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Diversification of marketing strategies among small farms: empirical evidence from family farms in Taiwan

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Abstract: Farm marketing has been recognized as an important factor for a successful farm business. Due to the increasing interest of consumers in food safety, direct marketing of farm products to consumers in the local farmers' markets has become very popular. Compared to traditional farm marketing channels, relatively little is known about the use of direct-to--consumer marketing strategies by farmers. This paper aims to provide a more comprehensive picture of farmers' choices among available farm marketing channels using the case study of Taiwan. Using a population-based survey of 5600 family farms in Taiwan in 2014, in this study we quantify the extent to which demographic characteristics of farm operators, farm production and family conditions may influence the decision of farms to sell farm products to the government, wholesale markets, and in direct-to-consumer sales. We develop a trivariate probit model, and our results indicate that education level and engagement in the off-farm labour market of farm operators, the number of household members, farm size, land ownership, and the type of farm are the key factors in determining farmers' choice of marketing channels. The findings of this study may have important implications for the design of more effective farm marketing programs by agricultural authorities.

Keywords: direct-to-consumer sale, farm business, farm marketing strategies

Marketing channel selection is one of the most important decisions a farmer can make and has a significant effect on the profitability of farm businesses. Due to the increased demand of consumers for local foods and growing concerns regarding food safety and health, direct marketing of agricultural products has become increasingly popular (Curtis 2010; Timmons and Wang 2010). Farmers' markets, roadside stands, pick-your-own farms, community-supported agriculture, as well as direct online order are common forms of direct marketing strategies. In bypassing intermediaries and selling agricultural products directly to end consumers, farmers typically receive better prices and earn a greater share of income. However, the volume of products sold through direct marketing is usually low and farmers have to face the risk of unsold products (Morgan and Alipoe 2001). On the other hand, farmers can sell large volumes of products through wholesale markets but at relatively lower prices. Because of its lower marketing costs, transparent pricing, and lower expected risk, wholesale marketing is usually the most commonly used outlet by farmers (Kim et al. 2014). Moreover, many governments worldwide implement price supports for agricultural products by direct government purchases. If market price falls below the support price, farmers may sell their products to the government at the support level. Marketing channel selection among different outlets is a strategic decision for farmers. Involvement in different marketing channels may allow farmers to maximize profits and reduce overall risks (Kim et al. 2014).

There is a considerable body of existing literature describing the factors influencing farmers' choices of

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marketing strategies for various types of agricultural products. For example, using a sample of 72 Louisiana crawfish farmers in 2008, Nyaupane and Gillespie (2011) found that compared to selling directly to consumers and retailers, the wholesale market was more commonly used as a marketing outlet in the crawfish industry. The estimated results from the binary probit model showed that socioeconomic characteristics (age, education, and household income), farm characteristics (farm size and farm income), and pre-market activities (grading and washing operations) significantly influenced the crawfish farmers' marketing channel selection. Using a face-to-face interview survey of 153 cattle producers in three provinces in China, Gong et al. (2006) found that transaction costs (negotiation and monitoring costs) and socioeconomic characteristics (age of farmer, education level, raising experience, and ownership structure) were significantly related to farmers' choices of cattle marketing channels. Using a sample of 212 small fruit and specialty-crop producers in Virginia and employing an ordered logit model, Monson et al. (2008) concluded that farmers who operate smaller-sized farms have a smaller share of farm income from high-value markets (specifically small fruits, such as strawberries, blueberries, and other non-tree fruits), do not apply USDA-certified organic production methods, and live in smaller households that tend to be more reliant on direct marketing outlets.[1]

This study provides a more comprehensive picture of marketing channels available to farmers, using a case study in Taiwan as an illustration. Agriculture was the foundation for Taiwan's economic miracle and rapid development after World War II. Currently, Taiwan's agricultural production and related activities (such as agricultural processing and agritourism) account for 11% of Taiwan's gross domestic product. In Taiwan, rice is the staple crop, and pork and chicken are the two most important livestock products consumed. Taiwan is world famous for its fruits, tea, orchids, aquaculture, etc. (Hu et al. 2014). Agriculture plays a vital role in Taiwan, which makes Taiwan an ideal case study to understand the factors influencing farmers' marketing strategies.

