Smallholders' choice of avocado marketing channels in Murang'a County, Kenya

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Abstract

Avocado fruit continues to experience increased demand at both the local and export markets. However, smallholder avocado farmers have not benefited from this expansion in demand. This is attributed to use of non-performing marketing channels that does not link them to the high value markets. The purpose of this paper is to investigate the determinants of choice of avocado marketing channels in Murang'a County. Stratified sampling procedure was used to obtain a sample of 384 smallholder avocado farmers from the seven key producing areas of the County. Descriptive statistics and multinomial logit regression model were used for analysis, with marketing through farmer organizations being the reference marketing channel. Results of Multinomial regression analysis showed that the probability of choosing brokers was significantly affected by farm size, household head's gender, education level of HHH, time taken to collect avocado, access to extension, farm income and intercropping avocado with coffee. Likewise probability of farmers' decision on direct sales to market was influenced by off farm income, dairy cattle kept by the farmer, intercropping avocado with coffee, growing organic avocado, travelling costs to buyer locations, farmer organization membership fees and subscriptions. Trainings on avocado farming methods, time taken to collect avocados, delayed buying of avocados and off-farm income were among the factors that significantly affected the probability of choosing to market through local traders. Farm gate price reduced the likelihood of choosing brokers and direct sales. Enhancing adoption of organic avocado production technology would increase the likelihood of smallholders' choice of export markets.

Keywords; smallholders, marketing channels, multinomial logit model

1. Introduction

Avocado (*Persia americana*) is experiencing a rapidly increasing global demand. It is the most traded fruit after pineapple and mango that contributes more than 25% of tropical fruits export annually in the global market (FAO, 2019). Avocado contains fat-soluble vitamins, protein, potassium and unsaturated fatty acids that are less common in other fruits (Duarte et al., 2017).The fruit pulp has about 30% oil content similar to olive oil [10]. It is used in the pharmaceutical and cosmetic industries as a raw material (Duarte et al., 2017).

Africa has a shown a bourgeoning trend in uptake and production of avocados that currently stand at 751,881 metric tonnes (FAO, 2019). South Africa, Ethiopia, Cameroon, Rwanda and Kenya are the top five exporters of avocados in the region. Despite the immense growth in production of avocados, small-scale avocados farmers in the rural set-up of Africa face many constraints when choosing the marketing channels for their produce. Such constraints may include lack of assured markets and low farm gate prices (Yankson et al., 2016).

In Kenya, horticultural industry is the fastest growing agricultural subsector and is ranked third in terms of value after dairy and tea (USAID, 2017). Banana, pineapples, mangoes and avocados are the major fruits grown in Kenya. The annual value of fruits in Kenya stands at 53.24 billion. Avocado alone accounts for more than 17 percent of this value and is projected to increase due to the access of a new market in China (Yankson et al., 2016). The area under the production of avocado has also been on the increase and is currently estimated to be 7500 Ha and yielding 115,000 MT annually (Wasilwa et al., 2017). However, in the face of this growth, majority of farmers hardly report substantial benefits.

Choice of marketing channel is one of the most important farm level decisions that have a great impact on household's income (Shewaye, 2016). The marketing outlet choices are mostly household head's specific and this might require consideration of multiple factors like socio-economic, market related factors and transaction costs variables (Berhanu et al., 2013; Shewaye, 2016; .Pokhrel., et al. 2020). These factors thus, can either attract farmers to a particular channel or discourage them from using other channels (Sigei et al., 2014; .Kihoro et al., 2016; Shewaye, 2016; Mango et al., 2018).

As pointed out, there exist various avocado marketing channels in Murang'a County, but little is known on what informs their choices among. Several studies carried out in Murang'a County have focused on determinants of avocado farmers' participation in export market (Mwambi et al., 2016; Oduol et al., 2017), and also impact of export market participation on avocado farmer's income (Amare et al., 2019), but to the best of our knowledge none has addressed the choice of avocado marketing channels. This paper therefore, contributes to narrowing this knowledge gap in this developing literature on avocado.

2. Theoretical framework

This study appeals to the Random Utility theory (McFadden, 1986). The main assumption of this theory is that individuals are rational decision makers with well-defined preferences, and will make decisions based on the utility derived (Thaler and Eric, 1990). In regard to the theory, a farmer is expected to make decisions considering exclusive alternatives that constitute a set of avocado marketing channels that maximizes the returns (Sigei et al., 2014). An avocado farmer assigns a set of perceived utility to the alternative marketing channels and selects the marketing channel that maximizes his/her utility. The utility assigned to each alternative depends on a number of measurable attributes of the alternative choice and those of the avocado farmer who is the decision maker.

Radom utility theory is widely used with the multinomial logit model to explain farmers' behaviour with regard to choice of marketing channels (Maina et al., 2015; .Sigei et al., 2014; Muthini et al., 2017; Kihoro et al., 2016). This is because the model allows measurement of dependent variable with multiple choices (Wasilwa et al., 2017). In this case avocado farmers were expected to make a decision on four major marketing channels considered in the study. Henceforth, the Random Utility theory was used to develop a framework that explains the determinants of choice of avocado marketing channels among smallholders in Murang'a County.

