

DETERMINANTS OF MARKET PARTICIPATION AND FAILURE OF TABLE EGG PRODUCTION BY SMALL SCALE POULTRY FARMERS IN ANAMBRA STATE, NIGERIA

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ABSTRACT

The study on the determinants of market participation and failure of Table egg production by small scale poultry farmers in Anambra State, Nigeria adopted a descriptive survey approach. A multi-stage sampling technique was adopted to collect data from 370 sample representatives. The objectives were to identify the factors influencing the decision to participate in table egg marketing, ascertain the determinants of market participation, and observe the determinants of market failure by small scale table egg farmers, while controlling for the study bias through introduction of inverse of mill ratio (IMR); the study estimated the market shares controlled by the small scale Table egg farmers. Heckman two stage regression analysis was adopted to achieve the study objectives. The summary statistics of the study representatives revealed that the mean age, level of education and annual income of the small scale Table egg farmers were 43 years, 18 years and 2,554.58 USD respectively. The study revealed that 38.1% of the farmers do not have the capacity to participate in the market, thus, the factors influencing the decision to participate in table egg marketing by the farmers were sex (2.99)***, marital status (3.37)***, level of education (2.67)***, and cooperative membership (1.92)* and all were statistically significant. Equally, the determinants of market participation or the variables affecting the volume of egg offered for sales were labour, chicks, feeds, and drugs, depreciation of capital asset, household size, farm size, cooperative membership, and annual income. Furthermore, the study revealed that the market failure index is 1.35, while its determinants were farm size (3.60)***, and annual income (2.22)** respectively. Thus, the importance of these study cannot be overemphasized since the study on agricultural marketing has become of interest to policymakers in the sector.

Keywords: Market participation, market failure, small scale, egg, poultry farmers, decision.

INTRODUCTION

Agriculture has played a great role in Nigeria's independence since the colonial era (Yahaya and Luka, 2012). The sector remains strategic to the development of the economy of low income countries (SFB, 2015; Osmani and Hossain, 2015) like Nigeria where small scale farming is a

dominant livelihood economic activity. Corroboratively, Obianefo *et al.* (2020) opined that the sector is dominated by smallholder farmers operating between 0.5ha to 3ha, and experiencing a limited access to improved farm inputs, access to extension service which in turn affects their agricultural productivities. This dominance of the sector by smallholders or small scale farmers most times causes stagnation. Thus, self-sufficiency in food production and supply is continuously threatened by the increasing influx of small scale farmers and low productivity in the sector (World Bank, 2015), and these lowers their (small scale farmers) ability to participate in the market particularly in the poultry industry, while those that participates is sometimes inequitable (Osmani and Hossain, 2015).

The need for an extensive budget in agriculture cannot be over-emphasized. This sector is important not only to rural development by employment to the rural population, but also nationally by its contribution to GDP makes it an attractive niche for investment in developing countries (UBOS, 2013; Akidi, 2016). This could be due to the fact that Nigeria has a competitive merit in agriculture as compared to other sectors. The agricultural sector has created many opportunities in the country such as bee-keeping, crop production, animal production, agroforestry, poultry production, among others. Several author(s) have reported about the importance of agriculture to the development of rural economy; in an earlier research, Egbetokun *et al.* (2017) reported that the sector contributed 30 percent of the country's (Nigeria) gross domestic products (GDP), but in a later study by Obianefo *et al.* (2019), the sector's GDP contribution was 29.15 percent. Similarly, Egbetokun *et al.* (2017) asserts that the sector employed about 70 percent of the active labour force in Nigeria and 40 percent globally, while Obianefo *et al.* (2019) equally reported 60 percent employment of the active labour force. The decline in labour engagement could be attributed to the revitalization of other industrial sectors like mine and steel, increase in road construction by recent government administration among others which could be causing labour migration. Some few years back, Ebojei *et al.* (2012) noted that agricultural sector contributed 70 percent of non-oil export and 80 percent of foods needed in Nigeria.

Poultry is a sub-sector in the livestock industry constituting a major component of the agricultural economy. It has emerged as the most dynamic and fastest growing segment in the animal husbandry sub-sector and it represents an important source of high quality proteins, minerals and vitamins to balance the human diet (Heinke *et al.*, 2015). The sector provides animal protein to the populace as well as employment for a considerable percentage of the population (Yusuf *et al.*, 2016). According to FAO Report (2010), poultry comes fourth among sources of animal proteins for human consumption in Nigeria and contributes about 27% of the national meat production. Also, the popularity of poultry production can be explained by the fact that poultry has many advantages over other livestock (Heinke *et al.*, 2015). The poultry birds are good converters of feed into useable protein in meat and eggs. Their production costs per unit remain relatively low and the return on investment is high as a result of efficient allocation of resource, but if otherwise, the market is said to have failed. Furthermore, poultry meat is very tender and acceptability to consumers is high, regardless of their religious beliefs and the eggs which are one of the major products of poultry production are more affordable for the common person than other sources of animal protein (Ojo, 2003; Aboki *et al.*, 2013).