The objectives of this study were multiple. In this paper, we investigated (a) the proportions of farmers using direct marketing, wholesale marketing, and government purchasing for product sales, (b) the interrelationships between any two marketing strategies, and (c) the factors influencing the selection of marketing channel that farmers in Taiwan incorporate into their farm businesses. This study contributes to the existing literature of marketing channel selection among farmers on three fronts. Firstly, a nationally representative sample of the farmers in Taiwan was used. A sizable body of studies on farmers' choices of marketing channels has relied either on small-scale samples (e.g., Nyaupane and Gillespie 2011; Mafukata 2015; Osmani and Hossain 2015) or sampled subjects only from specific regions, provinces, or states (e.g., Gong et al. 2006; Monson et al. 2008; Mojaverian et al. 2014; Zhang et al. 2014). Thus, the number of studies with nationwide scope is limited in the existing body of literature on farm marketing. Secondly, previous studies tended to focus on only one or two marketing channels. In contrast, this study simultaneously considers direct-to-consumer marketing, wholesale marketing, and government purchases as the three available options for farmers' marketing. Lastly, this study represents a methodological departure from the previous literature. We employ a trivariate probit model, which allows for correlation between any pair of marketing strategies, to identify the factors associated with the decision of farmers in Taiwan between direct-to-consumer sale, wholesale marketing, and government purchases.

MATERIAL AND METHODS

Data

The data used in this study were drawn from the Agricultural Household Survey (AHS) of Taiwan in 2014, conducted by the Agriculture and Food Agency from the Council of Agriculture of the Executive Yuan of the Republic of China, Taiwan (Agriculture and Food Agency 2014). The survey gathered information of farmers' production practices and farm household activities through face-to-face interviews. Only one principal farm operator was identified for each farm household. The principal farm operator was requested to report his/her socio-demographic characteristics, farm production practices, family characteristics, etc. In the 2014 edition of the AHS, the marketing channels for the sale of agricultural products were

[1]Other authors have also investigated the factors that influence the choice of marketing channels, including Mojaverian et al. (2014), Zhang et al. (2014), Mafukata (2015) and Osmani and Hossain (2015).

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also documented. The principal farm operators were asked to report whether their agricultural products were sold to wholesale markets, purchased by the government, or whether they were sold directly to consumers, or via other channels.

The AHS dataset is nationally representative and represents a large-scale dataset of farm households in Taiwan. It has been one of the important tools used by the Council of Agriculture to monitor farm production practices and farm household populations in Taiwan. In total, 7500 farm households were included in the 2014 AHS dataset. Since the primary objective of this study is to examine the choice of marketing channels of farm businesses, we deleted observations that did not produce any farm outputs in the sample. After further deletion of a few entries with missing values in some significant socio-demographic characteristics of the family members, we had a final sample comprising 5600 farm households. The sample statistics and detailed definitions of the selected variables are shown in Table 1.

Three dichotomous dependent variables were specified to indicate whether the agricultural products of the farm households were sold to wholesale markets, purchased by the government, or sold directly to consumers. Note that these three marketing channel selections are not mutually exclusive, so the sum of three dummy indicators defined for each marketing channel selection is not necessarily equal to one. As presented in Table 1, the participation rates in wholesale trade, government purchases, and direct marketing sales are 43.4, 17.5, and 21.5%, respectively.

