*Corresponding author : Freddy Ruzhani, Department of Agricultural Economics and Development, Manicaland State University of Applied Sciences, Stair Guthrie Road, P Bag 7001, Fernhill, Mutare, Zimbabwe
E-mail: freddyruzhani@gmail.com

cogent
economics
& finance

DEVELOPMENT ECONOMICS | RESEARCH ARTICLE

Factors affecting the profitability of smallholder broiler production in Mutare district, Manicaland Province, Zimbabwe: A quantile regression approach

Precious T Phiri[1], Freddy Ruzhani[1]*, Faustino Madzokere[1] and Pamela Madududu[2]

Abstract: Small-scale broiler farming has become one of the fastest-growing sub-sectors in Zimbabwe. However, the profitability levels of these small ventures have been questioned due to the rising production costs owing to the highly inflationary macroeconomic environment. Using a sample of 110 small-scale broiler producers selected using the exponential non-discriminative snowballing sampling method, the paper analysed the factors affecting these farmers' profitability. Gross margin analysis and quantile regression were used to analyse the data. We found that, although feed costs constituted 56.8% of the total variable costs, small-scale broiler production is a profitable venture in the area with a mean gross margin of US$ 65.25 per batch of 100 broilers and a return per dollar variable costs invested of $ 1.15. Training on broiler production, farming experience, level of education, access to extension services, access to credit and household size significantly determine the profitability of the broiler enterprise at various quantiles, with only training affecting profitability at all three quantiles. All these factors are essential

ABOUT THE AUTHORS

Phiri Precious Tapiwa is a graduate student in the Department of Agricultural Economics and Development at Manicaland State University of Applied Sciences.
Ruzhani Freddy is a Researcher and Lecturer in the Department of Agricultural Economics and Development at Manicaland State University of Applied Sciences (MSUAS). He holds a Master of Science Agricultural Economics degree from the University of Fort Hare, South Africa, and a Post Graduate Diploma in Project Management from Project Management Zimbabwe (PMZ) among other qualifications. He currently has three publications in peer-reviewed journals. His research interests include smallholder farmer development, rural development, livelihood improvement, perception dynamics, food security, climate change and welfare economics.

PUBLIC INTEREST STATEMENT

Broiler production has become one of the common activities in most peri-urban areas amid a general lack of formal employment opportunities in Zimbabwe. However, the profitability levels of these small enterprises have been questioned due to the rising production costs as a result of the highly inflationary macroeconomic environment currently prevailing. Most smallholder farmers have failed to afford medications and feed due to the prohibitive increase in costs, thus, drastically reducing their profit margin. In this paper, we ascertain whether small-scale urban broiler production is still viable under the highly inflationary environment currently prevailing in Zimbabwe due to several macroeconomic problems. We also determine the factors affecting the profitability of small-scale broiler production in an urban or peri-urban set-up using various economic models. Our findings indicate factors capable of improving the profit margins of the farmers to improve their livelihoods.

contributing factors to the profitability or lack thereof of small-scale broiler production in Mutare district. We recommend that training programs on effective broiler production be offered to small-scale farmers in the Mutare district. The government and non-governmental organisations should also develop small loan packages that can assist the farmers in improving their production levels and profits. Government extension workers should be more visible and accessible to the farmers in peri-urban areas to positively influence their profitability levels.

Subjects: Rural Development; Economics and Development; Economics

Keywords: broiler production; profitability; gross margin analysis; quantile regression; Zimbabwe

1. Introduction

Agriculture remains one of the most fundamental sectors for development in most developing countries in Africa, especially Zimbabwe. It is the backbone of Zimbabwe's economy, contributing 7% to the Gross Domestic Product while providing a livelihood source to most rural households (FAO, 2022). The livestock sub-sector provides income and employment to farmers, service providers and the majority of individuals involved along the value chain. The Poultry industry as a livestock segment is the fastest-growing component of global meat production, with developing countries assuming a leading role (Assa, 2012). Poultry comprises birds like guinea fowls, ducks, turkeys and chickens which include broilers.

