

PAIRED PRICE COMPARISONS OF FARMERS' MARKET AND SUPERMARKET
PRODUCE IN SAN LUIS OBISPO COUNTY

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Chapter 1

INTRODUCTION

Farmers' markets have been around for decades, and have been growing in popularity year after year. From 2010 to 2011, there was a 17 percent increase in farmers' markets throughout the United States (AMS-USDA, 2011). This increase in farmers' markets could be attributed to the rising consumer interest in fresh, locally produced food (Otto and Varner, 2008). The demand for fresh fruits and vegetables has been on the rise as people are becoming more health conscious of the food they eat. In purchasing fresh produce, farmers' markets can be a viable alternative to supermarkets because they support the local farms, and may even sell specialty items that supermarkets may not offer. Studies have found that in some states, local supermarkets commonly had a limited supply of local produce items and often didn't offer products from the small local growers (Eastwood, 2000).

San Luis Obispo began their first farmers' market in 1983, which is now held every Thursday evening in the downtown area. Farmers' markets have a social gathering quality about them and provide an alternative outlet for consumers who would like to deal with the farmers directly (Ahern and Wolf, 2002). Shopping at a farmers' market is different than shopping at a supermarket in many ways; the customer wanders through the stands more leisurely, talking to the grower about the seasonal items that are on sale, it is a slower market with greater sociability (Lyon, *et al.*, 2009). Farmers' market's local emphasis offers an undoubtedly higher quality product, especially in regard to consumers' verdict of freshness, while supermarkets put a high value on easy access, and a large product range. Farmers' market produce is picked at a more mature stage, often the day before the market's sale, ensuring fresh, high quality fruits and

vegetables. Examining the local market area, there has been an emergence of farmers' markets in San Luis Obispo and other neighboring cities in the county. With this emergence, consumers are faced with the decision of shopping at a farmers' market, at the local supermarket for their fresh produce, or a combination of both.

Problem Statement

Can consumers find lower priced fresh produce at farmers' markets or supermarkets in San Luis Obispo County?

Hypothesis

After examining the prices of produce being sold at farmers' markets compared with paired supermarkets, the average prices at the farmers' markets will be lower than at the local competing supermarkets in San Luis Obispo County, *ceteris paribus*.

Objectives

- 1) To select six produce items that can be found at farmers' markets and supermarkets to be used for the price comparison study.
- 2) To examine price equality of the selected produce by correlating produce prices from three farmers' markets against each locally paired supermarket over a given period of time.
- 3) To identify the individual market, supermarket and farmers' market price differences to determine which market offers on average, lower priced produce.

Significance of the Study

Over the past few years, there has been a growing trend of consumer demand for fresh produce. As this demand for fresh produce escalates, farmers' markets are getting increasingly popular in communities worldwide (Caprio and Isengildina-Massa, 2009). Consumers are once again discovering the many benefits of buying produce directly from the producer. Studies show that by mid-2011, there was a record of 7,157 farmers' markets operating throughout the United States, with 729 operating in California alone, and 1,000 new farmer's markets emerging from 2010 to 2011 (AMS-USDA, 2011). In addition to being beneficial to the consumer and producer, farmers' markets can have a huge impact on the economy. In 2005, total farmers' market sales were estimated to be just over one billion dollars (AMS-USDA, 2011). The growth of farmers' markets in volume and in revenue, is attributed to the increasing numbers of farmers selling at the markets, and of customers utilizing the markets, which indicates that farmers' markets are important to farmers, customers, and to communities where the markets operate. A study done in South Carolina by Caprio and Isengildina-Massa (2009) found that 82% of respondents reported visiting a farmers' market at least once during the last year.

Consumers today are becoming ever more price conscious, so by comparing produce prices at farmers' markets with the prices at supermarkets, a conclusion can be formed about which outlet offers lower prices. It is important for each community to know where they can find the best prices for fresh, local produce. Since there are multiple farmers' markets in the city of San Luis Obispo and many more in the surrounding cities of San Luis Obispo County, the information from this study will be valuable to the community as well as students of Cal Poly who may be on a budget and are looking for the best priced produce in the area.

Chapter 2

REVIEW OF LITERATURE

Healthy diets have been a growing concern to people in the United States in recent years. The focus has switched to fruits and vegetables as people are becoming more health conscious about the foods they are eating (Eastwood, 2000). Attributed with the concern for healthier foods, the demand for fresh, locally grown produce has also been increasing. Caprio and Isengildina-Massa (2009) reported that locally grown produce is the “new ideal” for healthier bodies and in turn, a healthier planet. With this rise in consumer demand for fresh produce, farmers’ markets are emerging like never before.

In parallel with the rise of the fresh produce consumption, there has been an increase in farmers’ markets, which are a modern form of the ancient retail practices known as village markets that link the consumer with the producer (Lyon, *et al.*, 2009). Farmers’ markets have been around for thousands of years, and are defined as a common area where multiple farmers or growers gather on a regular occurring basis to sell a variety of fresh fruits, vegetables, or other farm products directly to the consumer (Payne, 2002). Farmers’ markets are a form of direct marketing, which is more of a social gathering where consumers can take their time and talk to the local farmers face to face about the produce they are purchasing. Farmers’ markets benefit the consumer, the producer, the community and the economy. An Iowa study found that aside from purchasing locally grown produce, consumers benefited from direct interaction with the farmers, giving them a break from the ordinary shopping experience at the supermarket (Otto and Varner, 2008). Farmers’ markets are also important to the producers since these direct sales are often the only access small farmers may have (Payne, 2002).

The numbers of farmers' markets are drastically rising as the years go by, and every year the growth percentages of farmers' markets are also increasing. As these numbers grow, the revenue brought in from the markets are increasing as well, making a huge economic impact on local economies. From 2000 to 2005, there was a 2.5% growth in total farmer's market sales (Rangland and Tropp, 2009). As farmers' markets continue to grow, the farmers have a greater potential for gaining a larger share in the consumer market, while the local and regional economies continue to profit from the growing retention of local dollars (Hughes, *et al.*, 2008).

