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# The Factors Influencing Terminal Market Prices of Organic Vegetables & Fruits: Illustrated by The Examples of Carrot, Broccoli, and Banana

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This article studies the factors influencing the market price of organic fruits and vegetables. After several decades' development, organic farming has become an important part of global agricultural markets, and besides, organic vegetables are also the largest part of organic sales. The study tends to find the significant factors that exert influence on the market. What's more, carrot, broccoli and banana are the examples in the study. The results show that the increase of the market price of organic fruits and vegetables is influenced by the PPI, the number of stores, and the market price of non-organic fruits and vegetables, which is directive for the farmers who plant banana, carrot, and broccoli, and is especially conducive to their quarterly planting plan. The weak relationship between the market price and the retail price means the higher retail price fails to give enough support to increase the market price. Meanwhile, it proves that the higher market price may be caused by other reasons including higher production costs.

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# CHAPTER 1

# INTRODUCTION

In 2002, USDA published the national standards for organic production and processing, since the demand for organic goods has continuous increased. In 2015, over 4% of U.S. food sales are organic sales. Fruits and vegetables were the best-selling categories in organic food. To be specific, the sale of organic fruits and vegetables accounts for about 41% of organic sales. Organically grown fresh fruits and vegetables play an important role in U.S. agricultural market. Almost 90% lower pesticide exposure makes organic food popular in the food market. Consumer demand for organic fruits and vegetables was growing consecutively during the past ten years. Many previous research focused on consumers' behavior for organic food, and some researchers studied for changes in organic price, while less researches paid attention to how the market price changes. Thus, in this paper, the market price of organic fruits and vegetables will be estimated according to some facts. Besides, the retail price, stores' number and the producer price indexes (PPI) of agriculture will be considered, and moreover, the seasonal factor is also regarded as an imperative condition.

## Institutional Background

Before the 1990s, people had conducted many studies on the factors that can affect the prices of fruits and vegetables. Gardner (1975) used purchased agricultural commodities and other marketing inputs to research the retail price, and took the relation of supply and demand as an influencing factor. He expected to reduce the price by increasing demand, and it also was mentioned that the price of supplies would decrease,

if the elasticity of supply of farm products is greater than that of marketing inputs. McFall and Paul(1981) adopted consumer price indexes(CPIs) and producer price indexes(PPIs) to estimate the effect of changing input cost on food prices. And then they found the non-farm factors also have a significant impact on the price of produce. Meanwhile, Trostle (2008) analyzed the supply and demand of global agricultural produces by taking US dollar exchange rates, trade policies and so on into consideration.

In 1995, S.M. Krebs-Smith (1995) started a research to prove whether adults' psychosocial factors affect fruit and vegetable consumption. A positive conclusion that most adults should be educated to eat enough fruit and vegetables and children should be promoted to increase intake was got. This view showed that people started to focus on their health by eating fruits and vegetables, which is a good sign for the development of agricultural industry. The studies on health from the perspective of eating fruit and vegetables are continued. E.A. Estes and V.K. Smith (1994) estimated consumers' choices by analyzing price, appearance and health risk considerations. The factors revealed that consumer may pay attention to health nutrition and diet needs. And the large demand under a high premium price gave them a positive implication. They hold that a higher premium price for oranges will happen just like apples. A good prospect extends to organic fruits and vegetables, and an increasing number of researches on organic food appeared.

"A production system that is managed in accordance with the Organic Foods Production Act and regulations in this part to respond to site-specific conditions by integrating cultural, biological, and mechanical practices that foster cycling of resources, promote ecological balance, and conserve biodiversity." The USDA gave organic

production a standard definition in 2002. Dimitri and Greene (2002) directed the identifying of organic food and submitting the increase trend by different categories. USDA posted that U.S. organic food sales reached $43 billion in 2014, while it was just $12 billion in 2004. And the certified organic cropland and pasture reached nearly 5.4 million acres in 2011 from 1.4 million acres in 1997. All of the data proved that people started to accept organic food.