Broiler farming has become one of the growing sub-sectors in Zimbabwe, and small-scale farmers are considered pivotal for the inclusive growth of the sector (Gororo and Kashangura, 2016). Due to its potential role in contributing to food and livelihood securities, broiler production is expected to meet the critical shortage of animal protein needed by Africa (Abu Hatab et al., 2019). Broiler chickens are birds that reach a marketable size after 6 weeks of age on average, depending on the feeding regimes and feed types adopted by the farmer. They have the advantage of greater efficiency in feed conversion into meat in a shorter space compared to other poultry types. Broiler chickens have become popular because of their short growth cycle and lower initial investment capital requirements. Most households have resorted to chicken meat as all sectors widely accept it despite religious differences. It is anticipated that the demand for broiler meat will continue to increase due to urbanisation, rapid population growth and a shift in meat consumption patterns (Gororo and Kashangura, 2016).

The Zimbabwean economy has failed to create reasonable formal employment opportunities for most urban and peri-urban inhabitants. Hence, poverty and food insecurity problems are rising in these areas. As a result, most urban and peri-urban households have turned to small-scale broiler production to supplement their meagre incomes. However, these small ventures' profitability levels have been questioned due to the rising production costs owing to the highly inflationary macroeconomic environment currently prevailing in Zimbabwe. Despite the contribution of the small-scale broiler sector to the livelihoods of urban and peri-urban households, there is less documented information to guide policy in trying to find ways to strengthen and improve the sector (Gororo and Kashangura, 2016).

Literature specifically focused on small-scale broiler profitability in Zimbabwe is very limited. Studies undertaken in developing countries on this subject have shown various levels of profitability for the farmer (Abdurofi et al., 2017; Adeyonu and Odozi, 2022; Al-Mamum et al., 2013; Aminu and Hermanns, 2021; Ike & Ugwumba, 2011; Kawsar et al., 2013; Ojo et al., 2021; Olorunwa, 2018; Oluwatayo et al., 2016; Parveen et al., 2016; Zimunya and Dube, 2021). Attempts to identify the factors influencing small-scale broiler profitability have been done, with the majority of the studies using the Ordinary Least Squares (OLS) method or linear

regression model (Zimunya and Dube, 2021; Ike and Ugwumba, 2011; Aminu and Hermanns, 2021; Adeyonu and Odozi, 2022 among others). However, it is highly subjective and inadequate to assume homogeneity in the profits earned by small-scale farmers as the small-scale sector is characterised by some outliers in production performance, both positive and negative, which may be far away from the mean.

Many factors and constraints affect broiler production's profitability, such as feed price, price of purchased chicks, labour costs, medication and veterinary services (Chawker et al., 2021). These factors are relatively impactful as a decision-making tool for the farmers. Most small-holder farmers have failed to afford medications and feed due to the prohibitive increase in costs, thus, drastically reducing their profit margin. In this paper, we ascertain whether small-scale urban broiler production is still viable under the highly inflationary environment currently prevailing in Zimbabwe due to several macroeconomic problems. We also determine the factors affecting the profitability of small-scale broiler production in an urban or peri-urban set-up. To identify the factors, we use the Quantile Regression model, which addresses the problem of heterogeneity and can depict outlier performers by categorising farmers into quantiles concerning their profits or losses. Ultimately we contribute to the small available strand of literature on the profitability of small-scale broiler chicken production in Zimbabwe and the rest of the world.

2. Data and methods

2.1. Study area
The study was carried out in the peri-urban areas of the Mutare district in the Manicaland Province of Zimbabwe. A huge part of Mutare district is in Natural Farming Region 1 and its climatic conditions consist of low temperatures with high chances of frost in the winter months (FAO, 1999). The climatic condition has a huge implication in broiler production, as good temperature management is vital in the brooder in the early stages of broiler production to avoid high mortality rates. Furthermore, Mutare is a high rainfall zone, which receives 1000 mm per annum on average (FAO, 1999). Due to the abundant, reliable and evenly distributed rainfall received in this district, many crops are effectively rain-fed up to maturity. Small scale poultry production is highly practised in this area, while intensive livestock production comprises dairy cows, beef production and sheep.

2.2. Research design and sampling
The study utilised a cross-sectional survey design which analyses data from a representative subset at a specific time. In the first stage, three peri-urban areas, namely Dangamvura, Chikanga and Sakubva, were purposively selected based on the researcher's assessment of the number of small-scale broiler farmers in these areas. In the second stage, 110 small-scale broiler farmers were selected using the exponential non-discriminative snowballing sampling method proportionately distributed among the three peri-urban areas. The selection of respondents was also based on respondents' willingness to participate in the research. This sampling method was used since the respondents were scattered over a wide area and no complete list of the target population was available.

