses, sales value and commercialisation have different influences on marketing outlet choice. From the results, it is recommended that farmers, in a bid for choosing marketing outlets, should consider the contractual agreement as it has the potential to decrease postharvest losses.

Keywords: Poultry; commercialisation; postharvest losses; marketing outlet.

1.0 Introduction

In sub-Saharan Africa (SSA), agriculture has been the cornerstone for many countries. Notable among these countries is Ghana, where the agricultural sector has contributed to the Gross Domestic Product (GDP) by 18.3% (Ministry of Food and Agriculture, 2018). Also, above 70% of the Ghanaian populace rely on agriculture as their primary livelihood source (World Bank, 2018). However, Ghana's agricultural activities are widely inundated with small-scale farmers, with a low adoption rate of agricultural technologies due to their subsistence orientation (Akudugu et al., 2012).

However, the high population growth in Africa - of which Ghana is no different - implies an excellent demand for farmers' marketable surplus to mitigate food insecurity thresholds. This demand, thus, increases the market share of farmers via commercialisation. Although subsistence farming is marked as a problem in developing countries, commercialisation could change subsistence farming's extensive practice to highly market-oriented farming. In particular, commercialisation is recognised as a significant catalyst of economic development for emerging nations (Barrett et al., 2012).

As part of the commercialisation of farming, farm produce is not consumed immediately or in its raw state; however, it undergoes postharvest activities like storage, transport, marketing and processing. The mismanagement of these postharvest activities could translate into postharvest losses which pose grave implications to food security and farmers' welfare (Affognon et al., 2015). For instance, Ansah et al. (2018) revealed that farmers in the Tamale metropolis of Ghana had, on average, lost 9.6% of stored yam within two months. Likewise, 0.75-1.21 percent of cereals had been lost during storage, with 4.65-5.99 percent at the national level and 3.90-4.78 percent on on-farm operations in India (Vishwakarma et al., 2020). Across the value chain of most agricultural products, vast quantities of food are physically lost at the different divisions which can erode commercialisation gains. The Food

and Agriculture Organization (FAO) professed that approximately one-third of the global food produced for human consumption is lost annually. In sub-Saharan Africa (SSA), food lost is about 37% or 120-170 kg per year per capita (Boon & Anuga, 2020). In the poultry context, 5-7 percent of layer eggs are lost at storage (Safaa et al., 2008) and 6-20 percent losses are incurred during transportation (Çatlı et al., 2012). The magnitude of these postharvest losses could be dependent on the types of roads and transport used in transporting the eggs (Kader, 2005); the availability of cooling facilities for long storage (Ortmann & King, 2010); and the type and nature of packaging materials (Komarnicki et al., 2016). Therefore, postharvest losses could influence the choice of marketing outlet (contract buyers, retailers and distant market in the study area) since most farmers may not want to increase their postharvest losses as a result of the afore-listed situations. Given this, it is envisaged that the choice of marketing outlet among farmers could be influenced by the postharvest losses incurred via that outlet.

Notwithstanding the possible effect of commercialisation and postharvest losses on the choice of marketing outlets among poultry farmers, there is currently no study that considered their effect or otherwise simultaneously, particularly, in poultry. However, we found little research on commercialisation and marketing outlets (Oppong-Kyeremeh et al., 2019; Tesfay, 2020). Therefore, we add to the body of knowledge by bridging the lacuna of literature on the same. In this study, we hypothesise that postharvest losses and the extent of commercialisation could influence the choice of marketing outlets among poultry farmers in Ghana.

In the ensuing section, we present our objectives in twofold: first, to describe the extent of commercialisation among poultry farmers in the Dormaa Traditional Area and, second, to examine the effect of postharvest losses and commercialisation on the choice of marketing outlet among poultry farmers.

The rest of the paper is structured as follows: after the introduction, a literature review is presented, followed by materials and methods, results and discussion, and finally, the conclusions are detailed.

