

# Ordered Logistic Analysis of Farmers' Market Regulations: Who Finds Them Easy?

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## Abstract

This study applies an ordered logistic regression to data collected in 2015 using in-person survey, mail, and online surveys from fresh produce vendors at farmers' markets within the south central and western Kentucky regions. The purpose was to explain levels of difficult the vendors face when complying with market regulations. Results indicate that an average fresh produce vendor at farmers' market is 26 percent likely going to comply with market regulations easily, 69 percent moderately, and 4 percent hardly. Participating in CSA and "local" labeling programs, years of farming experience, and being a male vendor are associated with finding relatively easy to comply with farmers markets regulations. Market managers and policy makers will find this study useful in ensuring that those regulations pose no greater difficult to the vendors. Likewise, findings are useful to the vendors for they indicate variables that make easier for them to comply with the regulations.

**Keywords:** farmers' market regulations, fresh produce vendors

## 1. Introduction

Farmers' markets are an alternative to supermarkets where farmers sell their produce directly to consumers without middlemen. The markets have a set of market regulations for vendors to follow. This structure varies from state to state and market regulations are different (Public Health Law Center, 2014). According to the Kentucky Department of Agriculture (2014), farmers' markets in Kentucky do not have a general set of rules for all markets to follow. Each market operates independently and decides upon their rules and how they will be enforced. Market rules are decided in a variety of ways. Market manager, a committee or the vendors make the regulations. Even though there are no official regulations across all farmers' markets, there are common rules that are seen throughout markets for vendors (Hamilton, 2002). The difficulties that vendors might face when complying with market regulations include paying participation fees, attending vendors' meetings, adhering to market hours of operation, language barriers for those whose English is not their first language, and meeting quality standards.

The levels of difficult to comply with regulations are different among vendors. Some vendors find them easy to comply while others find them difficult. Very little is known about farmers' market regulations and the difficult they pose to vendors. This study focuses on vendors of fresh produce and explains the levels of difficult they face in complying with the market regulations. Our research questions were: what are the partial probabilities for fresh produce vendors to face difficult in complying with farmers' market regulations? What are vendor characteristics associated with facing greater difficult? We describe the vendor characteristics and explained the probabilities of facing difficult. We then formulate policy suggestions. Although this study uses data collected from fresh produce vendors at farmers' markets in the south central and western Kentucky regions, the findings are applicable to vendors throughout the state and surrounding regions.

This study is significant because it provides policy makers with suggestions helpful in creating a user-friendly legal framework. Farmers' market managers will find this study significant for its results identify and explain vendor characteristics that are associated with various levels of difficulty in complying with market regulations.

This study is relevant for vendors because the findings serve as an advocacy for those who feel burdened by the regulations.

## 2. Literature Review

This section presents few previous studies that are closely related to this topic. Ernst (2014) indicated an upward trend in farmers' markets in Kentucky as a result of a considerable support from the Kentucky Department of Agriculture and other state agencies. Futamura (2007) found that over the past century more consumers in Kentucky became concerned about their health and diet as a result of industrialized agriculture production. Farmers' markets in Kentucky have also settled on the idea of locally produced food or "made in Kentucky" foods. This gives the consumers greater sense of "where" their food is coming from. Baharanyi and Boateng (2012) found that there are three levels of farmers markets: developed, developing and underdeveloped. The study showed that most of the markets were underdeveloped. The developed markets tend to locate in urban areas with a full paid staff and well-developed physical structure, which brought more customers into the market. The study recommended better facilities and marketing strategies to attract consumers at the underdeveloped farmers' markets.

There are various products available at farmers' markets (McGarry-Wolf, Spittler, & Ahern, 2005; Brown & Miller, 2008; George, Kraschnewski, & Rovniak, 2011; Alonso & O'Neill, 2011). However, Gumirakiza, Curtis, and Bosworth (2014) indicated that 78 percent of consumers go to these markets to primarily purchase fresh produce. Selling at farmers' markets is generally a part-time agribusiness venture. In fact, Varner and Otto (2008) showed that being a vendor was only a part-time job and most successful vendors travel from one market to the next. Ostrom and Drován (2013) found that farmers' market vendors have a unique relationship with customers. That relationship brings several customers to the markets as opposed to super markets.