The sampling frame encompassed all small-scale broiler farmers keeping between 25 and 150 broilers as this was the common flock size for the majority of the farmers in the area. Primary data was used for this study and collected using a structured questionnaire. The questionnaire was used to collect both qualitative and quantitative data. The questionnaires were administered to the respondents and completed by the interviewer to enable illiterate people to participate in the research and to overcome misinterpretation of questions to collect accurate data. In addition, data on respondent demographics, cost and returns of broiler production and socioeconomic characteristics were collected. The period of data collection was from February—April 2022.

cogent • economics & finance

2.3. Analytical techniques

2.3.1. Descriptive statistics
We utilised descriptive statistics to describe the essential characteristics of the respondents by means of tables, simple summaries, frequencies and mean.

2.3.2. Gross margin analysis
Gross Margin Analysis was used to determine the profitability of the respondents involved in broiler production. Gross Margin Analysis is a measure that is used to determine if a business or enterprise is profitable or not. As a rule of thumb in agriculture, an enterprise with a higher positive gross margin is reckoned profitable. Several similar studies have utilised this method (Al-Mamum et al., 2013; Emokado and Eweka, 2015; Ike and Ugwumba, 2011; Olorunwa, 2018; Zimunya and Dube, 2021). For uniformity and to ensure that comparisons were made with a reasonably constant flock number, a batch of 100 broilers was used for this study since most respondents kept this number of broilers. For the farmers who kept a number above or below the target mark of 100, the statistics were standardised proportionately upwards or downwards to 100.

Gross margin (GM) is the difference between total sales, commonly known as gross income (GI) and total variable costs (Johnson, 1992). Gross income is the total value of production. The farmers' income was generated from selling matured birds after mortalities emanating from any causes during the production cycle. The variable costs are the production costs allocated to the broiler operations. These costs included feed costs, cost of medication, cost of bedding were applicable, marketing costs, cost of day-old chicks, labour costs and feed and water trough depreciation costs.

Labour costs for small-scale farmers are usually difficult to estimate because small-scale farmers usually rely on family labour in the production process. However, from the interviews, we established that for a flock size of 100, respondents spend an average of 2 hours per day of labour, specifically for the broiler enterprise. Hence, labour costs for all the farmers were estimated as (2 h per day × 42 days to reach maturity)/8 h per day. The calculation gave an estimate of 11 labour days per cycle. The labour hours were then multiplied by US$ 3, the average established cost of a labour day in the study area, to give $33 as the estimated labour cost for all farmers.

The gross margin function for this study is expressed as follows;

$$GM = GI\text{—}TVC;$$

Where;

GM = Gross Margin measured (US$)

GI = Gross Income (US$)

TVC = Total Variable Costs (US$)

Therefore;

$$GM = P_iQ_i - \Sigma R_j; \tag{1}$$

Where:

P_i = Price of a broiler bird,

$Q_{i\ =}$ Total number of broiler birds sold,

R_j= Cost of variable inputs (feed, day-old chicks, bedding, labour, medication, feed and water trough depreciation).

In the end, the average return per dollar variable cost was computed by dividing the average gross income by the average total variable costs. This is the average return for every dollar variable cost invested by the farmers in the study area.

2.3.3. Quantile regression model

Quantile Regression Model shows the relationship between a number of independent variables and specific percentiles of a target variable, the dependent variable. We used Quantile Regression to determine the factors that influence the profitability of small-scale broiler production in the Mutare district. This model was used despite the availability of other models, such as the Ordinary Least Square method, because the model can depict outlier values which may be far away from the mean (Cade et al., 1999; Cook and Manning, 2013). The quantile regression model for this study is denoted from the linear regression equation as follows;

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \mu_i. \tag{2}$$

Where;

Y_i = Gross Margin (US\$); X_1 = Gender; X_2 = Age; X_3 = Marital status; X_4 = Level of education; X_5 = Household Size; X_6 = Farming Experience; X_7 = Training in poultry; X_8 = Access to credit; X_9 = Access to extension services and μ_i= Error term.

The Quantile Regression Model for the rth quantile is

$$Q_r(Y_i) = \beta_0(r) + \beta_1(r)X_1 + \ldots \ldots \beta_9(r)X_9 + \mu_i \tag{3}$$

Quantile regression was run at the 25%, 50% and 75% quantile to ascertain the explanatory variables affecting the dependent variable at different performance levels. Table 1 briefly describes the variables included in the model, their measurements and expected sign.