Egg production involves the use of good layer birds for the purpose of table egg production (Ogunlade and Adebayo, 2007), and it is a major sources of animal protein in human diet (Mukhtar, 2012). The York and albumen contains 17.5 percent and 19 percent protein by weight respectively (Esingmer, 1991; Banerjee, 1992; Mukhtar, 2012). Burika *et al.* (2018) noted that the demand for egg products in conditioned by physiological need. Therefore, the demand for egg often depends on socioeconomic factors and eating habits of the people. Consumption of table egg is increasingly justifying the need to develop egg markets that will boost its production and supply. FAO (1990) purported that eggs ranked second to cow milk in terms of nutritive value and the most economically produced animal protein that supplies human body with digestible and complete protein, amino acid, vitamins and other essential substances. Despite these positive aspects, egg supply has not being able to keep pace with local demand (Rothschild, 2002; Heinke *et al.*, 2015). The World Health Organization (WHO, 2010), opined that the demand for eggs has significantly increased Africa due to the high population growth. An estimate made by the United States Agency for International Development (USAID), reported that the demand for eggs is likely to continue over the next few years. Therefore, the consumption of eggs will increase by 200 percent between 2010 and 2020 for at least some countries in Sub-Saharan Africa (Obi, 2003; USDA, 2013; Heinke *et al.*, 2015).

Despite these high demand for egg products, the producers which are mostly small scale farmers in Nigeria are not market oriented which is one the internal factors that causes market failure in Table eggs marketing and it is a threats to market participation (Kassa and Yosefe, 2017). Nigeria. A short fall in egg production in Nigeria has been as a result of grossly high demand for poultry egg and a dwindling supply of the product (Ojo *et al.*, 2012; Hassan *et al.*, 2016). Before participating in marketing of table egg, it is important to acquaint the readers with the concept of market before digressing to its participation. Harford and Cunningham (2011) defined market as an important place where producers and consumers coordinates their actions. Recently, market is beyond a physical structure but can also be a virtual medium especially in this time of digital technology advancement to include social media, clouding, among others.

IFAD (200); Osmani and Hossain (2015) noted that most time, small scale farmers are often passive participants and are obliged to sell low not minding the high cost of inputs, with little choice of where they conduct transactions, with whom and at what price? Though, asymmetric market structure, high transaction cost, lack of skills, remoteness of rural areas, poorly maintained road, inadequate transport, and storage facilities, difficulties in accessing reliable market information on products and price limits the farmer's extent of participation in a competitive market dominated by few powerful purchasers (World Bank, 2007; Osmani and Hossain, 2015). Increasing agricultural output will mean improving productivity which cannot be achieved without market that would effectively bind the increasing specialized activities of farmers widely dispersed into an integrated national economy (Egbetokun *et al.*, 2017). Thus, market is a prerequisite for enhancing agriculture-based economic growth and increasing rural income. These increase in rural income cannot be achieved if the farmers are not market oriented (Adeoti *et al.*, 2014). Abbot (1993); Egbetokun *et al.* (2017) noted that the importance of market and marketing cannot be

overemphasized as it helps to fulfil the important role of stimulating and extending development, this will help the farmers to move from semi-subsistence to growing produce regularly for sales.

Having justified the need for small scale egg producers to participate in a competitive market in order to grow the rural economy; Sebatta *et al.* (2014) defined market participation as the proportion of farmer's output and or produce offered to the market for sales by an individual farmer or marketer. It is important to note that, farmer's demographic profile play a very crucial role in either promoting or impeding their participation in agricultural market. Determinants of market participation have in recent time is of interest to policymakers as most scholars like Egbetokun *et al.* (2017) identified age, sex, marital status, household size, farming experience, level of education and cooperative membership as the determinants of market participation by smallholders farmers where the study reported an average age, level education and farming experience as 50.9, 11.5, and 17.7 respectively.

This study corroborate the earlier work of Egbetokun and Omonona (2012) which asserts that the determinant of market participation by smallholder maize farmers were age, marital status, availability of labour, farming experience, and farm size. They also purported that the probability to participate was influenced by sex, household size, distance to the market, and price of commodity. Also, a study by Ele *et al.* (2013) reported that the determinants of market participation were volume of output, farming experience, access to extension services, farm size, household size, and membership of farmers' cooperative. While the factors influencing the volume of sales were age, household size, and food security. Internationally, Osmani and Hossain (2015) reported an average age, level of education, and farming experience as 44.8, 5.4, and 27.5 respectively. While their determinants of market participation by smallholder's farmers in Bangladesh were farm size, availability of labour, and income, which after the analysis reported their coefficient of multiple determinant as 0.6550.

Apart from undertaking a study on the determinants of market participation by small scale egg farmers, the researcher finds it pertinent to also investigate on the factors that causes market failure. Though not much abound in the area of the determinants of market failure by small scale egg producers, but the researcher took a twist to identify the variables responsible for market failure in the area of study. Market failure occurs when the market outcome does not maximize benefit of the economic activities involved till the products is utilized by the final consumers. It is possible to classify the causative factors to market failure as externalities and internalities. The external factors include the presence of a competitor, government policy, taxes, market due among others. While on the other hand, the internal factors include age, skills, level of education, among other socioeconomic variables which the study hopes to ascertain. Samuelson and Nurdhans (1992) opined that market failure is an imperfection in the price system that prevent efficient allocation of scarce resource, this suggest that price should reflect the true cost and value of products. Finally, table egg marketing requires a critical evaluation of the existing egg marketing system and identifying the determinants of farmers' participation in the egg market and if possible take a critical look at what factors that lead to market failures (Awol, 2010). Thus, the study was designed to investigate the following research objectives which are to;

- i. identify the factors influencing the decision to participate in table egg marketing,
- ii. ascertain the determinants of market participation, and
- iii. observe the determinants of market failure by small scale table egg producers.

