

Research Paper

Farmers' Choice for Output Marketing Channels of Cauliflower in Himachal Pradesh, India: A Multinomial Logit Model Analysis

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Received: 11-09-2022

Revised: 27-11-2022

Accepted: 05-12-2022

ABSTRACT

The market channel choice are the contributing issues which has impact on production and sales of cauliflower crop. Despite their importance, yet adequate research has not been carried out on it, particularly in hill regions of India. Considering this, the present study focuses on the factors affecting cauliflower farmers' choice of output marketing channels and what level their market choice influences the market participation in Himachal Pradesh. The field survey was employed on a sample of 200 farmers through field interviews based on a structured questionnaire. The multinomial logistic regression model was employed to determine the factors influencing farmers' choice for output marketing channels. The finding of this paper reveals that there are five output marketing channels used by cauliflower growers in the study area, producer-retailer-consumer (1%) followed by producer-retailer-consumer (2.50%) producer-commission agent-retailer-consumer (39%), local trader-wholesaler-retailer-consumer (24%) and producer-wholesaler-retailer-consumer (33.50%) respectively. Further, the empirical results shows that education, farm income, experience, market distance market information found to be significant at 1%, 5% and 10% significant level which affects farmers choice to choose marketing channel. However, slows sale slow sales of cauliflower crop in marketing Channel-A affects farmers choice to participate in other marketing channels such as Channel-B, D and E. Moreover, the study concluded with the suggestion for development of suitable institutional support programmes, such as public-private partnerships, to better connect farmers to markets.

HIGHLIGHTS

- Education factor was found to be positively significant at 1% significant level in Channel-B which increased the probability by 2.8%.
- Compared to the base category, the likelihood of selecting output marketing Channel-C with farming experience increased by 17.2%.

Keywords: Choice, Output, Marketing channels, Multinomial logistic regression model

How to cite this article: Thakur, P., Mehta, P., Guleria, A., Divyanshu, Singh, P. and Sharma, P. (2022). Farmers' Choice for Output Marketing Channels of Cauliflower in Himachal Pradesh, India: A Multinomial Logit Model Analysis. *Econ. Aff.*, 67(05): 731-738.

Source of Support: None; **Conflict of Interest:** None



Marketing plays an important role in meeting the goals of food security, and sustainable agriculture particularly in developing countries (Thakur *et al.* 2017; Thakur *et al.* 2021). The choice of a marketing channel is one of the most important aspects of successful marketing of agricultural products. At the same time marketing channel choice is one of the most complex decisions that is faced by farmers (Adejobi and Adeyemo, 2012). The channel has a vertical structure in which stakeholders interact at markets and output flows from producers to the final consumer. Producers, local traders, commission agents, wholesalers and retailers are the components in the channel arrangements and work together to perform marketing functions which helps in the product flow. Thus, marketing channel is the route through which a commodity travel or moves from producer to the final consumer (Edoge, 2014; Ozor and Nwankwo, 2018; Zhang *et al.*, 2019).

The cultivation of vegetable crops provides better income to the hills farmers as compared to the cereal crops (Thakur *et al.* 2022). In the present research, we mainly focus on cauliflower which is one of the major vegetable crops grown in the mid-hill region of Himachal Pradesh. Majority of farmers are small holders running their farm business in small farms (Thakur *et al.* 2020). Farmers also faced difficulties in storage and cannot store for long time because of perishable nature of the vegetable. Due to this farmer have to sell their farm produce soon after harvest in order to payback credit used in production as well as to support the livelihood (Aliyi *et al.* 2021). It may be convenient for the farmers to sell their vegetable produce at farm gate, but it entails a limited choice of buyers. The buyers such as local trader and wholesaler offer volatile price and discriminate the buying price between small and large farmers. Choice of output marketing channels is important factor for farmers because different channels are characterized by different profitability (Ma and Abdulai, 2016; Ntimbaa and Akyoob, 2017). Therefore, it is essential to understand what are the factors influencing the channel choice and how the conditions concern with these factors can be eradicated is also important not only in the output marketing channels development but also in enhancing the farm income. Moreover, it has been seen that there is no research study conducted on farmers choice of agricultural output marketing

channels in Himachal Pradesh. This study therefore aimed at determine the factors which affects the farmers choice for output marketing channels of cauliflower in Himachal Pradesh. With the help of this, research able to point out the necessity of cauliflower growers for increase the crop production and also formulate the policy for the development of hill farmers marketing abilities.

