Factors Driving Farm Gate Price of Tomatoes in Ghana: An Application of Hedonic Model

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Authors' contributions

This work was carried out in collaboration among all authors. Author MASH designed the study and wrote the first draft of the manuscript. Author AGA managed the data collection. Author DAV performed the statistical analysis. All authors read and approved the final manuscript.

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ABSTRACT

The study examined the relationship between product characteristics and price of tomatoes in Ghana. A well-structured questionnaire was used to collect data from 300 sampled tomato farmers. The data collected included the price and quality characteristics of tomatoes traded in spot transactions in Akumadan and Tanoso districts in the Ashanti and Brong Ahafo Regions of Ghana. Descriptive and inferential statistics were used to analyse the data. In respect of inferential statistics, hedonic price model was used to determine factors influencing farm grate price of tomatoes in the study area. The results of the study revealed that the age group involved in tomato production in the study area is youthful and dominated by men. Illiteracy is high and the majority of farmers are of Akan origin with a family-size above five (5). About half of the respondents sell their produce at the farm gate. According to the result of the hedonic model, five factors are statistically significant in the determination of the price of tomatoes, namely: distance to the farm, road quality, market information, graded product and quantity of tomatoes available for sale. The study therefore

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concluded that improved road networks, access to market information by the farmers, access to credit facilities from financial institution, and quality control with respect to product sorting or grading would improve the price received by the farmers. Thus there is the need for the government to improve the road network in the study area, particularly feeder roads to improve price received by the farmers. This would encourage existing farmers to continue with tomato production. Also, farmers need to be trained in sorting and grading of their produce to attract a good price.

1. INTRODUCTION

Tomato is an important component of Ghanaian dishes. It is grown throughout the country but concentrated in the Greater Accra, Ashanti, Brong Ahafo, Volta and Upper East Regions under both rain-fed and irrigated systems. The area under production is about 16,130 hectares with yields of 17.6 mt/ha, giving a production level of 284,000 metric tonnes [1].

The cultivated tomato (*Lycopersicon esculuntum Mill*) is the most important and widely grown vegetable in the world [2]. To date, its importance is increasing in Ghana. It is widely accepted and commonly used in a variety of dishes as raw, cooked or processed products: more so than any other vegetables [2]. The bulk of fresh market tomatoes are produced by small-scale farmers. Farmers prefer tomato production over other vegetables for its multiple harvests, which can result in high profit per unit area. Tomatoes vary in visible fruit characteristics, which is important for fresh market and processing values. These include shape, size, colour, flesh thickness, number of locules, blossom end shape and fruit quality. The fruits may be globe-shaped (Mar globe), oval or flattened (Marmande), and pear-shaped (Roma VF), which differ in acceptability, quality and storability in the local market.

The Food and Agricultural Sector Development Policy document of Ghana (FASDEP) [3] reported that post-harvest losses are high due to very little processing and strategies in marketing. Breisinger et al. [4] reported that Ghana had a yield gap of 28.6% and 53.8% for rain-fed and irrigated tomatoes, respectively, making Ghana a net importer of processed tomatoes. Ironically, there is a glut of tomatoes experienced seasonally and in other times of the year, the produce is in short supply. Coupled with the problems of seasonal glut and its corresponding low prices is the poor supply or lack of marketing services provided to the farmers and traders in the tomato trade. Since consumption is spread all over the country, the commodity has to be transported over varied distances to consumers. The defective methods of picking, packing and transportation result in a large proportion of the commodity deteriorating in transit [5]. The extent of spoilage is stated as ranging between 5 and 50 per cent [6].

In Ghana, tomatoes are mainly marketed by women led by "Market Queens". Because of its perishable nature, the market queens generally have the upper hand over the farmers they buy from, often putting extreme pressure on the farmers, who accuse them of cheating to pocket the lion's share of profits. The traders, on the other hand, disclaim the common perception of their power in such transactions. Most of the time the commodity is offered for sale at the farm gate at prices quoted by the market women or traders.

Data for the tomato sector have not been collected consistently at the national level since 1980s and so it is difficult to describe the trends concerning contribution to GDP and employment. However, the available data primarily suggests import competition from neighbouring countries such as Burkina Faso from which Ghana imports about 100 thousand tonnes per year [7].

According to [8], around Christmas or the rainy season, the price falls as low as GH¢ 0.34 per kilogram whilst in the dry season, it may go as high as GH¢ 1.30 per kilogram of fresh tomatoes in the market.

