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Price Premiums of Organic Produce: Examining Regional Variations

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PRICE PREMIUMS OF ORGANIC PRODUCE: EXAMINING REGIONAL VARIATONS

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Organic products, especially fruits and vegetables are becoming more popular in both their production and consumption. This study analyses the price premium of organic over conventional specialty crops at the retail market level. Data from the USDA's Agricultural Marketing Service (AMS) custom average tool (CAT) was used. The main focus of this study is regional premium differences. Controls for seasonal differences, variety, and unit of sale differences were also included in the model. Regional differences can play a huge role in the price premium. Apples and tomatoes show the highest premium in Southwest region, 0.141 percentage points and 0.286 percentage points respectively. This study suggests that organic apples and tomatoes are more valuable in this region.

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CHAPTER 1

INTRODUCTION

There is a growing concern among consumers about their food, where does it come from, how is it grown, and how much does it cost. As consumers become more conscientious about how their food is produced, we see a greater demand for organically produced crops. Since 2002, when the United States Department of Agriculture (USDA) began to regulate organic labeling, the organic food sector has been steadily increasing (Carlson and Jaenicke, 2016). The National Organic Program (NOP) defines organic as a labeling term used to describe agricultural products that have been produced in ecologically friendly ways that promote environmental health and biodiversity. Products should also be free of synthetic fertilizers, irradiation, sewage sludge, and genetic modification (USDA NOP, 2016). The Economic Research Service (ERS) stated in 2009 that the retail sale of organics has grown from 3.6 million dollars in 1997 to 21.1 million dollars in 2008. Organic products are becoming common place on grocery store shelves, and stores are developing private organic brands to market to consumers; (Dimitri and Oberholtzer, 2009).

Consumers have been leaning toward a less is more approach when it comes to purchasing food. They are looking for products that have as few synthetic ingredients as possible. This especially applies to specialty crops that are often eaten with little or no preparation like apples, strawberries, and lettuce. The term organic has become widely associated with a higher quality of food product, and consumers are willing to pay a premium for certified and USDA organic labeled products. For example, leafy vegetables, including, chard, green onion, parsley, leeks, and cabbage had an 83% price premium in the Argentinian domestic market as of 2005 (Rodríguez, Lacaze, and Lupín, 2007). Larger premiums depict opportunities for growers and retailers who are interested in expanding production, broadening their market, or

using organic farming practices to better the environment. Since consumers are willing to offer price premiums for organic products.

Several studies have been conducted regarding consumer willingness to pay using retail premiums including a study conducted by Govindasamya, Arumugama, Vellanganya, and Ozkanb (2018), which analyzed consumer willingness to pay high premiums 11%-20% for organic produce. Studies that have been conducted up to this point have focused on retail price premiums, organic products other than specialty crops, and other factors pertaining to price premiums other than being organic. Carlson and Jaenicke (2016) identified a number of contributing factors to organic price premium including premium changes over time; they concluded that organic premiums fluctuated over the period, but most did not steadily increase or decrease. Researchers have not looked specifically at price premium differences between regional locations at the retail level. After determining that there is a niche that can be filled with organically grown food, the next question is where is the most beneficial location for building or expanding an organic production operation. The price premium for organic products is expected to naturally differ across the United States, depending on the tastes and preferences of the consumers, and production costs and availability in a given region.

This study used information collected from the Custom Average Price tool to determine if any of the eight selected retail regions has a price premium advantage. The selected regions are classified as Alaska, Hawaii, Midwest, Northeast, Northwest, South Central, Southeast, and Southwest. These regions offer a represent eight distinct locations in the United States. Four specialty crops were selected to be analyzed; apples, strawberries, tomatoes, and cucumbers. Each crop will be analyzed in a separate regression model. A series of dummy variables will be used to account for any differences in variety, unit of sale, and season. The models contain a

variable accounting for secular trends in the supply and demand in the long run.

Knowing which region has the greatest price premium will be valuable to organic specialty crop growers and purchasers of organic products. Growers that are planning to expand their organic operations or begin growing organics may choose to locate in regions with higher organic price premiums. While retail consumers cannot feasibly travel to regions that offer the lowest premiums, this information may help them to be more informed about what varieties and packaging sizes have higher premiums. The premium differences across the regions may also offer insight into how consumers value organic specialty crops over conventional crops.