2.0 Literature Review

2.1 Commercialisation

Agricultural commercialisation can be explained as the proportion of agricultural production that is marketed. Gebreselassie and Ludi (2007) also defined agricultural commercialisation as the transition from subsistence-oriented farming to market-oriented farming. From a broader perspective, it encapsulates production, marketing, distribution, customer support, sales, among other relevant functions resulting in the sale of a product. Pingali and Rosegrant (1995) classified farming systems as subsistence, semi-commercial and commercial based on market orientation. Subsistence farming implies that farmers solely produce for household consumption. On semi-commercial farming, farmers participate in the market and at the same time, ensure food security for the household. Commercial-based farmers are entirely focused on maximising profit. Commercialisation also expands and deepens farmers' market transactions concerning inputs and outputs. The transaction of farmers would, at first, influence the product market and, consequently, farmers' participation in other markets would also augment in significance since the proportion of marketed output becomes colossal. However, farmers' integration into the factor and product market is not straightforward and simple due to the endemic drawbacks of market failures and missing markets in emergent countries. Farmers' integration into the market necessitates establishing new links and strengthening the relationship that exists between farmers on the one hand and microfinance firms, traders and other farmers ready to rent land and supply labour, on the other hand.

2.2 Marketing outlet

FAO (2003) describes a marketing outlet as a set of independent but interdependent entities participating in making a commodity available to customers. Precisely, market outlets are alternative routes of product flow. Farmers are faced with the choice of alternative routes; however, a rational decision is made to select the outlet that offers the optimal impact (Abera et al., 2016). The marketing outlet option is often considered as one of the most dynamic and challenging decisions faced by farmers. A marketing outlet is incredibly convenient when the product does not have the financial power to accrue enough profits. In effect, the farmers' proceeds are affected by the market outlet selected (Tsourgiannis et al., 2008). The outlet choice role is to help meet producers' and consumers' needs. Also, market outlets perform different roles to ensure that production moves at a cost that will enable farmers to achieve economies of scale.

Additionally, marketing outlets have a role to ensure that farmers are provided with accurate market information to reduce the chances of information asymmetry (Abebe et al., 2020). Globally, numerous studies have been carried out on the choice of marketing outlets, revealing socioeconomic and institutional factors to influence the choice of marketing outlets among poultry farmers. For instance, Indrawan et al. (2018) found that price, level of consumer trust and safety controlled the market channel choice. Nonetheless, there is a paucity of research on marketing outlet choice among poultry farmers worldwide and specifically in Ghana. This, then, necessitates the study on the same.

2.3 Postharvest loss of eggs

Postharvest loss is one of the significant problems in the supply chain of poultry eggs in Ghana. Postharvest losses result from direct physical losses and quality losses that minimise products' economic value (Kuma & Kalita, 2017). In extreme cases, these losses can amount

to 80% of total output (Fox, 2013). Reducing postharvest losses is recognised as an essential component of food security. Losses are particularly high for underdeveloped countries (about 50%) and most of them are attributed to inefficient technology and low expertise in the handling of produce and lack of logistical support (Adarkwa, 2011). Since losses occur at all stages of the market chain, long market outlets amount to high losses as compared to short ones. Although farmers commercialise poultry eggs through different market outlets, few to no research of postharvest studies have been conducted on poultry in the world and Ghana, precisely, but postharvest studies have largely been in crops' space (Abass et al., 2014; Ambler et al., 2018).