Even though farmers' markets have been gaining ground, supermarkets have established themselves as the significant market leader. With the growing trend for fresh produce, Caprio and Isengildina-Massa (2009) found that in South Carolina, supermarket chains were supporting the trend and began to offer locally grown products. Wolf, Spittler, and Ahern (2005) also observed that supermarkets were beginning to sell products identified as locally grown, even though nationally branded produce and ready to eat products are still something that can only be found at supermarkets. Aside from starting to offer fresh produce, supermarkets offer other advantages over farmers' markets. In Scotland, Lyon, *et al.* (2009) found supermarkets to be more reliable and more convenient compared to farmers' markets, which were not a place that could be depended on to have every day necessities. On the other hand, Eastwood (2000) found that local Tennessee supermarkets in general sold a limited amount of local produce items and did not offer many products from small local growers. He also noticed since people have become more health conscious and the demand for locally grown produce has increased, consumers have started to pull away from supermarkets, giving more of their business to farmers' markets. Although there are discrepancies, Wolf, Spittler, and Ahern (2005), Lyon, *et al.* (2009), and Eastwood (2000) seem to agree that supermarkets have the convenience factor advantage.

Supermarkets and farmers' markets both offer similar produce items and each consumer has their own reasons where they choose to take their business. An Oklahoma study found the primary reasons for shopping at farmers' markets were as follows; 50% of respondents for a higher quality of food, 33% liked supporting the local community, 8% to promote more equitable food production system, 5% because of the low food prices, and 5% for the entertainment (Toler, *et al.*, 2009). Consumers believe that when compared to supermarket produce, farmers' market produce is fresher looking, of a higher quality, a better value for the money, fresher tasting, and more reasonably priced (Wolf, 1997). Consumer frequency of shopping at farmers' markets was also found to be greater than at supermarkets. Toler, *et al.*(2009) concluded that 51% of respondents in their study shopped at farmers' markets two to three times per month, while 73% of respondents shopped at supermarkets only one to two times each month. According to the "National Farmers' Market Manager Survey", the top three reasons why managers believed their customers shopped at their farmers' markets were freshness, taste, and access to local food (Rangland and Tropp, 2009). When purchasing produce, consumers continue to reveal that quality and price are the two main factors that drive their decision making.

As interest in farmers' markets increases, it is also important to understand the factors affecting the performance of the markets. An Iowa study found that aside from purchasing locally grown produce, consumers benefit from the direct interaction with the farmers, giving them a break from the ordinary shopping experience at the supermarket (Otto and Varner, 2008). Pirog and McCann (2009) found the main factors affecting produce markets were product availability, consumer willingness-to-pay, and local market competition. Research has shown that consumers are willing to pay a premium price for locally grown produce. A study done in South Carolina determined consumers were willing to pay an average of 27% more for fresh,

local produce sold at farmers' markets (Caprio and Isengildina-Massa, 2009), while a study done in Iowa documented that over 50% of consumers were willing to pay 30% more at farmers' markets for produce identified as local. Thilmany, Bond, and Bond (2008) also determined consumers in Colorado expressed a willingness to pay more for local produce in order to support their local agriculture. There are many things that drive the performance of farmers' markets, although price has shown to be the most apparent.

As a result of the growing interest in locally produced foods and the consequent increase in farmers' markets, the question arises whether local foods sold at farmers' markets are more expensive than at their supermarket competition. A study done by Ahern and Wolf (2002) examining actual price comparisons of farmers' market prices to paired, same day supermarket prices found that produce at farmers' markets were less expensive than at the supermarkets for the goods selected. Also from survey research, they found the quality of the produce was superior at farmers' markets, showing a statistic that 54% of farmers' markets sold goods at a lower price than supermarkets after calculating mean prices of 345 produce items. After doing a study comparing produce prices of four different commodities at farmers' markets, with the same produce at each paired supermarket, Giacalone (1999), found the average price for farmers' market produce to be \$1.21 per pound, while the supermarket average was \$1.93 per pound. This is a significant difference of 72 cents between the two outlets. Hindman (2001), Farber (1999), and Ange (2001) compared prices of produce between farmers markets and supermarkets in San Luis Obispo County as well, and found mean prices to be lower at farmers' markets than at supermarkets for their chosen commodities.

One can see that from previous studies, farmers' markets on average offer lower prices than supermarkets. Since supermarkets buy produce from the farmer, they raise the prices so they

can make a revenue off their purchase. This is why farmers are able to sell their produce at a discounted rate since they sell their products directly to the consumers, completely bypassing any middlemen. As farmer profits increase, they are able to provide their customers with a fresher, higher quality produce than comparable produce found at supermarkets. Although farmers' markets seem to have better quality produce at lower prices, supermarkets still have the advantage of convenience and it's ultimately up to consumer preference in deciding where to shop for fresh produce.

Chapter 3

METHODOLOGY

Procedures of Data Collection

Six commodities were examined for the price comparison study. The commodities include: sweet onions, broccoli, Romaine lettuce, butternut squash, vine ripened tomatoes, and Navel oranges. Prices of the six commodities were collected and recorded every other week over a five week period. During this time, produce prices were gathered from three farmers' markets in San Luis Obispo County, along with three nearby supermarket locations. There are about fifteen farmers' markets held weekly in San Luis Obispo County, as some of the markets are seasonal. Due to this seasonality and time conflicts, three operating farmers' markets were chosen for the study.

Three year round farmers' markets were chosen to analyze price data based on their specialization in fresh fruit and vegetable emphasis. The first is the farmers' market located in downtown San Luis Obispo, which is held every Thursday evening from 6:10 pm-9:00pm. It is one of the largest Farmers' markets in California, with almost 70 contributing farmers and over 10,000 potential consumers visiting each week. The second farmers' market is held every Thursday from 2:30pm-5:00 pm in the parking lot of Spencer's Fresh Market in Morro Bay. This market is known for its variety of seasonal fruits and vegetables and is easily accessible to people traveling along Highway 1. The third farmers' market is located in the City Hall parking lot in Arroyo Grande, which operates Saturday afternoons from 12:00 pm-2:30 pm. Although this is a smaller scale market, it offers the most ample selection of produce in the area.