Consistent with the findings of previous studies, some explanatory variables that can reflect (a) the socioeconomic characteristics of farm operators, (b) family structures, and (c) farm characteristics were defined. Regarding (a) the socioeconomic characteristics of farm operators, age, gender, and marital status of the farm operator were specified. In addition, five dummy variables, including illiterate, elementary, junior high, senior high, and college or higher, were used to indicate the farm operator's educational

Table 1. Sample statistics and definitions of the selected variables

Variable	Definition	Mean	S.D.
Dependent variables			
Wholesale markets	If farm products are sold to wholesale markets (= 1)	0.434	0.496
Government purchases	If farm products are purchased by government (= 1)	0.175	0.380
Direct to consumers	If farm products are sold to consumers directly (= 1)	0.215	0.411
Explanatory variables			
Age	Age of the operator (year)	66.516	12.015
Male	If the operator is male (= 1)	0.807	0.395
Married	If the operator is married (= 1)	0.739	0.439
Illiterate	If illiterate (= 1)	0.132	0.338
Elementary	If elementary education (= 1)	0.419	0.493
Junior	If junior high education (= 1)	0.182	0.386
Senior	If senior high education (= 1)	0.198	0.399
College	If college or higher (= 1)	0.070	0.255
HH size	The number of household members aged 15 or more	3.885	2.066
Off-farm	If the principal operator works off the farm (= 1)	0.198	0.398
Land	Farm size (hectare)	0.954	2.128
Ownership	Ratio of self-own land area to total land area (0–1)	0.860	0.303
Rice	If rice farm (= 1)	0.340	0.474
Cash grain	If cash grain farm (= 1)	0.076	0.265
Specialty	If specialty crop farm (= 1)	0.053	0.223
Vegetable	If vegetable farm (= 1)	0.152	0.359
Fruit	If fruit farm (= 1)	0.324	0.468
Mushroom	If mushroom farm (= 1)	0.009	0.096
Flower	If flower farm (= 1)	0.011	0.106
Other crops	If farm growing other crops (= 1)	0.008	0.086
Livestock	If livestock farm (= 1)	0.026	0.160
Sample	Number of farms	5 600	

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level. Regarding (b) family structures, a further variable – the number of household members aged 15 or over – was created to control for family structure. Regarding (c) farm characteristics, a dummy variable created to indicate whether or not the principal farm operator worked off the farm in 2014 was created. Moreover, farm size and proportion of owned land to total operated land were specified. Lastly, a number of dummy variables for characterizing various types of farms were defined, including rice, cash grains, specialty crops, vegetables, fruits, mushrooms, flowers, other crops, and livestock farms.

As shown in Table 1, the average age of farmers in the AHS is 66.516, which reflects the fact that without sufficient numbers of new entrants into the agriculture sector, Taiwan's agriculture is facing the severe challenge of an aging labour force. The educational attainment of Taiwanese farmers is generally low; 41.9% of the principal operators have completed only elementary education. Taiwan's agriculture is typically characterized by small-scale farms; in the AHS, the average farm size is 0.954 hectares. Taiwan's main crops are rice, fruit, and vegetables, and farms producing these crops account for 34, 32.4, and 15.2% of Taiwan's farms, respectively.

Method

A trivariate probit model was developed to investigate the interrelationships among the three risky decisions regarding farm products (choice between three different marketing channels): selling to wholesale markets, government purchases, and direct-to-consumer sales. The aim of the empirical analysis is to understand how these three choices of marketing channels are related, and how they may be determined by the farm operators' socioeconomic characteristics, family structures, and farm characteristics.

We started by defining each farm's marketing strategy decisions using a trivariate probit model, which allowed for correlation between any two of a farm's marketing choices. It is assumed that the marketing channel chosen by a farmer can be determined by comparing the net benefits of participation and non-participation of each marketing channel. For instance, the decision to sell farm products to wholesale markets is determined by comparing the reservation profit of this decision to the associated costs. The econometric specifications of these reduced forms can be written as (Chib and Greenberg 1998):

