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Structure and entry barriers to access groundnut markets for intermediary traders in central and northern Malawi

Admire Katunga [a], Edilegnaw Wale Zegeye [b] and Gerald Ortmann [c]

[a]Department of Agricultural Research Services, Chitedze Agricultural Research Station, Lilongwe, Malawi; [b]Department of Agricultural Economics, Faculty of Natural and Agricultural Sciences, University of the Free State, Bloemfontein, Republic of South Africa; [c]University of Kwazulu-Natal School of Agricultural, Earth and Environmental Sciences Discipline of Agricultural Economics, Pietermaritzburg, South Africa

ABSTRACT

Traders that participate in more competitive market structures earn relatively little marketing margins than those that participate in less competitive ones. For better returns, commodity producers have to transact in competitive market structures. Therefore, understanding market structures and market entry barriers are essential to inform policy. The study's objectives were to examine forms of market structure and investigate entry barriers into the local, district, and city groundnut markets for intermediary traders in central and northern Malawi. The findings revealed that the three markets were relatively competitive. Other results showed that business experience and sole ownership of business increased the traders' likelihood to enter the district and local markets, respectively. Market transaction costs and storage infrastructure negatively and positively influenced the probability of traders' entry into the local and city markets, respectively. The quantity of produce transacted increased and decreased the likelihood of entry into the local and city markets. Access to credit and informal credit sources increased and decreased the likelihood of entering the city market, respectively. Membership to informal trader associations increased the probability of entering the city market. Thus, institutions, markets and road infrastructure are critical to enhancing intermediary traders' participation in the local and city groundnut markets.

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1. Introduction

Before liberalising agricultural grain markets, farmers in most developing countries sold their produce to state-owned marketing boards (Kherallah et al. 2000). For example, in Malawi, between 1971 and 1987, the state-controlled Agricultural Development and Marketing Cooperation (ADMARC) was the sole buyer of smallholders' agricultural produce (Chirwa et al. 2005). Consequently, the prices that farmers received were usually controlled by the monopsonist and relatively low (Kherallah et al. 2000). This suggests that the markets were not competitive. With liberalisation, many private traders (large and small) were allowed to participate in grain marketing. The expectation was that their participation in the grain markets would create competition. As a result, prices offered to crop producers were also expected to improve (Chirwa et al. 2005). This was not realised due to structural hurdles and entry barriers. Further, market liberalisation did not translate

CONTACT Admire Katunga katungaadmire@gmail.com Department of Agricultural Research Services, Chitedze Agricultural Research Station, P.O. Box 30779, Lilongwe 3, Malawi
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to better profit margins for smallholders. Understanding the challenges behind these outcomes is critically important to inform market development policy.

Decades after market liberalisation, agricultural output markets remained underdeveloped and inefficient (Coulter and Onumah 2002; Swinnen et al. 2010). Such markets benefited certain market actors while the majority remained poor. In particular, private traders were offering relatively lower prices to producers than their profits (Pokhrel and Thapa 2007). They took advantage of farmers' inability to store and transport their products. This inability has resulted in an oversupply of agricultural products right after harvest as all farmers tend to sell at the same time and place to meet their financial needs (Mapila et al. 2013). Low prices demotivate farmers to invest in improved agricultural technologies (Muratori 2016), consequently affecting crop productivity (Osborne 2004; Murphy 2006). Reduced marketable surplus affects the drive to commercialising the smallholder crop subsector (Barrett 2008), with its adverse effects reflected on farmers' welfare (Mmbando et al. 2015). Understanding the structural sources of these challenges and their welfare impacts is an input for informed policy interventions.

Generally, uncompetitive markets are associated with high price-cost margins that accrue to buyers of commodities but with low prices offered to commodity producers (Hernandez and Torero 2013). Besides, there are many entry barriers in less competitive market structures. As a result, few traders and other intermediaries that participate in the less competitive market structures earn relatively larger market margins (Mann 1966; Bakucs and Fertõ 2005). From the traders' perspective, large market margins mean higher profits. Thus, to make large profits, traders would prefer to transact in less competitive markets with few buyers and middlemen.

On the contrary, producers view large marketing margins that traders earn as exploitative (Pokhrel and Thapa 2007). They feel that the traders offer lower prices than the profits they expropriate (Muratori 2016). Moreover, the traders take advantage of farmers' inability to bargain for better prices (Mapila et al. 2013) when few participate in the market. For this reason, producers would want to transact in competitive market structures with many buyers for better market returns.

Despite its policy relevance for the welfare of all market actors, empirical evidence on the relationship between market structure and entry barriers for sub-Saharan African (SSA) is scarce. Nevertheless, some empirical studies have determined the market structure for agricultural produce in the SSA. For instance, empirical findings for banana traders in Nigeria suggest a near perfectly competitive structure at the retail level and an imperfect structure at the wholesale market (Enibe et al. 2008). Such findings show that market concentration is dependent on the market channel at which traders participate. Dessalegn et al. (1998) also found that it is challenging for traders to enter a market where they do not enjoy economies of scale. Such economies of scale could be either in transport or quantities of produce that traders buy.