For the comparison analysis, the same six commodity prices were collected from a supermarket located near each of the farmer’s markets. The San Luis Obispo farmers’ market was paired with Sclaris in San Luis Obispo, the Morro Bay market with Spencer’s Fresh Market in Morro Bay, and the market in Arroyo Grande with the Arroyo Grande Albertsons. Prices were gathered and analyzed once every two weeks at the farmers’ markets and supermarkets. Price data was collected from the supermarkets on the same day as their paired farmer’s market took place to make sure all data was accurate. All produce prices observed were measured on a per pound basis or by number of units sold. The data was organized by date, location, and price, arranged in Microsoft Excel, with proper headings, and appropriate abbreviations. (See appendix tables A, B, and C for actual data.)

| <u>Table 1. Selected Farmers’ Markets with Paired Supermarkets in San Luis Obispo County.</u> | | |
|---|--|--|
| Farmers’ Markets | | Supermarkets |
| Spencer’s Parking Lot Morro Bay-(FM1) | | Spencer’s Fresh Market Morro Bay-(SM1) |
| Downtown San Luis Obispo Higuera Street-(FM2) | | Sclaris Food and Drug San Luis Obispo-(SM2) |
| City Hall Parking Lot Arroyo Grande-(FM3) | | Albertsons Arroyo Grande-(SM3) |

Procedures of Data Analysis

When analyzing the data, it was easier to use abbreviations for the six commodities, the farmers' markets, and the supermarkets. The names of each commodity were shortened, while farmers' markets were be represented as FM1, FM2, and FM3, and supermarkets as SM1, SM2, and SM3, (shown in Table 1.) which correspond the sub fixed numbers to their paired farmers' market. After all of the data was collected, it was transferred to a program called Minitab 16 Statistical Software (State College, PA) where correlation, analysis of variance, and regression were tested. Mean values of each individual commodity was calculated at farmers' markets and supermarkets. Through Minitab, an analysis of variance (ANOVA) was run to identify market group mean prices of the commodities at each market location by testing the variance between the groups of means. This procedure evaluated paired F-statistics and calculated probability type/error in the form of a P-value, which used a significance level of 0.05 to identify significant differences between the means. The hypothesis that farmers' markets have lower priced produce than supermarkets was proven by running multiple ANOVA tests and a regression analysis, ultimately determining the null hypotheses.

Assumptions

This study assumed that at each farmers' market and supermarket, the produce analyzed was of comparable quality and that all six produce items were available during the five week period of observation and no substitutions were made.

Limitations

In the beginning of the study, it was planned to analyze prices of fifteen different produce items. Due to seasonality and product accessibility, prices of all of the original items were not able to be gathered, so the six that were able to be studied at every outlet over the entire time were used in the final study. Although incomplete, price data of the nine commodities can be found in appendix table D, at the end of the report. Aside from seasonality, this study may not have accurately depicted price data that would be congruent with every state in the United States. California has a warm weather climate, so farmers are able to grow different types of commodities at differing prices that may not be the same in surrounding areas since the state is able to grow produce throughout the entire calendar year.

Chapter 4

DEVELOPMENT OF STUDY

The next step after all produce prices were collected over the five week period was to analyze all of the price data. There were six produce items that were selected and observed from the three farmers' markets and also from each paired supermarket. The six produce items were, sweet onions, broccoli, Romaine lettuce, butternut squash, vine ripened tomatoes, and Navel oranges. During the five week period, price data was gathered every other week at the farmers' markets and the neighboring supermarkets, visiting each outlet three times for a total of 108 observations.

Table 2. Descriptive Statistics of all Farmers' Market and Supermarket Produce Prices in SLO County, Winter 2012.

| <u>Variable</u> | <u>N</u> | <u>Mean</u> | <u>SE Mean</u> | <u>StDev</u> | <u>Variance</u> | <u>CoefVar</u> | <u>Min</u> | <u>Q1</u> | <u>Median</u> | <u>Q3</u> | <u>Max</u> |
|------------------------|----------|-------------|----------------|--------------|-----------------|----------------|------------|-----------|---------------|-----------|------------|
| Farmer's Market Prices | 54 | 1.644 | 0.133 | 0.977 | 0.954 | 59.44 | 0.750 | 1.000 | 1.500 | 2.000 | 3.750 |
| Supermarket Prices | 54 | 1.893 | 0.0847 | 0.622 | 0.387 | 32.88 | 0.890 | 1.490 | 1.870 | 1.990 | 3.290 |

As can be seen in Table 2 above, accounting for every observation, it shows the combined statistics for all of the data from the three farmers' markets against the three paired supermarkets. The prices of all the commodities from the farmers' markets were averaged to get a mean price of \$1.64 per pound. The same was done with all of the commodities at the supermarkets and a mean price was calculated to be \$1.89 per pound. Therefore, the mean prices at the combined farmers' markets proved to be 25 cents less than the mean price at the combined paired supermarket. This shows that given the six produce items selected and used in this study, the average price at farmers' markets are numerically less than the average price found at their paired supermarkets.

Another important aspect from the data collection is the standard deviation which roughly estimates the average distance of each individual observation from its mean. Since the standard deviation for farmers' market is 0.98, this means that each individually priced commodity on average deviates by about 98 cents from the mean price. The standard deviation for supermarket prices is 0.62, meaning that each individually priced commodity on average deviates from the mean by about 62 cents. Through these numbers, it is clear farmers' markets have a greater spread in prices when compared to supermarkets.

The coefficient of variation (COV) derived from Table 2 is significant as well. The COV is a measure of relative variability and is equal to the standard deviation divided by the mean and then multiplied by 100. It is a useful measurement when comparing the dispersion of populations having means that are significantly different. Since farmers' markets COV is 61.55 and the supermarket COV is 38.04, farmers' markets have a greater variability relative to its mean. Non-the-less, the farmers' markets are still revealed to have an apparent lower grouped mean price than supermarkets.

ANOVA tests were performed on each farmers market against their locally paired supermarket. Since this study is about comparing the average prices at farmers' markets versus their paired supermarket, it is imperative to test the mean data by location or market type (FM/SM) rather than by individual commodities. The ANOVA is a procedure that uses variance to determine whether means are significantly different; this is done by apportioning the variances between the groups of means versus the variance within groups. The ANOVA process reveals whether the means of the farmers' markets against the supermarkets at each market type have statistically significant differences, through the F-statistic. After running an ANOVA for each farmers' market against their paired supermarket, an ANOVA of all of the combined farmers'

markets and supermarkets was done to further prove the hypothesis that farmers' market prices on average were less than supermarket prices.

