Assessing Tomato Marketing Efficiency in Selected Agro-Ecological Zones of Ghana

ABSTRACT

Tomatoes are a key component in the diets of Ghanaian households and contributes significantly to the nutritional needs of most rural and peri-urban farmers.However, tomato marketing and its related activities in Ghana is low compared to its production. Against this backdrop, this study examines the marketing efficiency of tomatoes in selected agro-ecological zones of Ghana. A snowball technique was used to select 65 market players from four (4) major markets of the three agro-ecological sectors. Using marketing margins and the ordinary least squares (OLS) regression we analyze the marketing efficiency of actors in the tomato value chain and the determinants of farmers marketing efficiency. The results revealed that marketing efficiency (ME) of farmers was higher than ME of wholesalers but not as high as those attained by retailers, however, farmers had the least market power. The results further revealed that variables such as education, experience in tomato farming, membership in FBO, GSZ location, price of tomato, cost of storage, and cost of postharvest losses significantly affect ME of farmers. The study recommends that government should invest in efficient transportation and storage infrastructure to reduce transportation and storage costs in the tomato value chain. The buffer stock program should be strengthened to buy farm produce and stabilize prices so as to minimize exploitative power of market queens and retailers in the tomato value chain.

Keywords: Marketing, Efficiency, Marketing Efficciency, Value chain, Tomatoes

1.1 Introduction

In Ghana, tomato cultivation is a thriving agricultural activity in the savanna and forest-savanna transition zones. Differences in rainfall patterns and access to water make its production highly seasonal and also bring about the variation in harvest periods (Robinson and Kolavalli, 2010). Two periods (period of abundance and period of scarcity) is created due to seasonality and reflects in market prices (Ihle and Amikuzuno, 2010). In addition, high production costs, poor seed distribution, poor adaptation to a variety of climatic conditions, inadequate use of irrigation water when needed, sub-optimal and/or untimely application of inputs such as fertilizers, lack of access to credit and inadequate control of pests and diseases contribute to low yields and inefficiency of tomato production in Ghana. It is believed that a farmer can obtain the maximum attainable yield levels by using the recommended quantity of fertilizer, improved seeds and other relevant inputs in tomato production (MoFA, 2018).

Horticultural products such as tomatoes offer huge prospects for poverty reduction and export growth in Africa due to their increasing demand throughout the world (Anang *et al.*, 2013). The tomato industry contributes significantly to the nutritional status and livelihoods of most West African farmers in the rural and peri-urban areas (Adenuga *et al*, 2013). In Ghana, tomato production has increased over the years to meet the growing demand. Tomato production increased from 196,991 tons in 2000 to 381,015 tons (see Figure 1.1). Production was stable in the early 2000s until 2005 when the country reported a sharp decline in production from about 100,000 tons per year to around 50,000 tons per year. The variations in production were primarily due to climate change rather than output in the area of cultivated land. Output grew virtually exponentially between 2008 and 2018, as shown in figure 1.1.