Then, the studies on whether price and income affect choice appear and are popular. Giovanni and Nucifora are the leaders of this kind of research. Specifically, they did quantitative analysis concerning the factors which can affect the prices of organic fruit and vegetables by investigating 47 stores, and the results presented that organic produce is more likely to be sold in the stores which can provide consumers with good information. This finding supports previous studies on subjective knowledge determining the consumption of organic vegetables (Pieniak, Aertsens, and Verbeke in 2010). Pieniak(2010) found subjective knowledge is significantly, relatively, strongly and directly associated with organic vegetables consumption, which means healthy knowledge is important to most potential customers. Some consumers who knew the benefit of organic food prefer to purchase organic fruit and vegetables.

The higher quality of organic fruit and vegetables leads to the higher prices. The premium prices of organic fruit and vegetables exist, when compared with conventional fruits and vegetables by Oberholtzer, Dimitri, and Greene in 2005. Higher prices for organic products encourage new farmers to join in the market and old farmers to expend production. It's the result of natural tension. And growing supply will cause the decrease of the price, which is a positive expectation for it. It's better for consumers, which means

more demand and market expansion. However, the discussion that premium price may affect organic choice can also be found. Smith, Huang and Lin found a significantly positive effect of income on the demand for organic foods. To be specific, an increase in income will lead to more demand. In addition, children are also a factor to influence the decision of purchasing organic products. They found the household who has a child under 6 is inclined to buy organic fruit and vegetables.

Munoz, Lakner, and Brummer considered farm size may influence organic farming revenue, or in other words, farm size has a significant impact on the revenue growth. However, an interesting result showed that farm size has a negative impact on the rate of the revenue growth, which means that the larger farms in the samples are difficult to be more efficient than smaller farms. Ullah, Shah, and Ali (2015) used binary logistic regression analysis to study the factors about the adopting of organic farming. A fit R square presented some positive and significant factors to us, such as productivity, profitability and so on.

Further research studied the profitability of organic foods related to its price. Ndungu, Macharia, and Kahuthia(2013) estimated the adoption and profitability by using the OLS multiple linear regression model. The result indicated social economy has been shown to affect the decision of small farmers. Social economy can be reflected by PPI in our research. By researching the profitability of organic soybeans via a treatment-effects model, McBride and Greene found that farmers prefer to plant food-grade soybeans because of the higher price, and the premium prices were described in that article. Meanwhile, they also indicated the higher price is based on the higher cost.

According the statistics released by USDA in 2013, 0.26% of U.S. corn acreage was certified organic in 2011; and 0.17% of U.S. soybeans were certified organic. In the same term, certified organic acreage of apple reached 4.9%; the coverage of organic citrus and carrots reached 2.29% and 14.35% respectively. These data reflected that organic fruit and vegetables are more important in the fruit and vegetable market than corn and soybeans. Thus, the author decided to choose representative vegetables to do this research.

# CHAPTER 2

## RESOURCE AND DATA

From 2008, USDA started to collect statistics of the retail price of organic fruit and vegetables. In this study, all of the data is collected from USDA Agricultural Marketing Service and USDA Economic Research Service.

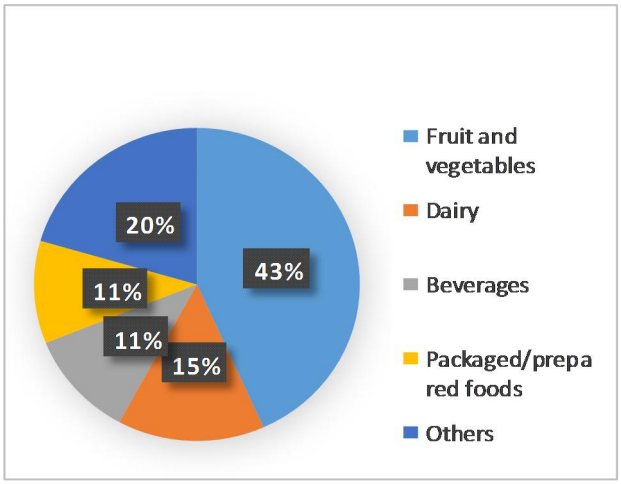


**Figure 1. Persentage of Organic sales in 2014**

Organic program achieved a great improvement in the past fifteen years. United Fresh Research and Education Foundation posted the top ten fruit and vegetable purchase in 2008. Apple, banana, citrus, grape, carrot, potato, tomato and broccoli are all on the list. Because of the limitation of data, in this article, we chose carrot, broccoli and banana as the examples and estimated them separately.