METHODOLOGY

Anambra state is located in the south-eastern part of Nigeria, and comprises of 21 Local Government Areas which include Aguata, Awka North, Awka South, Anambra East, Anambra West, Anaocha, Ayamelum, Dunukofia, Ekwusigo, Idemili North, Idemili South, Ihiala, Njikoka, Nnewi North, Nnewi South, Ogbaru, Onitsha North, Onitsha South, Orumba North, Orumba South and Oyi. The state is sub-divided into four (Onitsha, Aguata, Awka and Anambra) agricultural zones to aid planning and rural development. The state is bounded with Delta State to the West, Imo State and Rivers State to the South, Enugu State to the East, and Kogi State to the North. The indigenous ethnic groups in Anambra state comprised of 98% Igbo and 2% Igala mainly living in the North-western part of the state. Anambra State is situated between Latitudes 5°32' and 6°45' N and Longitude 6°43' and 7°22' E. The State has an estimated land area of 4,865sqkm² with a population of 4,177,828 people as at the last census (NPC, 2006). The State equally have an annual temperature and rainfall of 25.9°C and 138mm respectively (available at: www.climate-data.org).

A descriptive survey design was adopted, a well-structured questionnaire was used to elicit information from the representatives of the study population. This population include the **4698** (2232 male and 2466 female) small scale poultry farmers (SSPF) registered with the control center of the Anambra State Ministry of Agriculture.

Table 1: Distribution of SSPF according to their Agricultural Zones in Anambra State

Zone	LGAs	Male	Female	Total
Aguata	Aguata	252	193	445
	Anaocha	133	164	297
	Nnewi North	216	238	454
	Nnewi South	52	36	88
	Orumba North	60	66	126
	Orumba South	82	68	150
	Total		795	765
Anambra	Anambra East	27	16	43
	Anambra West	4	0	4
	Ayamelum	4	4	8
	Oyi	30	22	52
Total		65	42	107
Awka	Awka North	7	4	11
	Awka South	164	136	300
	Njikoka	145	178	323

	Dunikofia	106	256	362
	Ekwusigo	79	76	155
Total		501	650	1151
Onitsha	Idemili North	77	76	153
	Idemii South	67	76	143
	Ihiala	172	235	407
	Ogbaru	64	35	99
	Onitsha North	403	494	897
	Onitsha South	88	93	181
Total		871	1009	1880
Grand Total		2232	2466	4698

Source: Anambra State Ministry of Agriculture. 2019.

Sampling Size and Sampling Procedure

A multi-stage sampling technique was adopted to collect adequate data for the study, in the first stage, the list of registered small scale poultry farmers was supplied by the Anambra State Ministry of Agriculture as reflected in Table 1 and was subjected to Taro Yamane (1967) in Otabor and Obahiagbon (2016) sample size calculation as defined by:

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

$$n = \frac{4698}{1 + 4698(0.05)^2} = 368.62$$

Where: n is sample size, N is the study population, and e is the error margin. Thus, the sample size was approximated to 370 for the study representatives. Later on; R. Kumaison in Obianefo *et al.* (2020) stratum allocation formula was adopted to proportionately allocate sample strata to the four agricultural zones in the State as defined by;

$$nth = \frac{ni}{N} * n$$

Where: nth is the sample strata, ni is the sample population of each zone, N and n remains as earlier defined.

Table 2: Stratum representation of Small scale Table Egg producers in Anambra State

Agricultural Zone	Population	Strata
Aguata	1560	$\frac{1560}{4698} * 370 = 123$
Anambra	107	$\frac{107}{4698} * 370 = 8$
Awka	1151	$\frac{1151}{4698} * 370 = 91$
Onitsha	1880	$\frac{1880}{4698} * 370 = 148$
Total	4698	370

Source: Researcher's computation, 2020.

At the second stage, 2 Local Government Areas (LGAs) (Aguata zone; Aguata and Nnewi North, Anambra zone; Anambra East and Oyi, Awka zone; Dunukofia and Awka South, and Onitsha; Ihiala and Onitsha North) were purposively selected based on the LGAs with the dominant small SSPF in the study area. Furthermore, the number of SSPF represented by the strata was randomly sampled from not less than 2 communities and 3 villages in each LGA.

Analytical Framework

Ideally, the ordinary least square (OLS) model should be applied if all farmers have the ability to participate in egg marketing, but in reality not all farmers will be able at the same time. Some farmers may not be able to participate in favour of another, while others may be excluded due to some conditions. If the OLS regression is estimated excluding those farmers not able from the analysis, a sample selectivity bias is introduced into the model. Such a problem is overcome by following a two-stage procedure as suggested by Heckman (1979) or Tobit procedures. These procedures were discussed broadly in Tobin (1958), Greene (1981, 1993), Maddala, (1988), and Gujarati (1995) and applied in several instances such as Adejobi *et al* (2006).

Both Heckit and Tobit procedures also addressed this concern. The Heckit procedure is a consistent but not an efficient way to control for selectivity bias, while Tobit procedure is efficient and consistent. Technically, if Heckit specification was run using maximum likelihood estimation (MLE) procedure without lambda, the results would be identical to Tobit-MLE selection models with iterations constrained to one.