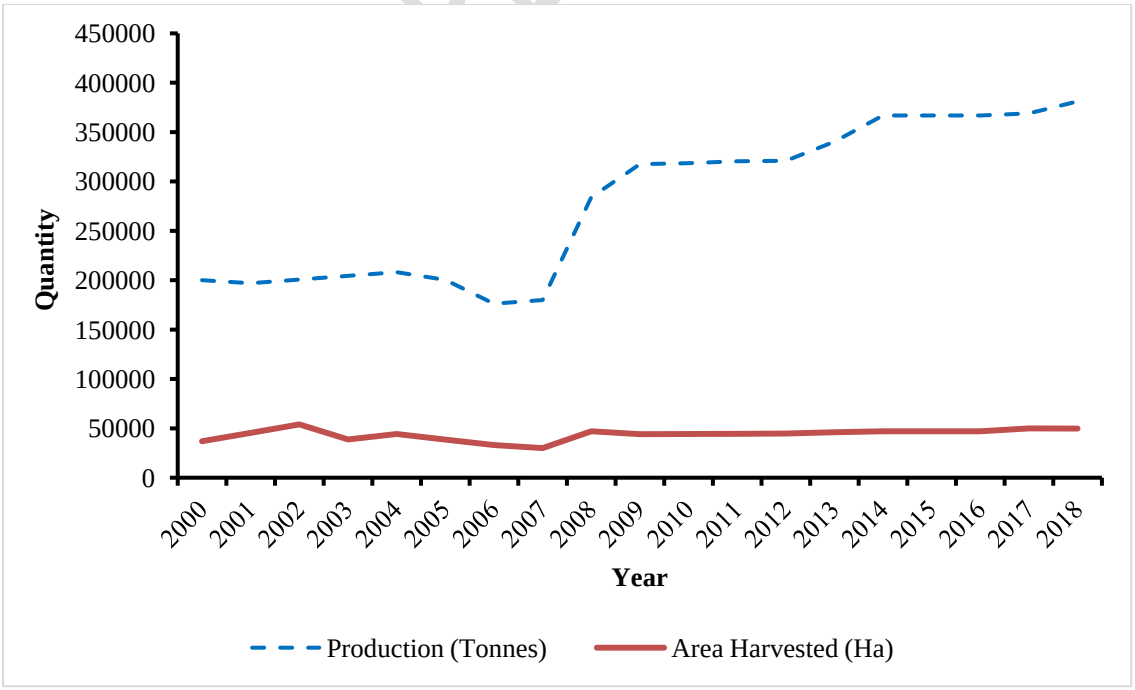

Figure 1. 1: Tomato production trends and yields

Source: FAOSTAT, 2018

Despite the increase in tomato production, national demand for tomatoes has long outstripped domestic supply a situation that attracts large imports from neighbouring countries (Dapaah and Konadu, 2004; Melomey *et al.,* 2019). In 2017 for instance, some 75,000 tonnes of tomatoes was imported to meet domestic demand. The supply shortfalls are attributed to low yields (Attoh, 2011), which are on average between 63,500 hg/Ha (6.50 t/Ha). Low agricultural productivity is partly due to resource-using inefficiency in agricultural production and low adoption of improved agricultural technologies including crop varieties (Owusu, 2016). The use of local and poor quality seed variety limits productivity (Mohiuddin et al., 2007) and the quality of tomato, which in turn affects pricing (Horna *et al.,* 2007; Clottey *et al.,* 2009). Although the crop has many benefits, most developing countries, particularly those in Africa, face many challenges in cultivating it, rendering it unprofitable for its production.

Since the end of World War II, governments in many developed countries have helped to transfer agricultural technology to developing countries to improve agricultural productivity. Recently, the introduction of advanced agricultural technologies has become the focus of the political interests of developing countries. The introduction of improved tomato varieties provides a significant increase in yields by reducing post-harvest losses, which can lead to the creation of processing and export industries, thereby promoting economic development, (Aidoo *et al.,* 2014; Perez *et al.,* 2017). In addition to its ability to induce the transition from current low-productivity farmers and subsistence farming to commercial agriculture (Awideide *et al,* 2016), adoption of improved agricultural technologies such as using improved seed varieties can also play a vital role in mitigating the malnutrition problem (Rashid and Anwar, 2001). Anang (2019) stated that, adoption of improved technologies is particularly important in developing countries where productivity, efficiency gaps and production inefficiencies of smallholder farmers remain high.

Marketing of tomatoes in Ghana has been a problem, indequate funds, high cost of inputs and high level of importation from other countries (Robinson and Kolavalli, 2010) are major issues of concern. The problems have heightened fears of subsequent loss of market and livelihood as liberalization is deepening within the economic of West Africa states regional market. According to the Ghana News Agency report on 11th March 2009, in the Upper East Region, Pwalugu inclusive, there is no tomato season that passes without some farmers reportedly get frustrated as a result of low prices for their produce or lack of access to market opportunities and as a result are unable to pay back loans owed financial trade, small scale production and poverty" undertaken in 2008 and facilitated by Social Enterprise Foundation of West Africa which found that the inability of farmers to raise funds to repay loans resulted from both price volatility and competition which was a characteristic of the increasing market share of imported tomato paste. These reports raise questions about the efficiency of the tomato marketing system especially as it relates to farmers. It appears from these reports that tomato producers and marketers are not making any meaningful profit from tomato and its related activities. In order to provide answers to these imperative concerns, this paper sought to analyze the market efficiency of actors in the tomato value chain in the selected agro-ecological zones of Ghana and also determine the factors influencing the marketing efficiency of farmers in particular. Previous studies have focused on specific segments of the market such as farm gate, or wholesale stage or retail stage or a combination of the previous two. This approach

obscures the fact that marketing is a system and must be analysed holistically. This study is unique in the sense that, it examines the efficiency of tomato marketing of all the actors in the tomato value chain from the farmer to wholesaler and to the retailar.

2.1 Theoretical and empirical specification of the models

2.2 Tomato Marketing Channels and Value Chain Actors

The prevailing tomato value chain is made up of farmers, market traders (wholesalers and retailers), and buyers. The tomato value chain can simply be viewed as the routes through which tomato pass to reach to final consumers. In Ghana, huge tomato markets are often located in the cities whereas production is a rural activity, generally done in a village or small town, by small-scale farmers. Wholesalers (market queens) buy and sell large quantities of tomatoes, usually in big and terminal markets while retailers buy and sell small quantities of tomatoes directly to final consumers. Market queens exercise monopoly in the market. However, the retailers are many which make their business highly competitive. The study identified four types of marketing channels in the tomato value chain. These relationships or marketing channels can be found below:

(1) Producers → Wholesalers (Market Queens) → Retailers → Final Consumers
(2) Producers → Wholesalers (Market Queens) → Final Consumers
(3) Producers→ Retailers → Final Consumers
(4) Producers → Final Consumers

Off-taking of tomato occurs when farmers begin to harvest the crop. Transaction activities in both producer and consumer markets occur on the market and nonmarket days. For tomato, harvesting can be done continuously for 3-6 months if the farm is properly managed. The channel through which tomato passes to reach the final consumer can be long or short. In the first route, the harvested tomato passes through many hands before it gets to the final consumer. In the second route, wholesalers can sell the harvested produce directly to consumers after they have bought the products from the farmers. Similarly, retailers can sell the harvested produce directly to consumers once they take possession of the produce from the farmers. In the fourth and final route, producers can also sell the harvested produce directly to the final consumers without passing through the hands of market intermediaries.