Generally, in Ghana, the average wholesale nominal price for major food commodities increased in 2009 compared to 2008. The highest percentage change was observed in tomato i.e. 236.7% and the least in cocoyam i.e. 10.9 % [9].

Huge post-harvest tomato losses are experienced during glut and to clear the market, traders use the perishable nature of the product to their advantage, forcing farmers to accept low prices. Boriss and Brunke [10] observed that

prices for fresh tomatoes are especially sensitive to surplus and shortages of supply, causing variability in prices over the past decade. A bone of contention, therefore, exists between the tomato farmers and the traders as to who benefits more than the other in the business. It has also been observed that the traders engage in all sorts of activities to maximise their profit or minimise their costs, which range from defrauding their clients to entering into concubinage with transport owners, operators and the farmers or producers. All these aspects introduce certain elements of risk and uncertainty in the trade and marketing of tomatoes. This makes the study and analysis of factors that influence the price of tomatoes in Ghana imperative.

According to [11] Factors that influence the farm gate tomato price do not favour farmers. This is because the prospect of huge post-harvest losses at the farm gate allows room for exploitation by traders. Farmers are therefore forced to clear the market by the law of demand. The result is low returns to farmers, which deepen their poverty and worsens their welfare. The foregoing therefore raises the following question: what factors influence the price received by farmers? As a consequence, the study aims to assess the determinants of the farm gate price of tomatoes.

2. LITERATURE REVIEW

2.1 Perishable Commodity Marketing and Price Determination

Agricultural marketing plays an important role not only in stimulating production and consumption but also in accelerating the pace of economic development [12]. It leads to the optimization of resource use and output management; increase in farm income; growth of agro-based industries; adoption and spread of new technologies; better living; and creation of utility. An increase in the efficiency of the marketing process, which results in a lower cost of distribution and lower prices to consumers, might bring about an increase in the national income. An efficient marketing system may contribute to an increase in the marketable surplus by scaling down the losses arising out of inefficient processing, storage, and transportation. It guarantees the farmers better prices for their products and induces them to invest their surpluses in the purchase of modern inputs so that productivity may increase [12]. Price determination for many consumer products

is often a function of the cost of production and a desired level of mark-up. Price determination by this desired level of the mark-up is often referred to as cost-plus pricing, mark-up pricing or full-cost pricing. There are several "rules-of-thumb" related to mark-up pricing. For example, some retailers who sell to consumers may expect to price items at 20 to 100% above their cost. There is, however, a fine line between the desired mark-up, cost of production and the price that the market will bear. All of these elements must be carefully understood and respected. For instance, the price the market will bear is a function of demand. For example, a 20% mark-up may yield a selling price that is less than what the market will support. Luxury goods and niche products often command a premium that exceeds the set mark-up. That is why the cost of production, desired mark-up and market demand should all be evaluated when establishing a product's selling price. To determine a product's selling price using the mark-up method, the total cost of producing a product on a per unit basis must be known. Total cost should include all costs incurred in getting the product to the point of sale. This would include but is not limited to, input costs, labour, overhead costs, transportation costs, warehousing costs, distribution costs and marketing.

Price is determined by the supply and demand in the market, more particularly for tomatoes in Ghana. The market queens first determine the purchase price of the tomatoes. Jema [13] postulates that market imperfections and risk preferences impact upon farm price determination. He observed that farm prices significantly and negatively depend on traders' market power and risk-seeking behaviour. Outcomes such as harvest volume, shipping cost, and time tend to be significant factors explaining variations in the price spreads. Traders' utmost audacity to risk, although somewhat unexpected, might be related to their wealth status and the prevalent imperfect contract enforcement. Moreover, his findings show that traders share of the marketing surplus increases with the degree of the perishability of the produce. That is, the more perishable the produce is, the higher the share that traders capture from the marketing surplus [13].

Most of the tomatoes produced in Akomadan and Tanoso are sold to retailers all over markets in the southern sector of the country. There have appeared differences in farm-gate price among

farmers within a variation in price in each seasonal crop. The study focuses on this disturbance variation in the farm-gate price of tomatoes among farmers during the tomato season.

2.2 A Model for Price Determination

The perishable commodity pricing model developed by [14] accounts for the market power component only; and while it overcomes many weaknesses of the conventional method of perishable commodity pricing rules, it does not allow for the testing of the impact of output price risk in farm gate price determination.