3. Methodology

This research was conducted in Murang'a County which is located in the Central Highlands of Kenya, that lies between latitudes 0° 34' and 107' South and longitudes 36° and 37° 27'. The County occupies an area of 2558.8 square kilometres (GOK, 2018). The main agro-ecological zones occupied are upper midland (UM) agro-ecological zone with some traces of lower midland (LM) zone. Murang'a County was selected for the study since it is the leading producer of avocados in Kenya with production level of up to 120,645 tons annually and area under avocado estimated at 4,319 hectares (USAID, 2017). Seven key avocado producing locations were selected for the study namely; Kigumo, Kagunduini, Ruchu, Gaichanjiru, Ithiru, Muruka and Ng'araria.
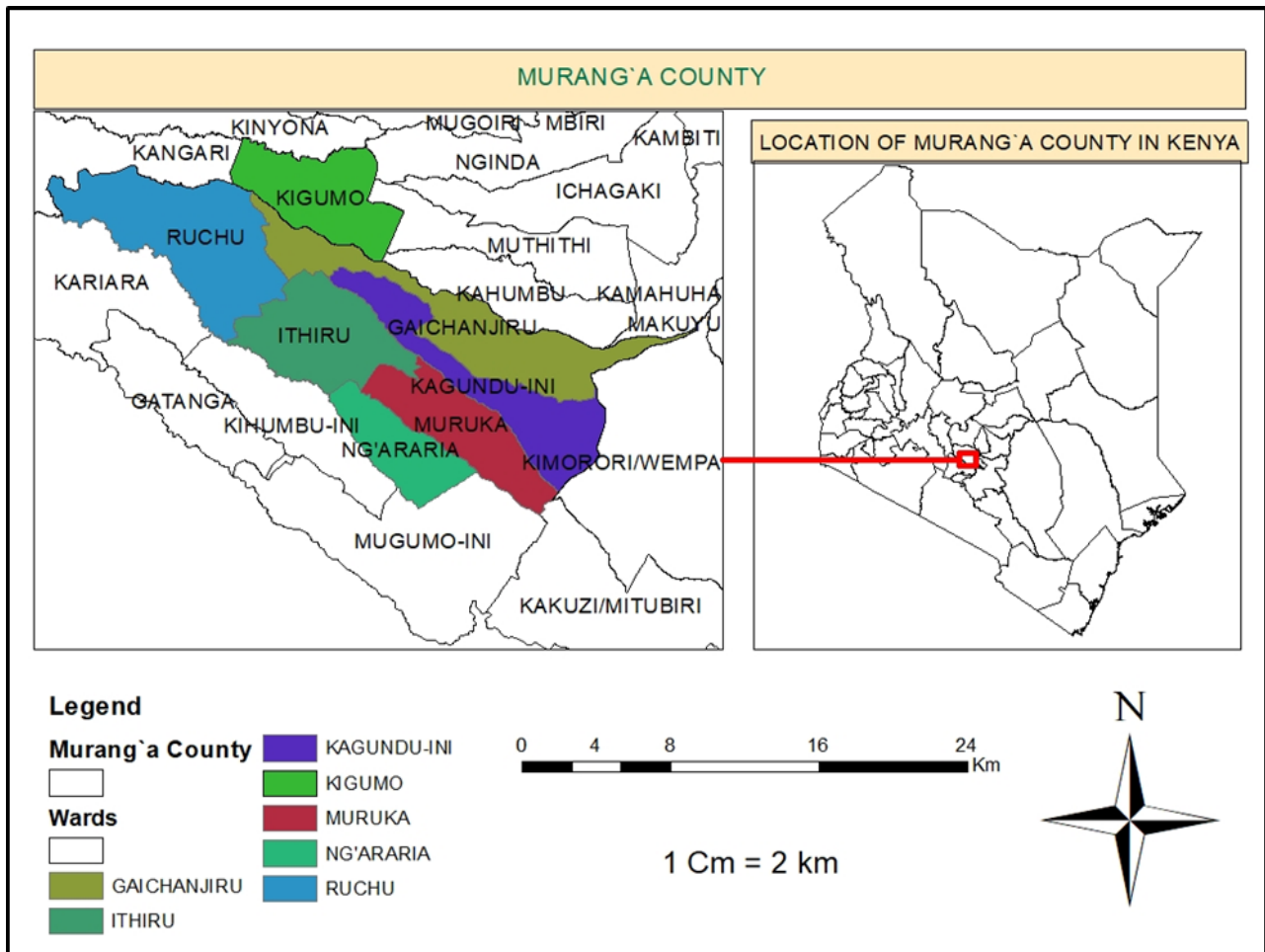
Figure 1: Map of the study area

3.1. Sampling procedure

The study applied the stratified sampling technique to randomly select a sample comprising 384 smallholder avocado farmers (Kumar, 2018). Firstly, the seven avocado producing locations in Murang'a County were identified. Secondly, seven sub-locations were randomly selected from the identified locations. Proportionate to size formula was applied to determine the total number of farmers to be interviewed in each village. The total population of farmers in each village was divided by the total number of farmers in the selected villages and then multiplied by the expected sample size (384 smallholders avocado farmers). Finally, the interval between the farmers to be interviewed was estimated by dividing the total number of farmers in the village by the required number of farmers.

3.2. Empirical model

Multinomial logit model (MNL) was used to analyse the factors affecting choice of avocado marketing channels. The model was preferred since it allows for analysis of decisions on multiple dependent variables (Maina et al., 2015). Choice of avocado marketing channels had four possible outcomes (brokers, farmer marketing organizations, local traders and direct sales to market). Thus, the multinomial model was suitable for this analysis. The model was specified according to Muthini et al. (2017);

$$\text{Prob}(Y_j = i) =$$

$$\frac{\exp(X'_j\beta_i)}{\varepsilon^m_{j=1}\exp(X'_j\beta_k)} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\; 1$$

Y_j is the probability of farmer j choosing avocado marketing channels i (brokers, farmer marketing organizations, local traders and direct to market sales). X is vector of households socioeconomic, market and transaction costs variables. β is the vector of coefficients associated with the market choice. Maximum likelihood estimator was used to determine the parameters in the model (Greene, 2000).

The model was summarized as follows;

$$prob\,(Y_j = i) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 \dots\dots +$$

$$\beta_n x_n \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 2$$

Where;

$prob\,(Y_j = i)$ is the probability choosing avocado marketing channels. β_0, β_1 to β_n are parameters to be estimated by the model. X_1 to X_n are the factors.

4. Results and discussions

4.1 Preliminary tests

The Hausman test was carried out to check for Independence of Irrelevant Alternative assumption (IIA). The IIA Property requires that the relative probabilities of two options being selected are unaffected by the introduction or removal of other alternative. The first two set of choices involves brokers and direct to market while the second set is brokers and local traders. The results of Hausman test were positive and insignificant indicating that the IIA assumption was not violated Hausman and Mc-Fadden, 1984). The results are given in Appendix 1.

Additionally, the multicollinearity test was also done to check for correlation within the explanatory variables. The rule of thumb is that if the pairwise correlation between the variables is greater than 0.5, multicollinearity problem exist (.Gujarati and Sangeetha, 2007). The results showed no multicollinearity problem that existed between explanatory variables (Appendix 2).