2.3 Empirical Specification of Marketing Efficiency Formulas

According to Acharya (1988), marketing efficiency could be determined by using marketing margin, where

$$\text{Marketing margin} = \left(\frac{consumer\ price - producer\ \ price}{consumer\ price}\right) * 100\% \qquad \textbf{[1.0]}$$

Olukosi and Isitor (1990) however proposed an alternative formula for computing marketing margins as follows;

Marketing margins = $(\frac{Valueadded\ \ by\ marketing\ \ activities}{Marketng\ \cos t})*100\%$ **[2.0]**

Sabu and Tripathy (1998) mentioned that minimum cost is the basis for efficient markets.

2.4 Gross Margin

Barnard and Nix (1979) reported that a venture's gross margin is its financial output minus its variable costs. The gross margin for the individuals in the supply chain of tomatoes will thus be measured as:

Gross margin=Total Revenue-Total variable cost

Also, Kohls (1985) stated that the marketing margin is equal to the difference between what the consumer pays and the farm gate per unit price of the food produce. From the above and on the assumption that farmers sell directly to wholesalers while wholesalers directly sell to retailers, implies wholesalers' gross margin equals: *wholesalers' selling price per unit minus farmers' selling price per unit while retailers' margin is equals to the retailers' selling price per unit minus wholesalers' selling price per unit.*

Marketing margins are computed as follows:

$$GMM = (P_s - P_c)100 \qquad \textbf{[3.0]}$$

Where GMM is the Percentage Gross Marketing Margin,

P_s , is the average selling price of a particular player and P_c is the average cost price for the same player.

The difference between the gross marketing margin and marketing costs is the *net margin* accrued to both the wholesaler and the retailer while the *marketing cost* is the sum of transport cost, storage cost, labor cost and other cost associated with carriage out of the commodity from the point of purchase to the customer or the end user.

$$NMM = GMM - MC \qquad \textbf{[4.0]}$$

Where a given traders Net Marketing Margin (*NMM)* is denoted by *MC* the trader's Marketing Cost. From the above, Net marketing Margin (NMM) divided by the Marketing Cost (MC), gives as the markeing effivciency (ME).

2.5 The Ordinary Least Squares (OLS) Regression

A multiple linear regression model was used to identify factors that influence farmers marketing efficiency. The OLS technique was used to estimate the model parameters since the dependent variable (thus, marketing efficiency) is a continuous variable. The technique usually produces the best linear unbiased estimators (Koutsoyiannis, 1977). The Ramsey (RESET) was estimated for omitted variables and correct functional form. The result (y=0) indicates no omitted variables and the correct functional form was employed. Though the marketing efficiency of farmers was computed as a ratio

of net marketing margin (NMM) to total marketing cost (TMC), it has scores of more than 1% and approaches positive infinity. This makes the OLS superior to the fractional regression model in estimating the determinants of ME of farmers; fractional regression is appropriate when the dependent variable consists of values between 0 and 1. A 100% ME shows a perfect efficient market. However, if ME is greater than 100%, it indicates that tomato farmers make abnormal profits. Also, if ME is less than 100%, it means that the market is inefficient.

Empirical Specification of the OLS Model

$$\begin{aligned} ME_i &= \alpha_0 + \alpha_1 Sex_i + \alpha_2 Educ_i + \alpha_3 Farming\_Exp_i + \alpha_4 FBO_i \\ &+ \alpha_5 GSZ_i + \alpha_6 FTSZ_i + \alpha_7 Price\_Tomato_i + \alpha_8 Cost\_Storage_i + \\ &\alpha_9 Cost\_Transportation_i + \alpha_{10} Postharvest\_Loss_i + \xi_i \end{aligned} \quad \textbf{[43.0]}$$

Where the slope parameters are $\alpha_1, \alpha_2 \ldots \alpha_{10}$ and the error term is ξ

Chart 1 Definitions, Measurements and *a-Priori* Expectations of Determinants of Farmers Marketing Efficiency