The model of farm gate price determination by [15], which accounts for market power and risk preferences of the traders, is used to determine the farm gate price for four vegetables, namely potato, onion, tomato and cabbage. According to [15], farm prices significantly and negatively depend on traders' market power and risk-seeking behaviour. Furthermore, Vishwajith et al. [16] in Pulses, Sahu et al. [17] in rice and wheat, used this method in different crops.

A hedonic price function is a regression of the observed price of a commodity against its quality attributes [18]. It can be extended to include non-quality attributes such as brand and country of origin. At a given point in time, it can identify both factors that are important in determining the price of a commodity as well as how important each factor is and the consistency of its relationship with price. These are usually important informational inputs in the decision-making process of farmers, processors and policy-makers.

3. METHODOLOGY

The study was conducted in Ashanti and Brong Ahafo Regions of Ghana, specifically Tanoso and Akumadan Districts. Multistage sampling procedure was used to sample the respondents for the study. At the first stage, the two districts were selected purposively based on their importance in tomato production. At the second stage of the sampling, the District Agricultural officers at the District Development Unit of Agriculture (DADU) were contacted and they identified and listed all tomato producers in each of the districts. At the third stage, a simple random sampling technique was used to select the respondent farmers for the study.

The sample size was determined following [19]:

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

Where,

n is the sample size;
e = error level; e = 1 – confidence level; and
N is the total population of qualified farmers in the study area.

Assuming a 95% confidence level, e = 0.05 and N an estimated 1,200 tomato farmers, a sample size of 300 farmers were selected for the study. This was proportionally distributed between the two districts. Also, a focus group discussion was held with sample traders and marketers who were randomly selected. A structured questionnaire was used to collect primary and secondary data relevant to the study. Data collected from the sampled farmers were analysed with descriptive statistics followed by inferential analysis using the hedonic price model to determine factors influencing the price of tomatoes.

3.1 The Theoretical and Analytical Framework

Descriptive statistics such as frequency tables and percentages were used to present the socio-economic characteristics of the respondents. The hedonic price model was used to evaluate factors influencing farm gate price received by tomato farmers. Kendall's Coefficient of Concordance (W) analysis was used to rank the challenges faced by the respondents with regards to tomato production and marketing.

Hedonic regression is a method in which the price of goods is expressed as a function of characteristics of those goods [20,21]. Thus the price is the dependent variable and products' characteristics are independent variables. The estimated coefficients can be considered as contributions of those characteristics to the prices. Dummy variables are employed to represent the non-numerical characteristics of the goods.

The model is specified as:

$$y_i = \beta_0 + \sum_{i=1}^{24} \beta_i x_i + \mu$$

Where y_i is the dependent variable denoting the farm gate price of the tomato and x_i denoting independent variables.

The correlation between independent variables in a model leads to the problem of Multicollinearity. If the degree of correlation between the independent variables is high it affects the model fits and the interpretation of the results. With Multicollinearity, the coefficient estimates tend to swing widely based on other independent variables in the model and the coefficients also tend to be very sensitive to small changes in the model. Multicollinearity also reduces the statistical power of the regression model as it reduces the precision of the coefficients estimates, also p-values cannot be trusted to identify the statistically significant variables. Therefore, there is a need to test for Multicollinearity.

The study employed the Variance Inflation Factor (VIF) and contingency coefficients to test for multicollinearity. VIF was used for association among the continuous explanatory variables and contingency coefficients for dummy variables. According to [22], VIF was estimated as:

$$VIF(X_i) = \frac{1}{1 - R_i^2}$$

Where VIF = Variance Inflation Factor and R_i^2 is the square of the multiple correlation coefficient between X_i and the other explanatory variables. The larger the value of VIF the more collinear the variable X_i is. As a rule of thumb, if the VIF of a variable exceeds 10, there is a multicollinearity problem.

Heteroscedasticity is a systematic change in the spread of the residuals over the range of measured values. This implies that the residuals do not have constant variance which is one of the assumptions underlining the regression model hence the result cannot be trusted as it makes the coefficient less precise. Lower precision increases the likelihood that the coefficient estimates are further from the correct population value. Therefore, there is a need to test for Heteroscedasticity. The Breusch-Pagan-Godfrey test was used to test for the presence of heteroskedasticity.