In the past ten years, organic food sales in the United States increased continuously with the total sales increasing from $13 billion in 2005 to nearly $35 billion in 2014. Organic fruit and vegetables is a large section in the organic sales. Figure 2 shows the percent of organic fruit and vegetable sales in total organic sales. Organic fruit and vegetables are always the best-selling categories. Although the proportion always

approximates 40%, the value of sale is increasing. In 2014, the proportion of organic fruit and vegetables reached 43% and the value is $15.06 billion, which reveals the significant role of the categories in the organic market.

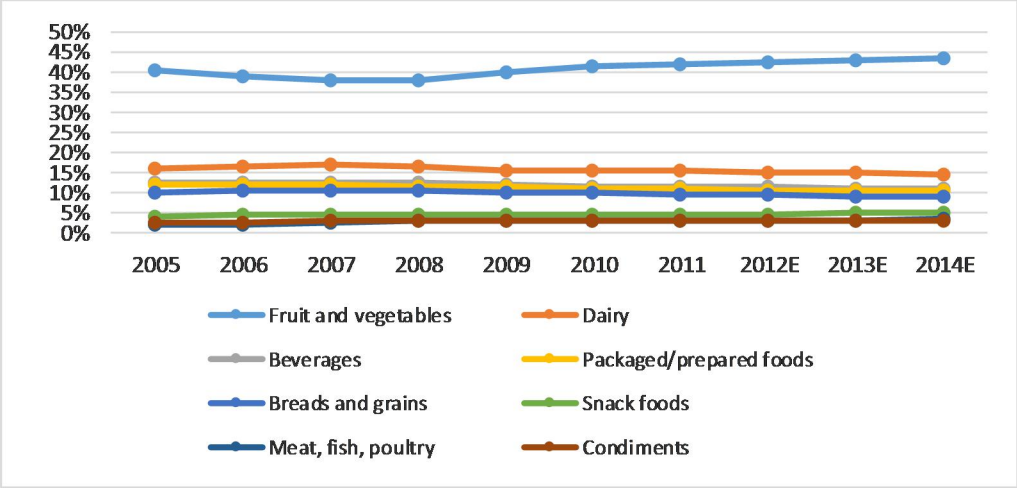


**Figure 2. Percentage of Organic Sales**
Source: The U.S. Department of Agriculture's (USDA) Agricultural Marketing Service (AMS)

Figure 3 and 4 shows the comparison of the market prices and the retail prices of organic and non-organic carrots respectively. From figures in the figures, it can be seen that both the market price and the retail price of organic carrots are higher than non-organic carrots'. The obvious premium prices for organic carrots appeared.