Six ANOVA tests were run; the combined farmers' markets against the combined supermarkets, the Morro Bay farmers market against its paired supermarket (Spencer's), San Luis Obispo farmers market against its paired supermarket (Scholaris), the Arroyo Grande farmers' market against its paired supermarket (Albertsons), the incomplete price data of the additional nine produce items at all markets, and the fifteen total produce items at all markets. In addition to the ANOVAs, a regression analysis was performed as well.

The results from each ANOVA test are shown below in Tables 3, 4, 5, 6, 7, and 8, while the regression analysis is shown in Table 9.

Table 3. ANOVA Test of All Produce Prices at Farmers' Markets and Supermarkets in San Luis Obispo County, Winter 2012.

| Source | DF | SS | MS | F | P |
|---------|-----|--------|-------|------|-------|
| SM Obs1 | 1 | 1.678 | 1.678 | 2.50 | 0.117 |
| Error | 106 | 71.100 | 0.671 | | |
| Total | 107 | 72.778 | | | |

S = 0.8190 R-Sq = 2.30% R-Sq(adj) = 1.38%

Individual 95% CIs For Mean Based on Pooled StDev

| Level | N | Mean | StDev | -----+-----+-----+-----+ | | | |
|-------|----|--------|--------|--------------------------|------|------|------|
| FM | 54 | 1.6435 | 0.9769 | (-----*-----) | | | |
| SM | 54 | 1.8928 | 0.6223 | (-----*-----) | | | |
| | | | | -----+-----+-----+-----+ | | | |
| | | | | 1.60 | 1.80 | 2.00 | 2.20 |

Pooled StDev = 0.8190

- Notes: a) SM Obs1 represents all supermarket observations compared to the all paired farmers' markets.
 b) FM represents the Farmers' Market.
 c) SM represents Supermarket.
 d) All units are expressed in dollars per pound.

The ANOVA test above shows the results from all of the price data from the three farmers' markets against the three paired supermarkets. Based on the mean data, it shows that the combined farmers markets have an average price of \$1.64, while their paired supermarkets have an average of \$1.89. This information proves that farmers' market prices are on average, 25 cents per pound less for each commodity when compared to neighboring supermarkets. Since the trend that farmers' markets have a lower mean price than supermarkets is established, one must decide if this price differentiation is significant or not. Looking at the degrees of freedom, observed from Table 3, the F-table value of 1.39 is identified looking at a F-table using 106 as the numerator and 107 as the denominator. Derived from the ANOVA test, the F-statistic is shown to be 2.50, which is greater than the F-table value, so the trend is found to be significant.

Through the ANOVA, a P-value of 0.117 was identified and compared against the significance level of 0.05. Since the P-value was greater than the significance level, the null hypothesis is accepted that the trend is significant. This means that statistically, there is significance between the mean prices, ultimately proving that farmers' market prices are less expensive than their paired supermarket, in this case on an average basis of 25 cents per pound.

Table 4. ANOVA Test of Morro Bay Farmers' Market Produce Prices Paired with Morro Bay Supermarket Produce Prices, Winter 2012.

| Source | DF | SS | MS | F | P |
|---------|----|--------|-------|------|-------|
| SM Obs2 | 1 | 0.321 | 0.321 | 0.40 | 0.529 |
| Error | 34 | 26.997 | 0.794 | | |
| Total | 35 | 27.318 | | | |

S = 0.8911 R-Sq = 1.18% R-Sq(adj) = 0.00%

Individual 95% CIs For Mean Based on Pooled StDev

| Level | N | Mean | StDev | |
|-------|----|--------|--------|---------------|
| FM | 18 | 1.6389 | 0.9897 | (-----*-----) |
| SM | 18 | 1.8278 | 0.7800 | (-----*-----) |

+-----+-----+-----+-----
1.20 1.50 1.80 2.10

Pooled StDev = 0.8911

- Notes: a) SM Obs2 represents the MB supermarket observations compared to the paired MB farmers' market.
 b) FM represents the Farmers' Markets.
 c) SM represents the Supermarket.
 d) All units are expressed in dollars per pound.

From the ANOVA table, it is proven that the mean price at the Morro Bay farmers market was \$1.64, while the mean price at its paired supermarket was \$1.83. Although the trend is established that the average price at the farmers market is less than that at the supermarket by 19 cents, significance of this difference needs to be determined. Using the degrees of freedom,

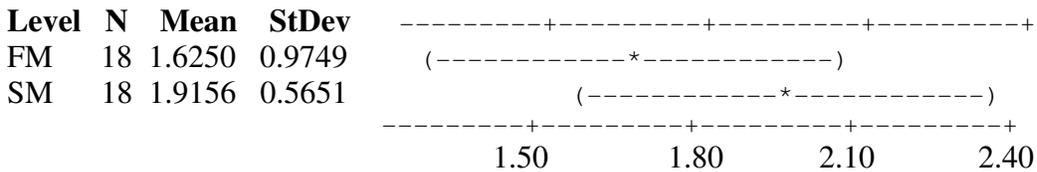
with a numerator of 34 and a denominator of 35, the F-table value was found to be 1.76. Looking at the table above the F-statistic is 0.40, which is less than the F-table value, therefore, the trend is found to be insignificant. Since the significance level of 0.05, is less than the P-value of 0.529 taken from the table, the null hypothesis is accepted that the trend is insignificant. This means that there is not a significant difference in the prices from the Morro Bay farmers' market versus Spencer's, Morro Bay's local supermarket.

Table 5. ANOVA Test of San Luis Obispo Farmers' Market Produce Prices Paired with San Luis Obispo Supermarket Produce Prices, Winter 2012.

| Source | DF | SS | MS | F | P |
|---------|----|--------|-------|------|-------|
| SM Obs3 | 1 | 0.760 | 0.760 | 1.20 | 0.282 |
| Error | 34 | 21.584 | 0.635 | | |
| Total | 35 | 22.344 | | | |

S = 0.7968 R-Sq = 3.40% R-Sq(adj) = 0.56%

Individual 95% CIs For Mean Based on Pooled StDev



Pooled StDev = 0.7968

- Notes: a) SM Obs3 represents the SLO supermarket observations compared to the paired SLO farmers' market observations.
 b) FM represents the Farmers' Market.
 c) SM represents the Supermarket.
 d) All units are expressed in dollars per pound.