The paper is structured as follows: The section 2 presents the methodology used for the study and variable used in the analysis followed by section 3 highlights the empirical results of the research whereas the final section stressed on the conclusion based on the results of the study.

METHODOLOGY

The present study was carried out in Himachal Pradesh, India. The state has been divided into 4 agro-climatic zones whose elevation ranges from less than 650 to more than 2200 m amsl. The research area is located in the mid-hills sub humid, agro-climatic Zone-II of Himachal Pradesh. The mid hills zone is suitable for wide variety of vegetables and cauliflower is one of the major vegetables grown by the farmers of the region (Economic Survey of Himachal Pradesh. 2020-21). For the present investigation a multistage random sampling was used to select the sample size. At the first stage of sampling 5 blocks were selected randomly. At the second stage of sampling, a complete list of Gram Panchayats in the selected blocks was prepared and out of which, 4 Gram Panchayats from each selected block were selected randomly. At the final stage of sampling, 10 farmers from each Gram Panchayats were selected randomly to constitute a sample size of 200 farmers in total. The study incorporated variables such as households' factor, vegetable production factor, sales factor, source of market information. Both the primary as well secondary data were used for the present study. All the primary information has been collected through field survey while secondary data has been collected with the help of research papers, journal, articles, research reports and scientific publication etc. During the field survey it was found that, In the study area farmers have more than two output marketing channels choice. So, to determine the factors influencing farmers' choice for output marketing channels of cauliflower, we

choose a multinomial logistic regression model (MNL) (Martey *et al.* 2012; Panda and Sreekumar, 2012; Gelaw *et al.* 2016). The relevant and suitable independent variables likely to affect the choice of marketing channel were identified. The independent variables can be either dichotomous (i.e., binary) or continuous (i.e., interval or ratio in scale). The multinomial logistic regression uses maximum likelihood estimation to evaluate the probability of categorical membership (DeLong *et al.* 2018; Asante-Addo and Weible, 2020). The table 1 shows the list of the explanatory variables.

Formula of MNL –

$$P_{ij} = \frac{\exp(\beta_j x_i)}{1 + \sum_{j=1}^4 \exp(\beta_j x_i)} \quad \text{for } j = 1, 2, 3, 4$$

Where, x_i is a different characteristics of the i^{th} farmer

β_j is a vector of regression parameter estimates associated with alternative j , and 4 is the number of the output market channel in the choice set.

The probabilities of the i^{th} farmer being in the other three categories ($j = 2$ or 3 or 4) can be estimated as:

$$P_i(j = m | x_i) = \frac{\exp(\beta_j x_i)}{1 + \sum_{j=2}^4 \exp(\beta_j x_i)} \quad \text{for } m > 1$$

The marginal effects of the individual characteristics on the probabilities can be estimated as:

$$\frac{\partial P_j}{\partial x_i} = P_j \left[\beta_j - \sum_{j=0}^4 P_j \beta_j \right] = P_j [\beta_j - \bar{\beta}]$$

P_j is the probability of the farmer choosing market channel j , and

β_j is a vector of regression parameter estimates associated with alternative j

The empirical MNL for factors affecting the farmers choice of output marketing channels specified as:

$P_{ij} = 1/n (P_i/P_1) = \beta_0 + \beta_1$ education + β_2 farm income + β_3 farming experience + β_4 storage facility + β_5 distance + β_6 financial urgency + β_7 payment in advance + β_8 payment at the time of sale + β_9 slow sale. + β_{10} market information through word of mouth + β_{11} market information T.V /Social-Media /Govt. Agency