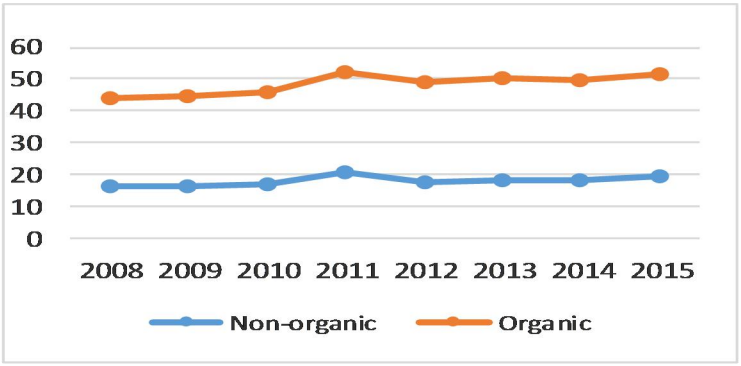


**Figure 3. Terminal Market Price(Carrot)**
Source: USDA Agriculture Marketing Services

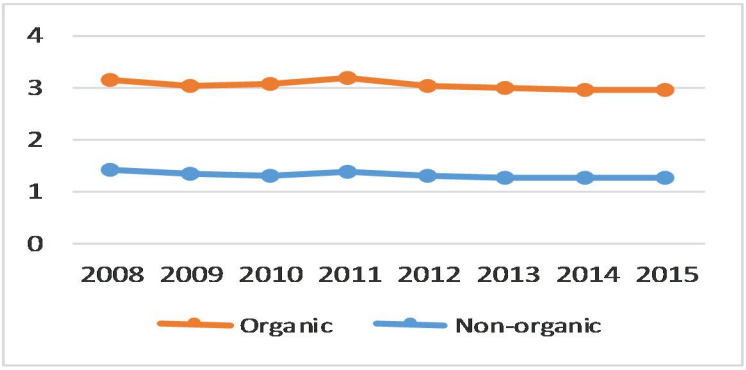


**Figure 4. Retail Price(Carrot)**
Source: USDA Agriculture Marketing Services

Meanwhile, it can be found that both the market prices and the retail prices of conventional and organic carrots are always in the same trend. Generally speaking, its market price increased slowly in the past 8 years, but the retail price had a bit of decrease. In 2011, the market prices of organic and non-organic carrots reached the extreme points. And the decreasing trend of retail prices can be seen in 2011. From the data of USDA's Economic Research Service, we knew that the area of certified organic carrot is 23643 acres and 12080 acres in 2010 and 2011 respectively. The enormous decrease of the acreage may lead to supply shortage, which explains why organic carrot's price in 2011 is higher than 2010.

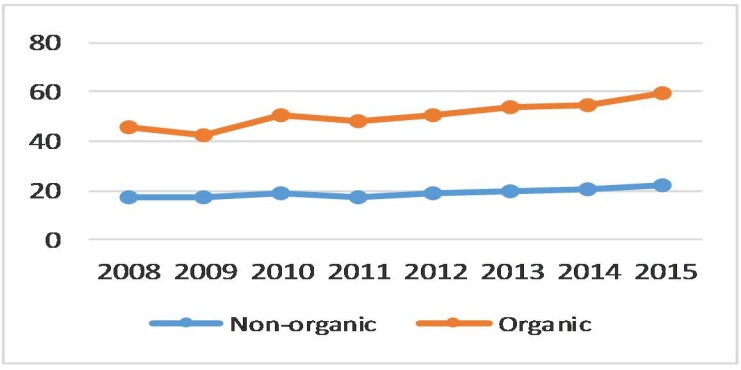


**Figure 5. Terminal Market Price(Broccoli)**
Source: USDA Agriculture Marketing Services

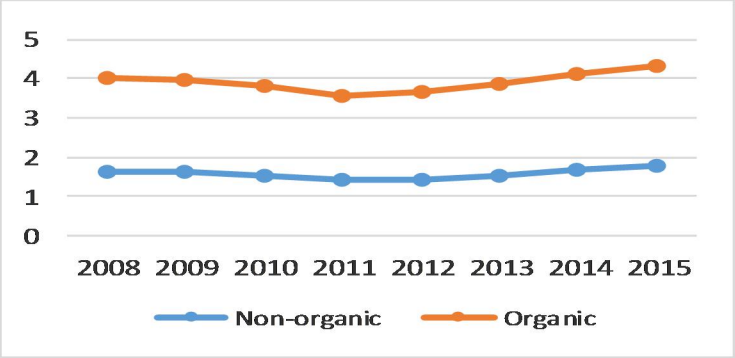


**Figure 6. Retail Price(Broccoli)**
Source: USDA Agriculture Marketing Services

According to figure 5 and 6, non-organic broccoli's prices are stable in the terminal markets, while the price of organic one witnessed an increase in the past 8 years. And the retail price had a reduction in 2011, but in general, the retail prices are stable.