It is shown above, that produce prices from the San Luis Obispo farmers' market averages \$1.62, while its paired supermarket averages \$1.92 in price. Using the F-statistic of 1.20, it's concluded there are no significant differences in the price data since the F-table value is

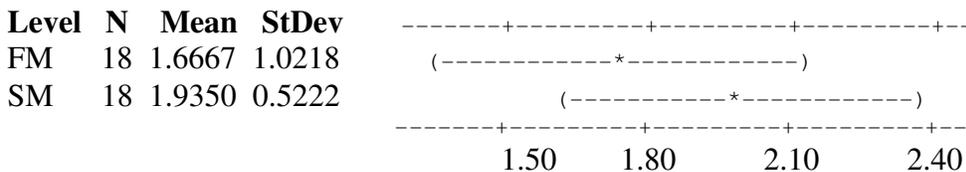
greater than the F-value. The P-value of 0.282 is greater than the significance level, therefore, the null hypothesis is accepted that there is no significant difference in the prices from the farmers' market and supermarket. Although, the test does show with 95% confidence, the mean prices at the San Luis Obispo farmers' market are on average 20 cents per pound less than at Scholaris, its paired local supermarket.

Table 6. ANOVA Test of Arroyo Grande Farmers' Market Produce Prices Paired with Arroyo Grande Supermarket Produce Prices, Winter 2012.

| Source | DF | SS | MS | F | P |
|---------|----|--------|-------|------|-------|
| SM Obs4 | 1 | 0.648 | 0.648 | 0.98 | 0.328 |
| Error | 34 | 22.386 | 0.658 | | |
| Total | 35 | 23.034 | | | |

S = 0.8114 R-Sq = 2.81% R-Sq(adj) = 0.00%

Individual 95% CIs For Mean Based on Pooled StDev



Pooled StDev = 0.8114

- Notes: a) SM Obs4 represents the AG supermarket observations compared to the paired AG farmers' market observations.
 b) FM represents the Farmers Market.
 c) SM represents Supermarket.
 d) All units are expressed in dollars per pound.

Arroyo Grande farmers' market has a mean price of \$1.67, which is 27 cents lower than the mean price at its paired supermarket which is \$1.94. The F-statistic of 0.98 is less than the table value of 1.76, so the trend is insignificant. The P-value of 0.328 is greater than the significance level so the null hypothesis is accepted that the price difference between outlets is

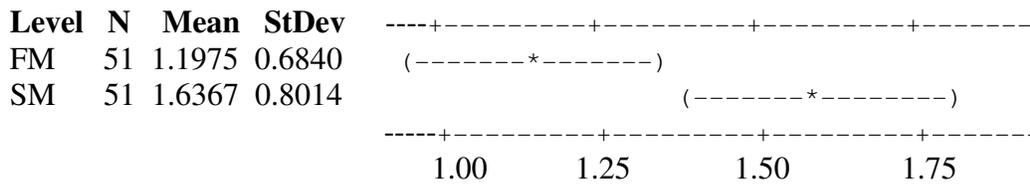
insignificant. The ANOVA test also shows that the standard deviation at the farmers market is 1.02, while the supermarket's deviation is 0.52. This means the prices of the individual commodities at farmers market strays from the mean on an average of \$1.00, which is double what the supermarket's deviation is. In conclusion, there is more variation in price at the Arroyo Grande farmers' market opposed to at its paired supermarket, Albertsons.

Table 7. ANOVA Additional Nine Produce Items With Incomplete Price Data in San Luis Obispo County, Winter 2012.

| Source | DF | SS | MS | F | P |
|---------|-----|--------|-------|------|-------|
| SM Obs5 | 1 | 4.919 | 4.919 | 8.86 | 0.004 |
| Error | 100 | 55.509 | 0.555 | | |
| Total | 101 | 60.428 | | | |

S = 0.7450 R-Sq = 8.14% R-Sq(adj) = 7.22%

Individual 95% CIs For Mean Based on Pooled StDev



Pooled StDev = 0.7450

- Notes: a) SM Obs5 represents all supermarket observations compared to the all paired farmers markets.
 b) FM represents the Farmers Market.
 c) SM represents Supermarket.
 d) All units are expressed in dollars.

The nine additional commodities observed were, artichokes, cauliflower, cucumbers, beets, Swiss chard, cabbage, celery, grapefruit, and lemons. These items were a part of the original fifteen commodities that were to be included in the study, but because of product

inaccessibility, the nine listed were eliminated since they were not able to be found at each outlet every week. Therefore, price data was collected sporadically throughout the five week period depending on availability of each product, for a total of 51 farmers' market and 51 supermarket observations. Although prices for all nine items were not found throughout the entire period, testing through ANOVA was possible because each item included had a farmers' market price which was tested against its paired supermarket price, for an accurate price comparison. A list of the incomplete price data of the nine items was included in appendix D. Given the nine items, the average price at farmers' markets was \$1.20 and \$1.64 at supermarkets, accounting for a substantial 44 cent mean price difference. The significance of this trend is then determined by comparing the F-table value of 1.39 found using the degrees of freedom, to the F-statistic of 8.86 taken from ANOVA test. Since the F-statistic is considerably greater than the F-table value and the P-value is very small, one can say with 95% confidence that the price difference is significant. The additional price data observed was beneficial for the study since they do reflect accurate paired comparisons and can further prove the point that farmers' market prices on average are lower than supermarket prices in San Luis Obispo County.

Table 8. ANOVA Test of All Fifteen Produce Items at All Market Locations in San Luis Obispo County, Winter 2012.

| Source | DF | SS | MS | F | P |
|---------|-----|---------|-------|------|-------|
| SM Obs6 | 1 | 6.168 | 6.168 | 9.57 | 0.002 |
| Error | 208 | 134.026 | 0.644 | | |
| Total | 209 | 140.194 | | | |

S = 0.8027 R-Sq = 4.40% R-Sq(adj) = 3.94%

Individual 95% CIs For Mean Based on Pooled StDev

| Level | N | Mean | StDev | |
|-------|-----|--------|--------|---------------|
| FM | 105 | 1.4237 | 0.8726 | (-----*-----) |
| SM | 105 | 1.7665 | 0.7261 | (-----*-----) |

-----+-----+-----+-----+-----
 1.40 1.60 1.80 2.00

Pooled StDev = 0.8027

- Notes: a) SM Obs6 represents all supermarkets observations compared to the all paired farmers markets.
 b) FM represents the Farmers Market.
 c) SM represents Supermarket.
 d) All units are expressed in dollars.