The results obtainable from the Tobit procedure are the MLE, as well as the marginal effects (MEs). The MEs indicate the magnitude of participation resulting from a unit change in the explanatory variables. The MEs account for the probability of the farmer's decision to participate in egg marketing, they have the same interpretation as the OLS coefficients. It is sometimes important to compare the MEs and OLS coefficients, though the OLS are distorted.

Data providing for the decision to participate tends to be censored at the lower limit of zero. That is, the farmers may be willing to participate at a particular market price, while another may not be willing at all. If only probability of decision to participate is to be analyzed, Probit or Logit models would be adequate techniques for addressing probability questions. Moreover, it is interesting to know factors that influence their decision to participate in egg marketing, at the same time, there is a need for a model that is a hybrid between the Logit or Probit and the OLS. The appropriate tool for such is the Tobit model that uses MLE (Tobin, 1958, Gujarati, 1995). A Tobit model is there to answer the following questions:

1. What factors influence the decision to participate in egg marketing? This question is answered by Logit and Probit.
2. What factors determine the level or magnitude of participation? This question is not answered by Logit and Probit models, but by OLS.

Using this type of econometric model (Tobit) to determine the factors influencing the farmer's decision to participate in egg marketing, while controlling for other factors is expressed as:

$$Y^* = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \mu_i$$

$$Y = 0 \text{ if } y \leq 0, \\ y = Y^* \text{ if } y > 0.$$

Y^* = index of farmer's decision to participate in egg marketing, $\beta_1 - \beta_n$ = estimated parameter or coefficient, X_i = the explanatory variables, and μ_i = error term and is normally distributed with zero mean and constant variance.

The dependent variable y equals 0 if the latent variable y^* is below a certain threshold, usually 0. If the values of the latent variable are positive, the dependent variable is equal to the latent variable.

$$y^* = \beta_0 + x\beta_1 + \mu, \mu / x \text{ Normal } (0, \sigma^2) \quad (1)$$

$$y^* = \max(0, y^*) \quad (2)$$

The latent variable y^* satisfies the classical linear model assumptions; in particular, it has a normal, homoscedastic distribution with a linear conditional mean.

Equation (2) implies that the observed variable y , equals y^* when $y^* \geq 0$, but $y = 0$ when $y^* < 0$. Because y^* is normally distributed, y has a continuous distribution over strictly positive values. In particular, the density of y given x is the same as the density of y^* given x for positive values. Further,

$$P(y = 0 / x) = P(y^* < 0 / x) = P(\mu < -x\beta) \quad (3)$$

$$= P(\mu/\sigma < -x\beta/\sigma) = \Phi(-x\beta/\sigma) = 1 - \Phi(x\beta/\sigma) \quad (4)$$

Because μ/σ has a standard normal distribution and is independent of x ; we then absorb the intercept into x for notational simplicity. Therefore, if (x_i, y_i) is a random draw from the population, the density of y_i given x_i is

$$(2\pi\sigma^2)^{-1/2} \exp[-(y-x_i\beta)^2/(2\sigma^2)] = (1/\sigma)\Phi[(y-x_i\beta)/\sigma], y > 0 \quad (5)$$

$$P(y_i = 0/x_i) = 1 - \Phi(x_i\beta/\sigma) \quad (6)$$

Where Φ is the standard normal density function. From (5) and (6), the log-likelihood function for each observation i is then obtained by;

$$l_i(\beta, \sigma) = 1(y_i = 0) \log[1 - \Phi(x_i\beta/\sigma)] + 1(y_i > 0) \log\{(1/\sigma)\Phi[(y_i - x_i\beta)/\sigma]\} \quad (7)$$

The log-likelihood for a random sample size n is obtained by summation of equation (7) across all i . The maximum likelihood estimates of β and σ is obtained by maximizing the log-likelihood which is easily executed in STATA. Tobit regression will be employed to estimate the factors influencing the farmer's decision to participate using all the data information that will be acquired from the field.

The second stage which is to analyze for the determinant of market participation by the farmers, will use Ordinary Least Square (OLS) model. Though, if the data is contaminated with an outlier and influential observation, a robust regression will be used to correct the standard error through the generated inverse of mill ratio (IMR). OLS and Robust Regression for the volume of egg the farmers are ready to offer to the market. This second stage involved OLS using observation in the regression model and or robust regression when the data have the presence of outlier or influential variable(s). An additional regressor equation called inverse of mill ratio to correct selection bias is stated as;

$$\delta = \frac{\delta(h(x_i, \alpha^*))}{\delta(x_i, \alpha^*)}$$

δ = normal probability density

Thus, the second stage equation is defined by;

$$E = \left(\frac{y_i}{x_i} = 1 \right) = \frac{f(x_i\beta) + \lambda\delta(h(x_i, \alpha^*))}{\delta(x_i, \alpha^*)}$$

Where:

E = expected predictor, Y_i = continuous (volume offered for sales), x_i = explanatory variable that affect the amount payable, δ and β as defined above.