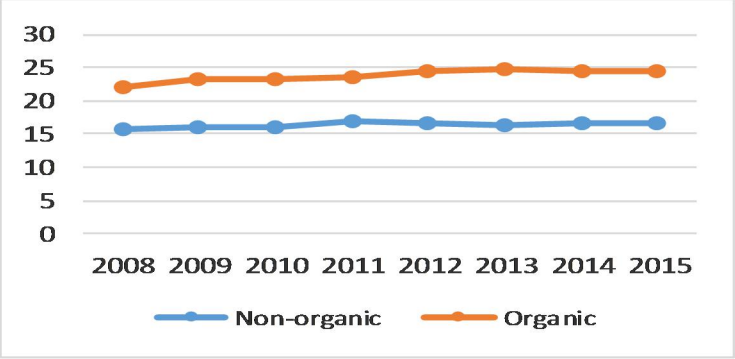


**Figure 7. Terminal Market Price(Banana)**
Source: USDA Agriculture Marketing Services

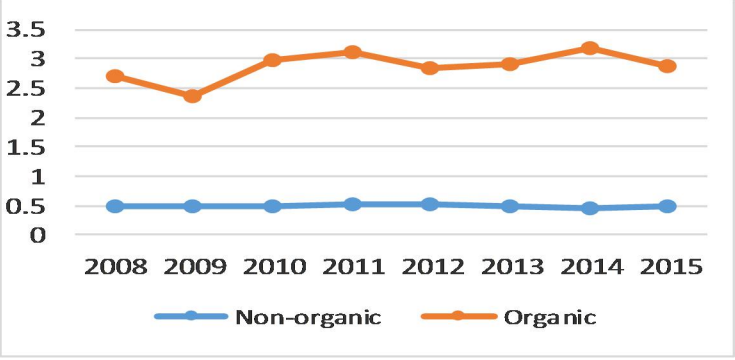


**Figure 8. Retail Price(Banana)**
Source: USDA Agriculture Marketing Services

In the banana market, an organically premium price is also existing. Both in the markets and in the retail stores, the price of organic bananas is twice higher than the price of non-organic bananas. Just comparing from percentages, we cannot say organic bananas have more profits than non-organic ones. But there is no doubt that organic bananas have some loyal consumption to keep its high price. Of course, the high cost is also a reason for the higher price. Meanwhile, non-organic banana' price is stable, while organic banana' price is fluctuant, which may indicate that some other factors such as the number of organic banana sellers, the changing prices of other vegetables influence organic banana' price.

# CHAPTER 3

## THE MODEL

The multiple regression model is used in this studySet random variable(y) and explanatory variables(x1, x2,...,xp) have interactions, and this relationship can be expressed by:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + ... + \beta_p x_p + e$$

The equation describes how the explanatory variables influence y to change. In the linear regression model, β0 is called regression constant and βp is called partial regression coefficient.In order to estimate the value of parameters: $\beta_0, \beta_1, \beta, ... \beta_p$. The model can be written as:

$$\hat{y} = b_0 + b_1 x_1 + b_2 x_2 + ... b_p x_p$$

where $x_1, x_2 ... x_p$ are the predictors and $b_0$ is the intercept.

Using Least-Squares Regression model, the best-fitting line for observed date is calculating to minimize the sum of the square of the vertical deviation for each data. The sum of residuals should be equal to zero.

We often use F test statistics to test the hypothesis. In order to calculate F-value, some formulas should be known.

$$SSR = \sum (\hat{y} - \bar{y})^2, \qquad SSE = \sum (y - \hat{y})^2 \ , \qquad \text{SST = SSR + SSE}$$

Using these formulas, F-value can be calculated by:

$$F = (SSR/p)/\left[SSE/(n-p-1)\right] \sim F(p, n-p-1)$$

Compare F with F - critial value. If $F > F_{cv}$, we say it's significant, and reject the hypothesis. And if $F < F_{cv}$, we say it's not significant and fail to reject hypothesis.

In general, the regression model is estimated by using statistical software. In this study, we use SPSS to compute the models.

In the study, it is assumed that the market prices of organic vegetables are determined by the five variables. And the regression linear model is used below.

(1) $$Y = f(P_{NonMar}, P_{OrgRe}, P_{OrgStor}, PPI, Q)$$

$$= b_0 + b_1 P_{NonMar} + b_2 P_{OrgRe} + b_3 P_{OrgStor} + b_4 PPI\text{-}A + b_5 Q + e$$

Y: Terminal marketing price of organic example

$P_{NonMar}$: Terminal marketing price of non-organic example

$P_{OrgRe}$: Retail price of organic example

$P_{OrgStor}$: Number of stores of organic example

PPI: Producer price index for farm products

Q: Quarter

e: Residual

Generally speaking, the price of a commodity depends on its cost and the substitute's price. As the substitutes of organic fruits and vegetables, the terminal market prices of non-organic fruits and vegetables are the direct factors to influence the terminal market prices of organic fruits and vegetables. According to the figures above, the overall trends of organic prices and non-organic prices are similar in the terminal markets, which reveals the relationship between organic and non-organic fruits and vegetables.