Vendors at farmers' markets must comply with a set of regulations. The most crucial regulations enforce food safety to ensure that the food products sold to the public are safe for consumption. Markets can also make the decisions on what can and cannot be sold at their markets. Markets along with vendors must have the proper permits to participate in a farmers market. Hoffman, Dennis, Gilliam, and Vargas (2007) indicated that if a food is ready to eat it should be labeled as such. The study suggested that vendors must use clean utensils, properly store food products to reduce the risk of food poisoning, and no sick person should handle the food being sold at the market. In this regard, Hofmann et al. (2007) argued that receiving a permit to sell food products at farmers' market signifies that the vendor met all requirements of the food code. They also suggested that the permits should be suspended or revoked when vendors fail to comply with the food code.

According to May (2005), farmers have a strong sense of duty to comply with regulations. They were found with low fear of punishment with the regulations. In fact, less than 10% of the farmers who have had some kind of written warning have had actions taken against them. The amount of farmers with a serious punishment from their offense is even less. Along with farmers' market regulations, farmers also have to deal with the changing policy regarding their farming operations. According to Hazell (2010) the policies create more difficulty to access inputs and the markets and changes in regulations for small farms have caused failures in some cases. The fact is that little is known about farmers' market regulations and the difficulty the cause to the vendors. This study contributes to the existing literature by examining factors that explain levels of difficulty in complying with the market regulations.

## 3. Methodology

### 3.1 Data Collection Procedures

This study employs data collected from farmers' market vendors of locally grown fresh produce at farmers' markets located within the south central and western regions of Kentucky. We chose these two regions for the closeness and convenience to researchers. The research was conducted between March and September in 2015. We used surveys and distributed them via email, mail, and in-person strategies. The survey was created online using Qualtrics software. The software generated a link accessible to respondents who wish to participate online. Researchers used the farmers' market registry to locate the markets, visited them on days of operations, and asked vendors to complete them. Some vendors were too busy to take the surveys immediately because they were interacting with customers. We asked a convenient way to take the surveys; either online or by mail. We provided an online link to those vendors who preferred the online route. We gave copies of surveys to those who chose to complete the surveys at home and requested them to mail them to us upon completion. Another strategy we used is to get a list of email addresses for all farmers' market managers available at Kentucky Department of Agriculture webpage. We emailed the survey's link to the managers within the two regions of our study and asked them to distribute it to all fresh produce vendors at their markets.

In total, we were able to receive forty-six completed surveys out of seventy-eight surveys we distributed. Thus, we had a fifty-nine percent response rate. Compared to the average response rate of forty-five percent reported by Nulty (2008), our data collection strategy led to a higher response rate. The nature of the outcome (dependent variable) has dictated the choice of the model to use for this analysis. Respondents were presented 5 levels of difficult (Very easy, easy, moderate, difficult, and very difficult) they face when meeting farmers' market regulations. We asked respondents to indicate the level that best reflects their situation.

### 3.2 Theoretical Framework

The dependent variable for this study consists of polychotomous with an ordinal/ranking nature. Kennedy (2008), Greene (2010), and Wooldridge (2009) indicate that an ordered logistic model is appropriate for such a case. Ordered logistic model generalizes the binary logistic analysis which is used as an explained variable to more than two ordinal outcomes (Train, 2009). This analysis is done in a situational framework where we assume that a respondent  $i$  faces  $j$  ranking levels/alternatives and chooses the one that is the most appropriate to his/her situation. In this framework, there is an observed ordinal variable,  $Y$ ; which is a function of another variable  $Y^*$ , that is not measured (Williams, 2015). In other words, there is a continuous, unmeasured latent variable  $Y^*$ , whose values determine what the observed ordinal variable  $Y$  equals.