$$D_{1i}^* = \beta_1' X_{1i} + \varepsilon_{1i} \quad (1)$$

$$D_{2i}^* = \beta_2' X_{2i} + \varepsilon_{2i}$$

$$D_{3i}^* = \beta_3' X_{3i} + \varepsilon_{3i}$$

where D_{1i}^*, D_{2i}^*, and D_{3i}^* are the unobserved latent propensities for marketing strategies of selling to wholesale markets, government purchases, and direct-to-consumer sales for farm i (i = 1, ..., N), respectively. The vectors X_{1i}, X_{2i}, and X_{3i} are exogenous variables that may affect these three marketing strategies of farm businesses. β_{1i}, β_{2i}, and β_{3i} are parameter vectors of interest. The vectors ε_{1i}, $\varepsilon_{2i,}$ and ε_{3i} are random errors, with a trivariate normal distribution. The mean of the distribution is equal to zero, and the variance-covariance matrix is given by

$$\Omega = \begin{bmatrix} 1 & \rho_{12} & \rho_{13} \\ \rho_{12} & 1 & \rho_{23} \\ \rho_{13} & \rho_{23} & 1 \end{bmatrix}$$

where the correlation coefficient between any two choices (ρ_{kj}) captures the joint nature of any pair of decisions.

We assumed that the observable binary choices resulted from the following latent decision structure:

D_{ji} = 1 (farm i engages in activity j)
iff $D_{ji}^* > 0$

D_{ji} = 0 (farm i does not engage in activity j)
iff $D_{ji}^* < 0$; j = 1, 2, 3

Given this choice structure, eight decision outcomes (regimes) are possible. Based on the observed outcomes, we can define the probability of participation in each regime as a trivariate cumulative normal distribution. For instance, the probability of engaging in all three marketing strategies can be shown as Equation 2, where $\Phi_3(.)$ is the cumulative distribution of the trivariate normal distribution. If we define k_{1i}, k_{2i}, and k_{3i} as $(2D_{1i} - 1)$, $(2D_{2i} - 1)$, and $(2D_{3i} - 1)$. Respectively, we can write the probability of any outcome generally as Equation 3.

By combining the probabilities of these eight regimes, the three-choice model can be estimated by using the maximum likelihood method based on the log likelihood function (Equation 4).

Although Equation (4) is a straightforward extension of the binary choice probit model and is theoretically attractive, the computations are demanding, since one needs to evaluate multi-dimensional integrals of normal density functions. This is accomplished using

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$$\Pr(D_{1i}=1, D_{2i}=1, D_{3i}=1) = \Pr(\varepsilon_{1i} > -\beta_1' X_{1i}, \varepsilon_{2t} > -\beta_2' X_{2i}, \varepsilon_{3t} > -\beta_3' X_{3i}) = \Phi_3(\beta_1' X_{1i}, \beta_2' X_{2i}, \beta_3' X_{3i}, \rho_{12}, \rho_{13}, \rho_{23}) \quad (2)$$

$$\Phi_3[k_{1i}\beta_1' X_{1i}, k_{2i}\beta_2' X_{2i}, k_{3i}\beta_3' X_{3i}, k_{1i}k_{2i}\rho_{12}, k_{1i}k_{3i}\rho_{13}, k_{2i}k_{3i}\rho_{23}] \quad (3)$$

$$\log L = \sum_{i=1}^{N} \log[\Phi_3(k_{1i}\beta_1' X_{1i}, k_{2i}\beta_2' X_{2i}, k_{3i}\beta_3' X_{3i}, k_{1i}k_{2i}\rho_{12}, k_{1i}k_{3i}\rho_{13}, k_{2i}k_{3i}\rho_{23})] \quad (4)$$

the method of full information maximum simulated likelihood (FIMSL) with the Geweke, Hajivassiliou and Keane (GHK) simulator. The GHK simulator is unbiased for any given number of replications, and it has been recognized as the most reliable method for simulating normal probabilities (more details can be found in Train 2009).

With the estimated coefficients on hand, one can further calculate the marginal effects for all of the selected explanatory variables. For each marketing channel, the marginal effect for the k^{th} explanatory variable can be derived as:

$$\frac{\partial \Pr(D_j = 1)}{\partial X_{jk}} = \frac{\partial \Phi(\hat{\beta}_j' \bar{X}_j)}{\partial X_{jk}} = \phi(\hat{\beta}_j' \bar{X}_j) \times \hat{\beta}_{jk} \quad (5)$$

where $\Phi(.), \phi(.)$ are the cumulative density function and the probability density function of the standard normal distribution, respectively. $\bar{X}$ is the sample mean, and $\hat{\beta}_{jk}$ is the estimated coefficient of the variable X_{jk}. The standard errors of the marginal effects can be calculated by using the delta method.