The linear regression to be used to analyze the volume offered for sale is defined by;

$$Y = \beta_0 + \beta_i X_i + \delta$$

Where:

X_1 = Labour, X_2 = Chicks, X_3 = Feed, X_4 = Drugs, X_5 = Logistics, X_6 = Dep. on capital, X_7 = Sex, X_8 = Marital status, X_9 = Age, X_{10} = level of Education, X_{11} = Household size, X_{12} = Farm size, X_{13} = Cooperative membership, X_{14} = Annual income from other source (USD), X_{15} = Farm experience, δ = inverse of mill ratio.

RESULTS AND DISCUSSION

Socioeconomic Profile of the Small Scale Table Egg Farmer

Table 3 reflects the summary statistics of the socioeconomic characteristics of the small scale table egg farmers in Anambra State, Nigeria. The study reveals that the average age, level of education, household size, farm size, annual income, and farming experience is approximately 43 years, 18 years, 6 people, 986 birds, ₦919,648.10 (2,554.58 USD), and 8 years respectively. This findings implies that the farmers are well experienced and adequately educated to handle the technicalities and innovations needed to maximize output in the study area. The findings on mean age is in line with the report of Osmani and Hossain (2015) which implies that the farmers are still in their active farm age. The findings on level of education is consistent with Egbetokun *et al.* (2017) since the farmers are fairly educated and can adopt and manage changes that will give rice to increased participation. The farmers in this study are less experienced compared to what was reported by Egbetokun *et al.* (2017); Osmani and Hossain (2015). The researcher equally estimated the participatory index of the small scale Table egg farmers to understand their ability or probability to participate in Table egg marketing in the study area, finding shows that the small scale farmers contributed a total of 814310 eggs (27144 crates) to the State and National food basket. On the average, each small scale farmer contributed about 2201 eggs (73 crates) to the state food basket in one year production. Furthermore, the participatory index was 1.0, with only 38.1% of the farmers lacking the adequate ability to participate in the local market.

Table 3: Summary Statistics of the Small scale Table Egg Farmers in Anambra State

Socioeconomic Variable	Mean	Std. Dev.	Min.	Max
Sex	1.370	0.484	1	2
Marital status	2.316	1.262	1	5
Cooperative association	0.541	0.499	0	1
Age	43.489	9.167	27	60
Level of education	17.538	5.500	6	21
Household size	6.435	3.876	1	16
Farm size	986.487	517.793	500	2000
Annual income	2,554.58 USD	1558.95	110.56	4,333.33
Farming experience	8.330	3.173	5	15

Market Participation Index

Total Table Egg produced	814310
Mean Table Egg produced	2200.84
Table Egg Index (per farmer production/mean)	1.0
Percentage of farmers without the capacity to participate	141 (38.1%)

Source: Field Survey Data, 2019.

Factors Influencing the Decision to Participate in Table Egg Marketing by Small Scale Farmers

Table 4 reflects the factors influencing the decision to participate in table egg marketing. The Log likelihood ratio is a diagnostic tool used to check the data adequacy for the analysis, the Log likelihood ratio of the dataset is -226.745. The more negative the Log likelihood ratio, the better the model. The Likelihood ratio (LR) of 38.31*** was significant at probability value less than 0.05 which signifies that the model was fit to investigate the factors influencing the decision to participate in table egg marketing. Thus, the study reveals that the factors were sex, marital status, level of education, and cooperative membership.

The marginal effect of sex (0.173) was positive and significant at 1% level of probability, this implies that an increase in the number of male small scale Table egg farmer by one person will increase the probability of market participation by 0.173 units. This could be as a result of physicality requirement of agricultural enterprise. This findings is consistent with Egbetokun and Omonona (2012); Egbetokun *et al.* (2017). The marginal effect of marital status (0.0106) was positive and significant at 1% level of probability, this implies that an increase in the number of married small scale farmers by one person will increase the probability of market participation by 0.106 units. Marriage also aid the supply of family labour which to a greater extent reduce the amount expended in providing labour to the farm. This is in agreement with Egbetokun *et al.* (2017). The marginal effect of level of education was positive and significant at 5% level of probability, this implies that a unit increase in years spent in formal learning by the small scale Table egg farmers will increase the probability of market participation by 0.0162 units in the study area. This finding was consistent with the report of Egbetokun *et al.* (2017). Also, the marginal effect of cooperative membership (0.169) was positive and significant at 10% level of probability, this implies that a unit increase in the number of small scale Table egg farmers that belongs to cooperative society will increase the probability of market participation by 0.169 units. This is because being a member of cooperative society will help the farmers access many benefits like principles of bulk purchase, cooperative marketing of products, among others. This finding is equally in line with the report of Ele *et al.* (2013); Egbetokun *et al.* (2017).