4.2 Description of main marketing channels in the study area

The main marketing channels used by smallholder avocado growers in the study area were identified in terms of the flow of avocado products and participants in each channel (Figure 2). Marketing channel 1 entailed the flow of avocado from the smallholder avocado farmers to brokers, then to oil manufacturing companies as well as to domestic markets in the nearby towns like Thika, Ruiru and Nairobi, and finally to the domestic consumers. Marketing channel 2 involved flow of avocado from the smallholder farmers to the farmer marketing organizations sub-contracted by the exporting companies in the study area. The marketing organizations ensure that farmers are trained on desired quality standards. Ultimately, the avocado ends in export markets. In marketing

channel 3 avocado moves from smallholder avocado farmers to the local traders. These local traders collect avocados from farmers in small quantities and then sell them to nearby local retail markets such as Kandara, Kagunduini, Kigumo, Muruka and Murang'a. In marketing channel 4 the movement of avocado is direct to the nearby markets and finally to the domestic consumers. In most cases avocado in this chain are sold to nearby shopping centres that are accessible to the farmers.
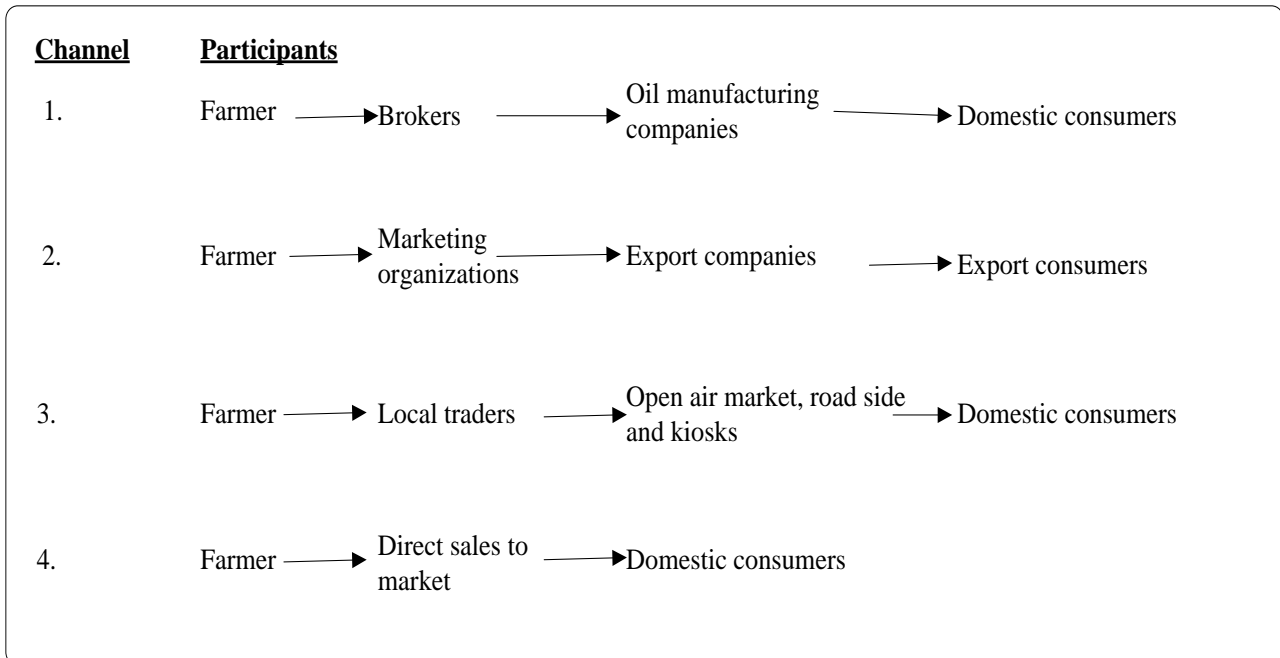
Figure 1 Description of main marketing channels

4.3 Descriptive statistics on socioeconomic factors across the main marketing channels

The study analysed the variations of farmers' socioeconomic characteristics across the four avocado marketing channels used in the study area. The significance of variations of continuous variables was tested using Analysis of variance (ANOVA), while Chi-square (χ^2) was used to test the significance of variations of discrete variables. The results are given in Table 1. The variations in farmer's age and marketing experience were significant at 1% level, while farmer's household size was significant at 10% level. The mean age of the farmers selling through marketing channel 2 (farmer marketing organizations) was found to be higher (64.38 years), while that of farmers marketing through channel 4 (direct sales to market) was the lowest (45.59 years). This implies that the elderly farmers prefer to sell through the marketing organizations, while relatively younger farmers prefer making direct sales to the market. The older farmers are more risk averse compared to younger farmers, and therefore would sell through the marketing organisations that are less risky (Barrett, 2008). The mean experience in avocado marketing was highest in marketing channel 2 (17.25 years), while the lowest experience was among farmers who make direct sales to the market (10.59 years). It appears that farmers with more experience in avocado marketing understands the avocado market dynamics thus are likely to sell through marketing organization as compared to less experienced farmers. The findings also showed that farmers selling through

channel 1 (sales through brokers) had the highest family size (5 persons per household), while those with lowest household size sell through channel 3 (sales through local traders). This implies that farmers with large household sizes were likely to prefer quick cash sales with brokers for immediate payment.

The variations in farm incomes, farm size, land area under avocado, number of trees in production, quantity of fruits harvested and farm gate prices were significant at 1% level (Table 1). Farmers who sell through marketing organizations (channel 2) received the highest average farm income (KES 190,300.50) while those selling through brokers and direct sales to market (channels 1 and 4) earn the lowest level of farm income. Analysis also showed that the mean farm size in hectares was largest for farmers selling through channel 2 (0.34 Ha) while it was lowest for farmers making direct sales to market. Farmers who sold their produce through market organizations (channel 2) had the largest average land-size under avocado trees (0.34 ha) and the average number of avocado trees at production stage (22.49 trees). These results imply that the relatively large scale avocado producers prefer to sell through marketing organizations. On the other hand, the findings revealed that farmers making direct sales to market (channel 4) had the lowest average acreage under avocado and number of trees in production. In terms of avocado output, farmers who sell though local traders (channel 3) had the highest average quantity of avocado harvested (3440 kg), while the ones making direct sales to the market (channel 4) had the lowest average quantity of avocado harvested (1239 kg). The mean farm gate price was highest for farmers selling through market organizations (KES 64.53 per Kg) but lowest for those selling through local traders (KES 14.00 per Kg). These results show that marketing organizations are the most profitable channel compared to other marketing channels in the study area

Sales through farmer marketing organizations (channel 2) had the highest number of farmers intercropping avocado with macadamia (36.67%), but lowest for ones selling through local traders (11.11%). This implies that growing both avocado and macadamia could attract farmers to sell through farmer marketing organizations. Approximately, the number of farmers growing organic avocado was highest in channel 2 (sales through marketing organization) (28.78%), indicating that farmers trading through marketing organizations are likely to adopt organic avocado. This is because export markets buys avocado that has minimum chemical residues thus organic avocado is mostly preferred.