RESULTS AND DISCUSSION

To justify the use of the trivariate probit model and the computational burden that accompanies its use, it is important to examine the estimated correlations between each pair of farm marketing channel selections. Table 2 presents the results of the trivariate probit estimation. However, the effects of the explanatory variables on the choices of marketing channels are easier to interpret via the marginal effects. Therefore, the associated marginal effects of the explanatory variables on each marketing channel selection are presented in Table 3. As shown at the bottom of Table 2, the simultaneity of the three marketing strategies is statistically supported by the likelihood ratio (LR) test with the null hypothesis that the correlation coefficients of the error terms for the three marketing strategies are simultaneously equal to zero. The estimated test statistic is 508.041, which is significantly larger than the 5% critical value ($x^2(0.95, 3) = 7.81$), resulting in a rejection of the null hypothesis. In addition, all of the correlation coefficients are statistically significant. The highest negative correlation is found between the decisions of selling farm products to wholesale markets and to consumers directly ($\rho_{13} = -0.521$). Negative correlations of 0.15 and 0.029 are found between the marketing strategies of selling farm products to wholesale markets and government purchases and between the marketing strategies of government purchases and direct-to-consumer sales, respectively. A negative correlation shows that as the probability of selecting one marketing channel rises, the probability of selecting the other marketing channel falls.

The marginal effects of the explanatory variables on the choices of marketing channels can be found in Table 3. Male farm operators are more likely than their female counterparts, by 4 percentage points, to choose wholesale marketing as a strategy. There is a lack of literature addressing how the gender of principal farm operators affects the decision to sell agricultural products at a wholesale market. However, there is evidence indicating that female farmers have a greater reliance on direct marketing channels (Chiappe and Flora 1998; Park 2015). Similar to Gong et al. (2006) and Nyaupane and Gillespie (2011), an influence of the farmers' education level on marketing channel selection was also found in this study. Farm operators with higher levels of education generally exhibit decreased wholesale market participation and an increased probability of using government purchasing and direct sales as marketing outlets. For example, compared to farm operators who are illiterate, those who have a college degree or higher are less likely to participate in wholesale markets, by 7.6 percentage points, and those who have a high school degree are more likely to choose government purchase as an outlet for farm products, by 3.3 percentage points. Family structure is significantly associated with marketing channel selections. An additional household member aged 15 or higher is associated with a significant 0.9 and 0.5 percentage point increase in the probability of choosing wholesale market and direct-to-consumer sales as a marketing channel, respectively. Farm households with more family members

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Table 2. Estimation results of the trivariate probit model

	Wholesale markets		Government purchases		Direct to consumers	
	coefficient	S.E.	coefficient	S.E.	coefficient	S.E.
Age	–0.002	0.002	0.003	0.003	–0.003	0.002
Male	0.104*	0.056	–0.035	0.080	–0.064	0.059
Married	0.057	0.050	0.075	0.072	–0.040	0.053
Elementary	–0.143**	0.064	0.212**	0.086	0.160**	0.071
Junior	–0.036	0.081	0.152	0.112	0.132	0.088
Senior	–0.045	0.083	0.265**	0.115	0.081	0.090
College	–0.190*	0.102	0.134	0.146	0.085	0.110
HH Size	0.021**	0.010	0.007	0.013	0.022**	0.010
Off-farm	–0.149***	0.054	–0.099	0.079	–0.045	0.057
Land	0.022**	0.011	0.025***	0.010	0.003	0.009
Ownership	–0.167***	0.064	0.088	0.103	0.142**	0.067
Rice	–1.124***	0.112	1.905***	0.217	–0.965***	0.133
Cash grain	–0.137	0.122	0.389*	0.237	–0.012	0.139
Specialty	–0.357***	0.128	–0.277	0.290	0.634***	0.140
Vegetable	0.316***	0.114	–0.256	0.242	0.554***	0.128
Fruit	0.694***	0.110	–1.008***	0.278	0.328***	0.124
Mushroom	–0.839	0.226	–0.125	0.460	1.267***	0.208
Flower	0.045	0.193	–3.590	157.992	1.144***	0.199
Other crops	–1.230***	0.290	–3.561	179.836	0.930***	0.230
Constant	0.072	0.205	–2.481***	0.336	–0.896***	0.223
ρ_{12}	–0.150***	0.036				
ρ_{13}	–0.521***	0.020				
ρ_{23}	–0.029***	0.008				
Log-likelihood			–6684.934			
LR test			508.041 (p-value = 0.003)			