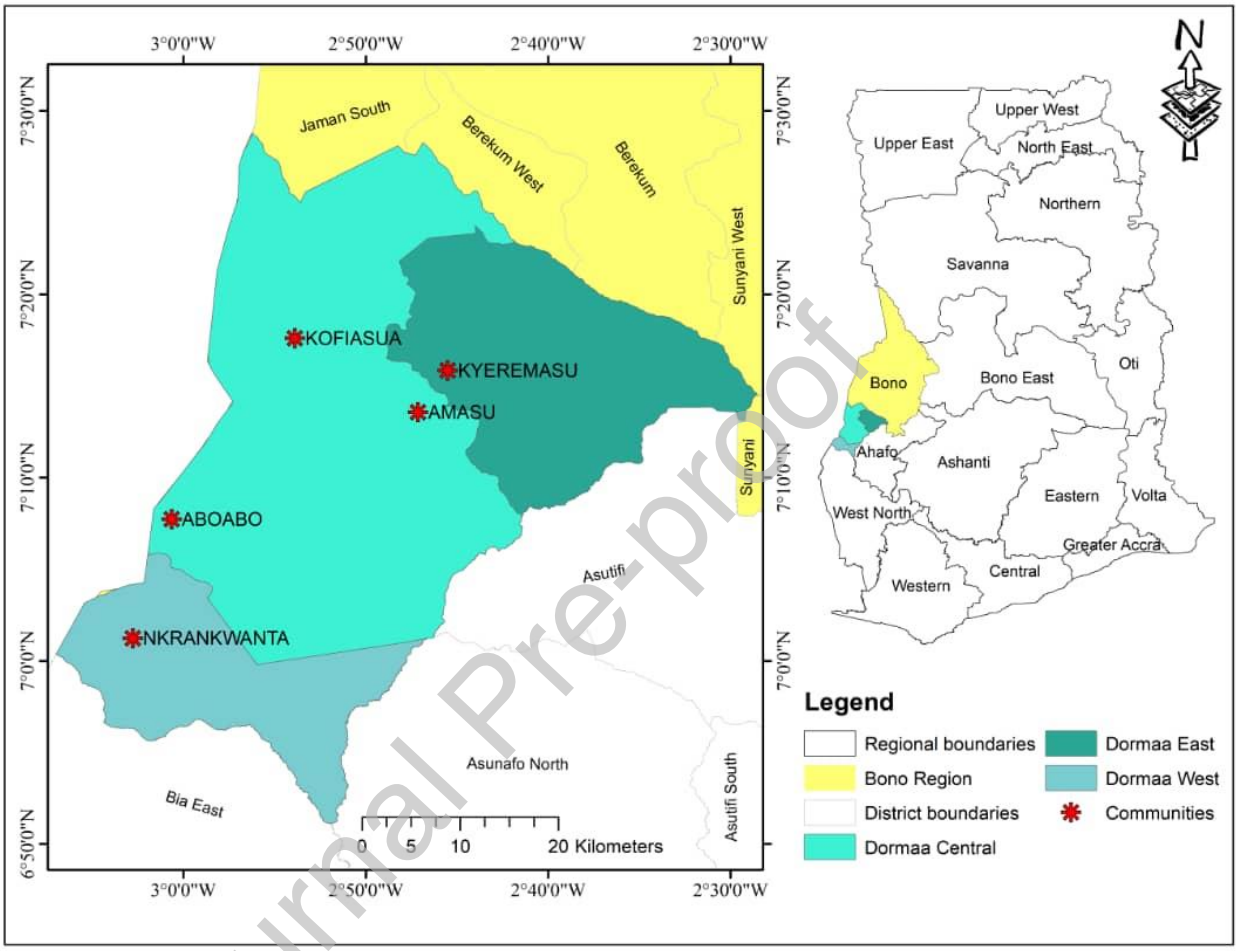
3.0 Materials and Methods

3.1 Study area

The Bono Region of Ghana was selected for the study because it has a leading role in poultry (layers and broilers) production relative to Ghana's 16 administrative regions (Bannor et al., 2020). The Dormaa Traditional Area (Dormaa Central Municipal, Dormaa West and Dormaa East districts) was considered for the study area. Primarily, the area is agrarian and known as the hub for the commercialisation of poultry. About 56% of the economically active populace are employed in the agricultural sector, wherein 15% have inundated the poultry sector, 19%, the service sector, with the commerce and industry sector engaging 9.5 and 15.5 percent, respectively (Adei & Asante, 2012). The study area is located in the western part of the region with annual mean rainfall between 125mm and 175mm (Ghana Statistical Service, 2010). The study has double regimes of rainfall. Thus, May-June's first regime commences whilst the second begins from September-October (Ghana Statistical Service, 2010). The

favourable climatic condition has, therefore, engendered the widespread of commercial poultry in the area of study. Further information on the study area is presented in Figure 1.

Figure 1: Map of the study area



Source: ***Authors' construct, 2021.***

3.2 Sampling and data

The multistage sampling procedure was adopted in this study. This procedure was preferred because the target population (poultry farmers) were dispersed geographically. In the first stage, the Bono Region was purposively selected based on it being the predominant commercial poultry producer (Bannor et al., 2020). In the second stage, despite the numerous districts/municipalities in the region, three districts/municipalities were purposively selected from the region, given the details in the study area (refer to 3.1 [study area] for the

information). In the third stage, given the number of 600 poultry farmers' sampling frame, a random sampling was done to select the farmers to be interviewed.