Haliru and Ibitoye (2014) investigated the gum-arabic market structure in north-eastern Nigeria. The study found that the few traders that participated in the market expropriated a substantial proportion of the market's total revenue. Findings from Haliru and Ibitoye (2014) were inconsistent with those of Dessalegn et al. (1998), suggesting that traders who participate in relatively high concentrated markets earn relatively high marketing margins. The inconsistencies in the studies' findings could emanate from the contextual differences of the study areas. However, Scott (1995) cautions not to interpret such a relationship in isolation of other intervening factors such as the market channel, nature of the produce, and other locally contextual factors.

Dessalegn et al. (1998) investigated the concentration of wholesale grain marketing with a few merchants along the different stages of Ethiopia's grain market. Estimates from this study also confirmed a high market concentration among the four largest grain traders in the wholesale market. Accordingly, where grain markets are highly concentrated, some barriers (such as transportation costs) exist. Such barriers hamper the entry of traders that handle small quantities of produce.

What remains unclear in the empirical literature is the association between market structure and entry barriers of agricultural markets and the relationship between market structure and marketing

margins, especially in SSA. Furthermore, most empirical evidence is from developed countries (Mann 1966; Hall et al. 1979; Kalirajan 1993). Therefore, the current study examines the structure and investigates entry barriers and marketing margins into local, district and city marketing channels for intermediary groundnut traders in Malawi.

Understanding market structure is an input to know how various players along the marketing chain earn crop income. Policy mitigation measures on poverty alleviation and improved food security rely on our understanding of the income distribution among the market channel actors (Muratori 2016). Policymakers could also use the information on the market structure to facilitate an enabling environment in which all market actors would benefit from the value they add. Information on the market structure is also critical on the quantities produced and sold, and the incomes producers receive. Consumers would also benefit from the outcomes of the current research because the extent of market competitiveness has a bearing on the supply and cost of food, which affects their welfare.

Notwithstanding their exploitative market behaviour, intermediary traders remain a reliable source of market outlet for smallholders' produce (Mapila et al. 2013; Sitko and Jayne 2014). Their participation and the value they add have implications for the efficient functioning of the markets and improved farmers' livelihoods (Mmbando 2014). Understanding the entry barriers that affect the participation of traders in the commodity markets provides policy strategies that would contribute to the efficient functioning of the markets.

The rest of the paper proceeds as follows. First, section 2 presents the study methods, including data collection, description of variables, and analytical framework. Then, the results and discussions are presented in section 3, followed by conclusions and recommendations in the last section.

2. Methods

2.1 Data collection and study areas

Groundnut is one of the legume crops that policymakers are promoting in Malawi. It is a potential crop to contribute to sustainable food security and increased incomes among smallholder farm households (Malawi-Government 2011). It is also the second income earner after tobacco and widely grown by smallholder farmers in Malawi (Tsusaka et al. 2016). The central and northern regional districts are the potential production areas of groundnuts, hence their selection for the study. These districts account for 68% of the total groundnuts that the country produced in the 2016/17 crop season (Malawi-Government 2017).

The study used primary data collected in a market survey of intermediary groundnut traders in August 2017. Intermediary traders purchase groundnuts from farmers at their homesteads and local markets to resell them to other buyers along the marketing chain (Simtowe et al. 2010). The survey was conducted in selected rural and semi-urban trading centres of Mchinji, Kasungu, Mzimba, Salima, and Lilongwe districts in Malawi. Except for Mzimba, which is in the north, the other districts are in the country's central region.

A three-stage sampling procedure was used to select the districts, trading centres, and traders. Firstly, the districts were purposively selected for their potential as groundnut production areas. Secondly, the trading centres that participated in the study were systematically randomly selected from the list provided by the district agricultural office. The trading centres were visited on designated market days, which vary from one trading centre to the other. Such an arrangement ensured that the traders had an equal chance of being selected. Finally, a systematic sampling procedure was used to select the traders by selecting every fifth trader that was spotted buying and selling produce at the trading centres. The traders were interviewed while they were either buying or selling groundnuts. Some traders refused to be interviewed, saying they were busy. A semi-structured questionnaire was administered to 124 traders who gave consent. Trained enumerators administered the questionnaire supervised by the researcher. The data collected included ownership of

the business, financial sources of the business and the volume of produce traders handled (procured and resold) in the 2015/16 marketing season.

2.2 Analytical frameworks

2.2.1 Measures of market concentration

The number of traders participating in the market and their respective market shares are a proxy for determining market concentration (Sun and Shao 2009). The results of market concentration indices are used to evaluate the structure of markets. Markets where few traders transact a high proportion of produce are considered concentrated and less competitive. In a more competitive structure, many players participate in the market, and the market shares of the products transacted are distributed among the traders according to the value they add (Haji 2014).