CHAPTER 2

LITERATURE REVIEW

Previous research has been conducted on organic price premiums of products including dairy, meat, eggs, and specialty crops. It is necessary to determine if there is room for growth and expansion in the organic market and if possible which crops are most popular. Past research has focused on studying price premiums at the retail level, and this study does as well, specifically focusing on regional differences. Region and location are important factors to review when considering the nature of the price premiums and the selection of areas for data collection. The literature suggests that price premium evaluation can be conducted with a variety of models. In this study dummy variables were used to capture premium variation between regions, variety, and unit of sale; and require a different model than the hedonic price model that was used by researchers conducting similar studies.

Producer Opinions and Concerns

Organic products of any kind are usually more expensive than their conventional counterparts. This difference is referred to as the price premium, or the percentage difference between organic and specialty crops. Organic price premiums are based in general on the amount of extra effort that is put into producing certified organic crops including, labor, alternative pest prevention, and other certification requirements (Carlson and Jaenicke, 2016). Carlson and Jaenicke's (2016) study found the most variability occurred in organic price premiums of fresh fruits and vegetables. This premium can vary greatly depending on the type of crop and the steps involved in organic production. Seasonality of the crop impacted the premium so that greater seasonal variability had larger premiums over conventional (Smith, Lin, and Huang, 2008).

When considering organic price premiums it is important to also examine the production

side of the organic market. A price transmission study of organic carrots conducted by Darbandi and Saghaian (2016) examined the rate of price adjustment for conventional and organic carrots in both retail and terminal markets. They found that organic prices were relatively slow to respond to market shocks or policy changes. Inefficient price adjustments of organic produce could have significant impacts on producer decisions concerning joining the organic market.

Several studies have been conducted that examine different challenges organic farmers face when deciding to produce organically. A survey of 116 Tennessee farmers, conducted by Liyanage and Bhavsar, (2018) found that those currently using organic methods faced high production, certification, and labor costs and pest issues to be the biggest challenges of production. Additionally, non-organic farmers who were considering adopting organic practices were most concerned about the similar issues as well as the labor intensive nature of producing organic specialty crops. Explanatory variables including gender, farm size, years farming and farm income, were examined to determine their effect of farmer perception on organic production. Most farmers had relatively small farms (under 50 acres) and the majority owned their own farms; the largest percentages of farmer years of experience was 5 years or less and 30 years or more of experience. Serra, Zilberman, and Gil (2007) caution that while organic farmers do incur higher production expenses compared to their conventional counterparts, exact comparisons should not be made. The quality and quantity of the production inputs vary enough that it would be biased to treat them as interchangeable. Serra, Zilberman, and Gil (2007) examine the views and assumption of risk that organic versus conventional farmers confront in Spain. The organic farmers enjoyed greater yields per hectare than those who used conventional methods and also saw better prices for their crops. However, as previously stated by Liyanage and Bhavsar (2018) in agreement with Serra, Zilberman, and Gil (2007) agree the input costs and

labor intensity is greater when producing organically.

A Michigan study of market opportunities for organic farmers proposed that small and midsized farms, which are common in Michigan (Martinez, Conner, Bingen, and Reardon, 2009) and Tennessee (Liyanage and Bhavsar, 2018), would have difficulty competing at a larger scale. Small and midsized operations may also have difficulty forming a relationship with a wholesale distributor or large retailer. Martinez, Conner, Bingen, and Reardon (2009) suggest that decreases in organic prices are leading to more interest in organic produce by processers and other mass purchasers of fruits and vegetables. Participants indicated, " interest in working closely with farmers to supply products to different retail and food-service outlets," (Martinez, Conner, Bingen, and Reardon, 2009, p. 120). Relationships of this nature could potentially open a door for the small and midsized farms to work with large retailers and wholesale buyers.

Specialty crop producers both organic and conventional are greatly impacted by weather changes. Ro and Frechette (2001) studied the effects of California temperature and precipitation on organic price premiums at terminal and shipping point levels. The organic price premium for vegetables was found to first decrease and then increase in response to an increasing heat index. In addition, this premium fluctuation varied depending on the crop's preferred growing conditions.