4. RESULTS AND DISCUSSION

4.1 Demographic and Socio-economic Characteristics of Respondents

Table 2 shows the demographic and socio-economic characteristics of respondents. The ages of the respondents ranged between 20 and 65 years. However, using the cumulative frequency, the majority of the farmers (64%) are between the ages of 36-55 years, which supports the assertion of Republic of Ghana [3] that there is an ageing farmer population in Ghana.

With respects to gender distribution, males form 63.3% while female respondents form 33.7% of the respondents. Gage and Njogu [23] commented that in agricultural communities in Ghana, men were usually responsible for

Table 1. Variable description and expected sign

Variable	Description
y_i	farm gate price of the tomato
X_1	Age of respondent at the time of interview in years
X_2	Gender of respondent specified as a dummy variable (0=male, 1=female)
X_3	Years of education measured in years
X_4	Household size of the respondent
X_5	Respondent's ethnicity specified as categorical variable (0= Ga, 1= Ewe, 2=Akan, 3 Northerner)
X_6	Experience in tomato production measured in years
X_7	Membership of farmer based organization specified as dummy (0=no; 1=yes)
X_8	Access to extension service specified as dummy (0=no; 1=yes)
X_9	Distance from farm to the market centre measured in Killometres
X_{10}	Quality of road specified as categorical variables(0= footpath, 1= graveled, 3=tarred)
X_{11}	Production cost measured in Ghana Cedis
X_{12}	Access to market information, specified as a dummy variable (0=yes, 1=no)
X_{13}	Access to production credit from buyer specified as a dummy variable (0=yes, 1=no)
X_{14}	Tomato variety specified as categorical variable (0=improved variety, 1=local variety, 2= local and improved varieties)
X_{15}	Respondent sort/ grades produce specified as a dummy variable (0= yes, 1= no)
X_{16}	Quantity of produce sold specified as number of crates

Table 2. Demographic and socioeconomic characteristics of respondents

Items	Sublevel	Frequency	Percentage
Age groups			
	20-35	91	30.3
	36-55	193	64.3
	>55	16	5.3
Gender	Male	199	66.3
	Female	101	33.7
Level of education	None	101	33.7
	Primary	19	6.3
	JHS/MSLC	112	37.3
	SHS	68	22.7
Ethnic group	Ga	1	0.3
	Ewe	11	3.7
	Akan	259	86.3
	Northerner	29	9.7
Household size	1-5	171	57
	6-10	120	40
	11-15	6	2
	>15	3	1
Experience in selling	1-5	70	23.3
	6-10	84	28.3
	11-15	49	16.3
	16-20	45	15.0
	21-25	26	8.7
	>25	26	8.7
Frequency of extension visit	Weekly	18	6
	Fortnightly	55	18.3
	Monthly	110	36.7
	Yearly	8	2.7
	Outbreaks	11	3.7
Sales point	Farmgate	177	59
	0-2km	42	13
	>2Km	81	27
Road quality	Footpath	138	46
	Gravelled road	98	32.7
	Tarred road	40	13.3

Sources: Field data, 2019

clearing the land for cultivation and growing cash and food crops of high commercial value. However, women are usually involved in the production of food crops for home consumption and sale and the task of harvesting crops was shared by both sexes.

About 37% of the respondents have had formal education up to the Junior High School/ Middle School level and only 22.7% have had SHS level education (Table 2). The high level of illiteracy among farmers means a constant need for facilitating access to information by new approaches, opportunities and policies [3]. Changes in the global trade environment are widening the gap between the skills needs of the

private agribusiness and the skills of existing manpower of service providers. Escobal [11] asserted that farmers with higher levels of education are more likely to bargain for a higher selling price as they tend to have better access to price information on the produce.

The ethnic distribution of the respondents in the sample area is presented in Table 2. The Ga ethnic group represents 0.3% of the respondents, Ewes are 3.7 while those from the Northern part of the country accounted for 9.7% of the respondents. The Akans form 86.3% of the respondents and this is as a result of the study area being predominately Akan communities.

The household sizes of the correspondents ranged from 1 to 28. About fifty-seven (57) of the respondents have a family size of 1-5. The family size of 43% is within the range of 6-28 members. Also, 2% of the respondents had a family size of 11-15 while 1% had a family size larger than 15.