Where $\beta_0, \dots, \beta_{11}$ are the parameter to be estimated

P_{ij} is the probability of output marketing channel j being chose by farmer i , and

$j = 1$ for producer \rightarrow retailer \rightarrow consumer, $j = 2$ for producer \rightarrow commission agent \rightarrow retailer \rightarrow consumer, $j = 3$ for producer \rightarrow local trader \rightarrow wholesaler \rightarrow retailer \rightarrow consumer $j = 4$ for producer \rightarrow wholesaler \rightarrow retailer \rightarrow consumer

RESULTS AND DISCUSSION

Output marketing channels of cauliflower crop

Perusals of the data from the table 2 that, in study area there was five output marketing channels used by sampled farmers for the marketing of cauliflower crop. The most preferred channel for the marketing of cauliflower crop was found to be Channel- C (39%) followed by Channel- E (33.5%), Channel- D (24%), Channel- B (2.50%) and Channel- A (1.00%) respectively. Thus, it is observed that in study area Channel-C was most prominent output marketing channel used by sampled farmers and maximum cauliflower output transacted through this channel.

Maximum likelihood estimates for factors affecting farmers choice of output marketing channels

The data presented in table 3 using multinomial logistic regression analysis, shows the factors influencing output marketing channel choice decision among cauliflower crop farmers in in mid hills of Himachal Pradesh. We find five output marketing channels for cauliflower crop in the study area. In the model marketing channels were grouped into five categories or outcome. To run the model and explains the likelihood of choosing one market over the other we chose Channel-A as the base or reference category. The coefficients shown in the first, second, third and fourth columns represent the coefficients and significance of choosing Channel-B (Producer \rightarrow Retailer \rightarrow Consumer), Channel-C (Producer \rightarrow Commission Agent \rightarrow Retailer \rightarrow Consumer), Channel- D (Producer \rightarrow Local Trader \rightarrow Wholesaler \rightarrow Retailer \rightarrow Consumer) and Channel- E (Producer \rightarrow Wholesaler \rightarrow Retailer \rightarrow Consumer) instead of Channel-A (Producer \rightarrow Consumer). The log likelihood ratio test shows that the model is overall significant. The chi-squared test

Table 1: Definition of the variables included in the empirical model

Dependent Variables			
Variables	Description	Measurement	Expected Sign
Choice	Dependent variable indicating the choice of various marketing channels	Discrete multiple choice dependent variable	None
Independent Variables			
Variables	Description	Measurement	Expected Sign
Education	Educational status of farmers household	Discrete variable capturing education status of farmers household	+
Farming Income	Annual Farm Income of farmers	Continuous variable capturing annual farming income of farmers household in rupees	+
Farming Experience	Farming experience	Continuous variable capturing farming experience in Years	+
Storage Facility	Storage Facility for harvested Vegetable Output	Dummy variable: Yes= 1, No= 0	±
Distance	Distance to Agricultural Market	Continuous variable capturing farm to market distance in Kilometer	±
Financial Urgency	Farmers Financial Urgency	Dummy variable: Yes= 1, No= 0	±
Payment in Advance	Payment received by farmers in Advance	Dummy variable: Yes= 1, No= 0	+
Payment at the time of sale	Payment received by farmers at the time of sale	Dummy variable: Yes= 1, No= 0	+
Slow Sales	Delay in Payment after sale of vegetable	Dummy variable: Yes= 1, No= 0	±
Market Information Word of Mouth	Farmers received market information through word of mouth	Dummy variable: Yes= 1, No= 0	±
Market Information T.V /Social-Media /Govt. Agency	Farmers received market information through T.V/ Social-Media/ Govt. Agency	Dummy variable: Yes= 1, No= 0	+

Table 2: Output marketing channels of cauliflower crop in the study area

Particulars	Channels	Quantity Transacted (%)
Channel-A	P–C	1.00
Channel-B	P–R–C	2.50
Channel-C	P–CA–R–C	39.00
Channel- D	P–LT–W–R–C	24.00
Channel-E	P–W–R–C	33.50
		100

Abbreviations: C- Consumer; CA- Commission Agents; LT- Local Trader; P- Producer; R- Retailer; W- Wholesaler.

statistic is significant at 1 % level, which shows that estimated multinomial logit model shows suitable regression and therefore, independent variables of the model explain the variation of the dependent variable.