Variables	Definition of Variables	Measurement	A priori Expectation
Sex	Sex of the farmer	Dummy; 1 if the respondent is a male, 0 if otherwise	+
Education	Farmers Level of Educational	No. of years	+
Farming_Exp	Farming experience	No. of years	+
FBO	Membership in FBO	Dummy; 1 if the respondent belonged to an FBO, 0 if otherwise	+
GSZ	Guinea Savannah zone	Dummy; 1 if the respondent is located in GSZ, 0 if otherwise	+/-
FSTZ	Forest Transition Savannah zone	Dummy; 1 if the respondent is located in FTSZ, 0 if otherwise	+/-
Price of Tomato	Price of tomato	Ghana Cedi	+
Cost of Storage	Cost of storage	Ghana Cedi	-
Cost of Trans	Cost of transportation	Ghana Cedi	-
Postharvest Loss	Cost of postharvest losses	Ghana Cedi	-

3.1 Methodology

This study was carried out specifically in the Guinea Savannah, Forest Savannah Transition and the Coastal Savannah zones of Ghana. The study was cross-sectional and employed mainly primary data obtained from farmers using semi-structured questionnaires through a snowball sampling technique. A total of sixty five (65) tomato actors consisting of farmers , wholesalers and retailers were used for the study. Four (4) markets (Navrongo market, Tamale Market, Techiman and Ashaiman market were used for the study. The choice of the market (Consuming/ producing or both) informed the sampling of the actors (Wholesales or retailers) .We employed both quantitative and qualitative techniques in the analysis. The Stata software version 16 was used to provide descriptive statistics, such as the mean, standard deviation and variance of the respondents.' and to also estimate the maximum likelihood estimates.

4.1 Results and Discussion

4.2 Farmer and Farm-Specific Characteristics

Table 1 shows the descriptive results of the farmer and farm-specific characteristics, as well as institutional and environmental factors used in the study. As shown in the table, the respondents have a mean age of 40.53 years with a minimum of 22 years and a maximum of 77 years respectively. The mean ages of farmers in GSZ, FSTZ, and CSZ are 41.09 years, 40.97 years, and 39.367 years. This finding is consistent with the Dasmani *et al.* (2020) study which showed a mean age of 40 years. Also, about 89.6% of the respondents are male while the remaining 10.4% are females. The findings are consistent with Owusu (2016), Wongnaa and Awunyo-Vitor (2019), and Dasmani *et al.* (2020) who revealed male dominance in farming in the coastal, forest and savannah zones in Ghana. It was also revealed that the dominant 82.10% in cormmercial tomato farming are males with on a few females 17.90 also in commercial tomato faming. However in the case of small scale farming majority 91.29% are female with the remaining 8.71% being males. This finding does not meet the *a-priori* expectation, since a higher percentage of women are in commercial production than in subsistent/small-scale. The survey results show that 36% of the sampled respondents in the selected agro ecological zones are lliterate while the remaining 64% are illiterate. The mean formal education is 2.23 years with a minimum of zero and a maximum of seven. The results also show a low level of formal education in GSZ (2.21 years), FSTZ (2.74 years), and CSZ (1.50 years) respectively. The mean educational years also indicate that the highest level of education a respondent has attained on average is primary education (approximately Primary 3). The result is consistent with the GSS (2016) finding which indicates approximately half of Ghana's adults not to have obtained primary education or completed middle school/JHS. In terms of technology adoption and understanding of market dynamics this could have some negative influence on agriculture. According to Minot et al. (2006), education is also a means of accessing extra employment activities, especially in the non-farm sector. Moreover, majority (90%) of the family heads of the selected farmers in the agro ecological zones are without formal education and this may mean that most of these people would not be able to engage in any formal employment except agriculture. The findings are consistent with (Dasmani et al., 2020).

Table 1: Descriptive statistics of the sample's characteristics

	GSZ (n=250)		FSTZ (n=158)		CSZ (n=100)		Pooled (n=508)	
Variables	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Farmer characteristics								
Sex (dummy)	0.896	0.306	0.734	0.443	0.870	0.338	0.841	0.366
Age (years)	41.092	11.054	39.367	8.554	40.970	11.854	40.532	10.522
Household size (count)	7.488	3.662	6.677	10.693	9.250	4.774	7.583	6.874
Education (years)	2.208	2.426	2.741	1.130	1.500	1.806	2.234	2.027
Farming experience (years)	14.060	9.809	11.285	7.451	13.090	10.744	13.006	9.406
Primary occupation (dummy)	0.848	0.360	0.930	0.255	0.670	0.473	0.839	0.368
Policy variables								
Membership in FBO (dummy)	0.984	0.126	0.962	0.192	0.920	0.273	0.965	0.185
Membership in insurance policy (dummy)	0.080	0.272	0.050	0.219	0.000	0.000	0.049	0.217
Extension service (dummy)	0.436	0.497	0.816	0.388	0.830	0.378	0.632	0.483
Access to credit (dummy)	0.184	0.388	0.038	0.192	0.100	0.302	0.122	0.328

The mean household size is 7.58 persons per household with a minimum of one and a maximum of twenty-three respectively. This average size is slightly below the average of 7 members in Ghana's household (GSS, 2010). The average household sizes of farmers in GSZ, FSTZ, and CSZ are 7.49, and 6.68, and 9.25. This finding is in-line with the findings by GPHS (2010), which revealed Ghana to practice extended family system where a household has an average population 5 or more. Martey *et al.* (2012) indicated that large household sizes necessitate adequate supply of family labor. Al-Hassan (2008) also argues that large families enable members of household to earn additional income from non-farm activities and can help minimize marketable surplus through consumption.