The ANOVA test above took into account the main six produce items that were observed over the full period of five weeks, and the additional nine produce items observed intermittently. The sample size was comprised of a total 210 price observations, 105 from farmers' markets and 105 from the supermarkets. As the table shows above, the mean price at farmers' markets was \$1.42, while the mean price at the supermarkets was \$1.77. Using the degrees of freedom, a F-table value of 1.26 was identified, which is less than the F-statistic drawn from the test so the trend is found to be significant. It is apparent from the mean data that farmers' markets on average were 35 cents less expensive when compared to their local supermarkets, which was further proven by ANOVA that determined significance in the mean difference.

Table 9. Regression Analysis of All Fifteen Produce Items Observed in San Luis Obispo County, Winter, 2012.

The regression equation is

$$\text{Price} = 1.43 + 0.342 \text{ DV SM} - 0.005 \text{ DV SLO}$$

| Predictor | Coef | SE Coef | T | P |
|------------------|-------------|----------------|----------|----------|
| Constant | 1.4286 | 0.0888 | 16.09 | 0.000 |
| DV SM | 0.3415 | 0.1109 | 3.08 | 0.002 |
| DV SLO | -0.0049 | 0.1153 | -0.04 | 0.966 |

S = 0.803216 R-Sq = 4.4% R-Sq(adj) = 3.5%

Analysis of Variance (ANOVA)

| Source | DF | SS | MS | F | P |
|----------------|-----------|-----------|-----------|----------|----------|
| Regression | 2 | 6.1247 | 3.0624 | 4.75 | 0.010 |
| Residual Error | 207 | 133.5473 | 0.6452 | | |
| Total | 209 | 139.6720 | | | |

Notes: a) DV SM represents the dummy variable for supermarkets.

b) DV SLO represents the dummy variable for the city, San Luis Obispo.

c) All units expressed in dollars.

Regression analyses, as shown above in Table 9, are useful when partitioning market price effects. Regression indicates the direction, size, and the statistical inference between a predictor and a response variable. In this case, the response variables are the prices of the fifteen commodities studied, while the categorical predictors used were dummy variables for the San Luis Obispo location price observations apart from Morro Bay and Arroyo Grande, as well as a dummy variable for supermarket price observations. These predictors were assigned dummy variables, also known as indicator variables that indicated when the prices collected were from a supermarket or from a farmers' market/ supermarket in the San Luis Obispo location. By

isolating the variables, a regression analysis is able to compare the price differentiation between average supermarket prices and between prices found in San Luis Obispo versus Morro Bay and Arroyo Grande.

For the analysis, all fifteen commodities were included for a total of 210 observations, 105 from farmers' markets and 105 from supermarkets. The greater the sample size, the more accurate the results. The constant is the average price of the total observations and from the table above, one can see the constant is 1.64. This means that from all locations, farmers' markets and supermarkets in San Luis Obispo County, the average price is \$1.64 per item. This constant is the reference level to which the two predictor levels are compared and is important for further regression analysis.

The first predictor is the pricing at supermarkets, which measures the market differentiation of average prices. From the table, the coefficient for the supermarkets is 0.34, which means that supermarket prices on average are 34 cents more than the total average of prices of the selected produce. By adding \$0.34 to the constant of \$1.64, the average supermarket price is calculated to be \$1.98. It is then imperative to check if there is significance in this trend by testing the T-statistic against the T-table value. At 207 degrees of freedom, and a significance level of 0.05, a T-table was consulted to find a T-table value of 1.685. Since the T-statistic of 3.08 is greater than the T-table value, significance is found in the trend. Ultimately, the regression proved there is statistical significance in the 34 cent increased difference in supermarket prices.

The regression also measured city differentiation, by the use of a dummy variable for the San Luis Obispo location, differentiating prices found in San Luis Obispo to those found in Arroyo Grande and Morro Bay. The table shows the coefficient is -0.005, meaning farmers'

market and supermarket prices in San Luis Obispo on average tends to be less than one cent less than the average prices at Morro Bay and Arroyo Grande. Since the T-statistic is negative and obviously less than the T-table value, the trend is found insignificant. With a high P value, the null hypothesis is accepted concluding there to be no statistical significance that San Luis Obispo offers lower priced produce than the other two cities.

In addition to the regression analysis, an ANOVA was also included to test the variance of the entire regression. With an F-statistic of 4.75 and a F-table value of 1.26, the regression trend is found significant and since the P-value is greater than the significance level, the null hypothesis is accepted. The ANOVA testing verified that there was significance in the regression analysis, confirming that the 34 cent difference at supermarkets was significant. This further proved that not only do the six items selected, but all fifteen produce items on average are lower priced at farmers' markets than at their paired supermarkets.

Chapter 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

This purpose of this study was to determine whether farmers' markets or supermarkets in San Luis Obispo County offered lower produce prices. Three farmers' markets were chosen for the study, along with three paired supermarkets. Six produce items were selected and prices of each commodity were collected at each outlet every other week, during a five week period, for a total of 108 observations.

The hypothesis that farmers' markets would have lower prices on average than their paired supermarkets was proven to be correct through intensive price analyses. Although ANOVA results for the smaller sub samples at each individually tested location found no significant differences between the mean prices, when all farmers' markets and supermarkets were combined and tested against each other, the mean differences were shown to be significant. It was evident based on the six chosen commodities that the average price at the farmers' markets was 25 cents lower than at the supermarkets. Since the study began with fifteen produce items, but was reduced because of seasonality to six, the incomplete price data for the additional nine commodities was later tested. Based on the other nine commodities, mean price data was shown to be 35 cents less at farmers' markets than at the paired supermarkets. Through the ANOVA tests, the mean differences were proven to be significant for the six selected produce items, as well as the incomplete price data of the nine selected produce items, thus concluding

that farmers' markets on average offer lower priced produce than supermarkets in San Luis Obispo County.