We executed a number of diagnostic tests to the estimated regression to evaluate model assumptions and ascertain if there were observations with a large, undue influence on the analysis. In particular, we executed three diagnostic tests, namely the skewness kurtosis test for normality, Ramsey's RESET test for model misspecification and the Multicollinearity test to test if there were any linear relationships among some of the explanatory variables used in the regression model.

3. Results and discussion

3.1. Demographic and socioeconomic characteristics of the respondents

Table 2 shows the demographic and socioeconomic characteristics of the sampled farmers.

The analysis of demographics and socioeconomic characteristics of small-scale broiler production in Mutare district shows that 63.7% of the farmers engaged in broiler production are males, while 32.7% are females. The result implies that Mutare district's small-scale broiler industry is male-dominated. The results agree with Ettah, Igiri, & Ihejiamaizu's findings (Ettah et al., 2021), where broiler production was male-dominated in Cross River State, Nigeria. In addition, approximately 64.5% of the respondents were married, while 20.9% were single. Further, all respondents had acquired at least primary education, with the majority reaching secondary level (74.5%), 11%

cogent ·•· economics & finance

Table 1. Description and measurement of variables used in the quantile regression model			
Variable	**Variable Name**	**Measurement**	**A priori expectation**
Y_i	Gross Margin	**US$**	
X_1	Gender	0 = Male; 1 = Female	+/-
X_2	Age	Years since birth	+
X_3	Marital Status	0 = Single; 1 = Married;	+/-
		2 = Divorced; 3 = Widowed	
X_4	Level of education	0 = No formal education; 1 = Primary;	+
		2 = Secondary 3 = Tertiary	
X_5	Household Size	Number of household members	+
X_6	Farming Experience	Years in broiler production	+
X_7	Training in poultry	0 = No; 1 = Yes	+
X_8	Access to credit	0 = No; 1 = Yes	+
X_9	Access to extension services	0 = No; 1 = Yes	+

of the respondents had primary education, while 17% attained tertiary education. The potential of farmers to read and write helps them to participate effectively in agricultural activities and reason well.

The findings further indicated that, 60.9% of the respondents had no training in poultry, whilst 39.1% had received training in poultry. The result could signify a lack of adequate, relevant information on better practices of broiler production. About 76.4% of the farmers had no access to credit, signifying a general lack of access to funds. The respondents' experience ranged between 1 and 9 years with a mean of 4.4 years, while the household size ranged between 1 and 9 members with a mean of 4 members. The average age of the respondents was 42.65, ranging between 21 and 64 years. The results indicate that middle-aged individuals dominate the small-scale broiler production sector.

3.2. Profitability of small-scale broiler production

Results on the profitability of small-scale broiler production are illustrated in Table 3. These are based on a batch of 100 broilers, as explained in the data and methods section.

Results on the profitability of small-scale broiler chicken production in Mutare district indicate that the average gross margin profit for a batch of 100 broiler chickens was US $ 65.25, with a minimum of—US$ 139 and a maximum of US$ 220 being recorded for the whole sample. The results indicate that, although small-scale broiler chicken production is viable in the study area, there are some outlier performers at both ends of performance levels. Most farmers sold their broilers at US$ 6 each, while a few sold at US$ 7 each, giving an average selling price of US$ 6.10. The mean mortality rate was 16.86%. Most farmers attributed the major causes of mortality to poor heat management at early growth stages and disease outbreaks during the production cycle. The findings mean that farmers in the study area could significantly enhance their profit levels through improving heat and disease management practices.

Feed costs were the major component of the total production costs, accounting for 56.79% of the total variable costs, while the day-old chicks contributed 22.1% to the total variable costs. The results align with the findings by Al-Mamum et al. (2013), who established feed

Table 2. Respondents' demographic and socioeconomic characteristics		
Categorical Variable	**Frequency**	**Percentage (%)**
Gender		
Female	36	32.7
Male	74	67.3
Marital Status		
Single	23	20.9
Married	71	64.5
Divorced	10	9.1
Widowed	6	5.5
Level of Education		
Primary	11	10
Secondary	82	74.5
Tertiary	17	15.5
Training in Poultry		
No	67	60.9
Yes	43	39.1
Access to Credit		
No	84	76.4
Yes	26	23.6
Access to Extension		
No	66	60
Yes	44	40