Furthermore, majority (83.9%) of the farmers are engaged in tomato production as their primary occupation. For agro ecological zones, a higher number of farmers in FSTZ (93.0%) and GSZ (84.8%) are engaged in tomato production as their main source of livelihood, compared to those in CSZ (67.0%). This finding could be attributed to lack of formal education of the sample respondents. It is common to find many who are not formally educated engaged in informal jobs such as farming, craftsmanship, petty trading and others.

Table 1 also shows farmers' access to extension services, membership in FBOs, and environmental factors such as annual rainfall and annual temperature. The table reveals that about 96.5% of the farmers belonged to FBOs. The proportions of FBO members in GSZ, FSTZ, and CSZ are 98.4%, 96.2%, and 92.0%. FBOs act as platforms through which farmers get to identify new technologies, ideas and credit to mitigate current and future problems related to the acquisition and use of farm inputs, and marketing imperfections to ascertain other important and essential agricultural knowledge through training and demonstration (Osman *et al.*, 2018).

Furthermore, about 63.2% of tomato farmers have access to extension services. However, access to extension services is higher in CSZ (83.0%) and FSTZ (81.6%), compared to GSZ (43.6%). Just 12.2% of the entire farmers have access to credit for their tomato production. The proportions of farmers with access to credit in GSZ, FSTZ, and CSZ are 18.4%, 3.8%, and 10.0% respectively.

Also, less than 5.0% of the entire sample belongs to an insurance program. About 8.0% and 5.0% of farmers in GSZ and FSTZ belong in an insurance program, whereas none of the farmers in CSZ participated in an insurance program.

4.3 Household Expenditure of Tomato Farmers across the Agro-ecological Zones

Household expenditure, also measured in Ghanaian cedis (GH₵), is evaluated as the sum of cash expenditures on food commodities (including the estimated value of own production) and non-food commodities. As shown in Table 2, the mean annual household expenditure is estimated at GH₵8895.6, with food expenditure accounting for about GH₵3251.6 (36.55%). Regarding the non-food commodities, a greater amount of cash was spent on children's education (GH₵1550.5), followed by utilities (GH₵799.6); clothing (GH₵749.9), housing (GH₵706.2), transportation (GH₵518.7), health care (GH₵406.0), and fuel (GH₵199.6). The results of the one-way analysis of variance (one-way ANOVA) further show that household expenditure in FSTZ (GH₵11135.9) was

significantly higher than those in GSZ (GH¢8002.6) and CSZ (GH¢7588.9). Also, households in FSTZ spent more money on food and non-food commodities such as fuel, transportation, education, utilities, clothing, housing, and healthcare, compared to households in GSZ and CSZ. This finding could be attributed to the rational behavior of consumers, where if all other consumption determinants are held constant, as one's income increases one's consumption increases. Thus, since FSTZ has more income from all-year round production, it is expected that it expenditure on both food and non-food commodities should be more than that of GSZ and CSZ.

Table 2: Results of Annual Household Expenditure

	Pooled sample	**GSZ**	**FSTZ**	**CSZ**
Item	**Mean (GH¢)**	**Mean (GH¢)**	**Mean (GH¢)**	**Mean (GH¢)**
Food	3251.565 (1682.036)	2932.0 (1079.29)	3722.96 (1339.32)	3303.43 (2846.20)
Fuel (Gas)	199.575 (142.880)	88.46 (1874.55)	306.49 (1589.16)	192.48 (1577.48)
Transportation	518.707 (948.380)	362.06 (588.77)	860.0 (1332.93)	370.7 (804.5)
Education	1550.484 (1649.605)	1988.0 (1936.71)	1236.4 (1243.97)	952.52 (1022.05)
Utilities (Water / Electricity/Communication)	799.560 (1342.881)	723.5 (1680.41)	115.8 (971.55)	491.17 (605.38)
Clothing	749.990 (1541.475)	471.83 (474.22)	619.88 (563.3)	522 (833.92)
Housing	706.2001 (1504.467)	503.83 (637.40)	842.63 (893.22)	996.58 (3014.3)
Health Care	406.023 (579.386)	332.29 (330.3)	623.96 (886.5)	246.0 (287.96)
Total Household Expenditure	8895.597 (6394.805)	8002.62 (5394.0)	11135.95 (72.75.76)	7588.9 (6366.64)

NB: Figures in brackets are standard deviation
Source: Author's Estimations from Field Survey, 2020