Consumer Views

The 2009 Economic Research Service's report summary indicated that organic retail sales have increased from 3.6 million dollars in 1997 to 21.1 million dollars in 2008 (Dimitri and Oberholtzer, 2009) suggesting that there is a place in the market for organic products. Further a report by Martinez, Conner, Bingen, and Reardon (2009, p.118) states, "demand for organic products continues to grow by about 20% per year." Much of the research conducted thus far

examines the problem from the angle of retail consumer demand as suggested by Smith, Lin, and Huang (2008). Their study of organic price premiums focuses on the other components that might contribute to the premium, such as, product attributes like weight or packaging and characteristics of the consumer group. Their results indicate that subjects with higher income and younger than 40 years old paid higher premiums on produce, and those who had at least some college education paid more for organic vegetables. Further Govindasamya, Arumugama, Vellanganya, and Ozkanb (2018) found that those with incomes of $100,000 or more and have Graduate or advanced degrees are willing to pay higher premiums for organic produce. Their study also suggested that respondents were willing to pay higher price premiums for organic produce if they believed organic foods tasted better. A consumer survey study of Argentinian willingness to pay, conducted by Rodríguez, Lacaze, and Lupín (2007) found that participants were willing to pay higher price premiums for organic leafy vegetables due to health concerns about pesticides. As in previously discussed studies, consumers with higher incomes had higher willingness to pay. Carlson and Jaenicke (2016) use the same Nielsen Homescan data as Smith, Lin, and Huang (2008), however Carlson and Jaenicke's (2016) study uses data from 2004 to 2010 and Smith, Lin, and Huang (2008) use data only from 2005. Carlson and Jaenicke (2016) focused their study on 17 different organic products, including coffee, canned beans, apples, and bagged salad mixes to examine how the premiums fluctuate over the chosen time period. Smith, Lin, and Huang (2008) also separated out the commodities individually, and examined changes in price premium. This study will also consider the four selected crops individually. The literature from all angles suggests that the organic market is one that should be explored in further detail.

Model Consideration

Carelson, and Jaenicke (2016) and Smith, Lin, and Huang (2008) use hedonic price models to determine the premium in terms of dollar amounts. Price premiums for this study will be given as percentages, therefore a different model will be chosen. Regions, unit of sale, variety, and season of sale are all explanatory variables and need to be assigned numerical values in order to be used in an Ordinary Least Squares (OLS) model. Kuehn and Hamer (1978) suggest that dummy variables should be considered as factors containing different levels. The study examines two different models, the one-way model and the one-way covariate model, and several different treatments for each model. The one-way model's use of dummy variables is most consistent with the uses of dummy variables in this current study.

Previous literature has examined premium differences between crops and at terminal and shipping point levels; however most studies have not directly compared the organic premium difference between distinct geographical regions. Past studies have also looked into the components that contribute to organic price premiums from the consumer, retail, and producer angle. This study will focus mainly on the difference between regions using retail price data; additionally season, unit of sale, and variety will be considered in the models.

CHAPTER 3

DATA

The data used for this study was gathered from the USDA's Agricultural Marketing Service (AMS) custom average tool (CAT). This study focuses on monthly retail price data. Monthly average price data from 2007 to 2019 for each of the four selected crops was taken. The data included the year, month, unit of sale, variety, region, average monthly price, and product type (organic or conventional). For the purpose of this study the premium is calculated as: ((organic price – conventional price) / conventional price). Four commodities were selected to be analyzed: apples, strawberries, tomatoes, and cucumbers. A total of 8,298 valid observations were collected for use in this study.

The year is used as a simple time variable and is expected to be linier. In other studies, time has been used to measure fluctuations in price premium over the years. A previous study by (Carlson and Jaenicke, 2016) using panel data showed no consistent increase or decrease over the years, 2004-2010, studied, but instead most products fluctuated from year to year. The same study also suggested that the most volatility of premiums occurred in the years 2007 and before due to the newness of the organic market. In contrast Darbandi and Saghaian (2016) offer evidence that price differences between organic and conventional fresh carrots found converge in the long-run. It is expected that year will have a slightly positive effect on the price premium. As years increase, the premium is also expected to increase.