Continuous Variable	N	Min	Max	Mean	Std.Deviation
Age	110	21	64	42.65	11.01
Household Size	110	1	9	3.91	2.003
Experience	110	1	9	4.4	2.033

Source: Survey data (2022).

costs to contribute to approximately 63.4% of the total variable costs. The other components of variable costs incurred by farmers are shown in Table 3. The return per dollar variable costs were US$ 1.15 on average. This implies that small-scale broiler farmers in Mutare district are getting 15 cents for every dollar variable cost invested. The results, therefore, show that small scale-broiler production is profitable in the study area. The findings are in line with several studies done before, such as Ojo et al. (2021); Al-Mamum et al., (2013) and Ike and Ugwumba (2011), who also established that broiler production was a viable project in their respective studies.

3.3. Factors affecting the profitability of small scale broiler production

We ran a quantile regression analysis at the 25th, 50th and 75th quantile on several factors to see if they significantly influenced the profitability of small-scale broiler production. Multicollinearity between the explanatory variables was also checked and it was discovered that there were no linearity problems among the variables. The pseudo R squared for the 25th, 50th and 75th quantiles were 0.4536, 0.3999 and 0.3162, respectively. The values imply that, for the 25th quantile, 45.4% of

cogent · economics & finance

Table 3. Gross margin analysis				
Variable	**Minimum**	**Mean**	**Maximum**	**Percentage (%)**
Output	33	83.14	98	
Price per unit (US$)	6	6.10	7	
Gross Income (US$) Variable Costs (US$)	231	505.55	644	
Feed Costs	165	250.42	338	56.79
Transport Costs for feeds	4.50	8.99	12	2.04
Day Old chicks	85	97.47	110	22.10
Labour Costs	33	33	33	7.48
Marketing Costs	11.50	29.94	34.50	6.79
Medication/ Vaccines	4.50	8.49	12	1.93
Water and feed troughs				
(Depreciation)	9	12.96	20	2.94
Total Variable Costs	263	440.99	541	
Gross Margin (US$)	−139	65.25	220	
Return/$ Variable Costs invested		1.15		

Source: Survey data (2022).

the variation in gross margin among the farmers was explained by the variation in the independent variables. The results for the quantile regression are presented in Table 4.

3.4. Factors affecting the profitability of small scale broiler production

While training in poultry was found to significantly determine the profitability of the broiler enterprise for all quantiles, the level of education influenced profitability at the 25th and median quantile only, and farming experience influenced profitability at the median and 75th quantiles only. Training in poultry significantly influence the profitability of broiler production for the lowest performers at a 1% significance level ($p = 0.004$) with a coefficient of 66.5511. This implies that training a broiler producer in the 25th quantile, while other factors remain constant, would increase their profit by US$ 66.55. We also found tertiary education level to significantly influence broiler profits at 5% ($p = 0.041$) in the 25th quantile with a coefficient of 69.0928. This means that acquiring tertiary education for farmers in the 25th quantile increases profit by US$ 69.09.

The results align with Adebayo and Adeola (2005), who revealed that education level and poultry training significantly affect broiler production. The relationship between production and education level, as well as training, was attributed to the high need for sound knowledge and efficient management of the poultry business to ensure high output. This is also supported by Al-Fawwaz and AL-Sharafat (2013), who posits that education gives insight when farmers are trained in broiler production. This is based on the fact that an educated farmer will be knowledgeable, easy to train for managerial capacity and, as a result, will be able to manage production activities effectively and efficiently, thus increasing chances of obtaining better profits. The results contradict Mishra et al. (1999), who found contrary results when education level had an insignificant negative effect on the profitability of poultry production.

We found that farming experience was significantly influencing broiler profitability at 5% for the median and the 75th quantile. The coefficient for the 75th quantile was 11.141. This entails that an increase in broiler farming experience by 1 year would also increase broiler profits by US$ 11.14 all