In practice, the  $Y^*$  cannot be observed. We instead observe the response  $Y$  whereby

$$Y = \begin{cases} 1 & \text{if } 0 < Y^* \leq \mu_1, \\ 2 & \text{if } \mu_1 < Y^* \leq \mu_2, \\ \dots, \\ J & \text{if } \mu_{j-1} < Y^* \leq \mu_j \end{cases} \quad (1)$$

where the  $\mu$ 's are the unknown threshold parameters to be estimated. In this analysis,  $j$  is represented by the 5 levels of difficult of farmers' market regulations: 1 (Very easy), 2 (Easy), 3 (Moderate), 4 (Difficult), and 5 (Very difficult). Respondents expressed levels of difficult by choosing one alternative out of the five rankings.

The latent variable  $Y^*$  is given by:

$$Y_i^* = \sum_{k=1}^K \beta_k X_{ki} + \varepsilon_i = Z_i + \varepsilon_i \quad (2)$$

Where,  $X_{ki}$  represent explanatory variables. The model included dummy variables and their corresponding estimates are interpreted as the probability difference between  $X_{ij}$  values of zero and one. The  $\beta$ s are the ordered log-odds estimates that measure the impact that a corresponding explanatory variable has on the likelihood of difficulty compared to the chances of indicating otherwise. The  $\varepsilon_i$  is a random disturbance term. This disturbance term represents other factors not included in the model and is assumed to have a standard logistic distribution. In Equation (2), the part that is used to estimate the ordered Logit model parameters is:

$$Z_i = \sum_{k=1}^K \beta_k X_{ki} = E(Y_i^*) \quad (3)$$

Equation (3) indicates the expected value of the latent variable  $Y^*$ , whose values determine what the observed ordinal outcome  $Y$  is. The probability that  $Y$  will take on a particular value is given by

$$Prob(Y = j / X_{ki}) = \frac{\exp(\beta_k X_{ki})}{1 + \exp(\beta_k X_{ki})} \quad (4)$$

We hypothesized that there is no relationship between chooser's characteristics and the degree of difficult farmers face (null hypothesis), that is;  $H_0 \Xi \beta_k = 0$ . The alternative hypothesis is that there are significant relationship between chooser's characteristics and the degree of difficult farmers face, that is;  $H_1 \Xi \beta_k \neq 0$ .

## 4. Results

The main purpose of this study is to assess the levels of difficult faced by farmers' market vendors when complying with the market regulations. We examine whether or not vendor characteristics have significant impact on the probabilities of facing difficulties. This section presents two types of results: descriptive and econometric. The descriptive results show basic statistics about the variables of interest. Table 1 shows a numerical description of the variables we include in the ordered logistic model.

### 4.1 Descriptive Statistics

An average fresh produce vendor was 37 years old with some college degree (lower than a bachelor's degree) and 14 years of farm experience. The average farm size among participants is 212 acres; ranging from 2 acres to 610 acres. 33 percent and 29 percent of these vendors use farm stands and community supported agriculture programs respectively as other market venues. This suggests that the vendors are diversifying their market

options. 66 percent of participants in this survey were males, 52 percent indicated that farming is their primary occupation. When asked whether they label their fresh produce as “local”, a vast majority (90 percent) indicated doing so. This study found out that the use of social media and/or having market web-based advertisements among farmers’ market vendors in the south central and western Kentucky regions is 66 percent.

Table 1. Descriptive statistics

Variables	Stats
Age	37 (13)
FarmSize (acres of land)	212 (309)
FarmStand	.33 (.48)
CSA	.29 (.46)
LocalLabel	.90 (.30)
WebSocialMedia	.66 (.48)
FarmingPrimaryOccupation	.52 (.51)
FarmExperience (number of years)	14 (9)
EducationLevel	3 (some college) (1.5)
Male	.66 (.48)

*Note.* Standard errors are in parentheses.