Common approaches used to determine the concentration of markets include point estimates of four firm or eight-firm concentration ratios and the Herfindahl-Hirschman Index (Enibe et al. 2008; Haliru and Ibitoye 2014). However, point estimates of market concentration indices consider market information only for the largest firms in an industry. Excluding market information for other small players renders estimates of market concentration biased. According to Naldi and Flamini (2014b), the Herfindahl-Hirschman Index (HHI) interval estimate circumvents the bias by accounting for the small players' market information. This technique has been widely used in developed countries' service industries, and the findings of such studies suggested that the markets were not concentrated (Nauenberg et al. 2004; Naldi and Flamini 2014b; Naldi and Flamini 2014a). However, with market liberalisation, many private traders participate in grain markets (Chirwa et al. 2005). Collecting market information for all the traders is, therefore, difficult. For this reason, the interval estimate of the HHI was found to be suitable for the current study.

Following Naldi and Flamini (2014b), the interval estimation of the HHI is illustrated by first specifying its point estimate.

$$HHI = \sum_{i=1}^{m} a_{ij}^2 \tag{1}$$

Where a_{ij} = the market share of groundnuts for buyer i of category j; $i = 1, 2, ..m$; $j = 1, 2$; $m =$ the number of largest buyers (firms) in the groundnut market, whose information on market share is readily available. Consequently, the ratio of the market share of groundnuts for each buyer (q_i) to the total quantity transacted in the market (Q) is computed as;

$$a_i = \frac{q_i}{Q} \tag{2}$$

It is important to note that Equation (1) represents the HHI for the m largest traders. To account for information of small traders, a residual R is added to the point estimate and is computed as

$$R = 1 - \sum_{i=1}^{m} a_i \tag{3}$$

The appropriate lower and upper bounds used are determined by comparing R with the smallest market share S_m of the largest trader. If $R \leq S_m$, use is made of the lower bound interval, which is specified as:

$$HHI_{LB} > \sum_{i=1}^{m} a_i^2 + \left(1 - \sum_{i=1}^{m} a_i\right)^2 * \left(\frac{1}{N-m}\right) \tag{4}$$

Where N is the total number of traders in the market, and m is the number of traders with the largest shares. The second term on the right-hand side represents the minimum residual sum of squares for

the smallest firms' market shares. Subscript *LB* stands for the lower bound. Similarly, the upper bound interval of the HHI is defined by adding the point estimate of the HHI with maximum value residual sum of squares of market shares. This is specified as.

$$HHI_{UB} < \sum_{i=1}^{m} a_i^2 + (1 - \sum_{i=1}^{m} a_i)^2 \tag{5}$$

Use of Equation (5) to compute the upper bound is only applicable if $R \leq S_m$, but if $R > S_m$, a different residual market share is calculated as $Q = [R/S_m]$ and the upper bound interval becomes,

$$HHI < \sum_{i=1}^{m} a_i^2 + S_m^2 Q + (1 - \sum_{i=1}^{m} S_i - S_m Q)^2 \tag{6}$$

According to Naldi and Flamini (2014b), the decision rule of the interval estimation of the HHI is that values that are less than 0.01 indicate negligible competition in the market. An HHI of between 0.01 and 0.15 shows the absence of market concentration, while values between 0.15 and 0.25 depict moderate concentration and greater than 0.25 indicate a strong concentration. It is in the less concentrated markets where many traders would participate. Otherwise, only a few market players would participate in relatively more concentrated markets (Econnex 2012; Haji 2014).

2.2.2 Marketing margin and market concentration

The profit motive drives intermediate traders to participate in a market as sellers of produce. Such a profit is presented as a marketing margin. Following Bakucs and Fertõ (2005), the marketing margin is expressed as:

$$P^S = P^B + M \tag{7}$$

where P^S is the selling price of produce at the disposal markets, and P^B is the buying price at the source market, and M is the marketing margin, which is the difference between the selling and buying price. Marketing margins represent the seller's profit, costs of transport, storage, and search costs, among others. The marketing margin is composed of an absolute amount and a percentage mark-up of the selling price.

$$M = a + b * P^S, \text{ where } a \geq 0 \text{ and } 0 \leq b < 1 \tag{8}$$

In more competitive market structures where markets are not concentrated, M would be constant and would equal marginal cost. Conversely, if the market is concentrated, the market margin is pushed above the marginal cost by percent of the selling price, where $0 \leq b < 1$. Subtracting Equation (8) in (7) obtains Equations (9) and (10).

$$P^S = a + b * P^S + P^B \tag{9}$$

$$P^S = \frac{1}{1-b} a + \frac{1}{1-b} P^B \tag{10}$$

If the market is competitive and $b = 0$, Equation (10) is reduced to $P^S = a + P^B$ and thus $M = a$. Marketing margins are positively related to the degree of market concentration (Hall et al. 1979; Kalirajan 1993; Dessalegn et al. 1998). This assertion suggests that traders earn relatively high marketing margins in concentrated markets than in markets where concentration is low (Bakucs and Fertõ, 2005).