Conclusions

After extensive ANOVA testing and regression results on the full samples of price observations, it is determined with a 95% confidence that the combined farmers' markets have lower priced produce than their paired supermarket prices. This means that in San Luis Obispo County, farmers' markets would be a better outlet for buying fresh produce. It is important to point out that not all produce items were cheaper at farmers' markets, tomatoes for example, were shown to be more expensive at each farmers' market when paired against the supermarkets. In the end, farmers' markets and supermarkets both offer fresh produce, and even though this study proved farmer's markets to be less expensive on average, it is up each individual consumer to decide for themselves which outlet to utilize for their fresh produce.

Recommendations

If this study were to be done again, it would be beneficial to gather data for more than six produce items for the entire five week data collecting period. Selection of ten or more commodities would give further data that would carry more weight and be even more accurate when determining conclusions. Another recommendation would be to collect price data for a longer period of time. It would be a good idea to test prices of each commodity throughout an entire year, so fluctuations can be compared according to each season. In addition to analyzing prices, analyzing physical factors such as quality of the produce would also be useful in aiding to the final decision whether farmers' markets or supermarkets are a better produce outlet.

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Appendicies

| Appendix A: All Price Data Collected from the Morro Bay Farmers Market and Its Paired Supermarket, Winter 2012. | | | | | |
|---|-------|------------------------|-------|-------------------------|-----|
| | | | | | |
| Week 1 | | | | | |
| Thursday January 12, 2012 | | | | | |
| | | FM1 | | SM1 | |
| | | <u>Farmer's Market</u> | | <u>Spencer's Market</u> | |
| | OBS # | | OBS # | | \$ |
| Sweet Onions | 1 | 1.50 | 2 | 1.99 | /lb |
| Broccoli | 3 | 1.50 | 4 | 2.00 | /lb |
| Romaine Lettuce | 5 | 0.75 | 6 | 1.49 | /lb |
| Butternut Squash | 7 | 1.00 | 8 | 1.25 | /lb |
| Vine Ripe Tomatoes | 9 | 3.50 | 10 | 3.29 | /lb |
| Navel Oranges | 11 | 1.00 | 12 | 1.50 | /lb |
| Week 2 | | | | | |
| Thursday January 26, 2012 | | | | | |
| | | <u>Farmer's Market</u> | | <u>Spencer's Market</u> | |
| | | | | | |
| Sweet Onions | 13 | 1.50 | 14 | 1.99 | /lb |
| Broccoli | 15 | 1.50 | 16 | 0.99 | /lb |
| Romaine Lettuce | 17 | 0.75 | 18 | 1.49 | /lb |
| Butternut Squash | 19 | 1.00 | 20 | 0.89 | /lb |
| Vine Ripe Tomatoes | 21 | 3.75 | 22 | 3.29 | /lb |
| Navel Oranges | 23 | 1.00 | 24 | 1.99 | /lb |
| Week 3 | | | | | |
| Thursday February 9, 2012 | | | | | |
| | | <u>Farmer's Market</u> | | <u>Spencer's Market</u> | |
| | | | | | |
| Sweet Onions | 25 | 2.00 | 26 | 1.99 | /lb |
| Broccoli | 27 | 1.50 | 28 | 0.99 | /lb |
| Romaine Lettuce | 29 | 1.00 | 30 | 1.49 | /lb |
| Butternut Squash | 31 | 1.00 | 32 | 0.99 | /lb |
| Vine Ripe Tomatoes | 33 | 3.75 | 34 | 3.29 | /lb |
| Navel Oranges | 35 | 1.50 | 36 | 1.99 | /lb |

Appendix B: All Price Data Collected from San Luis Obispo Farmers Market and Its Paired Supermarket, Winter 2012.

| | | | | | |
|----------------------------------|-------|------------------------|-------|------------------|-----|
| | | | | | |
| Week 1 | | | | | |
| Thursday January 12, 2012 | | FM2 | | SM2 | |
| | | <u>Farmer's Market</u> | | <u>Scholaris</u> | |
| | OBS # | | OBS # | | \$ |
| Sweet Onions | 37 | 1.00 | 38 | 1.49 | /lb |
| Broccoli | 39 | 1.50 | 40 | 1.99 | /lb |
| Romaine Lettuce | 41 | 0.75 | 42 | 1.99 | /lb |
| Butternut Squash | 43 | 1.00 | 44 | 1.29 | /lb |
| Vine Ripe Tomatoes | 45 | 3.50 | 46 | 2.99 | /lb |
| Navel Oranges | 47 | 1.00 | 48 | 1.99 | /lb |
| | | | | | |
| | | | | | |
| Week 2 | | | | | |
| Thursday January 26, 2012 | | | | | |
| | | <u>Farmer's Market</u> | | <u>Scholaris</u> | |
| | | | | | |
| Sweet Onions | 49 | 2.00 | 50 | 1.49 | /lb |
| Broccoli | 51 | 1.50 | 52 | 1.99 | /lb |
| Romaine Lettuce | 53 | 0.75 | 54 | 1.99 | /lb |
| Butternut Squash | 55 | 1.00 | 56 | 1.29 | /lb |
| Vine Ripe Tomatoes | 57 | 3.50 | 58 | 2.99 | /lb |
| Navel Oranges | 59 | 1.00 | 60 | 1.99 | /lb |
| | | | | | |
| | | | | | |
| Week 3 | | | | | |
| Thursday February 9, 2012 | | | | | |
| | | <u>Farmer's Market</u> | | <u>Scholaris</u> | |
| | | | | | |
| Sweet Onions | 61 | 2.00 | 62 | 1.49 | /lb |
| Broccoli | 63 | 1.50 | 64 | 1.99 | /lb |
| Romaine Lettuce | 65 | 1.50 | 66 | 1.75 | /lb |
| Butternut Squash | 67 | 1.00 | 68 | 1.29 | /lb |
| Vine Ripe Tomatoes | 69 | 3.75 | 70 | 2.99 | /lb |
| Navel Oranges | 71 | 1.00 | 72 | 1.49 | /lb |
| | | | | | |