In terms of householders’ factors variable such as education was significant in influencing farmers choice to join output marketing Channel-B and Channel-C. However, farm income affects the farmers decision to participate in output marketing Channel- C and E. Whereas the vegetable production

factor like farming experience were found to influence farmers choice to sell cauliflower produce through output Channel B, C, D and E. Moreover, storage facility found to be negatively significant in Channel-C, D and E. Whereas, distance to market also affects farmers options in marketing Channel-C and D. With regard to vegetable sales factor payment at the time of sale was found to be significant in marketing Channel-C. Slow sale was also significant in Channel-B and Channel-D. Additionally, source of market information factors such as word of mouth/relatives’ friends was

Table 3: Maximum likelihood estimates for factors affecting farmers choice of output marketing channels

Variables	Channel B		Channel C		Channel D		Channel E	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Intercept	2.730 (1.779)	0.125	-4.332*** (1.631)	0.008	-3.105 (2.107)	0.141	4.882*** (1.664)	0.003
Household Factors								
Education	-2.733*** (0.702)	0.000	1.026* (0.552)	0.063	-0.146 (0.198)	0.461	0.014 (0.167)	0.935
Farm income	1.25E-06 (2.03E-06)	0.924	2.79E-06* (1.52E-06)	0.065	5.44E-06*** (2.24E-06)	0.015	2.85E-08 (1.74E-06)	0.987
Vegetable Production Factor								
Farming Experience	-0.184*** (0.061)	0.002	1.836*** (0.607)	0.003	-0.114* (0.070)	0.102	0.182*** (0.057)	0.001
Storage facilities	-1.644** (0.759)	0.030	-0.113 (0.426)	0.790	-2.643*** (0.761)	0.001	1.040* (0.585)	0.075
Distance to Market	-0.011 (0.111)	0.924	0.214** (0.093)	0.021	0.257** (0.130)	0.047	-0.298 (0.118)	0.012
Vegetable Sales Factor								
Financial Urgency	-0.058 (0.615)	0.925	-0.333 (0.510)	0.513	-0.250 (0.739)	0.735	-0.391 (0.591)	0.508
Payment in Advance	0.859 (0.688)	0.212	0.019 (0.048)	0.693	0.045 (0.810)	0.956	1.013 (0.645)	0.116
Payment at the time of sale	0.566 (0.801)	0.480	1.876*** (0.694)	0.007	-0.136 (0.810)	0.867	0.216 (0.735)	0.769
Slow sale	1.357* (0.787)	(0.085)	-0.340 (0.763)	0.655	2.335*** (0.827)	0.005	-0.967 (0.917)	0.291
Source of Market Information Factor								
Word of mouth/ Relatives, friends	1.068 (0.684)	0.118	0.14 (0.149)	0.368	2.093** (0.940)	0.026	-2.085*** (0.653)	0.001
Govt. Dept. TV Radio	-0.214 (0.173)	0.216	1.605*** (0.537)	0.003	-0.732 (0.817)	0.370	0.014 (0.167)	0.935
N	200							
LR chi-square	199.03							
Prob > chi-square	0.000							
Pseudo R ²	0.316							
Log Likelihood	-214.499							

Note: ***, **and * significant at 1 %, 5 % and 10 % significant level respectively; standard errors are in parentheses; Producer to consumer (Channel-A is used as the base category).

significant and to impacted farmers preferences to join Channel-D and E. Moreover, govt. dept/ TV/radio also had an impact on producers desires to market their cauliflower produce through a Channel-C.