2.2.3 Market participation and entry barriers

Previous studies have used qualitative approaches to determine entry barriers traders encounter in agricultural markets of developing countries (Dessalegn et al. 1998; Fafchamps et al. 2005; Fafchamps and Gabre-Madhin 2006). However, the findings of these studies do not indicate the

level of significance of the entry barriers. Therefore, the current study used a multivariate probit model to estimate intermediary traders' decisions to participate in different groundnut markets. The multivariate probit model is appropriate where the error covariances are correlated and statistically significant (Green 2012). Thus, intermediary traders' decisions on whether to participate in all the three markets (local, district and city markets) or not may be described by the following latent variable model:

$$y_i^* = x_i^{'}\beta + \mu_i^* \tag{11}$$

where $y_i = 1$ if $y_i^* > 0$; $y_i = 0$ otherwise; $x_i^{'}$ is the vector of explanatory variables that affect the participation of traders in the market; and μ_i^* is the error term. In addition, an estimate of interrelatedness (error covariance) of the decisions to participate in the market is obtained. A significant covariance estimate suggests that the decisions are interrelated. Using the standard binomial probit approach for an individual binary dependent variable assumes that the rac are unrelated, expressed as:

$$Cov(\mu_1, \mu_2, \mu_3) = 0 \tag{12}$$

where $Cov(\mu_1, \mu_2, \mu_3) = 0$ is the covariance of the error terms μ_1, μ_2 and μ_3. If the covariance of the error terms is non-zero, the results generated by the independently estimated probit equations would be biased. A parameter of key interest in the estimate is the covariance among the error terms. When this covariance estimate is significantly different from zero, it confirms some relationship among the three equations (markets). The empirical specification of the multivariate probit model for the entry determinants into the local, district, and city markets is specified as:

$$\begin{aligned} Y_{ij} = {} & \alpha_0 + \alpha_1 BUSEXP + \alpha_2 BUSOWN + \alpha_3 QTYSOLD \\ & + \alpha_4 CREDACC + \alpha_5 CREDACCSO + \alpha_6 TRADASS \\ & + \alpha_7 MARKSERC + \alpha_8 MOBP + \alpha_9 STOGFACIL + \varepsilon_{ij} \end{aligned} \tag{13}$$

where Y_{ij} is trader i participation in the market j and $i = 1, 2, 3, \ldots n$, j are the number of traders and markets, respectively, and ε_{ij} are unobservable covariates for the equations in the multivariate probit model. The market equation with more significant coefficients would have more positive or negative entry barriers than the one with few significant coefficients. Markets with more entry barriers are also more likely to be relatively concentrated. Traders would be expected to earn relatively high marketing margins in such markets (Mann 1966).

2.2.3.1 Variables used in market participation equations. The dependent and independent variables that were used in the market participation equations are defined in Table 1. The dependent variables comprised three binary traders' participation in the local, district and city markets. The traders who sold groundnuts in particular markets were coded 1 and 0 otherwise. The traders purchased groundnuts from either the farm gate or the local market. In turn, they sold them to consumers, other large traders, agro-processors, and grain exporters.

Local markets are rural spot markets that convene once or twice a week in designated marketing places. Most of these markets are located in remote areas with poor road connectivity to either the districts or city business centres. District and city markets are located in the central business centres of the district and the city. For example, Mchinji, Kasungu, and Salima district markets are all located at distances of not more than 100 Km from Lilongwe city. Similarly, Mzimba district business centre is not far from Mzuzu city. Good road networks connect the districts and the cities.

The explanatory variables used in the study were those related to traders' characteristics, institutional factors, market transaction costs, access to information and communication services, and storage infrastructure. These factors may affect the entry of traders into the markets positively or negatively.

Table 1. Definition of variables used in the study.

Variable	Definition	Expected sign		
		Local market	District market	City market
Trader characteristics				
Business experience (BUSEXP)	Years trader has been in grain trading business	Uncertain	Uncertain	Uncertain
Business-owernsip (BUSOWN)	1 if trader owns the grain trading business, 0 otherwise	Positive	Positive	Positive
Quantity of grain sold (QTYSOLD)	1 if a trader sells less than and equal to 10 tons of groundnut per year, 0 otherwise	Positive	Positive	Positive
Institutional factors				
Credit-access (CREDACC)	1 if trader has access to any credit facility, 0 otherwise	Positive	Positive	Positive
Informal credit source (CREDACCSO)	1 if trader's credit source is informal, 0 otherwise	Positive	Positive	Positive
Informal trader association (TRADASS)	1 if trader belongs to informal trade association, 0 otherwise	Positive	Positive	Positive
Market transaction factors				
Market transaction costs (MARKSERC)	Market transaction costs incurred by a trader (in Malawi Kwacha: 1 USD = 730 MWK) converted in logs	Negative	Negative	Negative
Market infrastructure				
Storage facility (STOGFACIL)	1 if trader has storage facility, 0 otherwise	Positive	Positive	Positive
Mobile phone (MOBP)	1 if trader uses mobile phone to access market information, 0 otherwise	Positive	Positive	Positive
Market channels				
Local market	1 if a trader sold produce at the local market, 0 otherwise			
District market	1 if a trader sold produce at district market, 0 otherwise			
City Market	1 if a trader sold produce at the city market, 0 otherwise			

Source: Authors compilation.