Month is recoded to into seasons. These seasons were spring, summer, fall, and winter. Spring consisted of premiums collected in March, April, and May. Summer premiums were collected in June, July, and August. Likewise, the premiums from September, October, and November, were classified as fall. Lastly winter was composed of December, January, and

February. This was done to capture premium changes that may be affected by the seasonality of specialty crops like those included in this paper. For example, apples are generally produced and most demanded in the fall. The seasons will be further recoded into dummy variables in order to be used in the multiple regression model. The base for each commodity was selected depending on the season in which the commodities are most available. Apples have a base season of fall because apples are typically harvested at this time. Summer is the base season for strawberries and tomatoes. Cucumbers have spring as the base season because this season had the most premiums reported at this time.

Smith, Lin, and Huang (2008) found significant difference in the prices of fresh produce base on the packaging and weights the produce was sold in. Tomatoes, in Smith, Lin and Huang's (2008) study were found to have a higher price premium when sold in packaged form as opposed to by random weight. In this study a variable to capture differences in packaging was implemented in the form of unit of sale. This variable will capture premium differences that may be effected in part by various units of sale. Apples were sold in one, two, three, and five pound units. Each of these were recoded into dummy variables and one pound was used as the base unit of sale. Strawberries were offered in one or two pound packages. Again both were recoded into dummy variables and the one pound package was selected because of frequency. The unit of sale for all the tomato data entries was one pound. Because only one unit of sale was included in the data set; unit of sale is excluded from the tomato regression. Cucumbers were either sold as per pound of each. The unit of sale "each" was selected to as the base year because cucumbers are most commonly priced per piece.

Another contributor to price premium is the variety of each commodity. Variety is controlled for but is not the main focus of this study. Apples had the most varieties, with nine

different varieties including red delicious, gala, and fuji, see Table 3 for the complete list of varieties. Gala was chosen as the base for the variety dummy variables in the apple regression due to its popularity. All of the dummy variable bases chosen will be the most commonly purchased variety according to this data set. Cucumbers only had two varieties included in the data: long seedless and other. The long seedless variety was chosen as the base. There were four tomato varieties including heirlooms and vine-ripes, which was used as the base. No variety was given for strawberries, therefore it was omitted from the regression for strawberries.

One of the main facets of this study is the price premium variations across regions. Eight regions in the United States are included and are the same in each of the commodities' regressions. The regions are Alaska, Hawaii, Midwest, Northeast, Northwest, Southcentral, Southeast, and Southwest. As with the other nominal variables, they were recoded into dummy variables with Midwest used as the base for all four commodities. The Midwest was chosen as the base because of its more central location.

The average monthly price for each commodity was collected. The data was sorted and refined so that there were no duplicate entries and each organic price had a corresponding nonorganic price. The monthly prices were collected for all twelve months from 2007 to 2019. The organic and conventional or nonorganic price was collected and the premium calculated from the average price at each collection point. Percentage price premium is the dependent variable explained as a function of years, season, region, unit of sale, and variety.

Table 1. Main **v**ariables included in the OLS regression.

Variable	**Definition**
Dependent Variable	
Premium	((organic price – conventional price) / conventional price), recorded as a percentage
Explanatory Variables	
Unit of Sale	
1 lb	=1 if 1 lb is the Unit of Sale, =0 otherwise
2 lb	=1 if 2 lb is the Unit of Sale, =0 otherwise
3 lb	=1 if 3 lb is the Unit of Sale, =0 otherwise
5 lb	=1 if 5 lb the Unit of Sale, =0 otherwise
Each	=1 if Each is the Unit of Sale, =0 otherwise
Region	
Alaska	=1 if Alaska is the Region, =0 otherwise
Hawaii	=1 if Hawaii is the Region, =0 otherwise
Midwest	=1 if Midwest is the Region, =0 otherwise
Northeast	=1 if Northeast is the Region, =0 otherwise
Northwest	=1 if Northwest is the Region, =0 otherwise
South Central	=1 if South Central is the Region, =0 otherwise
Southeast	=1 if Southeast is the Region, =0 otherwise
Southwest	=1 if Southwest is the Region, =0 otherwise
Season	
Spring	=1 if Spring is the Season, =0 otherwise
Summer	=1 if Summer is the Season, =0 otherwise
Fall	=1 if Fall is the Season, =0 otherwise
Winter	=1 if Winter is the Season, =0 otherwise

CHAPTER 4

MODEL CONSIDERATIONS

An Ordinary Least Squares (OLS) regression model using multiple dummy variables with more than two classes will be used. A regression for each of the four commodities will be run, resulting in four separate regressions. SPSS statistics version 26 will be the analysis software used to run the models. The basic model is as follows: percentage organic price premium as a function of years, season, region, unit of sale, and variety. The unit of sale will be excluded from the tomato regression because all entries were sold by the pound. The strawberry regression will not have a variable for variety. The empirical expression for each of the four regression models is given as a vector:

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon i$$

Where X_1 is years, X_2 is a vector for regions, X_3 is a vector for the seasons, X_4 is a vector for unit of sale, X_5 is a vector for the varieties. See Table 1 for a full list of dummy variables and see Table 3 in the appendix for a full list of the variety dummy variables.