The findings further revealed that the variations in proportions of farmers who intercropped avocado with macadamia or coffee, those producing organic avocado and those accessing extension services were significant at 1% level (Table 1). The marketing channel 2 (selling through marketing organization) had the highest proportion of farmers accessing extension services (97.13%) followed by marketing channel 3 (local traders) which had 80.00%. The marketing channel 4 (direct sales to market) had the lowest proportion of farmers accessing extension (29.6%). These

results indicate that farmers selling through the marketing organization have higher access to extension services as compared to the other three channels. Access to extension service is important in empowering avocado farmers with skills and knowledge on better methods of production and market information. These findings agree with those of Jagwe and Machethe, (2011); Noe (2020), that showed that farmers in marketing groups have better access to extension services than the non-members.

Table 1: Variations in Farm socioeconomic factors across the marketing channels

	Marketing Channels				
	1 (brokers)	2 (marketing organization)	3 (local traders)	4 (direct sales to market)	
	N=320	N=106	N=20	N=27	
	83.33%	27.60%	5.21%	7.03%	F/χ^2-value
Continuous variables					
Age (years)	59.72	64.38	59.20	45.59	2.03(0.00)***
Marketing experience (years)	13.93	17.25	16.35	10.59	2.11(0.00)***
Family size	5.15	4.76	4.35	4.63	1.64(0.09)*
Education level (years)	7.11	7.40	7.80	7.78	0.85(0.62)
Farm income(KES)	97911.40	190301.00	106590.00	85203.70	3.58(0.00)***
Farm size(Ha)	0.66	0.96	0.69	0.35	1.46(0.06)*
Farm area under avocado trees(Ha)	0.21	0.34	0.26	0.13	1.19(0.01)***
Number of avocado trees in production	16.59	22.49	17.75	14.63	3.21(0.00)***
off-farm income per year(KES)	105,382	99,105.3	56,250	113,429	1.19(0.23)
Dairy cows kept	1.25	2.01	2.12	1.32	1.26 (0.74)
Quantity harvested (Kg)	1815.41	2722.26	3440.60	1239.56	3.27(0.00)***
Farm gate price per Kg (KES)	23.95	64.53	14.00	48.15	12.41(0.00)***
Categorical variables					
Gender: Male (%)	77.81	83.02	90	59.26	2.52 (0.47)
Female (%)	22.19	16.98	10	40.74	

Intercropping avocado with macadamia Yes (%)	34.53	36.67	11.11	28.57	10.33 (0.02)**
No (%)	65.47	63.33	88.89	71.43	
Intercropping avocado with coffee Yes (%)	23.74	22.22	33.33	14.29	0.34 (0.95)
No (%)	76.26	77.78	66.67	85.71	
Growing organic avocado					
Yes (%)	23.33	28.78	22.22	0.00	181.92 (0.00)***
No (%)	76.67	71.22	77.78	100	
Access to information					
Yes (%)	97.81	98.11	95.00	100.00	0.31 (0.96)
No (%)	2.91	1.89	5.00	0.00	
Access to extension Yes (%)	33.13	97.13	80.00	29.63	81.22 (0.00)***
No (%)	66.18	2.83	20.00	70.37	
Access to credit Yes (%)	1.88	3.77	10.00	0.00	3.55 (0.31)
No (%)	98.13	96.23	90.00	100.00	

Notes: 1 USD=101.29 KES, Asterisks***, ** and * indicate significance at 1%, 5%, 10% level, $\chi 2$ indicate chi-square.

4.4 Descriptive statistics on market factors

Results in Table 2 indicates that the average waiting time for avocado collection was higher for farmers selling through channel 2 (2.55 days) and was found to be lowest for ones selling through channel 3, indicating that increase in waiting time for avocado exchange reduce the likelihood of selling through farmer marketing organizations. Farmers selling through channel 2 had the highest mean time taken to receive payment (3.49 days) but was lowest for farmers selling through channel 4 (direct sales to market), implying that farmers who sold through export market had to wait between 2 to 4 days to receive their payment while those selling in local markets were paid more promptly. With regard to farm gate price in Kenyan shilling, farmers selling through marketing channel 2 (sales through farmer organizations) received highest farm gate price per kilogram followed by marketing channel 4 (direct sales to market) while sales through channel 3 (sales through local traders) had the lowest farm gate price per kilogram. This imply that selling through farmer organization were likely to earn more profit than sales through other channels.

Comparatively, farmers in Marketing channel 4 (direct sales to market) reported that they often experience buying delays from their preferred buyer (71.43%), followed by sales through channel 2 (sales through farmer marketing organization) (60%). The preferred buyer in the study area was

export buyers since they paid competitive prices, and delays in buying of avocado thus made most of farmers to sell through local channels like brokers so as to mitigate the risk of produce spoilage and loss due to perishability. With respect to quality checks by the buyers, findings revealed that sales through channel 2 (farmer marketing organization) had high levels of quality checks (89.93%) while channel 4 (direct sales to market) reported lowest quality checks (85.79). Quality checks are vital because top quality avocados are sold through export markets while the lesser quality are sold to the domestic markets.

Table 2: Variations in market factors across the marketing channels

| | Marketing Channels | | | | |
	1	2	3	4	F/χ^2-value
Distance to market (Km)	2.83	6.21	4.77	2.10	1.09 (0.35)
Waiting time for avocado collection (days)	1.23	2.55	1.37	1.10	3.24 (0.00)***
Time taken to receive payment (days)	1.01	3.49	1.19	1.00	3.24 (0.00)***
Farm gate price per Kg(KES)	23.94	65.18	14.00	48.24	9.74 (0.00)***
Preferred buyer delays to buy avocado Yes (%)	60.00	56.83	55.56	71.43	65.12 (0.00)***
No (Yes)	40.00	43.17	44.44	28.57	
Attributes that buyer looks at;					
Quality checks Yes (%)	87.78	89.93	88.89	85.71	9.34 (0.03)**
No (%)	12.22	10.07	11.11	14.29	
Variety checks Yes (%)	85.61	88.89	83.45	71.43	2.59 (0.46)
No (%)	14.39	11.11	16.55	28.57	
Checks at size of avocado					
Yes (%)	97.19	99.06	95.00	92.59	3.52 (0.32)
No (%)	2.81	0.94	5.00	7.41	

Notes: 1 USD=101.29 KES, Asterisks***, ** and * indicate significance at 1%, 5%, 10% level, χ^2 indicate chi-square.