2.2.3.2 Traders' characteristics. Business experience in grain trading equips traders with information on the quantity and quality of produce buyers are looking for and its price (Tadesse and Shively 2013). Therefore, it is expected that business experience would positively influence a trader's participation in the three markets. Traders that operate grain businesses as sole owners have the flexibility to decide on the market to sell produce. However, as sole traders, they have little capacity to mobilise adequate finances to participate in distant markets or procure large quantities of produce. With little capital, the traders would incur more transportation costs to sell produce to distant district and city markets. It would, therefore, be cost-effective for such traders to sell produce in nearby local markets. To minimize transportation and other market transaction costs, traders that handle less than or equal to 10 tons of groundnuts a year would be expected to sell them in nearby local markets.

2.2.3.3 Institutional factors. Credit access supplements entrepreneurs' financial capital. With increased financial capital, traders would be more likely to transact in large quantities of produce and participate in distant markets. On their part, financial institutions require collateral to provide credit facilities to prospective money borrowers (Rahman et al. 2017). However, most intermediary traders lack the collateral such that informal money lenders become alternative credit sources. Therefore, it is expected that traders with access to informal credit sources to participate in all three market levels.

Informal trader associations are formed by the traders themselves and comprise 5–10 members. The associations are platforms through which the traders share market information. Omiti et al. (2009) point out that access to market information would reduce market transaction costs. According to the traders, members of the associations lend money to one another and collectively transport the produce to the markets. Through the informal associations, the traders are also encouraged to make formal savings for reinvesting in the business (Beck et al., 2017).

2.2.3.4 Market transaction factors. In the current study, market transaction costs define the costs traders incur to complete a transaction, including transportation and search costs. For example, traders who sell produce to distant district and city markets incur more transportation and search costs than those selling in nearby local markets (Muratori 2016). Therefore, the likelihood of participating in distant markets decreases with increased market transaction costs (Barret 1997).

When few traders participate in distantly located markets, there are prospects for them to earn a high marketing margin (Mann 1966), thus counteracting the negative influence of market transaction costs.

2.2.3.5 Market infrastructure. Storage facilities are essential elements of market infrastructure that enable traders to accumulate adequate quantities before selling them to distant markets over future periods (Femenia 2015). In this case, it is expected that own storage facilities to be positively related to the participation in distant markets. For example, traders that sell produce to the distant city markets and handle large volumes of stocks, for example, over 10 tons, may require their storage facilities to reduce the costs of hiring them. Thus, the expectation is that traders with their storage facilities would more likely participate in the city market. In addition, mobile phones facilitate the quick transmission of market information between market players, which reduces market transaction costs for widely dispersed markets (Aker 2008; Alene et al. 2008; Ouma et al. 2010).

3. Results and discussion

3.1 Socioeconomic characteristics of intermediary groundnut traders

The socioeconomic characteristics of the groundnut traders are reported in Table 2. The mean business experience in grain marketing for the traders was about 7 years, and individual traders owned close to three-quarters grain marketing. However, a moderate percentage of the traders handled less than ten tons of produce in the 2015/16 marketing season, suggesting that they lacked adequate own financial capital to transact huge quantities.

The revelation that the traders handled smaller quantities of produce is consistent with the finding that only 18 percent of them had access to credit. For the traders that had access to credit, their sources were informal money lenders (16%) and formal financial institutions (2.4%).

Discussions with the traders revealed that formal financial institutions demand collateral to access credit, which most of them do not have. In such circumstances, informal moneylenders become

Table 2. Socioeconomic characteristics of intermediary groundnut traders (n = 124).

Variable	Mean	Std.Dev	Min	Max
Trader characteristics				
Business experience (BUSEXP)	6.476	4.396	1	19
Business ownership (BUSOWN)	0.726	0.448	0	1
Quantity of grain sold of less than and equal to ten tons (QTYSOLD)	0.427	0.497	0	1
Institution factors				
Credit access (CREDACC)	0.185	0.390	0	
Informal credit source (CREDACCSO)	0.161	0.369	0	1
Informal trader association (TRADASS)	0.113	0.318	0	1
Market transaction factors				
Market transaction costs (MARKSERC)	7850.403	14325.110	100	100000
Market infrastructure				
Storage facility (STOGFACIL)	0.169	0.377	0	1
Mobile phone (MOBP)	0.847	0.362	0	1
Market channels				
Selling at Local Market	0.387	0.489	0	1
Selling at District Market	0.597	0.493	0	1
Selling at City Market	0.395	0.491	0	1

Source: Market survey data (2017).

reliable credit sources. Further descriptives revealed that few traders belonged to informal trader' associations. Intermediary traders are mobile and undertake grain trading for a short period (Mapila et al. 2013). For this reason, it would be difficult for them to get mobilised to form formal associations. In other descriptives, most traders had mobile phones, which they use to access market information. The revelation that few traders had their storage facilities suggests that most of them do not store produce long before selling it. The traders that participated in the local and city markets were relatively fewer, 39% and 40%, respectively, compared to 60% that participated in the district market. The decisions of the traders to participate in the three markets were mutually inclusive, which implies that a trader would participate in more than one market in a year. Being the case, the frequency of participation in the markets, as presented in Tables 2, would be more than 100%.