From the Dormaa Poultry Farmers' Association (DPFA), at the time of the study, 600 farmers had registered with the association. On this account, following the Yamane (1967) sample size determination approach, $n = \frac{N}{1+N(e^2)}$ where *n* connotes the sample size, *N* connotes the population of poultry farmers in the study area, *e* connotes the margin of error (at 10%) and the estimated sample size is 86. Based on this, 34 additional farmers (representing 120 farmers) were interviewed to increase the accuracy of the analysis. However, due to missing data, 104 datasets (representing approximately 87% of the data) were used in the final analysis.

3.3 Method of data analysis

The study adopted the Commercialisation Index (CI) to determine the actual commercialisation level of the farmers relative to either eggs or layers. Following Oppong-Kyeremeh et al. (2019), the CI is given as the ratio of the gross value of the total value of layers or eggs sold by a farmer to the total value of eggs or layers produced. It is expressed in percentage as follows:

$$CI_{layers} = \left[\frac{Gross\ Value\ of\ Layers\ Sold_{hhiyearj}}{Gross\ Value\ of\ Layers\ Produced_{\ hhiyearj}}\right] * 100 \quad (1)$$

$$CI_{Eggs} = \left[\frac{Gross\ Value\ of\ Eggs\ Sold}{Gross\ Value\ of\ Eggs\ Produced}\right] * 100 \quad (2)$$

The index captures the extent to which a farmer's production is market-oriented. The value ranges from 0 to 100. A zero value indicates that farmers practise subsistence production whereas a value closer to 100 indicates the high extent of commercialisation. The benefit of

this procedure is that commercialisation is treated as a continuum that vetoes the distinction between "market-oriented" and "non-market-oriented" households. However, a significant drawback of the CI is that it presumes the commercialisation index for farmers who have nearly sold their products as highly commercialised regardless of how little it is compared to others. For example, consider a farmer who produced, say, 1000 crates of eggs and sold 980 of them. The farmer is assumed to have a high commercialisation index to a farmer who produced 20,000 eggs but sold 10,000.

Further, a bivariate probit regression model was employed to study the factors influencing the joint outcome of the retail marketing outlet choice and contract arrangements with a marketing outlet. In this study, we argue that the farmers' decision process is simultaneous since they are confronted with a set of alternatives that maximises their utility rather than a stream of independent choices (Torres et al., 2017). In effect, the decision on the choice of retail marketing outlet and contract arrangement is determined endogenously. Retail marketing outlet decision leads to the choice for contract arrangement. Thus, both unobservable and observable factors influencing farmers' choice for retail marketing outlets also influence the contract arrangement choice. The bivariate probit is suitable for redressing endogeneity instances between both regressands (retail marketing choice and contract arrangement). The bivariate probit regression model can be modelled as follows:

$$Y1 = \begin{cases} 1, if\ Y1^* > 0 \\ 0,\ if\ Y1^* \leq 0 \end{cases} \quad (3)$$

$$Y2 = \begin{cases} 1, if\ Y2^* > 0 \\ 0, if\ Y2^* \leq 0 \end{cases} \quad (4)$$

with

$$\begin{cases} y1^*, X1\beta1 + \varepsilon1 \\ y2^*, X2\beta2 + \varepsilon2 \end{cases} \quad (5)$$

and

$$\binom{\varepsilon 1}{\varepsilon 2} \backslash X \sim \mu\binom{0}{0}, \binom{1\rho}{\rho 1} \quad (6)$$

where, $Y1^*$ and $Y2^*$ = Latent variables.

With Y1=1, the farmer selects a retail marketing outlet in the model; with Y1=0, the farmer does not select a retail marketing outlet; and with Y2=1, the farmer employs the retail marketing outlet to decide on a contract arrangement. $\beta 1$ and $\beta 2$ represent the coefficients of the independent variables. X1 and X2 are the independent variables used in the model. $\varepsilon 1$ and $\varepsilon 2$ are the stochastic errors with a normal distribution. ρ signifies the likelihood ratio (LR) test function. The probability density function (PDF) of the bivariate normal distribution is specified below:

$$P(x_1, x_2) = \frac{1}{2\pi\sigma_1\sigma_2\sqrt{1-\rho^2}} exp\left[{}^{z}/_{1-\rho^2}\right] \quad (7)$$

where

$$z = \frac{(x_1-\mu_1)^2}{\sigma_1^2} - \frac{2\rho(x_1-\mu_1)(x_2-\mu_2)}{\sigma_1\sigma_2} + \frac{(x_2-\mu_2)^2}{\sigma_2^2} \quad (8)$$