4.5 Descriptive statistics on transactional costs

Transaction costs incurred under various marketing channels were estimated (Table 3). The result indicate that farmers selling through channel 2 (sales through marketing organizations) incurred highest cost of travelling to the buyers' location (KES 201.55), but was lowest in channel 3 (sales through local traders) (KES 78.57). This cost was captured as fares paid by farmers when they made

trips to the buyers' location. Thus, these findings showed that selling through marketing organization attracts more extra cost in form of information search on price and demand conditions. Further, the analysis revealed that farmers selling through channel 2 (marketing organization) incur a cost of joining the marketing organizations and also the organization subscription fee of KES 100 each. These payments were not applicable in other channels.

Table 3 Transactional costs

	Marketing channels				
Transaction costs	1	2	3	4	F value
Travelling cost to buyer location (KES)	169.44	201.55	78.57	177.77	3.63 (0.00)***
Marketing Organization joining fee (KES)	0.00	100	0.00	0.00	13.88(0.00***)
Marketing organization subscriptions per season (KES)	0.00	100	0.00	0.00	12.53(0.01***)

Notes: *** indicate significance at 1%

4.6 Determinants of choice of avocado marketing channels

Multinomial model was used to assess the factors affecting choice of avocado marketing channels. Marketing through farmer marketing organization fetched the highest average farm gate price, and was therefore used as a reference category. The results of multinomial regression analysis are given in Table 4. The likelihood ratio (χ^2) value was 441.74 and significant at 1% level. The likelihood ratio test confirms that all the variable coefficients are significantly different from zero (Ojo et al., 2013). The pseudo R^2 was 0.5242 indicating that the selected factors collectively and significantly explain 52.42% of the observed variations in the choice of avocado marketing channels. The marginal effect from the multinomial regression analysis measures the expected change in the probability of a particular choice being made with respect to a unit change in an independent variable Gujarati and Sangeetha (2007), and therefore was used in the interpretation of the results.

The findings revealed that farm size positively affects the choice of brokers at 5% level of significance. Increase in farm size increases the probability of choosing brokers by 13.98% against that of choosing farmer marketing organizations. This is because a large farm size leads to increased avocado output and thus farmers may choose to sell to brokers as a way of reducing marketing costs incurred if selling through farmer organizations. The large producers may also not need the benefits that accrue from farmer organizations since they operate independently. Similar results were reported by Dessie et al. (2018); Kumar (2018) that farm size positively influenced choice of informal traders such as assemblers and retailers.

Results further showed that gender of the household head had a negative effect on the choice of marketing through brokers at 5% level of significance. This indicates that male-headed households decrease the likelihood of choosing brokers by 12.47% in favour of sale through marketing organization. Male headed households possess marketing networks unlike women who are in most cases restricted to household tasks (Maina et al., 2015). These findings are consistence with those of (Muthini et al., 2017; Kihoro et al., 2016), that found gender had negative effect with regard to decision to marketing through brokers.

The household's level of education had a positive coefficient and significantly affected the decision to choose brokers at 10% level of significance. This indicates that an increase in number of years spent in education increases the probability of farmers' decision to choose brokers by 1.76% against that of choosing farmer marketing organization. The possible explanation for this observation is because highly educated household may have more preference to off- farm jobs thereby reducing their investment on avocado farming which consecutively leads to choice of local channels. These results corroborate the findings of (Mango et al., 2018).

We further establish that farm income negatively affects the probability of choosing brokers by 0.0008% in favour of farmer marketing organization. This is because the endowed farmers are more likely to procure farm inputs which would in turn enable them to obtain the high grade quality of avocados that satisfy requirements of the export market. [Muthini et al., 2017) showed that household head's income negatively affected choice of brokers in favour of export market. The household heads' off-farm income positively affected choice of local traders and direct sales to market at 5%. This analysis implies that increased household's head level of off-farm income increases the likelihood of making direct sales and choice of local traders by 2.89% and 2.31% respectively against that of farmer marketing organization. This means that most farmers with off-farm income are occupied by off-farm jobs thus decreased effort in avocado farming, consequently leading to low avocado production that is sold through local markets. Similar findings by Dessie et al. (2018) showed that availability of off-farm income increases the probability of choosing local traders and direct to consumer channel than other channels.

Access to extension services negatively affects choice of marketing through brokers at 5% level of significance and decreases the probability of choosing brokers by 27.03% in favour of farmer marketing organization. Extension visits also decreases the probability of choosing brokers by 8.69% in favour of farmer marketing organization. This might have been as a result of information obtained by the farmer on avocado farming that improves the avocado productivity and quality, thus favouring choice of farmer marketing organizations. These results agree with Melese et al. (2018); Tarekegn et al. (2017) that access to extension services negatively affects choice of informal traders such as brokers.

Exposure to trainings on avocado farming methods negatively affected the choice of marketing through local traders at 5% level of significance. Increased trainings on avocado farming methods reduce probability of choosing local traders by 11.80% in favour of farmer marketing organization. Avocado farming methods increases skills and knowledge that improves the quality of avocado that is marketed in export market. Tarekegn et al. (2017) reported that trainings on farming methods negatively affects choice of local assemblers.

The practice of dairy enterprise in the farm positively affected the farmer's decision on direct sales to market at 5% level of significance. Existence of dairy enterprise increased the likelihood of making direct sales by a 21.49% against that of choosing farmer marketing organizations. This is because farmers with dairy cows in most cases had direct interactions with consumers while selling milk products that also could have resulted to direct sale of avocados to them. Similar findings were reported by Dessie et al. (2018); Melese et al. (2018), that having cattle unit in the farm affects the likelihood of selling the output direct to market since the cattle produce such as milk requires spot markets.

Intercropping avocado with coffee negatively affects farmer's choice of brokers, local traders and direct sales to market at 1% and 10% level of significance respectively. Intercropping avocado with coffee was found to decreases the probability of choosing brokers, local traders and direct sales to market by 15.05%, 6.48% and 12.77% singularly in favour of farmer selling through marketing organization. Farmers who grow coffee have previous marketing experience through farmer marketing organizations, which leads to formation of avocado marketing groups that facilitate marketing of avocados. Research shows that having a marketed intercrop encourages group formation and thereby choice of marketing groups, while having no intercrop leads to choice of direct marketing (Adanacioglu, 2017).