Table 4: Factors Influencing the Decision to Participate in Table Egg Marketing by Small Scale Farmers

Market Participation	Coefficient	Z-ratio	Marginal effect	Z-ratio
Constant	-1.187	-1.64		
Sex	0.497	2.99***	0.173	3.10
Marital status	0.303	3.37***	0.106	3.54
Age	-0.013	-1.08	-0.0047	-1.09
Education	0.0466	2.67**	0.0162	2.75
Household size	-0.012	-0.47	-0.0043	-0.47
Farm size	0.0001	0.60	0.00045	0.60
Cooperative	0.487	1.92*	0.169	1.95
Annual income	-1.660	-0.58	-5.770	-0.58
Farm experience	-0.0291	-1.06	-0.0102	-1.07
Diagnostic tool				
Log likelihood ratio		-226.745***		
Likelihood ratio (LR)		38.31***		
Prob. > Chi ²		0.00		
Number of Obs.		370		

Source: Field Survey Data, 2019. () Significant at 10%, (**) Significant at 5%, (***) Significant at 1%.*

Determinants of market participation by Small Scale Table Egg Farmers in Anambra State, Nigeria

Table 5 reflects the determinants of market participation by small scale Table egg farmers in the study area, the coefficient of multiple determinant (R^2) was 0.9610 implying that the explanatory variables explained 96.10% of the market shares (dependent variable), while the remaining 3.9% unexplained was as a result of error beyond the control of the farmers. The F-stat. value of 542.99*** was significant at 1% level of probability implying that the general model was normally distributed, while the adjusted R^2 value of 0.9592 shows that the model was 95.92% fit. The coefficient of inverse of mill ratio (68.571) though not significant at any probability level but helped to control for selection bias and the presence of outlier. Therefore, improving the quality of the estimation output.

The coefficient of labour (315.52) was positive and significant at 1% level of probability, this implies that a unit increase in labour supply to the farm will increase the farmer's market shares or egg supply to the market by 315.52 units. An increase in labour supply is expected to increase output to a certain point before the law of diminishing return set in. This was in agreement with Egbetokun and Omonona (2012). The coefficient of Chicks (day old chicks) (4.607) was positive and significant at 1% level of probability, this implies that a unit increase in the number of chicks stocked by the farmers will increase the farmer's market shares by 4.607 units. This finding is consistent with the *a priori* expectation. The coefficient of feed (0.124) was positive and significant at 1% level of probability, this implies that a unit increase in the quantity of feed supplied to the

farm will increase the farmer's market shares by 0.124 units. There is a great need for this feeds to be supplied in the right proportion with adequate nutrient content and formulations. This was in agreement with. The coefficient of drugs (0.0355) was negative and significant at 1% level of probability, this implies that a unit increase in the amount spent on drugs will reduce the farmer's market shares by 0.0355 units. This result was expected since under dosage of vaccination is worse than not administering the vaccine at all. The coefficient of capital depreciation (0.1718) was negative and significant at 1% level of probability, this implies that a unit increase in the amount of capital investment needed by small scale Table egg production will cause a 0.1718 units reduction in the volume of egg offered to the market by the farmers. The major challenges of small scale farmers has remained capital. Thus this finding is in agreement with the *a priori* expectation. The coefficient of household size (24.079) was negative and significant at 1% level of probability, this implies that a unit increase in the number of household dependent will reduce the volume of Table egg the small scale farmers offered to the market by 24.079 units. Despite that large household size supplied cheap labour to the farm, it equally amounts to consumption of greater proportion of the farmers produce. This finding though not in line with the *a priori* expectation but was consistent with the study of Ele *et al.* (2013); Egbetokun and Omonona (2012). The coefficient of farm size (0.083) was negative and significant at 10% level of probability, this implies that a unit increase in the number of pen constructed will reduce the quantity of Table egg offered to the market by 0.083 units. This could be as a result of introduction of more pen or poultry house by small scale farmers without proper management training/skills on how to handle a bigger establishments. This was also in agreement with Egbetokun and Omonona (2012); Ele *et al.* (2013); Osmani and Hossain (2015). Furthermore, the coefficient of cooperative membership (250.856) was negative and significant at 10% level of probability, this implies that a unit increase in the number of farmers that are not members of cooperative association will reduce the volume of Table egg offered for sale by the small scale farmers in the area. This result was expected and it is consistent with the *a priori* expectation. Finally, the coefficient of annual income (0.000231) was positive and significant at 1% level of probability, this implies that a unit increase the amount of farmer's annual income both from off-farm and on-farm will increase the volume of Table egg offered for sale by 0.000231 units. This result is in agreement with Osmani and Hossain (2015). Thus, the researchers summarized that the factors influencing the volume of Table egg offered to the market by the farmers in Anambra State were labour, chicks, feed, drugs, depreciation on capital, household size, farm size, cooperative, and annual income.

Table 5: Determinants of market participation by Small Scale Table Egg Farmers in Anambra State, Nigeria

Market Share Egg famers	Coefficient	Std. Dev.	t-ratio
Constant	765.5995	673.121	1.14
Labour	315.52	9.181	34.37***
Chicks	4.607	0.2227	20.68***
Feed	0.124	0.0342	3.62***
Drugs	-0.0355	0.0049	-7.21***
Logistics	0.008	0.0025	0.04
Dep. on capital	-0.1718	0.0129	-13.23***
Sex	89.134	117.812	0.76

Marital status	-45.989	71.908	-0.64
Age	-2.414	3.940	-0.61
Education	-8.795	12.223	-0.72
Household size	-24.079	4.784	-5.03***
Farm size	0.083	0.478	1.74*
Cooperative	-250.856	131.662	-1.91*
Annual income	0.000231	0.000064	3.57***
Farm experience	5.679	10.062	-0.14
IMR	-68.571	478.606	-0.14
Diagnostic tool			
R ²		0.9610	
Adj. R ²		0.9592	
F-stat.		542.99	
Number of Obs.		370	

Source: Field Survey Data, 2019. (*) Significant at 10%, () Significant at 5%, (***) Significant at 1%.**

Index of marketing Failure by Small Scale Table Egg Farmers

Some parameters were put under check to estimate the market failure index of the small scale farmers in the area. Samuelson and Nurdhans (1992) asserted that market failure occurs when the cost of market participation exceeds the gain of market participation. Thus, Table 6 reflects the market failure index as 1.35 showing that Table egg production in Anambra State by small scale farmers did not fail. The market realized 2,161.12 USD from the sales of Table egg, while a whopping sum of 1,600.46 USD was spent to relate the Table eggs to the market. The enterprise realized a gross profit of 560.66 USD. This result shows that Table egg farming is a profitable enterprise in the study area. Thus, the market was said to have failed for those farmers who fall below 0.5 market failure index, and these group of failed farmers represented 59.19% of the total sample size.