where μ_1 and μ_2= Means of the two variables, σ_1 and σ_2 =Standard deviations for both variables, where

$$\rho = \text{corr}(x_1, x_2) = \frac{\text{cov}(x_1, x_2)}{\sigma_1\sigma_2} \quad (9)$$

where corr = Correlation coefficient and cov = Covariance between the two variables. However, if the corr = 0, the joint PDF becomes the two independent normal PDFs' product. In general, zero correlation does not imply independence but zero correlation implies independence for the normally distributed variables. Thus the decision rule for the choice of bivariate probit to individual probit estimation is based on the correlation between the two

decisions. For example, in this study, the correlation is 0.018 (refer to Table 5 for details), suggesting that both contract arrangement and retail marketing outlet choice decisions are related hence the choice of bivariate probit over binary probit.

Table 1. Description of variables used for the analysis

Variable	Description	Measurement	1st Hypothesis	2nd Hypothesis	Supporting References
Dependent Variable					
Retail marketing choice	Retail marketing outlet choice	Dummy, 1=Yes 0=No			
Contract	Contract arrangement with marketing outlet	Dummy, 1=Yes 0=No			
Independent Variables					
Demographic factors					
Educational level	Years spent in school	Number	+	+	Bannor & Sharma (2017)
Expertise rate	Expertise on grades and standards	Interval scale, from 1=very low to 5= very high	+	-	Bannor & Sharma (2017)
Institutional factors					
FBO membership	Farmer is a member of Poultry Farmers' Association	Dummy, 1=Yes 0=No	+	+	Oppong-Kyeremeh et al. (2019); Onyeneke et al. (2020)
Access to credit	Farmer has access to credit	Dummy, 1=Yes 0=No	+	-	Adabe et al. (2019)
Postharvest losses	Quantity of egg losses per week	Number of eggs	+	+	Rafoneke et al. (2020)
Trip cost	Cost per trip to the market	Amount in Ghana Cedis	-	+	Onyeneke et al. (2020)
Road	Quality of the road to the nearest market	1=Good 0=Otherwise		+	Dlamini-Mazibuko et al. (2019)

Agribusiness factors

Postharvest losses	Percentage of egg losses per week	Percentage	+	+	Rafoneke et al. (2020)
Commercialisation	Value of sales/Value of eggs produced *100	Percentage	+	-	Park & Lohr (2006)

Source*: Authors' compilation based on field data and literature review, 2019. The first hypothesis is for the retail marketing outlet choice as a dependent variable and the second hypothesis is for contract arrangement as a dependent variable.*

NB: Retail outlet and contract agreement were the focus of this study because they were highly used by the population target vis-à-vis distant market.

Table 1 shows the variables employed in the bivariate probit regression model. The researchers hypothesised different variables under three main subheadings: demographics, institutional and agribusiness factors. Demographic features were based on educational level and the rate of expertise of farmers. However, the institutional characteristics are FBO membership (Farmer-based Organisation), access to credit, road quality and trip cost. Agribusiness variables were grounded on postharvest losses and commercialisation.

The dependent variables were the retail marketing choice and contract arrangement. These two marketing outlets were used because they are the predominant outlets preferred and used by the farmers in disposing of a large percentage of their products. The rest were the explanatory variables employed as the determinants influencing the dependent variables. Under the first hypothesis in Table 1, educational level, expertise rate, FBO membership, access to credit, postharvest losses, total sales value, commercialisation and road were hypothesised to influence the retail marketing choice positively. In contrast, a trip cost was hypothesised to influence the decision on retail marketing choice negatively. Under the second hypothesis in Table 1, expertise rate, access to credit and commercialisation were hypothesised to negatively influence contract choice, except educational level, FBO membership, postharvest losses, trip cost and road. It is worth noting that, all the variables and the expected sign deployed in the model were obtained from literature as shown in the supporting reference column of Table 1.