Based on the results, production of organic avocado was found to negatively affect choice of brokers and direct sales to market at 5% level of significance. It decreases the probability of direct sales to market by 43.14% in favour of farmer marketing organizations. Organic farming results to no chemical residues in avocados thus making them meet the European global gap standards. This therefore increases the chances of selling to the export market as reported by (Corsi et al., 2018).

Time taken to collect avocado positively and significantly affects the decision to choose brokers at 10 % level of significance. An increase in time taken to collect avocados increases the farmer's chances of choice of marketing through brokers by 9.23%, against the probability of selling through farmer marketing organizations. This implies that increased time taken to transact through farmer marketing organization encourages marketing through brokers in the region. Increased bargaining time encourages farmers to use other channels other than market cooperatives (Maina et al., 2015). Further, the results showed that time taken to collect avocado decreases likelihood of choosing local traders by 11.32% in favour of farmer marketing organizations. This was so because local traders

harvest avocado produce but not assemble them the same day, thus increasing the chances of loss due to perishability. Similarly the increase in time of transacting affects the likelihood of selling through marketing organizations (Fischer & Wollni, 2018).

Delayed buying of avocado by the targeted buyers positively affects the decision to choose local traders at 1% level of significance. This implies that delayed buying of avocados increases the probability of choosing local traders by 15.84% against that of farmer marketing organizations. These findings imply that farmers may prefer to sell through farmer marketing organizations, however delayed buying of avocados results to choice of other channels such as local traders. According to Fischer & Wollni (2018), delayed buying of the produce negatively affects the likelihood of selling through marketing organizations

Farm gate prices negatively affected farmer's decision on choice of brokers and direct sales to market at 1%. Increase in farm gate price offered reduces the farmer's likelihood of choosing brokers and direct sales to market by 0.49% and 0.14% respectively in favour of farmer marketing organizations. Price is an important aspect when choosing marketing outlets among farmers in rural areas. Farmer marketing organizations offered the highest farm gate price among the channels, therefore attracting farmers to use the channel. Results by Zhang et al. (2017); Kihoro et al. (2016) revealed that price satisfaction had an impact on farmer marketing decision.

With regard to transaction costs hypothesised, farmer marketing organization membership and farmer marketing organization subscription fees increases the probability of making decision in inclined to direct sales to market by 0.15% and 0.13% respectively against that of marketing through farmer marketing organizations. These costs were collected in terms of the amount of money smallholder spent while registering and maintaining the contract with farmer marketing organization. These findings imply that the transaction costs reduce avocado farmers' potential of selling through farmer marketing organizations as also observed by (Maina et al. 2015).

Travelling costs to buyer locations positively affects the decision on marketing through direct sales to market at 1%. This indicates that increased travelling cost to buyer location increases the likelihood of making direct sales to market by 0.03% against that of farmer marketing organization. Findings also revealed that the distance to market increases the likelihood of choosing local traders by 0.66% against farmer marketing organization. This implies that long distance to markets increases the cost of marketing, and thus farmers may choose to sell to nearby markets or sell to traders who the produce at the farm gates. This is in line with (Honja et al. (2017); Temesgen et al. (2017), that cost of transport cost affected the likelihood of making direct sales to market among smallholders.

Table 4: The results of Multinomial regression analysis

Variables	Broker Marginal effects	Std. Err.	Direct sales to market Marginal effects	Std. Err.	Local Trader Marginal effects	Std. Err.
Socioeconomic factors;						
Farm size (Ha)	0.1398 (0.0480)**	0.0708	-0.0365 (0.4420)	0.0475	-0.0061 (0.9020)	0.0496
Farm area under avocado	-0.0635 (0.7060)	0.1682	0.0035 (0.9870)	0.1253	-0.1480 (0.2450)	0.1272
Gender (Male , Female)	-0.1247 (0.0250)**	0.0555	-0.0670 (0.1170)	0.0427	0.0291 (0.4900)	0.0421
Family size	0.0011 (0.9230)	0.0116	-0.0120 (0.1900)	0.0092	0.0077 (0.2800)	0.0072
Age (years)	0.0002 (0.9060)	0.0020	-0.0016 (0.2870)	0.0015	0.0001 (0.9520)	0.0013
Education level (years)	0.0176 (0.1250)*	0.0115	0.0038 (0.6470)	0.0082	-0.0011 (0.8930)	0.0082
Experience in avocado marketing (years)	-0.0030 (0.3980)	0.0035	0.0015 (0.5760)	0.0027	-0.0017 (0.5250)	0.0027
Farm income (KES)	$-0.0836e^{-5}$ (0.0520)**	$0.0431e^{-}$	$0.0148e^{-5}$ (0.5920)	$0.0277e^{-5}$	$0.0310e^{-6}$ (0.9160)	$0.0294e^{-5}$
Intercropping with macadamia	-1.2700 (0.9780)	45.5253	1.5758 (0.9800)	62.6760	-0.1810 (0.9850)	9.8663
Access to extension services	-0.2703 (0.0350)**	0.1279	0.1166 (0.2080)	0.0926	0.0727 (0.4790)	0.1027
Access to market information	0.2352 (0.3520)	0.1439	-0.0690 (0.4960)	0.1013	-0.0268 (0.7750)	0.0936
Access to credit on avocado farming	1.0496 (0.9980)	525.0695	0.3563 (0.9970)	98.8094	-1.1905 (0.9990)	655.9655
Training on avocado farming	-0.0309 (0.6940)	0.0786	-0.0214 (0.6950)	0.0546	-0.1180 (0.0390)**	0.0571
Dairy cow kept by farmer	-0.0531 (0.5940)	0.0994	0.2149 (0.0080)***	0.0814	0.0206 (0.7430)	0.0630