The coefficient for years is expected to differ depending on the crop. Carlson and Jaenicke (2016) did not see steady time trend in the majority of crops that the examined, and this study expects similar results. Region is expected to have a significant coefficient. The strength and direction of this result may depend on the particular crop, the demand in the area, and availability. The Southwest region, containing California, is expected to have a positive effect. California is well known for its large scale organic produce farms, and should be considered in a study such as this. Some other regions to note are the Northeast and Southeast. Both of these regions contain large cities and the Southeast contains large production areas for produce. Tomatoes may have lower premiums in the Southeastern region because of the lengthened

growing season. Premiums may be larger in the Northeast for tomatoes and strawberries, but may be lower for apples due to the cooler climate. The Northwest may also show smaller premiums for apples because of the abundance of apple production in the region.

Seasonality of the four crops is taken in to account with the season variable. Apples are expected to have premiums that are slightly higher in the summer when compared to the main growing season; which is fall and is used as the base for apples. Tomatoes may have slightly larger premiums in the spring due to the added premium of being early to the market. Strawberries may have lower premiums in the summer after the main growing season in the spring, but overall may show high premiums. Smith, Lin, and Huang (2008) also used strawberries in their analyses and noted their seasonal nature as a contributor to the high premium. The main growing season for cucumbers is late spring to early summer and they remain in high demand for most of the summer; therefore, they are expected to show a higher premium in the summer. The winter season may have differing effects on the price premium of the crops. Cucumbers and tomatoes may show lower premiums due to lack of demand for during winter months. On the other hand, apples and strawberries may have higher or at least comparable premiums because of their relative scarcity during winter.

The unit of sale was considered in this study to monitor price discrimination based on package size. The data is collected at the retail level so it is reasonable to expect some level of price discrimination. If price discrimination is a factor the coefficients for unit of sale will reflect this by being negative or smaller when larger units of sale are compared to smaller. For example, a five pound bag of apples will most likely show a more negative premium when compared to a one of two pound bag.

Variety is controlled for in this study but is not considered a major focus. It is expected, however, that varieties that are most popular and easily recognized will have higher premiums. Heirloom tomatoes may also have a higher premium due to their difficulty to grow organically. The use of the Ordinary Least Squares method assumes that there is no serial correlation or heteroskedasticity problems. The regions, season, unit of sale, and variety are assumed to be good representatives for each crop.

CHAPTER 5

RESULTS

A linear model using the ordinary least squares method was conducted for each of the four crops. Dummy variables represented the nominal values in the model and the estimated regression model is displayed in Table 2. The constant term, which represents Midwest for all four crops, the selected base season, unit of sale, and variety depending on the crop was negative for apples and strawberries. The constant term was positive for cucumbers and tomatoes. The year was positive and statistically significant at the 99% level for apples and strawberries, indicating that with each additional year the premium increases by the given percentage points respectively. Cucumbers also had a coefficient that was significant at the 99% level, but it was negative. These results coincide with Carelson and Jaenicke (2016) who found no steady increase or decline in price premiums over a six year period for most crops. Generally speaking, there is no blanket trend in concerning the organic price premium and years. The four crops considered are apples, cucumbers, tomatoes, and strawberries. Each had separate regressions and their results differed considerable in terms of what variables were significant and the direction of the relationship to premium.