4.0 Results and Discussion

Table 2. Summary statistics of variables

Variables	Mean	Std. Dev.	Min	Max
Retail marketing choice	0.55	0.49	0	1
Contract	0.38	0.50	0	1
Distant market	0.08	0.27	0	1
Educational level	2.69	0.75	1	4
Expertise rate	1.55	0.75	1	5
FBO membership	0.61	0.49	0	1
Access to credit	0.28	0.452	0	1
Postharvest losses	3.54	1.80	1	7
Trip cost	14.93	10.10	2	50
Commercialisation	95.74	3.92	80	99.91
Road	0.31	0.46	0	1

Source: ***Authors' own, 2019.***

The results from Table 2 show the summary statistics of variables. The mean for retail marketing choice, contract and distant markets were 0.55, 0.38 and 0.08, respectively. The results mean that, approximately 55%, 38% and 8% mostly used the retail, contract and distant marketing outlet, respectively. Contract, in this study, is an agreement between a farmer and a buyer regarding the production and supply of eggs and/or layers (at the point of lay or spent layers). The specific terms of contracting vary among farmers; however, mostly the contract is either verbal or written. With regards to eggs, usually, retailers (sometimes a single firm performs the function of wholesaling and retailing) prefinance egg producers to produce several crates at agreed terms and conditions based on payment and purchases within a period. This practice is very known among the small to medium scale farmers. In this arrangement, funds are made available to the farmers either before production or when the

birds are 16 to 20 weeks old to supply eggs to the contractor. In detail, in most egg-contract-farming agreements in poultry production, the price of the product is agreed and grounded on the prevailing prices before the birds start laying. Optionally, the farmers may supply eggs to contractors on credit basis. In all contract arrangements, contractors come for the eggs at the farm gate and transport them, especially to Ghana's capital town (Accra), mostly in well-packaged boxes (made up of 14 crates per box).

On the educational level, it was approximately three. This implies that farmers had a secondary/vocational level of education. Using a five-point interval scale (refer to Table 1 for more details), farmers were asked to indicate their expertise rate. Averagely, the expertise rate was approximately two. This suggests that the expertise rate of farmers was low: perhaps, they barely engage in capacity-building trainings. More so, the respective mean for FBO membership and access to credit were 0.61 and 0.28, respectively. This indicates that farmers have poor access to credit which could reduce production capacity. Concerning postharvest losses, the mean loss was about four, signifying that, on average, four egg crates are lost in a week. At length, an egg crate contains 30 eggs (maximum) revealing a loss of 120 eggs/week. Monetarily, the average crate of eggs costs GH¢ 15.00 (US$ 3.00), hence, GH¢ 60.00 (US$ 10.00) loss/week. However, the average trip cost was GH¢ 15.00 (US$ 3.00). This could delay products' marketing because the closeness of farms to marketing outlets could facilitate a premium price for the products (Bannor et al., 2020). The mean for total sales value, commercialisation and road were, respectively, GH¢ 2,118,595.00 (US$ 359,083.89), 95.74, and 0.31.

Table 3 shows the value of sales per marketing outlet. It should be emphasised that, these three marketing outlets are not the only ones used by the farmers in the study area neither do

farmers sell via only one outlet (mutually exclusive); however, from the interviews, these are the major marketing outlet choices among the farmers. The results revealed that the gross value of layers sold to contract buyers is valued at GH¢ 1,023,737.00 (US$ 173,515.00). This value denotes ~ 46.5% of the value of layers sold by farmers. The result is not surprising since contract buyers have predominated the Dormaa Traditional Area and are actively involved in the purchase of spent layers. To explain, the layers bought are - more often than not - conveyed to the neighbouring country (Côte d'Ivoire) to be processed into dressed frozen chicken. The gross value of layer sales for retailers was estimated at GH¢1,031,780.00 (US$ 174,877.97), signifying 46.83% of the total gross sales. These retailers, being cognizant of their competitors (contract buyers), have challenged them to maintain a mutual relationship with the farmers. Having this comparative advantage, farmers seldom breach contract terms and siphon the spent layers to the retailers. The least marketing outlet was the distant market with total layer sales of GH¢ 147,820.00 (US$ 25,054.24), representing about 7% of the total gross sales.