The cost is related to production costs, transportation costs and the prices of its upstream products prices. The PPI of agriculture can reflect the wholesale price of farm products. Producer Price Index as an index of trend and degree of price changes is an important economic indicator to reflect the situation of price change in the field of

production. It indicates overall price movement at the producer level, which may forebode subsequent price changes for the consumers and business. In this case, the PPI not only can reflect the market prices of vegetables, but also affect the retail prices. In the estimation, the PPI of farm products includes fresh/dry vegetables, fruit and nuts. In other words, it not only involves the effect from the vegetables in the research, but also contains the effect from other vegetables and other farm products.

Meanwhile, the downstream products' prices may also influence the commodity' price, which means retail price may influence market price. The increase of price depends on the growth of demand, and increasing retail price and demand will bring an increase of wholesale price. And the substitute prices of organic products and retail prices for non-organic products are also equivalent.

Organic vegetable stores are the final sale points in the trade line. Most customers buy vegetables from the stores which spread all over the U.S.. Opening more organic stores is a good method that can advertise organic fruits and vegetables, and besides, the number of stores is also an aspect to affect the terminal market price of organic foods. Finally, as the season factor, the quarter also plays a role in the general agricultural studies. Table 1 provides brief summary statistics for all of the variables used to estimate the models.

**Table 1. Summary Statistics of Variables in Estimation**

| | **Mean** | **Std. Dev.** |
|---|---|---|
| **Carrot** | | |
| Terminal marketing price of non-organic carrot | 18.05 | 1.90 |
| Terminal marketing price of organic carrot | 30.26 | 1.94 |
| Retail price of organic carrot | 1.73 | 0.10 |

| | Mean | Std.Dev. |
|---|---|---|
| **Carrot** | | |
| Number of stores of organic carrot | 9024.33 | 4036.63 |
| Producer price index for farm products | 166.82 | 17.98 |
| Quarter | 2.50 | 1.12 |
| **Broccoli** | | |
| Terminal marketing price of non-organic broccoli | 18.73681477 | 2.972118031 |
| Terminal marketing price of organic broccoli | 31.60701863 | 6.437826992 |
| Retail price of organic broccoli | 2.302977952 | 0.215977468 |
| Number of stores of organic broccoli | 2372.270833 | 1622.847929 |
| Producer price index for farm products | 166.8229167 | 17.97637912 |
| Quarter | 2.5 | 1.123902974 |
| **Banana** | | |
| Terminal marketing price of non-organic banana | 17.10566341 | 0.896387656 |
| Terminal marketing price of organic banana | 24.06335542 | 0.918355898 |
| Retail price of organic banana | 0.794805556 | 0.045045362 |
| Number of stores of organic banana | 2063.864583 | 1444.591901 |
| Producer price index for farm products | 166.8229167 | 17.97637912 |
| Quarter | 2.5 | 1.123902974 |

# CHAPTER 4

# EMPIRICAL PROCEDURE AND RESULT

To evaluate the model, carrot, broccoli, and banana are used as three examples, and the regression linear model are estimated twice for every example. Dependent price variables are presented monthly. The number of stores is collected and published by U.S. Department of Agriculture(USDA) the Agricultural Marketing Service(AMS). The producer price index (PPI) is obtained monthly, too. Estimation is from the January of 2008 to the December of 2015. And all of the estimations are under the 95% confidence.

## Carrot

First, the terminal market price of organic carrot is estimated as the dependent variable. The regression model can be got as:

(2) $$Y=13.061 + 0.384P_{NonMar} + 2.175P_{OrgRe} + 0.027PPI +0.335Q$$

According to the regression estimation, four variables show statistic significance which means all of these four variables can influence the terminal market price of organic carrot.

**Table 2. ANOVA Results for Model of Carrot**

| | Sum of Square | Mean of Square | F | Sig. |
|---|---|---|---|---|
| Regression | 143.111 | 28.622 | 12.105 | 0.000* |
| Residual | 212.8 | 2.364 | | |
| Total | 355.911 | | | |

R square = 0.402

In the table 2 and table 3, F value is 12.105 which are larger than F critical value (2.34). And four variables present significant influence to the market price of organic

carrot. Non-organic carrot's market price has a positive effect on that of organic carrot. Every one dollar increase of non-organic carrot's market price will bring 0.384 dollar increase to organic carrot's market price. A healthy competition between non-organic carrot and organic carrot exits in the terminal markets. An increase in the price of non-organic carrot tends to transfer some consumption to organic carrot markets, and in addition, more demand will also make organic carrot's price rise. It's the market principle between price and demand. A positive influence is working that is organic carrot's retail price, and in this estimation, when its retail price gains an increase of 1 unit, organic carrot's market price will increase by 2.715 units, which is the same as our expectation. The number of organic stores exerts imperceptible influence on the market price of organic carrot. The Producer Price Index bringing a small positive effect to organic carrot's market price identifies the existence of impact from other farm products' price. Seasons also play a role in the price change.