***, **, * indicate the significance at the 1%, 5%, and 10% levels, respectively

H_0: rho12 = rho13 = rho23 = 0

aged 15 or higher are expected to have more labour availability to be allocated to the tasks of marketing, particularly to direct marketing in which the labour constraint tends to be the biggest concern (Uva 2002). Compared to those who do not, farmers who do work off the farm are less likely to sell their farm products through wholesale markets, by 6 percentage points. Off-farm work by the operator may imply decreased specialization in farming. As a result, those farmers may not be able to produce enough sufficient produce of consistent quality for wholesalers. Farm size and land ownership are also associated with marketing channel selections. The results in this study show that an additional hectare in the overall farm size leads to larger probabilities of selling farm products through wholesale markets and of government purchase, by 0.8 and 0.3 percentage points, respectively. In order to economize the marketing costs, larger farmers may have a stronger incentive to sell farm products through wholesale outlets where wholesalers can absorb a large amount of their products (Monson et al. 2008; Low and Vogel 2011). A single-percentage point increase in land tenure (owned hectares divided by total operated hectares) induces a 6.8-percentage point decrease in the probability of wholesale market participation and a four-percentage point increase in the probability of using direct marketing. It is not clear why the percentage of land owned is negatively (positively) associated with the likelihood of wholesale marketing (direct marketing) participation. This finding, however, may reflect the small farm structure in Taiwan. One major problem associated with Taiwan's agricultural development is the small scale of farming. In 2014, the average farm size in Taiwan was one hectare, compared to 177 hectares in the United States (USDA 2014, 2015). As a result, a common way for the professional farmer to increase economies of scale is to rent fields from elderly farmers who are unable to cultivate or landowners who are unwilling to farm (Executive Yuan 2014). Therefore, tenant-farmers

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Table 3. Marginal effects of the trivariate probit model

Variable	Wholesale markets		Government purchases		Direct to consumers	
	marginal effect	S.E.	marginal effect	S.E.	marginal effect	S.E.
Age	–0.001	0.001	0.000	0.000	–0.001	0.001
Male	0.040*	0.021	–0.004	0.009	–0.014	0.015
Married	0.017	0.019	0.008	0.007	–0.008	0.014
Elementary	–0.055**	0.025	0.023***	0.010	0.039**	0.018
Junior	–0.015	0.031	0.019	0.014	0.029	0.023
Senior	–0.019	0.032	0.033***	0.016	0.018	0.023
College	–0.076**	0.037	0.016	0.018	0.015	0.029
HH Size	0.009**	0.004	0.001	0.001	0.005**	0.003
Off–farm	–0.060***	0.020	–0.010	0.007	–0.009	0.014
Land	0.008**	0.004	0.003***	0.001	0.000	0.002
Ownership	–0.068***	0.025	0.009	0.011	0.040**	0.017
Rice	–0.396***	0.033	0.334***	0.057	–0.216***	0.023
Cash grain	–0.058	0.046	0.051*	0.040	–0.015	0.033
Specialty	–0.145***	0.043	–0.024	0.019	0.177***	0.050
Vegetable	0.122***	0.045	–0.024	0.018	0.155***	0.042
Fruit	0.267***	0.041	–0.085***	0.018	0.081**	0.034
Mushroom	–0.274***	0.050	–0.012	0.038	0.430***	0.083
Flower	0.019	0.074	–0.045	0.012	0.388***	0.078
Other crops	–0.337***	0.040	–0.165	0.082	0.300***	0.091