Table 3. Value of sales per marketing outlet

Marketing Outlets	Gross Value of Layer Sales (GHS)	Percentage of Total Gross Sales
Contract buyers	1,023,737	46.46
Retailers	1,031,780	46.83
Distant market	147,820	6.71
Total	2,203,337	100.000

Source: ***Authors' own, 2019. NB: US$ 1=*** *GH¢* ***5.9***

Table 4 presents the distribution of the extent of commercialisation. From the table, the gross value of sales for layers was worth GH¢ 655,983.00 (US$ 111,183.56). This value represents ~ 5% of the total gross sales of layers vended by farmers. The result is no different from the

typical farming practice since the layers are not readily sold until the production cycle (2 years) is ended; hence, the diminutive percentage (5%) of gross sales. On the commercialisation index, the results indicate that layers are highly commercialised. The average commercialisation index for both farms' value of 0.999 or ~100% is indicative that poultry farmers mainly participate in the market. The average commercialisation index for eggs was one (1). This reveals that the farmers' involvement in egg production is almost entirely commercialised. The plausible reason for the almost-perfect commercialisation of eggs is that the demand for eggs in Ghana is more than the supply (Global Agricultural Information Network, 2013). This presents an agripreneurial opportunity for the youth, as egg production and marketing is a demand-driven agricultural enterprise.

Table 4. Distribution of the extent of commercialisation

Poultry Products	**Gross Value of Layer Sales (GHS)**	**Percentage of Total Gross Sales**	**Average Commercialisation Index**
Layers	655,983	4.637	0.974
Eggs	13,486,779	95.362	1
Total	1,414,22 7	100	
Average commercialisation index for all farms			0.999

Source: ***Authors' own, 2019.*** **NB: US$ 1=** GH₵ **5.9** ***NB: All respondents produced both eggs and layers.***

Results from Table SM1 (Refer to Appendix) show the share of layers and egg output sold by each farmer. From the results (Table SM1), it is instructive to note that eggs are produced with the sole intention of selling. Thus, the ready market for eggs would spur farmers to produce eggs perpetually. A similar effect is observed in layers. The results indicate that poultry products (layers and eggs) produced by farmers in the study area are highly market-oriented.

Table 5. Factors influencing the choice of retail marketing and contract arrangement as marketing outlets

	Retail Marketing Choice				Contract Arrangement Choice			
Variable	**Coefficient**	**Std. Error**	**P-Value**	**Marginal Effect**	**Coefficient**	**Std. Error**	**P-Value**	**Marginal Effect**
Demographic factors								
Educational level	0.121	0.186	0.512	0.041	0.305	0.362	0.400	0.027
Expertise rate	0.467	0.201	**0.020	0.158	-0.118	0.345	0.732	-0.022
Institutional factors								
FBO membership	-0.809	0.281	***0.004	-0.287	1.378	0.606	**0.023	0.156
Access to credit	0.470	0.301	0.118	0.159	0.803	0.497	*0.104	0.082
Road					-0.925	1.776	0.233	-0.091
Trip cost	0.005	0.013	0.702	0.002	-0.047	0.023	**0.043	-0.005
Agribusiness factors								
Postharvest losses	0.054	0.078	0.487	0.018	0.325	0.175	**0.063	0.035
Commercialisation	-0.080	0.040	*0.046	-0.028	0.033	0.066	0.619	0.002
Constant	8.226	3.934	**0.037		5.895	6.620	0.373	
Prob>chi2=0.0275								
Wald chi2(15) =27.16								
Log likelihood=-78.907								
Wald test of rho=0: chi2(1) =0.018								

Source: ***Authors' own, 2019. Significance:10%=*, 5%=**, 1%=***. NB: US$ 1= GH¢ 5.9***

Table 5 presents the bivariate probit regression results of the retail marketing outlet choice and contract arrangement choice factors. The bivariate probit reveals a significant rho of 0.018, suggesting that both contract arrangement and retail marketing outlet choice decisions are related. As a result, the bivariate model's choice is a well-fitted model against the two probit models' estimation independently.

From Table 5, the results show that poultry farmers with sufficient expertise on grades and standards are more likely to choose the retail marketing outlet. The probability of choosing a retail marketing outlet increases by ~ 16% ($p < 0.05$). The result is consistent with Bannor and Sharma (2017) who revealed a direct relationship between the choice of marketing outlet and expertise on grades and standards. In contrast, there was a negative influence of FBO membership on the choice of retail marketing outlet. To elaborate, farmers who are members of a farmer-based organisation (FBO) are about 29% less likely to select retail marketing outlets. The finding of the inverse relationship between FBO membership and retail marketing outlet choice is at variance with Oppong-Kyeremeh et al. (2019) and Onyeneke et al. (2020). Perhaps, an explanation for this relationship is that FBO membership encourages contracting than the choice of retail outlets. This is because contract avenues (like marketers, Foani services of Ivory Coast, among others) provide easy access to poultry inputs such as improved breeds of Day-old Chicks (DOCs), feed and vaccines for optimal impact. The negative and significant relationship between commercialisation and retail marketing outlet choice reveals that, as a farmer becomes highly commercialised, s/he is about 2.8% less likely to choose a retail marketing outlet. The result suggests that the more the farmer becomes commercialised, the more s/he becomes abreast with the opportunities, challenges and benefits that come with the different marketing outlets. Mostly, in the study area, the highly commercialised farmers have large production outputs, thus, would want to dispose of their produce as immediately as possible due to the high perishability of eggs. As such, they