Table 6: Market Failure Index

Items	Quantity	Unit price (USD)	Amount (USD)
Revenue			
Egg sales	880.34	2.45	2,161.12
Variable cost			
Labour (Man-day)	5.2	25.54	132.82
Chicks	407.8	0.81	331.00
Feed	102.93	9.22	949.00
Drugs/supplements	1	87.88	87.88
Logistics	1	99.76	99.76
Total variable cost			1,600.46
Gross margin/year			560.66
Market failure (sale/cost)		1.35	
Percentage of failed market (%)		59.19	

Source: Field Survey Data, 2019. * N360/USD

Determinant of Market Failure by Small Scale Table Egg Farmers

Table 7 reflects the determinants of market failure by small scale Table Egg farmers in the study area. Log likelihood ratio is a diagnostic tool used to check the data adequacy for the analysis, the Log likelihood ratio of the dataset is -238.5579. The more negative the Log likelihood ratio, the better the model. The Likelihood ratio (LR) of 23.24 was significant at probability value less than 0.05 which signifies that the model was fit to estimate the determinants of market failure in the study area. Thus, the study reveals that the determinants of market failure by Table egg farmers were farm size, and annual income.

The marginal effect of farm size (0.000284) was positive and significant at 1% level of probability, this implies that a unit increase in the farm size will increase the probability of market failure by 0.000284 units. These could be as a result that the farmer may lose control of the farm as it increase without proper training for the expansion. Equally, the marginal effect of annual income (2.130) was negative and significant at 5% level of probability, this implies that a unit increase the farmer's annual income will reduce the probability of market failure by 2.130 units.

Table 7: Determinant of Market Failure by Small Scale Table Egg Farmers

Market Failure	Coeff.	Z-ratio	Marginal effect	Z-ratio
Constant	-0.2276	-0.35		
Sex	0.280	1.25	0.104	1.91
Marital status	-0.959	-0.40	-0.035	-1.26
Age	-0.0046	-0.40	-0.00169	-0.40
Education	-0.0156	-0.94	-0.0057	-0.95
Household size	-0.1993	-0.81	-0.0073	-0.81
Farm size	0.0077	3.60***	0.000284	3.80
Cooperative	0.0319	0.14	0.0118	0.14
Annual income	-5.790	-2.22**	-2.130	-2.27
Farm experience	0.0208	0.78	0.00769	0.78
Diagnostic tool				
Log likelihood ratio		-238.5579		
Likelihood ratio (LR)		23.24		
Prob. > Chi ²		0.0057		
Number of Obs.		370		

Source: Field Survey Data, 2019. () Significant at 10%, (**) Significant at 5%, (***) Significant at 1%.*

CONCLUSIONS

The study has analyzed the determinants of market participation and market failure of table egg production by small scale poultry farmers in Anambra State, Nigeria. After operationalization of the models, the study revealed that the average age, level of education, and farming experience were approximately 43 years, 18 years, and 8 years respectively which was consistent with the revealed literatures. Also, the participation index was 1.0 while only 38.1% of the farmers showed no ability to participate in egg marketing. The study inquisitively determined those variables

responsible to influencing farmer's decision to participate in egg marketing, and interestingly identified sex, marital status, level of education, and cooperative membership as the significant variables. While, labour, chicks, feed, drugs, capital depreciation, household size, cooperative membership, and annual income were found to be the determinants of market participation. The benefit cost ratio equally regarded as marketing efficiency was 1.35 implying that the entire egg marketing did not fail, despite identifying only farm size, and annual income as the determinants of market failure in the study area. This study have been able to establish the determinants of market participation and market failure, thus, have been able to contribute to the existing literature. The researcher(s) therefore recommend that:

1. Since labour supply was identified to significant affect market failure, adoption of modern technology should be advised to reduce cost of labour.
2. Small scale farmers should be advised to form a formidable group that will help to improve their marketing skills through capacity building and group networking.