We asked the vendors to indicate one level of difficult among five ordinal alternatives (very easy, easy, moderate, difficult, and very difficult) they face when complying with farmers’ market regulations. Results indicated that only one percent is in the extreme categories (very easy and very difficulty). Consequently, we decided to reduce the alternatives from five to three. To accomplish this, we merged very easy and easy into “easy” category, very difficult and difficult into “difficult” category, and left “moderate” intact. Hence, the dependent variable consists of three levels of difficult (Easy, Moderate, and Difficult). Responses are presented in Figure 1.

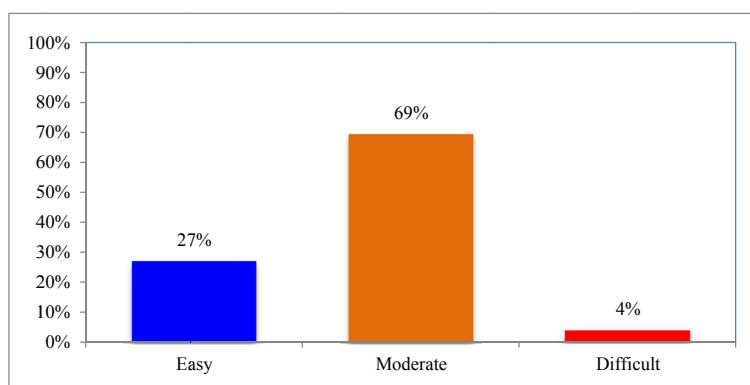


Figure 1. Histogram of levels difficult of farmers’ market regulations

This study shows that the majority (69 percent) of farmers’ market vendors believe that the market regulations are moderate. There were 27 percent of respondents said they find the farmers’ market regulations to be easy to comply. Only 4 percent think that the regulations are difficult. These results are exactly the same as the partial probabilities (in Table 3) that the ordered logistic model produced using mfx2 commend after ologit.

Furthermore, we asked a question to find out the level of satisfaction about how farmers’ market regulations are enforced in their market. Results indicate that a majority of farmers’ market vendors are either neutral or satisfied. Only six percent of the respondents are either dissatisfied with how farmers’ market regulations are enforced. Figure 2 below shows these statistics.

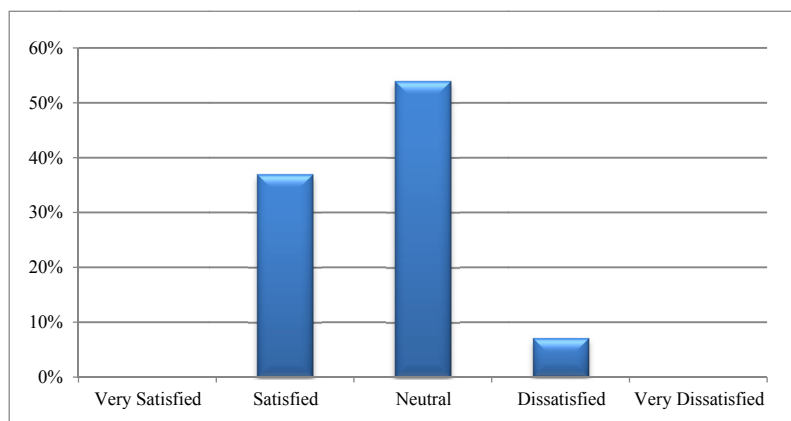


Figure 2. Histogram of levels of satisfaction of how farmers' market regulations are enforced

When asked if they strongly agreed, agreed, strongly disagreed, disagreed or neutral on if the regulations negatively affected their profitability, 13 respondents believe that regulations negatively affected their profitability. This study found out that that the majority of market vendors are either unsure of how regulations affect their profitability or believe that regulations have a positive impact on the profitability of their operation.