Most of the respondents have been selling their products for the past 1 to 25 years with a cumulative percentage of 92%. About 23% and 28%   23.3% of the respondents have sold their produce themselves for the 1-5years and 6-10 years respectively. For a period between 11-15 years and 16-20years, 16.5% and 15% of the respondents have been selling their produce. Also, 8.7% have been selling their products for the past 21-25 years and more than 25years respectively.

According to [11], the inclusion of experience of selling in the study implies that farmers with long-term involvement in tomato production and selling have more bargaining power and thus obtain higher prices than those with less experience. About 20.7% indicated they had yearly visited while 3.7% indicate that extension officers visit them only when there is a disease outbreak on their farm.

Table 2 shows the number of extension services visits received by the respondents. Six per cent of the respondents had extension officers visiting them every week.   Sixty- three percent of respondents said they receive services from Agricultural Extension Officers. About 37%percent said they were visited monthly, while 18.3% said they were visited fortnightly. Wenninker and Heemskerk [24] stress the importance of FBOs in agricultural innovations. According to them, research and extension organizations have moved from working with individual farmers to collaboration with groups, and increasingly with FBOs. They argue that individual farmers have always been involved in agricultural research and extension, but organized farmers are now considered an important means of exchanging and transferring knowledge, and thereby reducing transaction costs and creating synergy. Thus to improve the number of extension visit, the formation of FBO may be considered.

As presented in Table 2, 59% of the respondents sell their produce at the farm gate. Thirteen percent travelled a distance of 2 km and 27% travel over a distance of 12 km to sell their produce. The study thus revealed that the commodity is normally offered for sale at the farm gate. This may influence the prices received by the farmers. Forty-six per cent (46%) of respondents use graveled roads, 32.7% use tractor path, and 13.3% use footpath while 8% use tarred road. Thus the road and transport infrastructure for the movement of agricultural commodities and inputs are inadequate. This may have a negative influence on prices received by the farmers. According to [3], the lack of good feeder roads linking farms to villages affects the cost of imported inputs such as fertilizer and price of produce.

4.2 Factors Influencing Farm Gate Price

The VIF values show that all the continuous explanatory variables have no serious multicollinearity problem. The results of the Breusch-Pagan-Godfrey test of heteroskedasticity revealed high p-values: the study, therefore, did not reject the null hypothesis, however, rejected the alternative hypothesis that the variance is not homogenous (heteroscedastic).

From Table 3, it can be observed that the overall regression model is significant at a probability level of 1% with an F statistic of 4.326 which indicate a model with a good fit with the independent variables. Seven factors were important in influencing farm gate price, namely: distance (distance to farm-gate); quality of road, market information; use of credit for production from market queens or buyers; sorting the product prior to sale; and the total quantity of products available for sale.

Distance from farm to farm-gate negatively affects the farm-gate price. This implies that the further the farm-gate the higher the cost of transport, which relatively affects the farm-gate price in that farmers realise lower margins due to the higher transport cost.

This result supports a study by [25], which revealed that distance is one of the key determinants of cashew farm gate price received by farmers in Vietnam.

The regression results show that the quality of the road affects farm-gate price. It is depicted in the result that, as the quality of road deteriorates; the farm-gate price reduces. This may be attributed to the fact that, with bad roads, only a few traders visit the farm to purchase produce. This result in low demand and tomatoes being perishable produce, the farmers are consequently forced to sell it at a reduced farm

Table 3. Factors influencing the farm gate price of tomatoes

Variables	Coefficient	t-statistics	P-Values
Age	-2.056	1.0252	0.186
Gender	-1.706	0.250	0.695
Educational Level	2.517	0.786	0.266
Household Size	-0.150	1.0251	0.840
Ewe	13.944	1.087	0.700
Akan	8.225	1.005	0.813
Northerner	-13.190	0.124	0.708
Experience	1.684	1.045	0.299
Member of FBO	-9.220	1.012	0.164
Extension visit	5.184	0.890	0.262
Distance to market	1.935*	1.874	0.100
Tarred road	13.981*	1.925	0.140
Gravel road	16.212*	1.856	0.117
Cost of production	0.313	0.258	0.770
Market information	-20.001***	4.560	0.002
Credit from Market Queens	-14.683*	1.720	0.132
Improved variety	-6.755	0.987	0.338
Local and Improved variety	1.783	0.123	0.813
Grade/Sort product	21.201***	5.214	0.005
Total quantity of Produce harvested	-0.343***	6.021	0.000
Constant	244.323	3.251	0.000
Observations	300		
R-squared	0.292		
Adj. R-squared	0.224		
RMSE	33.401		
F-Statistics	4.326		
P-Value	0.000		

NB: Stars denote significance at *** $p<0.01$, ** $p<0.05$, * $p<0.10$ level; p-values for t-test in parentheses. Source: Computed from field survey data, 2019

gate price. Tarred road and graveled road are more likely to attract higher prices as compared with the footpath. This supports the finding of [26], which revealed that farmers in communities with a low level of infrastructure received lower prices than those with better infrastructure conditions. Specifically, road quality has closely been related to price variation.