cogent ·· economics & finance

Table 4. Quantile regression results

Variable	Quantile 25th			50th			75th		
	Coefficient	t-value	p-value	Coefficient	t-value	p-value	Coefficient	t-value	p-value
Gender	−25.7516	−1.00	.319	−14.6883	−0.55	.584	1.4594	0.06	.953
Age	0.3756	0,35	0,728	−0.0237	−0.02	.983	−0.7150	−0.76	.452
Marital Status									
Married	−18.7158	−0.66	.513	−20.5643	−0.66	.513	−11.6235	−0.43	.668
Divorced	−38.0257	−0.83	.409	−29.4633	−0.66	.512	−51.8860	−1.37	.175
Widowed	−29.0274	−0.75	.455	−31.0135	−0.76	.450	−11.6235	−0.41	.682
Level of Education									
Secondary	16.4423	0.66	.512	−40.6397	1.98	.051*	22.3074	0.76	.452
Tertiary	69.0928	2.07	.041**	−52.7655	1.56	.122	38.7392	0.96	.338
Household Size	13.5314	1.59	.092*	4.4906	0.65	.519	6.6304	1.50	.136
Farming Experience	6.7601	1.53	.13	9.5916	2.36	.020**	11.141	2.35	.021**
Training In Poultry	66.5511	2.98	.004***	46.9380	2.62	.010**	49.1969	2.55	.012**
Access to Credit	20.6607	0.90	.371	21.3022	1.66	.045**	22.3074	1.27	.208
Access to Extension									
Services	50.07	1.75	.084*	28.7747	1.34	.185	16.4318	0.98	.329
Constant	−117.8496	−2.09	.004	−35.3248	−0.57	.569	−16.1209	−0.32	.750
Pseudo R^2	0.4679			0.4070			0.3337		

***, ** and * indicate significance at 1%, 5% and 10%, respectively.

other factors held constant. This is because broiler production experience implies more knowledge of better management regimes, resulting in an improved profit. The results agree with Esiobu et al. (2014) and Tuffour and Oppong (2014), who concluded that more years of business experience help farmers set cost targets and appropriate time to achieve their goals. In their results, they discovered that agribusiness experience, in general, can help farmers allocate, combine and use resources effectively, resulting in high profits. Experience also helps farmers to identify marketing risks better, hence increasing chances for better profits in broiler production.

Access to extension and household size were found to significantly influence profitability at the 25th quantile. With access to extension services, profitability for the 25th quantile farmers was significantly impacted ($p = 0.084$) with a coefficient of 50.07. This means that access to extension services for a farmer in the 25th quantile would increase their profit level by US\$ 50.07. The results are in line with a study by Etuk et al. (2007), who explained that access to extension services is regarded as a form of informal education that is voluntary and aims to teach farmers to make wise decisions in production as well as wise use of resources to improve their productivity in economic activities.

On the other hand, household size significantly influenced broiler profits at 10% significance level ($p = 0.092$) for the 25th quantile, with a coefficient of 13.5314. This means that an increase in household size by 1 unit for the farmers in the 25th quantile while all the other factors are held constant would increase their profit by US\$ 13.53. This can be explained by the fact that small-scale broiler producers in Mutare district rely on family labour in their production process. Therefore, a larger family size means more labour available to help with broiler project management practices, hence improving profits.

Access to credit was significant ($p = 0.045$) with a coefficient of 21.3022 for the median quantile. With access to credit, farmers can potentially increase their profits by US\$ 21.30 while all other factors remain constant. This is in line with a study by Ali and Hossain (2010) on broiler production in Bangladesh, who reported a significant positive relationship between access to credit and profit levels in broiler production. Gender, age and marital status were found not to significantly influence broiler profitability, contrary to *a priori* expectations.

4. Conclusions and policy recommendations

Based on the findings of this paper, we conclude that small-scale broiler production is a profitable business for small-scale farmers in Mutare District despite the constraints generally faced by the farmers. Training in poultry significantly determines the profitability of the broiler enterprise for all quantiles, while level of education influences profitability at the 25th and median quantiles only and farming experience influence profitability at the median and 75th quantiles only. Further, access to extension services and household size are essential factors influencing the profitability of small-scale farmers in the low-performing quantile. On the other hand, access to credit influences the profitability of small-scale broiler producers for the median-performing farmers. All these factors are essential contributing factors to the profitability or lack thereof of small-scale broiler production in Mutare district.

The significant implication of this study is that initiatives meant to improve the profits of small-scale broiler producers should take an agile approach. A perfect example would be a case where credit facilities are tailored based on farmer performance and training programs are tailored based on levels of education. We recommend that farmers in the Mutare district be encouraged to adopt the production of broilers as it is a viable venture which has stood against the odds of a high inflationary environment and high feed costs. The government and non-governmental organisations should also develop small loan packages that can assist the farmers in improving their production levels and profits. Furthermore, training programs on effective broiler production should be offered to small-scale farmers in Mutare district to influence their profitability levels positively. Tailored training programs can be offered by government extension officers or other

interested stakeholders, such as non-governmental organisations interested in improving the poor population's livelihoods.