Marginal effects estimate for factors affecting farmers choice of output marketing channels

The data related to factors influencing farmers choice of output marketing channel of cauliflower crop in mid hills of Himachal Pradesh are presented in table 4. From the perusal of data, the marginal effects (ME) illustrates that each unit increase in the selected independent variable, increases or decreases the probability of selecting an alternative marketing channel. The estimated marginal effects for the multinomial logit model, are shown for household factors such as education was found to be positively significant at 1% significant level in determining farmers' preferences to sell cauliflower produce through agricultural output marketing channel producer-retailer-consumer (Channel-B).

Additionally, education was also found to be positively significant at 10% significant level in output marketing channel producer-commission agent-retailer-consumer (Channel-C) Thus, the finding reveals that education factor increased the probability of choosing marketing Channel-B and C by 2.8% and 3.0% respectively. This can be explained by the fact that if a farmer household access more education, then they are empowered with the marketing skills and knowledge that will enable them to sell cauliflower produce in lucrative market with high returns such as output marketing Channel-B and C. In mid hills sub humid, Zone-II, it has been seen that better-educated farmers are in a better position to understand and appreciate the advantages of marketing Channel-B and C. Whereas, the farm income was found to be significant at the 1% significant level in marketing Channel-C. Further, the marginal effect indicates that farm income has significantly increased the probability of selling to Channel-C by 0.1% (P-value 0.013).

Table 4: Marginal effects estimate for factors affecting farmers choice of output marketing channels

Variables	Channel B		Channel C		Channel D		Channel E	
	Marginal Effect	p-value	Marginal Effect	p-value	Marginal Effect	p-value	Marginal Effect	p-value
Household Factors								
Education	0.028*** (0.011)	0.009	0.030* (0.017)	0.086	0.005 (0.012)	0.692	0.003 (0.016)	0.842
Farm income	-6.92E-08 (1.91E-07)	0.717	4.35E-07*** (1.75E-07)	0.013	1.26E-07 (1.2E-07)	0.323	-260E-07 (1.81E-07)	0.152
Vegetable Production Factor								
Farming Experience	-0.003 (0.006)	0.591	0.172*** (0.064)	0.007	0.007* (0.004)	0.101	0.016*** (0.005)	0.003
Storage facilities	0.089 (0.056)	0.107	0.048 (0.389)	0.389	0.009 (0.052)	0.862	0.035 (0.061)	0.562
Distance to Market	0.006 (0.017)	0.739	0.024** (0.011)	0.029	0.084** (0.043)	0.049	0.039*** (0.011)	0.000
Vegetable Sales Factor								
Financial Urgency	0.020 (0.062)	0.751	-0.057 (0.062)	0.355	0.023 (0.044)	0.599	-0.006 (0.055)	0.916
Payment in Advance	-0.075 (0.068)	0.270	0.008 (0.006)	0.136	-0.059 (0.050)	0.238	-0.052 (0.063)	0.404
Payment at the time of sale	-0.122 (0.078)	0.117	0.241*** (0.076)	0.002	0.002 (0.007)	0.737	0.087 (0.066)	0.183
Slow sale	0.303*** (0.067)	0.000	0.021 (0.090)	0.812	0.181*** (0.041)	0.000	0.235*** (0.087)	0.007
Source of Market Information Factor								
Word of mouth/ Relatives, friends	0.175*** (0.054)	0.001	-0.016 (0.059)	0.793	-0.068* (0.039)	0.085	-0.120*** (0.051)	0.018
Govt. Dept. TV Radio	0.040 (0.083)	0.632	0.163*** (0.067)	0.016	0.063 (0.062)	0.313	-0.050 (0.058)	0.391

Note: ***, **and * significant at 1 %, 5 % and 10 % significant level respectively; standard errors are in parentheses; Producer to consumer (Channel-A is used as the base category).