Intercropping avocado with coffee	-0.1505 (0.0020)***	0.0477	-0.0648 (0.0630)*	0.0348	-0.1277 (0.0000)***	0.0354
Number of avocado trees in production stage	0.0029 (0.3170)	0.0029	-0.0008 (0.7180)	0.0022	-0.0011 (0.6290)	0.0022
Quantity of avocado harvested	-0.0270e^{-4} (0.3470)	0.0287e^{-4}	-0.0723e^{-5} (0.7380)	0.0216e^{-4}	0.0212e^{-4} (0.3110)	0.0020
Growing organic avocado	0.4249 (0.2320)	0.3553	-0.4314 (0.0580)**	0.2279	-0.2854 (0.3110)	0.2819
Market factors;						
Time taken to sell avocado	0.0923 (0.0610)*	0.0493	0.0071 (0.6540)	0.0158	-0.1132 (0.0530)**	0.0585
Time taken to receive payment	0.0484 (0.6030)	0.0932	-0.0063 (0.9160)	0.0603	0.0529 (0.4810)	0.0750
Delayed collection of fruits	0.0299 (0.6970)	0.0768	-0.0019 (0.0.9670)	0.0463	0.1584 (0.0090)***	0.0607
Quality checks by the buyer	-0.1219 (0.2340)	0.1025	0.0735 (0.2760)	0.0674	0.0833 (0.3070)	0.0815
Farm gate price	-0.0049 (0.0020)***	0.0034	-0.0014 (0.0010)***	0.0021	0.0026 (0.3780)	0.0030
Variety checks	-0.1607 (0.3370)	0.1672	-0.0858 (0.3540)	0.0925	0.0214 (0.7330)	0.0626
Buyer not reliable	0.0422 (0.7520)	0.1337	-0.0321 (0.7010)	0.0835	-0.0441 (0.7270)	0.1261
Distance to market	-0.0090 (0.1080)	0.0056	0.0044 (0.2860)	0.0041	0.0066 (0.1100)*	0.0041
Type of road	0.0159 (0.6550)	0.0355	-0.0126 (0.6270)	0.0258	-0.0302 (0.2890)	0.0285
Transactional costs;						
Farmer organization registration fee	0.0017 (-0.1190)	0.0011	0.0015 (0.0380)**	0.0007	-0.0006 (0.3770)	0.0007
	-0.0012	0.0010	0.0013	0.0007	0.0005	0.0007

Farmer organization subscriptions	(-0.2560)		(0.0430)**		(0.4750)	
Travelling to buyer location cost	0.0001 (0.7000)	0.0002	0.0003 (0.0030)***	0.0001	-0.0003 (0.2370)	0.0003

Reference category =farmer marketing organization, Asterisks ***, ** and * indicate significance at 1%,5%, 10% level. LR chi2 = 441.74, Prob > chi2 = 0.0000, Pseudo R2 = 0.5242, Log-likelihood = - 200.48. Figures in brackets are P-values

5. Conclusions and recommendations

This study assessed the factors affecting choice of avocado marketing channels among smallholders in Murang'a County, Kenya. Avocado in the this region is mainly produced for sale, thus farmers can select one or more marketing channels based on the comparative advantage of the channels in maximizing their return. In reference to this, the multinomial logit model results showed that the probability of choosing brokers was significantly affected by farm size household head's gender, education level in years, time taken to collect avocado, access to extension, farm income and intercropping avocado with coffee. Likewise, the probability of farmers making direct sales to the market was influenced by off farm income, dairy cattle kept by the farmer, intercropping avocado with coffee, growing organic avocado, travelling costs to buyer locations, farmer organization membership fees and subscriptions. Trainings on avocado farming methods, Time taken to collect avocados, delayed buying of avocados and off farm income were among the factors that significantly affected the probability of choosing local traders. It was noted that farm gate price reduced the likelihood of selecting brokers and direct sales to market in favour of farmer marketing organization.

Based on the results, the study recommends that increased trainings on avocado marketing will enhance farmers' skills on avocado marketing. This will also promote farmers' knowledge on the various worthwhile marketing channels that ultimately contribute to reducing poverty levels among smallholders in rural areas. Also male-headed households dominated in marketing through farmer marketing organizations, thus developing policy interventions that support more female-headed households' participation in avocado marketing will be appropriate in enhancing gender parity.

The findings showed that intercropping of avocado with coffee was found to be a good blend for farmer involvement in export marketing. Therefore, interventions that promote production of avocados alongside coffee or with other cash crops may require further investigation. Production of organic avocado was also an important variable with regard to choice of marketing channels. Thus, enhancing adoption of organic avocado production technologies among farmers' may increase access to the export markets.

Time taken to collect avocados and delayed buying of avocados led to sales of avocado in local channels. Hence, there is need to provide information on fruits collection calendar to smallholder farmers that shows the expected picking dates. This may reduce the risk of loss due to fruit perishability. Farm gate price was an important variable with regard to choice of marketing channels. Therefore, there is a need to protect farmers from low prices offered by the avocado traders in the region through government agencies such as Agriculture fisheries and Food Authority (AFFA).

Farm gate price was found to be an important variable with regard to choice of marketing channels. Thus, interventions by the Ministry of Agriculture through Agriculture, Food and Fisheries (AFFA) should formulate policies that protect farmers from exploitation by the avocado traders in the region.

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Appendix 1. Hausman Test

Choice	χ^2 value	P>z
Broker and direct sale to market	3.30	0.65
Broker and local traders	5.44	0.99
Local traders and direct sales to market	0.62	0.98