**Table 3.Regression Result for Carrot**

| | Parameter | Standard Error | t - statistic | P - value |
|---|---|---|---|---|
| Constant | 13.061 | 3.692 | 3.537 | 0.001 |
| NonMar | 0.384 | 0.094 | 4.063 | 0.000 |
| OrgRe | 2.175 | 1.824 | 1.193 | 0.236 |
| OrgStor | 0.000 | 0.000 | 2.472 | 0.015 |
| PPI | 0.027 | 0.011 | 2.562 | 0.012 |
| Q | 0.355 | 0.145 | 2.455 | 0.16 |

Dependent Variable: Y

In order to avoid multicollinearity, stepwise regression is estimated. Four variables are screened out including the market price of non-organic foods, the PPI, quarters and

the number of stores that carry organic products. Availability can be proved by R square(0.445).

(3) $$Y = 16.789 + 0.417P_{NonMar} + 0.025PPI + 0.337Q$$

(0.090) (0.011) (0.144) F=14.708

In the stepwise regression model, the effect from the market price of non-organic products expands. It may be interfered by the retail price of organic foods or the number of organic stores. Indeed, a significant effect exists between non-organic market price and organic market price.

**Broccoli**

The second model is taken broccoli as the example. The model can be expressed as:

(4) $$Y= 0.87 + 1.104P_{NonMar} - 3.123P_{OrgRe} + 0.095PPI +0.887Q$$

**Table 4. ANOVA Result for Broccoli**

| | Sum of Square | Mean of Square | F | Sig. |
|---|---|---|---|---|
| Regression | 2016.759 | 403.352 | 18.901 | 0.000* |
| Residual | 1920.574 | 21.340 | | |
| Total | 3937.334 | | | |

R square = 0.512

F value is larger than F critical value in table 4. Non-organic market price also plays an indispensable role in this model, from table 5 it can be seen that every 1 unit increase of non-organic terminal market price will bring 1.104 unit increases to terminal organic market price. It's larger than that of carrot, which may indicate that organic broccoli's market price relies more on non-organic broccoli's market price. Organic broccoli's retail price has a negative effect which is different from that of carrot, which may imply the

retail price of organic broccoli has little relationship with its market price. The number of organic stores is still a little parameter, or we can even say there is no relationship between organic market price and the number of organic stores. The PPI has a small effect in this model, and seasons still have a positive effect here, which means there are some effects coming from seasons.

**Table 5. Regression Result for Broccoli**

| | Parameter | Standard Error | t - statistic | P - value |
|---|---|---|---|---|
| Constant | 0.870 | 6.320 | 0.138 | 0.891 |
| NonMar | 1.104 | 0.212 | 5.213 | 0.000 |
| OrgRe | -3.123 | 2.267 | -1.377 | 0.172 |
| OrgStor | 0.000 | 0.000 | -1.146 | 0.255 |
| PPI | 0.095 | 0.035 | 2.690 | 0.009 |
| Q | 0.887 | 0.464 | 1.910 | 0.059 |

Dependent Variable: Y

A stepwise regression model is adopted again, and only one variable is significant in this model.

(5) $$Y = 4.538 + 1.445P_{NonMar}$$

$$(0.166) \qquad F=75.322$$

In this model, one significant variable don't mean only one variable can influence the dependent variable. It's just because that other variables have some interaction with the significant variable. R square equal 0.445 means 44.5% examples can be explained in this model. Stepwise regression identifies the most contribution of non-organic market price in this model.