4.4 Price Flows in the Tomato Value Chain

Prices of tomato are determined based on direct negotiations between the traders (buyers) and farmers. Besides the uncertainties of demand and supply in the market, prices of tomato may vary according to the season of production and distance that separates the place of production and the place of sale (Piya, 2001; Adepetu, 2010). In Ghana, for example, the FTSZ and CSZ experience two rainy seasons while the GSZ experiences only one rainy season. However, tomato production is usually highest in GSZ, especially in the wet season compared to the FTSZ and CSZ, suggesting that tomato production in

GSZ may have a two-sided influence on the supply and prices of tomato in the FTSZ and CSZ. Given this, the study compares the prices of tomato received by various market players in selected agro-ecological zones in Ghana. The prices of tomatoes were collected on a per box/crate basis. A crate weighs about 72 kg on average. The average prices per 72kg of fresh tomato paid to and received by farmers and market intermediaries including wholesalers (who are mostly market queens) and retailers/tomato marketers association are presented in Table 5. From the table, the average price at which a farmer sells 72kg of fresh tomato was estimated to be GH¢129.4 whereas retailers and wholesalers sell the acquired item at GH¢298.4/72kg and GH¢234.8/72kg respectively. The increase in wholesale and retail prices can be due to the higher marketing costs (see Table 3. for reference) and overexploitation of consumers, especially in the cities. The finding corroborates Boateng et al.'s (2016) finding that the mean selling price of vegetables received by retailers was the highest when compared to the average selling price of vegetables received by wholesalers and producers. The results also showed that farmers in the CSZ have a higher selling price (GH¢250.00/72kg) when compared to those in the GSZ (GH¢180.00/72/kg) and FSTZ (GH¢160.00/72kg). Similarly, wholesalers in the CSZ received a higher price (GH¢450.00/72kg) when compared to their counterparts in GSZ (GH¢370/72kg) and FSTZ (GH¢341/72kg). A similar trend was observed at the retail level. Retailers in the CSZ sell their tomato at a higher price (GH¢550/72kg) when compared to their counterparts in the GSZ (GH¢420/72kg) and FSTZ (GH¢380/72kg). For wholesalers and retailers, prices of tomatoes could reach as high as GH¢490/72kg and GH¢720/72kg respectively in the CSZ, whereas for farmers, prices of tomatoes could reach as low as GH¢120/72kg in the FSTZ.Price of tomatoes is higher in CSZ compared toFSTZ and GSZ.This high price of tomatoes in the CSZ could be attributed to higher demand of tomatoes in the CSZ which is partly due to higher population and the urban nature of the zone.Again it could be attributed to highly irrigational nature of the zone which makes cost of production high and the catalyst on cost of sales compared to the other zones who are mostly into rainfed production.

Table 3: Tomato Prices in Crates (72kg)

Variables	**GSZ (30)**			**FSTZ (20)**			**CSZ (15)**			**Pooled (65)**		
Tomato Actors	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**	**Mean**	**Min**	**Max**
Farmer/Self	180	150	200	160	120	195	250	200	350	183.3	156.7	248.3
Wholesalers/ Market Queens	370	245	425	341	230	400	455	420	490	388.7	298.3	438.3
Retailers/TMA	420	370	450	380	350	420	600	550	720	450.0	440.0	530.0

Source: Modified from Ghana Food Pricing, Dec, 2019.

4.5 Marketing Costs, Margins, and Efficiency of Tomato Value Chain Actors

Table 4 shows the descriptive statistics of marketing costs, margins, and efficiency per 72kg of fresh tomato earned by farmers, wholesalers, and retailers in the three agro-ecological zones. This table presents the means of the selected indicators. The marketing cost for farmers, wholesalers, and traders is recorded as variable costs including expenses on transportation, loading and off-loading, duties/taxes, and others (including paying fees for an undisclosed reason). The results revealed that on average, retailers had the highest gross margin (GH¢231.6 per 72kg of fresh tomato), followed by wholesalers (GH¢203.5 per 72kg of fresh tomato) and farmers (GH¢118.9 per 72kg of fresh tomato). This finding is partly because the retailers received fairly high revenues (GH¢530.0) per 72kg of fresh tomato than the wholesalers (GH¢438.3) and farmers (GH¢248.3) respectively. The finding is consistent with Toure and Wang (2013) in Bamako, Republic of Mali who found that the price of tomato at the farm gate is less than the retail price.