Appendix C: All Price Data Collected from the Arroyo Grande Farmers Market and Its Paired Supermarket, Winter 2012.

| Week 1 | | | | | |
|-----------------------------------|-------|------------------------|-------|-------------------|-----|
| Saturday January 14, 2012 | | | | | |
| | | FM3 | | SM3 | |
| | | <u>Farmer's Market</u> | | <u>Albertsons</u> | |
| | OBS # | | OBS # | | \$ |
| Sweet Onions | 73 | 1.50 | 74 | 1.69 | /lb |
| Broccoli | 75 | 1.50 | 76 | 1.99 | /lb |
| Romaine Lettuce | 77 | 1.00 | 78 | 1.69 | /lb |
| Butternut Squash | 79 | 1.00 | 80 | 1.49 | /lb |
| Vine Ripe Tomatoes | 81 | 3.75 | 82 | 2.99 | /lb |
| Navel Oranges | 83 | 1.00 | 84 | 1.50 | /lb |
| | | | | | |
| | | | | | |
| Week 2 | | | | | |
| Saturday January 28, 2012 | | | | | |
| | | <u>Farmer's Market</u> | | <u>Albertsons</u> | |
| | OBS # | | OBS # | | \$ |
| Sweet Onions | 85 | 2.00 | 86 | 1.99 | /lb |
| Broccoli | 87 | 1.50 | 88 | 1.99 | /lb |
| Romaine Lettuce | 89 | 0.75 | 90 | 1.69 | /lb |
| Butternut Squash | 91 | 1.00 | 92 | 1.49 | /lb |
| Vine Ripe Tomatoes | 93 | 3.75 | 94 | 2.99 | /lb |
| Navel Oranges | 95 | 1.00 | 96 | 1.49 | /lb |
| | | | | | |
| | | | | | |
| Week 3 | | | | | |
| Saturday February 11, 2012 | | | | | |
| | | <u>Farmer's Market</u> | | <u>Albertso's</u> | |
| | OBS # | | OBS # | | \$ |
| Sweet Onions | 97 | 2.00 | 98 | 1.99 | /lb |
| Broccoli | 99 | 1.50 | 100 | 1.69 | /lb |
| Romaine Lettuce | 101 | 1.00 | 102 | 1.69 | /lb |
| Butternut Squash | 103 | 1.00 | 104 | 1.49 | /lb |
| Vine Ripe Tomatoes | 105 | 3.75 | 106 | 2.99 | /lb |
| Navel Oranges | 107 | 1.00 | 108 | 1.99 | /lb |
| | | | | | |
| | | | | | |

Appendix D: Incomplete Price Data of Nine Additional Commodities in San Luis Obispo County, Winter 2012.

| Week 1 | | | | | | | | |
|---------------|--|--------------|--------------|---------------|---------------|--------------|--------------|-----------|
| | | MB FM | MB SM | SLO FM | SLO SM | AG FM | AG SM | |
| Artichokes | | 1.00 | 3.59 | 1.00 | 2.99 | - | - | \$ Each |
| Cauliflower | | 1.25 | 1.49 | 1.00 | 1.99 | 1.25 | 1.69 | \$/Lb |
| Cucumbers | | 1.00 | 1.60 | - | - | - | - | \$/Lb |
| Beets | | - | - | 2.00 | 2.99 | 1.50 | 2.00 | \$/Bunch |
| Swiss Chard | | 2.00 | 2.29 | 1.50 | 2.00 | - | - | \$/Bunch |
| Cabbage | | 1.40 | 1.60 | 2.00 | 1.99 | - | - | \$ Each |
| Celery | | 1.00 | 2.00 | 1.50 | 1.69 | 1.00 | 2.00 | \$/ Bunch |
| Grapefruit | | 0.50 | 1.00 | 1.25 | 0.99 | 0.75 | 0.99 | \$ Each |
| Lemons | | 0.25 | 0.50 | 0.60 | 0.75 | 0.50 | 0.69 | \$ Each |
| | | | | | | | | |
| Week 2 | | | | | | | | |
| | | MB FM | MB SM | SLO FM | SLO SM | AG FM | AG SM | |
| Artichokes | | 3.00 | 3.59 | - | - | - | - | \$ Each |
| Cauliflower | | 1.00 | 1.29 | 1.25 | 1.99 | 1.00 | 1.79 | \$/Lb |
| Cucumbers | | - | - | - | - | - | - | \$/Lb |
| Beets | | 1.50 | 1.79 | 2.00 | 2.99 | 2.00 | 1.99 | \$/Bunch |
| Swiss Chard | | 2.00 | 2.29 | 2.99 | 1.99 | 2.00 | 1.99 | \$/Bunch |
| Cabbage | | - | - | 0.75 | 0.89 | - | - | \$ Each |
| Celery | | 1.00 | 1.99 | - | - | 1.50 | 1.69 | \$/ Bunch |
| Grapefruit | | 0.50 | 0.79 | 0.50 | 0.99 | 0.50 | 0.99 | \$ Each |
| Lemons | | 0.20 | 0.50 | 0.25 | 0.79 | 0.35 | 0.50 | \$ Each |
| | | | | | | | | |
| Week 3 | | | | | | | | |
| | | MB FM | MB SM | SLO FM | SLO SM | AG FM | AG SM | |
| Artichokes | | - | - | - | - | - | - | \$ Each |
| Cauliflower | | - | - | 1.00 | 0.99 | - | - | \$/Lb |
| Cucumbers | | - | - | - | - | - | - | \$/Lb |
| Beets | | - | - | 2.00 | 2.99 | 2.00 | 1.99 | \$/Bunch |
| Swiss Chard | | 1.50 | 2.29 | - | - | 2.00 | 1.99 | \$/Bunch |
| Cabbage | | - | - | 0.75 | 0.89 | - | - | \$ Each |
| Celery | | 1.00 | 0.99 | 1.00 | 1.69 | - | - | \$/ Bunch |
| Grapefruit | | - | - | 0.50 | 0.99 | - | - | \$ Each |
| Lemons | | - | - | 0.20 | 0.50 | 0.25 | 0.50 | \$ Each |

Notes: a) MB represents Morro Bay, SLO represents San Luis Obispo, and AG represents Arroyo Grande.

b) FM represents Farmers Market and SM represents Supermarket.