will be less willing to use retail outlets which cannot take huge quantity of their products at a time. Also, in a typical agricultural marketing channel like eggs, the longer the marketing channel, the lower the margins accruing to the farmer. As such, any farmer who is highly commercialised is more likely to choose a marketing outlet that will increase his/her profit margins.

The estimates under contract arrangement choice revealed that a farmer who is a member of an FBO is likely to select a contract arrangement as a marketing outlet. The probability of choosing a contract arrangement increases by about 16%. The result corroborates the findings of Onyeneke et al. (2020) and Oppong-Kyeremeh et al. (2019). Similarly, access to credit had a positive influence on contract arrangement choice. This finding is inconsistent with Dubbert (2019) but aligns with Adabe et al. (2019) who revealed that credit access has a positive relationship with the contractual arrangement. The trip cost coefficient was negative and significantly different from zero ($p < 0.05$) on contract arrangement choice. Mostly, the contract arrangements are done with traders in the capital of Ghana, Accra, or other southern regions. One of the crucial motivations for contracting is the ease with which farmers can dispose of the produce to the offtaker (contractor) at the farm gate, in addition to the avoidance of increases in marketing cost via transportation costs. So, it is very surprising that the trip per cost decreases the choice of contract marketing outlet. The result contradicts Kiprop et al. (2020) who found a positive relationship between transportation cost and the choice of contract marketing outlet (processors of indigenous chicken) among farmers in Kenya.

Further, the findings indicate that postharvest losses were positive and statistically significant ($p < 0.05$) on the contract arrangement choice. Generally, contractors pick the eggs at the farm gate with their cars, ergo, farmers are less likely to incur postharvest losses; as such, any farmer who wants a reduction is more likely to choose a contract arrangement. Agreeably,

Adebola (2020) revealed that farmers engaged in contractual schemes often have lower magnitudes of postharvest losses.

5.0 Conclusions and Recommendations

The paper examined the influence of the extent of commercialisation and postharvest losses on marketing outlet choices in the Bono Region of Ghana. The existing marketing outlets were contract buyers, retailers and the distant market. The results revealed that, the extent of commercialisation negatively influenced the choice of retail marketing but had no influence on the choice of contract arrangement. In contrast, increases in postharvest losses increased the probability of choosing contract marketing outlet. The empirical results further revealed a negative relationship between retail marketing outlet choice and FBO membership. However, expertise rate had a positive influence on the choice of retail marketing outlets. On contract arrangement, the factors that had positive influences are FBO membership, postharvest losses and sales value. In contrast, access to credit and trip cost influenced the choice of contract arrangement negatively.

In terms of recommendation, the finding that expertise rate positively influences the choice of retail marketing outlets is suggestive that, retailers in need of producers for the supply of eggs should contact farmers who have sufficient knowledge on grades and standards as they are most likely to be responsive to such a course. Additionally, based on the positive effect of postharvest losses on contract arrangement, it is recommended that farmers who (on numerous occasions) have experienced postharvest losses on on-farm and during transportation of eggs (all of which the farmer bears the brunt of the cost) should redirect their attention to contract arrangement for optimal impact.

Further, the positive implication of postharvest losses on contract arrangement as a marketing outlet suggests that the Ministry of Food and Agriculture (MoFA) through the recent flagship

programme (Rearing for Food and Jobs) should consider contract arrangement as an efficient marketing outlet in the design of policy for poultry farmers.

In the context of future studies, it is recommended that future studies could quantify the impact of commercialisation and postharvest losses on poultry farmers' welfare.

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Appendix

Table SM1: Share of layers and eggs output sold by a farm

Poultry Products	Average Production Value per Farm	Average Sale Value per Farm	Share Sold (%)
Layers	6475	6308	0.974
Eggs	129681	129681	1.000

Source: ***Authors' own, 2019.***