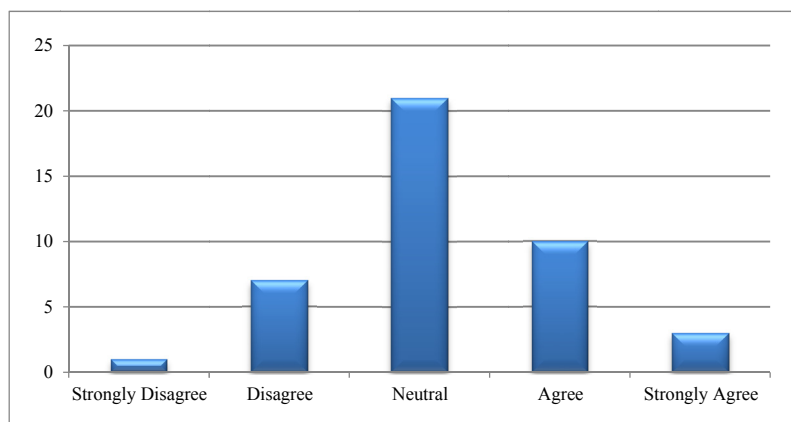


Figure 3. Histogram of if the vendors believed regulation negatively affected their operations

4.2 Model Results

Using stata/MP 13.1 and ologit command, we run the ordered logistic model to estimate the coefficients and odd ratios. Using the mfx2 command after running the ologit model, we computed the probabilities for random farmers' market vendor falling under a specific category of difficulty. Table 2 presents these probabilities.

Table 2. Ordered logistic probabilities using the mfx2 command

Difficult_Level_FM_Regulations	Probabilities	Cumulative probabilities
Easy	0.269	0.269
Moderate	0.694	0.963
Difficult	0.037	1.000

These results suggest that an average fresh produce vendor at farmers' market is 26 percent likely going to comply with market regulations easily, 69 percent moderately, and 4 percent hardly. Overall, this finding implies that the farmers' market regulations pose no great difficult to the vendors.

Coefficients in Table 3 are interpreted as the expected changes in the individual ordered log-odds of falling into the highest level of difficulty versus the lower levels as a result of a one-unit change in the predictor while the other variables in the model are held constant. Because the dependent outcomes are ordered from easy to difficult, a positive coefficient indicates that an increase in the corresponding variable increases the difficulty. The opposite is true for a negative coefficient. The odd ratios indicate the number of times that chances for subjects in the difficult category is multiplied when there a unit change in the specific predictor. The cut1 and cut2 are the estimated cut points on the latent variable used to differentiate the observed levels of difficulty when values of the predictor variables are evaluated at zero.

Table 3. Ordered logistic coefficients and odd ratios

Difficult_Level_FM_Regulations	Coefficients	Odds Ratios
FarmSize	0.003 (0.002)	1.003 (0.002)
FarmStand	-2.910* (1.549)	0.035* (0.101)
CSA	-1.936* (1.419)	0.118* (0.280)
LocalLabel	-3.457* (3.000)	0.128* (0.013)
WebSocialMedia	7.382* (4.006)	1.607* (6.438)
FarmingPrimaryOccupation	-4.008 (3.007)	0.018 (0.055)
FarmExperience	-0.304** (0.082)	.218** (0.100)
EducationLevel	-0.183 (0.498)	0.833 (0.415)
Male	-4.177* (3.070)	0.083* (0.016)
Constant Cut 1	-2.465 (3.129)	0.321 (0.369)
Constant Cut 2	-1.345 (2.201)	0.217 (0.282)

Note. The \* and \*\* represent 10% and 5% respectively. Standard errors are in parentheses.

Results in Table 3 indicate that all significant coefficients on all variables (FarmStands, CSA, LocalLabel, FarmExpeience, and Males), but WebSocialMedia are negative. This posits that various market strategies by selling at farm stands, participating in CSA programs, and participating in “local” labeling programs, years of farming experience, and being a male vendor are associated with finding relatively easy to comply with farmers markets regulations. If a farmers’ market vendor sells at farm stands, participate in CSA programs, and use “local” labels, his/her ordered log-odds of finding it difficult to participate in farmers’ markets would decrease by -2.910, -1.936, and -3.457 respectively. Likewise, males (with a coefficient of -4.177) find it easy to participate in farmers markets than females do. We found that farm size, education, and being a farmer as a primary occupation do not have any significant effect on the levels of difficult of farmers’ market regulations.