Market information (as in following upmarket price before the transaction) negatively affects the farm-gate price the farmer received in this study. The results revealed a negative coefficient for this variable.

This might be attributed to the receipt of distorted, late and inaccurate information, which placed the farmers at a disadvantage concerning price negotiations. These findings are similar to previous studies [27,11]. They observed that asymmetry information received by farmers placed them at a disadvantage when negotiating

with traders; also makes their bargaining power weak. However, a study by [25] revealed a positive relationship between market information and farm gate price received by farmers. The positive relationship is attributed to accurate price information farmers obtained, which assists them in negotiating a higher price for their produce.

The variable of a farmer's indebtedness to buyers creates a negative impact on farm-gate price. This can be explained by the fact that farmers who received production credit from buyers are always eager to settle their debt as early as possible to minimize the cost of capital incurred by them; therefore they are coerced to accept a lower farm gate price. Hence the higher the debt the more likely it is that the farmer would sell his/her produce at a lower price. It is not surprising that farmers who used credit from market queens for production are likely to accept low farm-gate prices.

From the regression result found in Table 3, it was observed that sorting has a positive relationship with the price received by the farmers. It appears that sorting or grading increases the total revenue received by the farmers. When sorted, the quality tomatoes attract a good price but the rest may not attract any buyer; as compared to the non-sorted tomatoes, which attract an average price. This result supports the finding of [25], which revealed that quality is positively related to farm-gate price as buyers purchase quality cashew.

Total quantity sold negatively influences pricing at the farm-gate. This may be because the demand lags behind supply, which pushes down the price for perishable produce like tomatoes, in communities where storage facilities are lacking. It was observed that the varieties are not significant; this might be because the respondents are not influenced by the variety in pricing their produce.

5. CONCLUSION AND RECOMMENDATION

Generally, tomato farming has attracted an ageing population as the majority of the respondents are above 40 years. Thus there is the need to encourage young people to venture into tomato farming. This can be achieved by providing incentives such as market access and facilitating the land acquisition and inputs for farming. Men are dominant players in the tomato farming hence the District Assembly is encouraged to collaborate with Ministry of Food and Agriculture and Ministry of Gender, Women and Children Affairs to increase women participation in the tomatoes value chain.

Most of the respondents had a good formal education, which enabled them to read and write and be able to understand market information and take good pricing decisions on their produce. The farmers should be provided with market information, particularly price information in various markets as they have the capacity and knowledge to make use of this information to support their pricing decisions.

Due to the location of the study area, Akans form the majority of the farmers, which is generally attributed to the cumbersome procedure for acquiring land for farming for non-natives. The land acquisition should be facilitated for non-native farmers; this would encourage more Ghanaians who are interested in tomato farming but not natives of the study area to acquire land and to go into tomatoes farming. This would not only improve their livelihoods but also reduce unemployment.

More than half of the respondents have experience in tomato farming that expands over five years. Thus they are in a position to bargain for a good price with the buyers if they had storage facilities. However, due to the lack of storage facilities and tomatoes being perishable produce they allow the market women or the buyers to dictate the price. Few of the farmers undertake to grade and sorting as well as the distribution of their produce.

However, from regression results, it can be concluded that improved road networks, access to market information by the farmers, access to the credit facility, and quality control would improve the price received by the farmers at the farm gate. Thus there is the need for the government particularly feeder roads, to improve the road network in the study area to improve price received by the farmers. This would encourage existing farmers to continue with tomato production and attract the youth to tomato farming. The financial institutions should be encouraged to offer loans to the farmers to support them to purchase inputs and assist with the payment for labour to improve their productivity. This would generally improve their earnings. Finally, it is important to market information is provided by MoFA for the farmers regularly to support their pricing decision.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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