We also recommend that government extension officers be more visible and accessible in peri-urban areas because most of the urban population has now adopted important farming initiatives like broiler production to enhance their income levels and livelihoods. Feed companies should develop innovative solutions for producing feeds at a lower cost, especially the big feed companies with a greater potential of enjoying huge economies of scale to reduce feed costs. More profitability studies on small-scale broiler production should be undertaken in other areas, especially in rural locations far from the urban centre, to ascertain if the distance to markets would significantly reduce profits. In addition, studies can also be carried out on the technical efficiency of small—scale broiler production in Mutare District.

Author details
Precious T Phiri[1]
Freddy Ruzhani[1]
E-mail: freddyruzhani@gmail.com
ORCID ID: http://orcid.org/0000-0003-1345-2113
Faustino Madzokere[1]
Pamela Madududu[2]
[1] Department of Agricultural Economics and Development, Manicaland State University of Applied Sciences, Mutare, Zimbabwe.
[2] Department of Agricultural Economics, Extension and Rural Development, University of Pretoria, Hatfield, South Africa.

Disclosure statement
No potential conflict of interest was reported by the author(s).

References
Abdurofi, I., Ismail, M. M., Kamal, H. A., & Gabdo, B. H. (2017). Economic analysis of broiler production in Peninsular Malaysia. *International Food Research Journal, 24*(2), 761–766.

Abu Hatab, A., Cavinato, M. E., & Lagerkvist, C. J. (2019). Urbanisation, livestock systems and food security in developing countries: A systematic review of the literature. *Food Security, 11*(2), 279–299. https://doi.org/10.1007/s12571-019-00906-1

Adebayo, O. O., & Adeola, R. G. (2005). Socio-economics factors affecting poultry farmers in Ejigbo local government area of Osun State. *Journal of Human Ecology, 18*(1), 39–41. https://doi.org/10.1080/09709274.2005.11905804

Adeyonu, A. G., & Odozi, J. C. (2022). What are the drivers of profitability of broiler farms in the North-Central and South-West Geo-political Zones of Nigeria? *SAGE Open, 12*(1), 1–13. https://doi.org/10.1177/21582440211071076

Al-Fawwaz, T. M., & AL-Sharafat, A. (2013). Estimation of resource use efficiency in broiler farms: A marginal analysis approach. *Global Journal of Finance and Banking Issues, 7*(7), 1–8. https://doi.org/10.5539/ijbm.v8n5p41

Ali, M. S., & Hossain, M. M. (2010). Factors influencing the performance of farmers in broiler production of Faridpur District in Bangladesh. *World's Poultry Science Journal, 66*, 123–131. https://doi.org/10.1017/S0043933910000127

Al-Mamum, K. A., Rana, M., Rahman, M. S., & Sattar, M. N. (2013). Profitability of small scale broiler production in some selected areas of mymensingh. *Progressive Agriculture, 23*(1), 101–109. https://doi.org/10.3329/pa.v23i1-2.16568

Aminu, F. O., & Hermanns, U. (2021). Profitability evaluation of poultry in Lagos state, Nigeria. *Discovery Agriculture, 7*(17), 37–44.

Assa, M. M. (2012). Poultry production and rural poverty among small scale farmers in Mzimba District of Malawi. *Livestock Research for Rural Development, 24*(9).

Cade, B. S., Terrel, J. W., & Schroeder, R. L. (1999). Estimation effects of limiting factors with regression quantiles. *Ecology, 80*(1), 311–323. https://doi.org/10.1890/0012-9658(1999)080[0311:EEOLFW]2.0.CO;2

Chawker, A. P., Kahate, P. A., Sul, D. M., Shelke, R. R., & Nage, S. P. (2021). Constraints in poultry production faced by poultry owners in Bhandara District, India. *International Journal of Current Microbiology and Applied Sciences, 10*(1), 1390–1395. https://doi.org/10.20546/ijcmas.2021.1001.165

Cook, B. L., & Manning, W. G. (2013). Thinking beyond the mean: A practical guide for using quantile regression methods for health services research. *Shanghai Arch Psychiatry, 25*(1). https://doi.org/10.3969/j.issn.1002-0829.2013.01.011