3.2 Market concentration and marketing margin

Table 3 present estimates of market concentration and marketing margins. The interval estimates of the HHI indicate that all three markets were less concentrated, suggesting that a near competitive structure of groundnut markets prevailed in the study areas. The finding of a more competitive market structure suggests that many traders participated in the groundnut markets in 2015/16. Furthermore, many traders participating in the grain markets indicates that crop producers would have alternative market channels to sell their produce. Besides, more competitive markets are associated with higher prices that are offered to the producers (Hernandez and Torero 2013). Table 3 also shows increasing value of the interval estimates of the HHI as the traders moved to sell groundnuts from the local to the district and city markets. The relatively high values of the interval estimate of the HHI in the district and city markets suggest that these markets were relatively less competitive than the local market. However, the traders who participated in the local and the district markets earned the same and relatively low marketing margins as those who participated in the city market.

The magnitude of concentration and the marketing margin in the city market is consistent with the finding by Hall et al. (1979) that a positive relationship exists between market concentration and marketing margin. This finding implies that traders that participate in relatively high concentrated markets earn relatively high marketing margins.

3.3 Market concentration and frequency of participation

Even though the values of the interval estimate of the HHI suggest more competitive market structures, the frequency of traders participating in the market was different (Table 4). The frequency of participation of the traders in the local and city markets was almost the same and relatively low, while that of the district market was relatively high. These findings suggest that many traders participated in the district market compared to the local and city markets. This finding also suggests that traders found the district market easier to enter than the other markets. In other words, the district market has fewer market entry barriers, and many traders participate. Transportation cost is a critical component of the market transactions that hinder traders from participating in agricultural markets in developing countries (Fafchamps et al. 2005; Fafchamps and Gabre-Madhin 2006).

The district market is located strategically between the city disposal market and the rural source markets. In this case, traders from the surrounding areas transport produce to the district market

Table 3. Market concentration and marketing margin.

Market	Market concentration	Average marketing margin (%)
Local	$0.043 < HHI < 0.057$	13.34
District	$0.077 < HHI < 0.085$	13.04
City	$0.086 < HHI < 0.095$	19.04

Source: Market survey data (2017)

Table 4. Market concentration and frequency of trader market participation.

Market	Market concentration	% Frequency of market participation
Local	0.043 < HHI < 0.057	39
District	0.077 < HHI < 0.085	60
City	0.086 < HHI < 0.095	40

Source: Market survey data (2017)

relatively cheaply. Thus, besides good road connectivity with the city markets, large grain buyers incur lower transportation costs to procure produce from the district market.

3.4 Produce transacted and market transaction costs

The percentage of produce transacted and market transaction costs that traders incurred in the study areas are reported in Table 5. The quantities of groundnuts that traders sold in the district market were relatively higher than in the local and the city markets. These results are consistent with Table 4, showing that the district market's frequency was relatively higher than in the local and city markets. Such a finding still suggests that traders found it easier to transact in the district market than in the other markets. Conversely, the traders that participated in the local market incurred relatively lower market transaction costs than those that participated in the district and city markets.

The local market is very close to farm gates, where traders procure some of the produce to resell in the markets. To sell the produce in the district market, traders would incur lower transportation costs. Because of the proximity of the district market to the local market where products are sourced, some traders use cheaper modes of transport (such as bicycles and oxcarts) to transport produce.

3.5 Estimates of the multivariate probit regression

The estimates of the multivariate probit regression are reported in Table 6. The estimated Wald chi-squared test is highly statistically significant, indicating that the explanatory variables used in the study collectively explain a larger portion of the variation in the response variable. The estimates of the correlation of error terms in the three market equations are negative and statistically significant. The likelihood ratio test rejects the null hypothesis for the independence of the three market participation equations. This indicates a strong association of the unobserved covariates that affected the entry of traders into the markets. Since estimates of the coefficients and marginal effects were the same, only the latter and the associated standard errors and Z scores were reported.

3.5.1 Market entry barriers into groundnut markets

The results in Table 6 suggest that the local and city markets had relatively more entry barriers than the district market. These findings are consistent with Table 4 on the frequency of participation and concentration and Table 5 on the produce transacted.

3.5.1.1 Entry barriers in the local market. The factors that influenced entry into the local markets included ownership of a business as a sole trader, trader transaction of quantities less than ten tons,

Table 5. Produce transacted, and market transaction costs incurred by traders.

Market	Produce transacted (%)	Average market transaction costs (%)
Local	8.5	12.39
District	55.4	40.19
City	36.0	47.42

Source: Market survey data (2017).

Table 6. Marginal effects of trader entry barriers into groundnut markets.