With regard to vegetable production factors, tabulated illustration 4 shows that there was significant positive correlation between farmers choice of marketing channels and farming experience at the 1% significant level in output marketing Channel-C, and producer-wholesaler-retailer-consumer (Channel-E). Whereas in marketing channel, producer-local trader-retailer-consumer (Channel-D), it was significant at 10% significant level. As the marginal effect suggests, this variable is a major predictor of farmers choice for output marketing channel of cauliflower crop in the model. The marginal effects indicate that compared to the base category, the likelihood of selecting output marketing Channel-C, E and D with farming experience increased by 17.2%, 1.6% and 0.7% respectively. The distance to the nearest market was another variable that significantly influenced the choice of agricultural output marketing channels. The data presented in table 4 reveals that farmers located a long distance from the market are likely to sell their cauliflower produce through agricultural output marketing Channel-C, D and E than to

marketing channel, producer-retailer (Channel-A). Thus, it can be drawn from the table that the distance to market was positively and significantly affects farmer choice of output marketing channels at the 1%, 1% and 5%, in marketing Channel-C, D and E. The marginal effects indicate that compared to the base outcome, the likelihood of selecting output marketing Channel-C, D and E with distance to market increased by 3.9%, 8.4%, and 2.4%.

Farmers' choice of cauliflower output marketing channel can change based on the maximization of benefits. Cauliflower sales factors can directly affect the production choice and the yield of cauliflower crop and this way can alter farmers' choice behaviour. Vegetable sales factor such as payment received at the time of sale significantly correlated with farmers choice of output marketing channel. There was a significant positive correlation at the 1% significant level in output marketing Channel-C. Moreover, marginal effects indicate that compared to base case, the likelihood of preferring output marketing Channel-C and with payment at the time of sale increased by 24.1%. The empirical

results shown in table 4 indicates that vegetable sales factors like slow sales will directly result in lower income for farmers. The results reveals that slow sales of cauliflower crop in marketing Channel-A affects farmers choice to participate in other marketing channels. The slow sales factor positively significant at 1% significant level in agricultural output marketing Channel-B, D and E. Further, the marginal effects shows that slow sales of cauliflower crop significantly increase the likelihood of selecting output marketing Channel-B, D and Channel-E by 30.3%, 18.1% and 23.5% respectively.

It is inferred from the data presented in table 4 that source of market information factors are important variables which influence farmers choice to participate in agricultural output marketing channel. Access to market information through word of mouth/relative and friends found to be positively significant at 1% significant level which affects farmers choice to choose marketing Channel-B and negatively significant at 5%, 10% significant level in marketing Channel-E and D. Further results reveals that word of mouth/relative and friends increases the probability of a farmers selling to the output marketing Channel-B 17.5%. Moreover, the marginal effect also indicates that compared to the base case, the likelihood of choosing marketing Channel-E and D with word of mouth/relative and friends decreases by 12.0% and 6.8%. However, farmers households who received market information through government department, tv and radio are positively significant at 1% significant level in marketing Channel-C. Thus, farmers with better access to market price information through government department, tv and radio are 16.3% more likely to choose selling their cauliflower produce at output marketing Channel-C.

CONCLUSION

On the basis of results obtained from the present research study, it can be concluded that the farmers of study area were using five majors output marketing channels for marketing their cauliflower produce. These channels were Channel-A (P—C), Channel-B (P—R—C), Channel-C (P—CA—R—C), Channel- D (P—LT—W—R—C) and Channel-E (P—W—R—C). The study provides an insight

as to what factors required to be addressed to encourage the cauliflower farmers in the study area. The empirical results shows that education, faming income, farm experience, distance to market and marketing information found to be significant at 1%, 5% and 10% significant level which affects farmers choice to choose marketing channel. These factors majorly impact on marketing Channel-C and E. Whereas, access to market information through word of mouth/relative and friends found to be negatively significant at 5%, 10% significant level in marketing Channel-E and D. Furthermore, it can observe that these factors make farmers tendency to produce more cauliflower crops simultaneously they are more likely to select market intermediaries like commission agents, traders and wholesalers and less likely to sell at the farmers market directly to the consumers. Thus, it can be concluded from the results that Channel C and E are the most significant on account of the reason that these channels have more opportunity and more demand value due to larger market intermediaries present in these channels and give wide options for the farmers to sale out their cauliflower crop produce. Based on the findings of the study, it is suggested that institutional support from public and non-public organisations should be provided to enhance market linkages of farmers in the study area.

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