Emokado, C. O., & Eweka, K. I. (2015). A comparative analysis of profitability systems in Urban Areas of Edo State, Nigeria. *Journal of Applied Sciences and Environmental Management, 19*(4), 627–631. https://doi.org/10.4314/jasem.v19i4.9

Esiobu, N. S., Onubuogu, G. C., & Okoli, V. B. (2014). Determinants of income from poultry egg production in Imo State, Nigeria: An econometric model approach. *Global Advanced Research Journal of Agricultural Science, 3*(7). http://garj.org/garjas/index.htm

Ettah, O. I., Igiri, J. A., & Ihejiamaizu, V. C. (2021). Profitability of broiler production in Cross River State, Nigeria. *Global Journal of Agricultural Sciences, 20*(1), 35–40. https://doi.org/10.4314/gjass.v20i1.5

Etuk, E. A., Agom, D. I., Isika, M. A., & Idiong, I. C. (2007). Resource use efficiency of broiler enterprises in Cross River State, South Eastern Nigeria. *International Journal of Poultry Science, 6*(1), 23–26. https://doi.org/10.3923/ijps.2007.23.26

FAO. (1999). Fertiliser strategies. Rome: Food and Agriculture organisation of the United Nations. Retrieved from http://www.fao.org/3/a0395e/a0395e0c.htm

FAO. (2022). Zimbabwe at a glance. Retrieved September 26, 2022, from https://www.fao.org/zimbabwe/fao-in-zimbabwe/zimbabwe-at-a-glance/en/

Gororo, E., & Kashangura, M. T. (2016). Broiler production in an urban and peri-urban area of Zimbabwe. *Development Southern Africa*, *33*(1), 99–112. https://doi.org/10.1080/0376835X.2015.1113123

Ike, P. C., & Ugwumba, C. O. (2011). Profitability of small scale broiler production in Onitsha North local government area of Anambra State, Nigeria. *International Journal of Poultry Science*, *10*(2), 106–109. https://doi.org/10.3923/ijps.2011.106.109

Johnson, D. T. (1992). *The business of farming. A guide to farm business management in the tropics*. McMillan Publishers Ltd.

Kawsar, M. H., Chowdhury, S. D., Raha, S. K., & Hossain, M. M. (2013). Impact of management intervention on productive performance and profitability of small scale broiler farming in Bangladesh. *Livestock Research for Rural Development*, *25*(3), 676–686. https://doi.org/10.1017/S0043933913000676

Mishra, A. K., E-L-Osta, H. S., & Steele, C. J. (1999). Factors affecting the profitability of limited resource and other small farms. *Agricultural Finance Review*, *59*, 77–99. http://pubag.nal.usda.gov/download39009

Ojo, S. O., Falaye, M. H., & Ojaomo, E. T. (2021). Determinants of profitability of broiler production in the out-growers schemes in Southwest Nigeria. *International Journal of Economics and Business Administration*, *IX*(2), 363–373. https://doi.org/10.35808/ijeba/708

Olorunwa, O. J. (2018). Economic analysis of broiler production in Lagos state poultry estate Nigeria. *Journal of Investment and Management*, *7*(1), 35–44. https://doi.org/10.11648/j.jim.20180701.15

Oluwatayo, I. B., Machethe, T. A., & Senyolo, M. P. (2016). Profitability and efficiency analysis of smallholder broiler production in Mopani District of Limpopo Province, South Africa. *Journal of Agribusiness and Rural Development*, *1*(39), 145–154. https://doi.org/10.17306/JARD.2016.17

Parveen, S., Gohar, K., & Khan, A. (2016). Profitability of broiler firms in Tehsil Shabqada (Charsadda): A domestic study for agricultural sector. *Industrial Engineering Letters*, *6*(5), 17–26. http://core.uk/download/pdf/234685528

Tuffour, M., & Oppong, B. A. (2014). Profit efficiency in broiler production: Evidence from greater Accra Region of Ghana. *International Journal of Food and Agricultural Economics*, *2*(1), 23–32.

Zimunya, K. T., & Dube, L. (2021). Profitability of broiler contract growers in Chegutu District of Zimbabwe. *Scholars Journal of Agriculture and Veterinary Sciences*, *8*(9), 87–94. https://doi.org/10.36347/sjavs.2021.v08i09.002