Appendix 2: correlation matrix

	farm size	farm area	gender	family size	age	education	experience	farm income	intercroping with coffee	dairy cow kept	intercroping with macadamia	off farm income	number of avocado trees	quantity harvested	growing organic avocado	waiting time	time taken	delayed fruit collection	quality checks	access to extension	access to market information	farmer organization members hip fee	farmer organization subscriptions	fa... pr
farm size	1																							
farm area under avocado	0.646	1																						
gender	0.0819	0.1304	1																					
family size	-0.0486	-0.0213	0.0487	1																				
age	0.3671	0.119	0.0016	-0.0464	1																			
education	0.0094	0.1423	0.2579	0.0331	-0.4426	1																		
experience	0.3623	0.2822	0.0598	0.037	0.4809	-0.2733	1																	
farm income	0.1555	0.2375	0.1105	0.049	-0.0052	0.281	0.1188	1																
intercroping with coffee	0.3144	0.2212	-0.0304	-0.0836	0.2495	-0.0328	0.0482	0.0907	1															
dairy cow kept	0.3981	0.2416	-0.0006	-0.0816	0.1746	0.0348	0.0165	0.0183	0.0532	1														
intercroping with macadamia	-0.0538	-0.0183	0.2109	0.0343	-0.0475	-0.0242	-0.0095	0.0296	-0.373	-0.2668	1													
off farm income	0.2134	0.1258	0.0368	-0.0016	0.3224	-0.3216	0.207	-0.0612	0.1886	0.0848	-0.0036	1												
number of avocado trees	0.4694	0.2261	0.0657	-0.0169	0.0634	0.0968	0.1271	0.1391	0.1444	0.1676	0.1057	0.12	1											
quantity harvested	0.4394	0.4144	0.1834	-0.0646	0.2117	0.0802	0.2761	0.2423	0.1892	0.2425	0.0353	0.1139	0.3751	1										
gerowing organic avocado	0.2925	0.2845	0.0537	-0.1063	0.1374	0.068	0.2411	0.1881	0.1091	0.104	0.0357	0.1242	0.1644	0.243	1									
WAITING_TIME	0.1925	0.1334	0.0094	-0.0546	0.0596	-0.001	-0.0215	0.0278	0.1825	0.1947	-0.0793	-0.1237	0.0734	0.107	0.1709	1								
time taken to receive payment	-0.2216	-0.2104	-0.036	0.0666	-0.1611	-0.0152	-0.1439	-0.1564	-0.0639	-0.0632	-0.0033	-0.0469	-0.0949	-0.1816	-0.6379	-0.2225	1							
delayed collection of fruits	-0.1413	-0.1185	-0.1056	0.0541	-0.0587	0.0105	-0.0906	-0.0987	0.0619	-0.001	-0.1067	-0.1104	-0.0085	-0.0482	-0.4707	-0.1248	0.51	1						
quality checks	-0.0128	0.0054	0.0486	0.0441	0.0347	0.0769	-0.0264	0.0245	0.0121	-0.011	0.0694	-0.0682	0.0826	0.0127	0.1332	0.0556	-0.0163	0.1486	1					
access to extension	0.2722	0.3105	0.0877	-0.1102	0.2399	-0.0508	0.2275	0.1341	0.0165	0.0408	0.0731	0.1285	0.2588	0.166	0.6619	0.1439	-0.4741	-0.3237	-0.0236	1				
access to market information	0.0869	0.0393	0.014	-0.0944	0.0192	-0.0457	-0.0059	0.0093	0.0377	0.0044	-0.0197	0.1262	0.013	0.0033	0.006	0.0311	0.0463	-0.0138	0.0086	0.0161	1			
farmer organization fee	-0.0317	0.0426	0.0129	-0.0372	-0.0503	-0.0359	0.023	0.0579	0.0393	0.0277	0.0008	0.0865	-0.0067	0.1285	-0.0343	-0.0488	0.0519	-0.0149	-0.0854	0.0055	0.0026	1		
farmers organization subscription	-0.0626	0.0114	0.0078	-0.0619	-0.036	-0.0321	0.0413	0.0456	0.0156	0.0036	0.0011	0.0438	-0.0233	0.0935	-0.053	-0.0579	0.0635	-0.0207	-0.0905	0.0049	0.0165	0.0032	1	
farm gate price	0.2518	0.2625	0.0451	-0.1074	0.1262	0.0495	0.2402	0.1718	0.0746	0.064	0.026	0.1178	0.1625	0.2465	0.3221	0.2216	-0.0014	-0.4163	0.1479	0.2864	0.0274	-0.0283	-0.0483	
variety checks	-0.061	-0.0032	-0.0403	-0.082	-0.046	0.0999	-0.0116	0.0321	-0.0994	-0.0844	0.0417	-0.1223	0.0353	0.015	0.2082	0.0692	-0.1008	-0.0208	0.4973	0.0576	-0.0055	-0.0748	-0.0708	
travelling cost to buyers location	0.2005	0.3124	0.0381	-0.0364	0.1169	0.1145	0.1308	0.0932	0.0939	0.0938	0.0755	0.0125	0.4052	0.2543	0.3884	0.2473	-0.3652	-0.1261	0.1474	0.3082	-0.0905	-0.0835	-0.1112	
DISTANCE	0.0399	0.0488	-0.1285	-0.0321	0.1201	-0.2175	0.1102	0.0116	-0.1499	-0.2351	0.019	0.1582	0.0842	-0.0379	0.0975	-0.0461	-0.2077	-0.2108	-0.1453	0.16	0.0134	0.0577	0.0158	
road type	-0.032	-0.0981	-0.1726	-0.0041	0.1915	-0.2419	0.095	-0.0781	-0.0681	-0.1136	0.0033	0.1313	0.0183	-0.0464	0.0584	-0.2323	-0.0177	0.0651	-0.0091	0.1344	-0.0551	0.0461	0.0386	
access to credit	-0.0098	0.0174	0.0705	-0.0387	-0.0265	0.111	0.0727	0.0909	-0.0754	-0.0539	-0.0079	-0.1448	0.0108	-0.0201	0.0933	-0.0291	0.0309	-0.0807	0.0471	0.157	0.0199	-0.0358	-0.0051	
membership to farmer organization	0.2177	0.2278	-0.0296	-0.0561	0.1154	0.0987	0.2796	0.2252	0.1299	0.1026	0.0182	0.0231	0.1958	0.2596	0.2223	0.0268	-0.3697	-0.2005	0.1399	0.466	0.0066	0.0185	-0.0061	
trainings	-0.1254	-0.1606	-0.1092	0.0934	-0.0992	0.0294	-0.0837	-0.1653	0.0754	-0.0003	-0.1598	0.0021	-0.0879	-0.2282	-0.4631	-0.2232	0.0014	0.5168	-0.0475	-0.4481	-0.0181	0.0571	0.0215	
extension visits	0.201	0.3213	0.0888	-0.0836	0.2049	0.0047	0.2124	0.1399	-0.0348	-0.0063	0.0917	0.1435	0.4144	0.2285	0.2356	0.0977	-0.4121	-0.2502	0.0331	0.0354	0.0387	-0.0066	-0.0185	
buyer not reliable	0.2825	0.2878	0.0574	-0.0944	0.1472	0.1113	0.2553	0.1936	0.1236	0.1404	0.0238	0.0593	0.1889	0.2652	0.8598	0.1861	-0.4999	-0.4026	0.1421	0.5842	-0.011	-0.0095	-0.0198	
checks on size	0.2083	0.0873	0.1816	-0.0837	0.0985	0.0505	0.0639	0.1323	0.0839	0.1975	0.1288	0.1457	0.1474	0.1521	0.1451	0.0789	-0.0813	-0.1488	-0.0545	0.1832	0.0608	-0.1025	-0.1025	