Variable	Marginal Effects	Std. Err.	Z
Local Market			
Business experience (BUSEXP)	0.007	0.031	0.22
Business ownership (BUSOWN)	0.608*	0.323	1.88
Quantity of grain sold of less than and equal to ton (QTYSOLD)	1.156***	0.283	4.08
Credit access (CREDACC)	−3.149	3.242	−0.97
Informal credit source (CREDACCSO)	3.752	3.275	1.15
Informal trader association (TRADASS)	0.416	0.444	0.94
Market transaction costs (MARKSERC)	−0.376***	0.126	−2.99
Mobile phone (MOBP)	0.118	0.376	0.32
Storage facility (STOGFACIL)	−0.771*	0.404	−1.91
District Market			
Business experience (BUSEXP)	0.050*	0.029	1.72
Business ownership (BUSOWN)	−0.203	0.274	−0.74
Quantity of grain sold of less than and equal to tons (QTYSOLD)	−0.386	0.240	−1.61
Credit access (CREDACC)	0.596	0.955	0.62
Informal credit source (CREDACCSO)	−1.010	0.999	−1.01
Informal trader association (TRADASS)	−0.109	0.362	−0.30
Market transaction costs (MARKSERC)	−0.058	0.097	−0.60
Mobile phone (MOBP)	0.382	0.326	1.17
Storage facility (STOGFACIL)	−0.163	0.315	−0.52
City Market			
Business experience (BUSEXP)	−0.001	0.031	−0.05
Business ownership (BUSOWN)	−0.371	0.291	−1.27
Quantity of grain sold of less than and equal to ten tons (QTYSOLD)	−0.612**	0.277	−2.21
Credit access (CREDACC)	1.597**	0.768	2.08
Informal credit source (CREDACCSO)	−1.618*	0.849	−1.90
Informal trader association (TRADASS)	0.910**	0.418	2.18
Market transaction costs (MARKSERC)	0.363***	0.113	3.21
Mobile phone (MOBP)	−0.229	0.339	−0.68
Storage facility (STOGFACIL)	1.154***	0.397	2.91
Number of Obs = 124 Wald chi2(27) = 67.18 Log likelihood = -186.05294 Prob > chi2 = 0.000 Likelihood ratio test of rho21=rho31=rho=32=0; Chi2(3)=33.876; Prob>Chi=0.000 *,**,***: Significance at 10%, 5%, 1%			

Source: Market survey data (2017).

market transaction costs, and storage facility ownership. Business ownership as a sole proprietor increased the probability of participating in the local market. Compared to other business forms, sole proprietorship has limited access to financial capital (Nguyen 2001). As shown in Table 5, participation in the local market was associated with lower market transaction costs. This makes the local market ideal for traders with limited financial capital. Table 6 also indicates that traders who transacted produce of less than and equal to ten tons per year had an increased probability of entering the local market. Selling such small quantities of produce in the district or city markets could be costly. As Table 5 shows, these markets were associated with relatively high average market transaction costs. In this case, the local market was the ideal destination for a trader with lower quantities of produce.

The other results revealed that market transaction costs decreased the probability that traders would participate in the local market. As shown in Table 5, on average, traders in the local market transacted relatively lower quantities of the produce transacted in the three markets. Moreover, the traders also earned relatively low marketing margins in the local market (Table 3). This means that a unit increase in market transaction costs would affect their profitability. This may explain the negative association between market transaction costs and the entry of traders into the local market.

Storage facilities allow traders to keep produce until prices increase and sell to distant markets in the future. However, the establishment and maintenance of storage facilities are costly. The study results show that ownership of storage facilities decreased the likelihood of traders participating in the local market. On the contrary, Enibe et al. (2008) observed that the participation of intermediaries in the banana market in Anambra State, Nigeria, made it necessary to own storage facilities.

The finding of the current study suggests that either the traders that participated in the local market did not store produce for a long time or that the quantity they transacted was relatively low (Table 5). For these reasons, it would indeed be costly for the traders who participate in the local market to own a storage facility as this would negatively affect their profitability.

3.5.1.2 Entry barriers in the district market. Business experience positively influenced the entry of traders in the district market. The findings suggest that traders found it easier to enter the district market than the other two markets. This is consistent with the results in Tables 2, 4, and 5, in which the frequency of participation was higher, and the volume of quantities that the traders transacted in the district market was relatively larger. Compared to the local and city markets, the district markets are situated strategically to production areas and disposable city markets. After procuring produce from the surrounding rural areas and local markets, the intermediary traders use bicycles and oxcarts to transport produce to the district markets. Because of better road networks between the district and the city, grain buyers from the city incur lower transportation costs to procure produce from the district market. Therefore, the district market is a hub linking the production sources of groundnuts and the disposal to distant markets.

3.5.1.3 Entry barriers in the city markets. The quantity of produce transacted, market transaction costs, access to credit, informal credit sources, membership of the informal traders' association, and storage facility influenced entry into the city market. Transaction of the quantity of the produce of fewer than ten tons a year decreased the trader's likelihood to enter the city market. The city markets are located at relatively long distances from the purchase sources of produce. Distant markets are associated with increased market transaction costs (Muratori 2016). Entry into such distant markets for the traders with fewer quantities of produce would be costly, hence the negative association between the quantity of produce transacted and entry of traders into the city market.

On the contrary, market transaction costs increased the probability of traders participating in the city market. This result is unexpected because market transaction costs are generally negatively associated with market participation (Alene et al. 2008). The finding in the current study suggests that although the city market is characterised by relatively high market transaction costs (Table 5), the traders were motivated to participate in the market because of the relatively high marketing margins they earned (Table 3). Furthermore, compared with traders in the local market, traders that participated in the city market transacted relatively large quantities of produce (Table 5). In turn, the traders enjoyed economies of scale in quantities of produce. The relatively high market transaction costs could, therefore, not deter them from participating in the market.