Furthermore, we found that farm experience is associated with easiness in navigating farmers’ market regulations, with a coefficient of -0.304. This means that if a vendor gains one more year of farming experience, his/her ordered log-odds of finding it difficult to participate in farmers’ markets would decrease by 0.304. This result is consistent with what one should expect; the longer a farmer participates in farmers markets the less difficult it is to abide by market regulations. Surprisingly, the coefficient on WebSocialMedia is positive; an indication that vendors who have both websites and use social media find farmers’ market regulations to be difficult compared to their counterparts. This result proposes that incorporating the farmers’ market regulations in these vendors’ online tools in simple terms might reduce the difficulty.

The odds ratio in the third column of Table 3 are measures of proportional chances that vendors find it either easy, moderate, or difficult (outcomes) for a unit increase in a specific explanatory variable. Specifically, for a one-unit increase in years of experience with farming, the chances of finding it difficult (versus the combined moderate and easy categories) to comply with market regulations are 0.217 times lower, given that other variables in the model are held unchanged. Similarly, for a one-unit increase in years of experience with farming, the chances of finding it moderate (versus the combined difficult and easy categories) to comply with market regulations are 0.217 times lower. The chances for males to find it difficult (versus the combined moderate and easy categories) to comply with market regulations are 0.0834 times lower. The likelihood of vendors who participate in the CSA program to difficult to comply with market regulations is 0.118 lower compared to those who do not participate. This indicates that encouraging vendors of fresh produce at farmers’ market to participate in CSA programs will make it easy for them to comply with market regulations.

## 5. Conclusion and Policy Implications

This study explains levels of difficulty of farmers' market regulations among fresh produce vendors. An ordered logistic model was employed on survey data collected from forty-six fresh produce vendors at farmers' markets in the south central and western Kentucky regions. Data collection was completed in 2015 using an in-person survey, mail, and online strategies. Results indicate that an average fresh produce vendor at farmers' market in the south central and the western Kentucky regions is 26 percent likely going to comply with market regulations easily, 69 percent moderately, and 4 percent hardly. Overall, farmers' market regulations pose no great difficulty to fresh produce vendors. This study posits that selling at farm stands, participating in CSA programs, and participating in "local" labeling programs, years of farming experience, and being a male vendor are associated with finding relatively easy to comply with farmers' market regulations. We found no evidence to claim that farm size, education, and being a farmer as a primary occupation affect the levels of difficulty of farmers' market regulations among fresh produce vendors.

Based on our findings, we propose to vendors of fresh produce at farmers' markets to diversify their market portfolios by selling at other direct-to-consumer market outlets like farm stands and participating in CSA and "local" labeling programs. Not only this will increase their revenues, but also will enhance their understanding about various regulations; making easy for them to comply with farmers' market regulations. Because we found that vendors who have both websites and use social media find farmers' market regulations to be difficult compared to their counterparts; we encourage these vendors to include farmers' market regulations in their online tools (websites and/or social media accounts) review them frequently. Doing so might increase understanding and easiness to follow the regulations. Findings from this study advocate for any assistance in making easy for vendors to comply with the market regulations.

In terms of policy implications, this study suggests that policies aiming at promoting CSA and farm-stand market arrangements are viable in easing market regulations. We further recommend assistance to facilitate females and those vendors with less farm experience in complying with the farmers' market regulations easily. Vendors with experience should assist less-experienced in the process of complying with the regulations. Because this study noticed that each farmers' market makes its own regulations, we propose a unified set of regulations for all farmers' markets throughout the state with provisions to leave room for individual markets to customize them to meet specific needs. Finally, we propose that future studies examine effects of new rules at the farmers' market on vendors' behavior. For example, if vendors were asked to pay different fees based on specific spots (located at high traffic of consumers, located in the middle, located at less-frequented spots, and the like), it would be interesting to know what their choices and willingness to pay would be and how that might affect their participation. We recognize that the sample size in this study was not large enough. As a result, we suggest further studies with more participants in the regions and/or other states to find similarities and/or differences in findings.

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