To begin, all of the regions, except one, in the apple regression were statistically significant to at least the 90% level of confidence. The Southeast was not significant by the measures of this regression. As previously predicted the Southwest had the highest premium at 0.141 percentage points and Alaska had the lowest premium at -0.141 percentage points. It should also be noted that the Northeast also had a strong positive premium. The premiums for season were all reported as highly significant and also negative. Fall, part of the constant term, is the main production time for apples and it is also one of the peak points in demand. Fall being

used as the constant term most likely plays a role in the negative results of the other season variables. Winter is the least negative, at -0.145 percentage points, meaning that the premium decreases the least from fall to winter than from fall to any other season. The unit of sale variables do in fact show evidence of price discrimination. Premium decreases with each increase in the unit of sale. A 3 lb bag of apples cause a -0.022 percentage point decrease; compared to a 5 lb bag that has a -0.331 percentage point decrease in premium. While variety was not the main focus of the study, it should be noted that four of the eight measured varieties were statistically significant to at least a 90% level. All four of these varieties are fairly common and recognized including, Fuji, Golden Delicious, Granny Smith, and Honey Crisp. The goodness of fit for this model is fairly low with an R-squared value of 9.20%.

The next crop to be examined was cucumbers. Four of the regions were considered statistically significant at a level of 95% or more. It is interesting to note that all of the regions showed negative values, which indicates that premiums are lower in regions when compared to the Midwest. Hawaii showed the most negative value at -0.915 percentage points. None of the season variables had a statistically significant effect. Cucumbers that were sold by the pound had 0.377 percentage point increase to the constant term. The “other varieties” variable was significant at a 99% level. The R-squared value was 14.00%, which is higher than the goodness of fit measure for apples.

Moving to tomatoes we see a similar story to the previous two crops; most of the regions are statistically significant, this time at a level of 99%. It should also be noted that all of the significant values are positive. Each of the five significant regions will increase the constant term, which in turn increases the overall price premium for tomatoes. The Southwest again shows the largest premium at 0.286, followed by, the Northeast at 0.233 percentage points. None

of the season variables were statistically significant for tomatoes, meaning that all of the season are not statistically different than the base season of summer. As predicted heirlooms had a negative premium that was statistically significant to the 99% level. The goodness of fit for the tomato model was the highest of all four models with an R-squared value of 24.20%.

The final crop to be examined was strawberries. Unlike the other three crops only two regions, Alaska and Hawaii, were statistically significant at a 90% level or higher and both values were negative. Season did have a significant effect with winter having the highest premium at 0.216 percentage points. This may be a result of relative scarcity of strawberries in the winter months. Similarly to apples, we see some evidence of price discrimination in strawberries. The 2 lb package had premium of -0.127 percentage points less that the constant term which incorporated the 1 lb package. The goodness of fit for the strawberry regression gives an R-squared value of 22.00%.

Overall the R-squared values of all the models were fairly small, however, Smith, Lin, and Huang (2008) had similarly low goodness of fit values for most of the commodities they considered. It was their suggestion that due to the unique nature of specialty crops the R-squared value will be low, but that the models are still generally a good fit.

Table 2. Estimated Regression results for each of the four models.

Variable	Apple	Cucumber	Tomato	Strawberry
Constant	-40.645	84.660	10.212	-24.262
Year	0.020***	-0.042***	-0.005	0.012***
Region: Midwest Excluded				
Alaska	-0.141***	-0.487***	-0.005	-0.101**
Hawaii	0.101*	-0.915***	0.131	-0.362***
Northeast	0.081***	-0.154**	0.233***	-0.009
Northwest	-0.043**	-0.225***	0.183***	0.001
South Central	-0.054**	-0.013	0.177***	-0.039
Southeast	0.013	-0.078	0.206***	-0.051
Southwest	0.141***	-0.044	0.286***	0.023
Season: Fall Excluded for Apple, Summer Excluded for Tomato, Spring Excluded for Cucumber and Strawberry				
Spring	-0.180***	-	-0.009	0.131***
Summer	-0.119***	0.055	-	-
Fall	-	-0.020	0.028	-0.056**
Winter	-0.145***	0.006	0.023	0.216***
Unit of Sale: 1lb Excluded for Apple and Strawberry, Each Excluded for Cucumber, No Unit of Sale for Tomato				
1 lb	-	0.377***	-	-
2 lb	-0.008	-	-	-0.127***
3 lb	-0.022*	-	-	-
5 lb	-0.331***	-	-	-
Variety				
Apple: Gala Excluded				
Braeburn	0.007	-	-	-
Fuji	0.045**	-	-	-
Golden Delicious	0.065**	-	-	-
Granny Smith	0.031*	-	-	-
Honey Crisp	-0.110***	-	-	-
Jonagold	0.034	-	-	-
Pink Lady	0.004	-	-	-
Red Delicious	0.029	-	-	-
Cucumber: Long Seedless Excluded				
All Other Cucumber Varieties	-	0.256***	-	-
Tomato: Vine Ripe Excluded				
Heirloom	-	-	-0.262***	-
On the Vine	-	-	0.079**	-
All Other Tomato Varieties	-	-	0.514***	-
R- Squared	0.092	0.140	0.242	0.220
Sample Size	4910	871	1663	850