Most intermediary traders do not have adequate own financial capital; hence access to credit would supplement their capital requirements. The study results showed that access to credit increased the probability of entry into the city market. On the contrary, Jagwe (2011) found no association between credit access and participation of traders in the banana market in Rwanda. The nature of the product and contextual differences between Rwanda and Malawi may explain the differences in the current study findings and Jagwe (2011). Banana is relatively more perishable than groundnuts. Money lenders may consider banana a relatively riskier enterprise and therefore not willing to lend money to the traders.

Conversely, credit from informal sources decreased the likelihood of traders participating in the city markets. As shown in Table 5, traders who participated in the city markets incurred relatively more market transaction costs than those in other markets. Moreover, to enjoy economies of scale in transporting produce to distant city markets, traders must transact in large quantities. The traders who operate on such a large scale may not get sufficient credit from the informal money lenders. Besides, the informal money lenders charge high interest rates (Mallick 2012; Mookherjee and Motta 2016), which might compel the traders to obtain small amounts of credit not sufficient to transact on a large scale. High-interest rates may also reduce traders' profits even though they

might be financially capable of accessing more lucrative markets. The reduction in profits of the traders would also affect the market returns of crop producers.

Membership of informal trader associations increased the likelihood of traders participating in the city market. Interviews with the traders indicated that the associations benefit them by sharing market information. Access to market information among market players contributes to reducing market search costs (Alene et al. 2008). The traders also indicated that the informal associations are sources of credit for their members. The intermediary traders would benefit from collective transportation of produce to distant markets by belonging to traders associations, an observation consistent with Kraybill et al. (2012). On the contrary, Jagwe (2011) found that trader associations were not related to participation in the banana market among the traders in rural Rwanda. However, the traders procured bananas from distances that averaged about 16 kilometres.

Own storage facilities increased the likelihood for the traders to participate in the city market. As reported in Table 4, traders that participated in the city market transacted four times more produce than those in the local market. Such a finding underscores the importance of storage facilities for traders with large quantities. The distant location of city markets from purchasing points requires that the traders accumulate large quantities of produce, making their storage facilities cost-effective. Similarly, Enibe et al. (2008) observed that the participation of intermediaries in the banana market in Anambra State, Nigeria, made it necessary to use storage facilities.

4. Conclusion and policy recommendations

The study's findings revealed a near-perfect competitive structure in all three groundnut markets, suggesting the absence of market concentration. However, the magnitude of competition and market participants were not related. The level of competition decreased as traders moved from local to the district and city markets. In this case, new entrants would find it easier to enter the local market than the district and city markets. The relatively high average marketing margins earned by traders in the city markets would attract new entrants to participate in the market. The prevalence of entry barriers in the city market would, however, prevent them from doing so. The multivariate probit model uncovered such entry barriers in the markets. The district market had relatively fewer entry barriers than the local and city markets.

Traders earned relatively high marketing margins in the city market, and many traders participated in the district market, where they transacted relatively large quantities of produce. As a result, the traders that participated in the district and city markets incurred relatively higher transaction costs. The number of traders and entry barriers in the markets would affect market channels available to smallholder farmers. Market transaction costs in most developing countries are, among other factors, exacerbated by poor road connectivity between purchase sources, assembly points of produce, and disposal markets. Public investment to improve road infrastructure could reduce transaction costs and enhance the traders' participation in the local market. The traders could pass on to crop producers the reduction in the market transaction costs in the form of better prices.

Even though storage infrastructure enables traders to sell when prices are high, privately owned storage facilities would be costly for the intermediary traders who transact small quantities of produce. Therefore, public-private partnership in the construction of storage infrastructure, which the traders could hire, would be critical. For example, local council authorities could build storage facilities in strategically designated places for traders to rent and store produce before selling it.

Inadequate financial capital remains a challenge for most intermediary traders. Traders have difficulties accessing credit from financial institutions because they do not have the collateral the institutions demand. Besides, institutions become skeptical in dealing with individual traders. Policy support to form formal trader associations, registered with the Ministry of Trade and Industry, would be critical to facilitate collective access to formal credit sources. The trader associations could also facilitate collective transportation of produce to distant city markets for the traders to enjoy

economies of scale in transportation. The trader associations could also link intermediary traders with large buyers of produce and negotiating better prices on their behalf.

Thus far, empirical studies have focused on understanding the determinants of market participation among smallholder farmers. However, empirical evidence on trader market participation remains scarce. Besides, empirical studies have reached no consensus on the relationship between credit access, trader associations, and trader market participation. The study, therefore, recommends more research to be conducted on the structure of agricultural output markets using the robust interval estimation of the HHI. Future research should also consider using quantitative methods to determine entry barriers in different marketing channels for intermediary traders.

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ORCID

Admire Katunga http://orcid.org/0000-0003-2025-0632
Edilegnaw Wale Zegeye http://orcid.org/0000-0003-4705-7971
Gerald Ortmann http://orcid.org/0000-0001-9644-7277

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