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APPENDIX

Factors influencing decision to participate in egg marketing

Probit regression	Number of obs	=	370
	LR chi2(9)	=	38.31
	Prob > chi2	=	0.0000
Log likelihood = -226.74508	Pseudo R2	=	0.0779

Market_participation	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
Sex	.4965864	.1661129	2.99	0.003	.1710111	.8221617
Marital_status	.3034777	.0900473	3.37	0.001	.1269882	.4799672
Age	-.0134595	.0124383	-1.08	0.279	-.0378382	.0109191
Edu	.0466314	.0174677	2.67	0.008	.0123953	.0808676
Household_size	-.0122114	.0262408	-0.47	0.642	-.0636425	.0392197
Farm_size	.0001292	.0002143	0.60	0.547	-.0002909	.0005493
Coops	.4868965	.2540121	1.92	0.055	-.010958	.984751
Income	-1.66e-07	2.86e-07	-0.58	0.562	-7.27e-07	3.95e-07
Experience	-.0291886	.0274105	-1.06	0.287	-.0829121	.0245349
_cons	-1.186553	.7231437	-1.64	0.101	-2.603889	.2307827

Marginal effect of factors influencing decision to participate

	Delta-method				
	dy/dx	Std. Err.	z	P> z	[95% Conf. Interval]
Sex	.1728812	.0557407	3.10	0.002	.0636315 .282131
Marital_status	.1056525	.0298836	3.54	0.000	.0470817 .1642233
Age	-.0046858	.0043098	-1.09	0.277	-.0131329 .0037613
Edu	.0162342	.005895	2.75	0.006	.0046803 .0277882
Household_size	-.0042513	.009128	-0.47	0.641	-.0221419 .0136394
Farm_size	.000045	.0000745	0.60	0.546	-.0001011 .000191
Coops	.1695078	.0869539	1.95	0.051	-.0009187 .3399343
Income	-5.77e-08	9.95e-08	-0.58	0.561	-2.53e-07 1.37e-07
Experience	-.0101617	.009504	-1.07	0.285	-.0287891 .0084658

Determinant of market participation

Source	SS	df	MS	Number of obs	=	370
Model	488483138	16	30530196.1	F(16, 353)	=	542.99
Residual	19847902.7	353	56226.3534	Prob > F	=	0.0000
				R-squared	=	0.9610
				Adj R-squared	=	0.9592
Total	508331040	369	1377590.9	Root MSE	=	237.12

Egg	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
Labour	315.5203	9.180936	34.37	0.000	297.4641 333.5765
Chicks	4.607303	.2227711	20.68	0.000	4.169178 5.045428
Feed	.1240021	.0342287	3.62	0.000	.0566843 .19132
Drugs	-.0355135	.004924	-7.21	0.000	-.0451975 -.0258294
Logistics	.000088	.0025103	0.04	0.972	-.0048489 .005025
Capital_Depreciation	-.1718271	.0129854	-13.23	0.000	-.1973656 -.1462885
Sex	89.13388	117.8116	0.76	0.450	-142.5669 320.8347
Marital_status	-45.9899	71.90788	-0.64	0.523	-187.4116 95.43184
Age	-2.414047	3.940367	-0.61	0.541	-10.16359 5.335501
Edu	-8.79499	12.22266	-0.72	0.472	-32.83338 15.2434
Household_size	-24.07999	4.78472	-5.03	0.000	-33.49013 -14.66984
Farm_size	.0832319	.047763	1.74	0.082	-.010704 .1771677
Coops	-250.8556	131.6615	-1.91	0.058	-509.7952 8.084078
Income	.000231	.0000647	3.57	0.000	.0001037 .0003582
Experience	5.679932	10.06163	0.56	0.573	-14.10834 25.4682
IMR	-68.57056	478.6062	-0.14	0.886	-1009.849 872.7076
_cons	765.5995	673.1205	1.14	0.256	-558.2313 2089.43

Determinants of Market Failure

Probit regression	Number of obs	=	370
	LR chi2(9)	=	23.24
	Prob > chi2	=	0.0057
Log likelihood = -238.5579	Pseudo R2	=	0.0465

Market_Failure	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
Sex	.2807311	.1495117	1.88	0.060	-.0123064 .5737686
Marital_status	-.0959928	.0768703	-1.25	0.212	-.2466558 .0546702
Age	-.0046007	.011406	-0.40	0.687	-.026956 .0177546
Edu	-.0155707	.0164949	-0.94	0.345	-.0479002 .0167588
Household_size	-.0199348	.0246973	-0.81	0.420	-.0683406 .0284709
Farm_size	.0007707	.0002138	3.60	0.000	.0003516 .0011897
Coops	.0319032	.229993	0.14	0.890	-.4188748 .4826812
Income	-5.79e-07	2.60e-07	-2.22	0.026	-1.09e-06 -6.85e-08
Experience	.020856	.0267868	0.78	0.436	-.0316451 .0733572
_cons	-.2276056	.6563452	-0.35	0.729	-1.514018 1.058807

Marginal effect of market failure

	Delta-method					[95% Conf. Interval]	
	dy/dx	Std. Err.	z	P> z			
Sex	.1035489	.0542597	1.91	0.056	-.0027981	.209896	
Marital_status	-.0354074	.028171	-1.26	0.209	-.0906215	.0198068	
Age	-.001697	.0042048	-0.40	0.687	-.0099382	.0065442	
Edu	-.0057433	.0060638	-0.95	0.344	-.0176282	.0061415	
Household_size	-.007353	.0090862	-0.81	0.418	-.0251617	.0104556	
Farm_size	.0002843	.0000748	3.80	0.000	.0001377	.0004308	
Coops	.0117676	.0848273	0.14	0.890	-.1544907	.178026	
Income	-2.13e-07	9.42e-08	-2.27	0.023	-3.98e-07	-2.89e-08	
Experience	.0076928	.0098584	0.78	0.435	-.0116292	.0270149	