***, **, * indicate the significance at the 1%, 5% and 10% levels, respectively

(usually large and professional farmers) are found to be more likely to choose wholesale marketing and less likely to choose direct marketing as a business strategy, likely reflecting Taiwan's unique small farm structure. The type of farm operated has divergent effects on the probability of marketing channel selections. For example, compared to livestock farmers, rice farmers are more likely to sell their rice to the government, by 33.4 percentage points, and less likely to use wholesale and direct marketing as their business strategies, by 39.6 and 21.6 percentage points, respectively. This result is expected as rice is the most important crop in Taiwan and the Taiwanese government has had a price-support program for purchasing rice at guaranteed prices for decades (Boisvert and Chang 2006). Rice farmers, therefore, may consider the difference between the market and guaranteed prices and determine whether or not to sell their rice to the government. Vegetable and fruit growers are more likely to sell their products through wholesale markets (direct-to-consumer sales), by 12.2 (15.5) and 26.7 (8.1) percentage points, respectively, compared to their livestock counterparts. These findings are consistent with the findings of Gale (1997), Lyson and Guptill (2004), and Low and Vogel (2011) and their claims that vegetable and fruit growers are more reliant on direct marketing. Specialty crops, mushrooms, and flowers usually represent high-value crops (Hewett 2012). We found that specialty crop, mushroom, and flower producers are more likely to be reliant on direct marketing channels, by 17.7, 43, and 38.8 percentage points, respectively, compared to their livestock counterparts. These results are consistent with those of Monson, Mainville and Kuminoff (2008), who found high-value crop production to be one of the determinants of the decision for direct marketing.

CONCLUSIONS

Marketing channel selection is as important as production decisions for farm businesses. This study used a unique dataset and employed a trivariate probit model to investigate the factors influencing the choices of marketing channel among farmers in Taiwan. Our results add to the current literature on marketing channel selection and suggest that the gender and education level of farm operators, the number of household members aged 15 or higher, whether or not farm operators work off-farm, farm size, land ownership, and the type of farm, are jointly the key factors determining farmers' choice of marketing channels.

The results in this study have potential implications for future policy design and marketing plans. For

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example, because of Taiwan's price-support program for rice, rice farmers are found to be heavily reliant on government purchasing as their marketing outlet in this analysis. The price-support program, however, strongly encourages overproduction of rice in Taiwan. As a result, the program becomes increasingly expensive. The Taiwanese government, therefore, tries to use a set-aside program to solve this overproduction problem. Moreover, larger farmers tend to sell their products through wholesale markets and government purchases. This tendency, however, is not observed among small farmers in this study. Helping smaller-scale farmers identify viable marketing opportunities is an important policy issue. A collaborative marketing to increase sales may help smaller-scale farmers receive a greater share of the consumer's food dollar. Further, the likelihood of choosing each marketing channel significantly depends on the types of farm. Therefore, different types of farms need to follow different marketing strategies to be successful. Lastly, Taiwan's agricultural labour market is facing pressure to attract a young labour force and trained professionals in specialized fields. Gaining work experience through internships, acquiring professional skills through education or training, and seeking institutional support and professional assistance are the important factors enhancing the competitive advantage of young people entering agriculture (Stojanová and Tomšík 2014).

Although this study reveals some interesting findings regarding the factors determining the choice of marketing channel among farmers in Taiwan, one limitation of the research should be mentioned. Due to data limitations, we do not have information on management, i.e., the quality of farm operators. The quality of managers is a significant factor determining the existence and development of organizations (Lišková and Tomšík 2013). Hence, a farm may be successful in using an effective marketing strategy if it is managed by experienced and capable farm operators. Thus, the robustness of our findings could be further validated by including the competencies of farm operators.

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