The mean marketing cost was also estimated to be GH¢30.00, GH¢ 65.00, and GH¢42.00 per 72kg of fresh tomato for the farmers, wholesalers, and retailers respectively. This finding is consistent with Boateng *et al.* (2016) who reported that wholesalers incurred higher marketing costs than retailers because the former incurs a higher transportation cost compared to the latter. According to Boateng et al. (2016), wholesalers tend to incur a higher marketing cost (and in particular transportation cost) because they assemble the product from different production areas before transporting them to the market, as compared to retailers who buy from wholesalers and resell usually on the same spot or a nearby market. Further analyses on the cost items revealed that, compared with duties/taxes, loading, and off-loading charges and other marketing charges, transportation and storage together accounted for more than 70% of total marketing costs incurred by farmers and wholesalers and 60% of total marketing costs incurred by retailers. Similarly, Iddi et al. (2017) reported that among levies, loading and off-loading charges, and other marketing expenses, transportation cost forms the highest part of total marketing cost of yam farmers, wholesalers, and retailers in Northern Region of Ghana.

Table 4 : Annual Gross and Net margins of Tomato Key Players

Items	Farmers		Wholesalers		Retailers	
Marketing Margins	**Mean (GH¢)**		**Mean (GH¢)**		**Mean (GH¢)**	
a. Goss Revenue/72kg	248.3		438.3		530.0	
b. Cost of product/72kg	129.4		234.8		298.4	
c. Gross Margin/72kg (a-b)	**118.9**		**203.5**		**231.6**	
Marketing Costs (Expenses)		**% of Total Cost**		**% of Total Cost**		**% of Total Cost**
Transportation cost/72kg	15.0	50.00	35	53.85	10	23.81
Loading/offloading/72kg	3.0	10.00	5	7.69	5	11.90
Tax/duties/72kg	1.0	3.33	3	4.62	2	4.76
Storage cost/72kg	7.0	23.33	12	18.46	15	35.71
Other costs/72kg	5.0	16.67	10	15.38	10	23.81
d. Total Marketing cost/72kg	**30**	100.00	**65**	100.00	**42**	100.00
e. Net Margin/72kg (c-d)	**88.90**		**138.5**		**189.6**	

Source: Author's Estimations from Field Survey, 2020

Net margin was evaluated as gross margins (sales receipts) minus the marketing cost. As shown in Table 4, net margin per 72kg of fresh tomato was averaged at GH¢138.8, with a mean gross revenue of GH¢184.7 and an average marketing cost of GH¢45.7. However, the results suggest that profit earned by retailers and wholesalers was about twice that of farmers. The mean net margin per 72kg of fresh tomato was estimated at GH¢189.0 and GH¢138.5 for retailers and wholesalers compared to GH¢88.9 for farmers. The results, on the other hand, suggest that retailers and wholesalers earn very high gross margins but incurring relatively low marketing costs compared to the farmers. In general, tomato marketing was found to be a profitable venture in the study area, as about18-25% of gross marketing margin was spent as marketing costs, with the remaining amount retained as net marketing margin. The finding agrees with Adesina et al. (2008) and Obayelu et al. (2014) who reported that marketing of fresh tomato, especially for retailers and wholesalers is more profitable in Nigeria. However, it disagrees with Wongnaa et al. (2014) who found that wholesalers have a higher marketing margin compared to retailers. The results in Table 7 further showed a mean marketing efficiency of 304.0%, indicating that tomato value chain actors make super-normal profits. The results also suggest that tomato value chain actors may increase profits by not merely minimizing cost, but also reducing postharvest losses. Comparatively, retailers were found to be the most efficient tomato value chain actors with a mean marketing efficiency of 450% (which is far over the break-even point), compared to farmers and wholesalers who on average, make a surplus of 296.33% and 213.08% respectively. The figures imply that tomato farmers and market intermediaries are highly efficient in the marketing of tomato. The finding agrees with Mandal et al. (2011) in West Bengal but disagrees with the findings of Iddi *et al.*

(2017) in the Northern Region of Ghana who found that farmers are more efficient when it comes to yam marketing when compared to wholesalers and retailers.

Table 5: Marketing Efficiency of Key Actors

Items	Pooled Average (GH¢)	Farmers Average (GH¢)	Wholesalers Average (GH¢)	Retailers Average (GH¢)
Gross Margin/72kg (c)	184.70	118.90	203.50	231.60
Marketing Cost/72kg (d)	45.70	30.00	65.00	42.00
Net Margin/72kg (e)	138.80	88.90	138.50	189.00
Marketing Efficiency/72kg (e/d)	3.04	2.963	2.131	4.50
Marketing Efficiency/72kg (%)	304.0	296.3	213.08	450.00

***NB**: The unit of measurement for the tomatoes' is a crate for a (72kg)*
Source: Author's Estimations from Field Survey, 2020

4. 6 Determinants of Marketing Efficiency of Tomato Farmers in Ghana

The OLS regression model was estimated to reveal the factors influencing the marketing efficiency (ME) of tomato farmers in Ghana. The coefficients (marginal effect estimates) and the standard errors corresponding are presented in Table 6. The F-statistic (48.310) was significant at 1% level, implying that at least one of the explanatory variables has a significant relationship with the ME of tomato farmers in Ghana. The R-squared is 0.874, indicating that about 87.4% of the total variation in the ME of tomato farmers was explained by changes in all the explanatory variables. The results further revealed that seven explanatory variables, education, experience in tomato farming, membership in FBO, GSZ location, price of tomato, cost of storage, and cost of postharvest losses significantly affect ME of tomato farmers in Ghana.