Note: the significance level as significantly different than zero is represented at the 1%, 5%, and 10% level respectively: ***, **, *. The level of significance is not given for the constant term. The dashes (-) represent omitted or nonapplicable variables

CHAPTER 6

DISCUSSION AND CONCLUSIONS

When all of the information is combined, we can get a good picture of what variables affect which crops the most. Region has a mostly significant effect for apples, cucumbers, and tomatoes; and very little effect on strawberries. Apple premiums vary region to region, being both positive and negative in comparison to the base of the Midwest. On the other hand, cucumber premiums are negative for all of the considered regions. Tomatoes, in contrast, have positive premiums for all of that statistically significant variables. Season has statistical significance for apples and strawberries, but no effect for cucumbers or tomatoes. This may be because of the ability to easily grow cucumbers and tomatoes in green houses and high tunnels to avoid adverse weather conditions. Apples and strawberry yields can be highly effected by weather events such as frost. The unit of sale generally showed price discrimination as previously discussed. Overall, apples were most signifincntly effected by: region, season, and unit of sale; cucumbers were effected by: region and unit of sale; tomatoes were effected by: region in a positive way; and strawberries were most effected by: season and unit of sale.

Implications

Farmers that are looking to start an organic specialty crop operation should consider growing primarily tomatoes and cucumbers to avoid some of the seasonality while keeping in mind that a higher premium may also indicate more input costs and higher labor intensity. If they are able, farmers should locate operations in regions like the Southwest and Southeast because of good growing conditions and the high demand. This study suggests that the premium differences at the retail level may also be influence by the unit of sale and variety in addition to the organic quality. Strawberries are not overly effected by region, suggesting they could be grown and sold

in most regions without adverse effects. Consumers should take note of the price discrimination and may be able to purchase larger amount of organic produce at a lower premium rate.

Limitations

The model may be limited by the lack of complete variety information for some crops. Additional knowledge may be gained by adding varieties of strawberries and cucumbers. This study does not take into full consideration the production or labor costs that are incurred by farmers. A survey could also be utilized to gauge the general tone of the industry and the views of farmers and terminal market participants.

Future Studies

A consumer survey combined with this current data could offer insight into the make-up or price premiums and how they relate to terminal markets. Studies could also examine the extra costs incurred by retailers and growers when handling organic specialty crops. Additional crops could be added to the study as well as an evaluation organic value added products**.**

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APPENDIX

Variety Table

Table 3. Variety variables that were controlled for in the OLS Regression.

Variable	Definition
Variety	
Apple	
Braeburn	=1 if Braeburn is the Variety, =0 otherwise
Fuji	=1 if Fuji is the Variety, = 0 otherwise
Gala	=1 if Gala is the Variety, =0 otherwise
Golden Delicious	=1 if Golden Delicious is the Variety, =0 otherwise
Granny Smith	=1 if Granny Smith is the Variety, = 0 otherwise
Honeycrisp	=1 if Honeycrisp is the Variety, =0 otherwise
Jonagold	=1 if Jonagold is the Variety, =0 otherwise
Pink Lady/Cripps Pink	=1 if Pink Lady/Crisp Pink is the Variety, =0 otherwise
Red Delicious	=1 if Red Delicious is the Variety, =0 otherwise
Tomato	
Heirloom	=1 if Heirloom is the Variety, =0 otherwise
Vine ripe	=1 if Vine ripe is the Variety, =0 otherwise
On the vine	=1 if On the vine is the Variety, =0 otherwise
All other tomato varieties	=1 if All other tomato varieties is the Variety, =0 otherwise
Cucumber	
Long seedless	=1 if Long seedless is the Variety, =0 otherwise
All other cucumber varieties	=1 if All other cucumber varieties is the Variety, =0 otherwise

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