Table 6: Determinant of farmers marketing efficiency

Variables	Coeff.	S.E
Sex	-3.420	4.622
Education	6.539***	3.492
Experience in tomato farming	-0.464***	0.178
Membership in FBO	-1.158**	0.516
GSZ	-1.268**	0.660
FSTZ	-3.787	6.668
Price of tomato	0.120***	0.009
Cost of storage	-0.031*	0.019
Cost of transportation	-0.001	0.013
Cost of postharvest losses	-0.019***	0.002
Constant	5.483	2.286
F-stat	48.310	
Prob>F	0.000	
R-squared	0.874	
Number of observations	508	

Source: Author's Estimations from Field Survey, 2020

Education is statistically significant at 1% level, indicating that education is an important factor explaining the ME of tomato farmers. The coefficient of education is positive (6.539), suggesting that the ME of tomato farmers will increase by 6.539 units if the individual attains one more year in formal education, *ceteris paribus*. This result meets the *a priori* expectation as better education enables one to acquire the vital skills on how best to strategize and to adapt to improved marketing conditions (Laper et al., 2003; Obasi, 2008). The finding is consistent with the findings of Wongnaa et al. (2014) using tomato market intermediaries in the Ashanti Region of Ghana and Offor et al. (2016) using yam marketers in Umuahia North Local Government Area of Abia State, Nigeria; but disagrees with Farayola et al. (2013) using smallholder cocoa marketers in Oyo State, Nigeria, who found a negative and significant influence of education on ME.The coefficient of experience in tomato farming is negative (-0.464) and significantly affected ME at 1% levelThe finding disagrees with Offor et al. (2016) who revealed that marketing experience had a positive and significant influence on ME. As opined by, Okoye (2011) marketing experience tends to reduce transaction costs due to the individual's ability to escape long and complex marketing chains, which in turn increases ME. However, the result of this study proves otherwise, as less-experienced farmers had a higher ME.Membership in FBO has a significant, but negative effect on ME at 5% level. FBOs offer farmers the opportunity to access information and learn improved marketing practices which tend to increase the ME of farmers. The result is consistent with the finding of Farayola et al. (2013) in Oyo State, Nigeria who revealed that membership in cooperatives had a positive and significant effect on ME. The coefficient of the price of tomato (0.120) is also found to have a positive and statistically significant relationship with the ME of tomato farmers. This result is also in tandem with the finding of Farayola et al. (2013) in Oyo State, Nigeria but disagrees with the findings of Nwaru et al. (2011) who found a negative and statistically significant relationship between profit and purchase price per unit of vegetables in Umuahia Agricultural Zone of Abia State, Nigeria.The location of farmers and their potential markets could be an important factor in encouraging farmers to increase their sales (Makhura, 2001). According to the results, living in GSZ has a negative and statistically significant effect on ME, further indicating that farmers located in GSZ are less efficient in the marketing of fresh tomato compared to their counterparts in CSZ. The coefficient of GSZ suggests that farm households located in GSZ improved their ME by 1.268 percentage points compared to those in CSZ at 5% significance level. Also, the cost of storage is found to have a negative and statistically significant coefficient (-0.031) at 10% level. Additionally, the cost of postharvest losses had a negative and significant effect on ME at 1% level.

5.1 Conclusions and Policy Recommendation

Marketing efficiency levels and its determinants were analyzed using marketing margins and OLS. It was reveled that, retailers had the highest marketing efficiencies which was far more than the break-even point (350%), compared to farmers and wholesalers, who on average, made a surplus of 296.33% and 213.08% respectively. They also incurred the least marketing cost (GH¢30.00), compared to the cost of wholesaling (GH¢ 65.00) and production (GH¢42.00 per 72kg. The OLS regression results revealed education and price of tomato as positive and significant determinants of marketing efficiency for tomato farmers. On the other hand, experience in tomato farming, membership in FBO, GSZ location, cost of storage and cost of postharvest losses had a significant negative effect on marketing efficiency of tomato farmers in Ghana.

Tomato production in the three selected agro-ecological zones was not very profitable as compared to marketing of tomato. Farmers had the least market power and marketing efficiency compared to wholesalers and retailers.

The study also suggests to government to invest in efficient transportation and storage infrastructure to reduce transportation and storage costs in the tomato value chain. The buffer stock program should be strengthened to buy farm produce and stabilize prices so as to minimize exploitative power of market queens and retailers in the tomato value chain. If this is done, there would be equitable welfare gains in tomato for the value chain actors. Higher prices for the tomatoes would increase the marketing efficiency of farmers. Finally, the study offers evidence on price determination and marketing efficiency in the tomato value chain, which is uncommon in most production efficiency and welfare studies.

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