**Banana**

Banana as the third example is analyzed by the regression linear model:

(6) $$Y = 17.191 + 0.33P_{NonMar} - 1.67P_{OrgRe} + 0.012PPI$$

**Table 6. ANOVA Result for Banana**

| | Sum of Square | Mean of Square | F | Sig. |
|---|---|---|---|---|
| Regression | 16.252 | 3.250 | 4.580 | 0.001* |
| Residual | 63.869 | 0.710 | | |
| Total | 80.121 | | | |

R square = 0.203

The model seems to be significant overall, in the table 6 and table 7, non-organic market price has the same positive effect, when it increases 1 unit, organic banana's market price will increase by 0.33 units. Organic retail price shows a negative effect which is same as the output of broccoli. The number of organic stores still has a weak effect. And the results of the PPI and Q demonstrate the positive influences on organic banana's market price.

**Table 7. Regression Result for Banana**

| | Parameter | Standard Error | t - statistic | P - value |
|---|---|---|---|---|
| Constant | 17.191 | 2.844 | 6.044 | .000 |
| NonMar | .330 | .103 | 3.204 | .002 |
| OrgRe | -1.670 | 2.156 | -.775 | .441 |
| OrgStor | 5.972E-5 | .000 | .879 | .382 |
| PPI | .012 | .005 | 2.338 | .022 |
| Q | .161 | .083 | 1.942 | .055 |

Dependent Variable: Y

In the following stepwise regression model, the results incorporate three significant variables to explain the market price of organic banana.

(7) $$Y = 15.519 + 0.328P_{NonMar} + 0.015PPI + 0.165Q$$

(0.103) (0.005) (0.082) F=6.922

Both in the model of carrot and in this model, the same significant variables can be found, and thus, the similar results may imply the close and powerful relationship between the market price of organic fruits and vegetables and the three variables.

Generally, the market price of non-organic products has obviously positive impact on the market price of organic products. The PPI also shows some influence on organic market price. The number of organic stores and the retail price have less or even no relationship with the market price. Besides, seasons as a necessary condition of agriculture have influence on organic market price.

# CHAPTER 5

## DISCUSSION AND CONCLUSION

The same results got and meanwhile some differences are seen from the three models above. The results indicate a common view that the terminal market price of non-organic fruits and vegetables has a moderately positive relationship with the terminal market price of organic fruits and vegetables, which implies the healthy competition in the market. Positive effect gives farmers an implication that they can do analysis on the market price of organic fruit and vegetables by using their experience on analyzing conventional vegetables and fruit. Of course, conventional fruit and vegetables account for the largest percentage in fruit and vegetable markets, while organic fruit and vegetables are still in a small proportion. Farmers can draw up their planting plans of organic vegetables and non-organic vegetables together.

The effect from conventional vegetables' market price is limited, however, both models of carrot and banana present the small parameters which are nearly 0.35. It seems that non-organic fruit's and vegetables' market prices cannot guide the trends of organic fruit' and vegetables' completely. Two reasons can explain it. First, organic fruit and vegetables have a number of loyal customers. With an increasing number of organic foods being sold in mainstream grocery stores, a large number of consumers are willing to pay premium prices for organic fresh fruits and vegetables in order to stay healthy. A lot of previous studies indicated that people who received higher education and higher-earning groups may prefer to purchase organic foods. Dimitri and Dettmann(2012) held that the household who has higher education has a higher frequency of organic fruit

purchase, once they decide to buy organic fruit. And income as a factor is also proved to have a positive effect on the demand of organic foods (Smith, Huang, and Lin in 2009). The second reason is that higher cost of organic fruit and vegetables may keep its price in a higher position, and it's difficult to reduce much.

Although market price and retail price are upstream-downstream relationship, the retail price of organic vegetables and fruit is estimated that it can't influence the market price because of the non-significant results. In generally, increasing retail price can give a support to the increase of wholesale price. The weak relationship may because organic foods have their particularities. Organic fruit and vegetables are always showed to us by the superior packing, and besides, many organic fresh foods are packaged as the preferable commodities to show their higher quality. It is an important reason why organic foods have premium prices. People prefer to purchasing better commodities. But it is less important for the increase of organic market price. Meanwhile, some stores sell organic foods with their private brands. For example, in Trader Joe's grocery store, most organic products are sold along with the brand of Trader Joe's in Trader Joe's stores, which causes higher retail price, but it's not related to the market price.

It seems that there is no relationship between the number of organic stores and the organic market price. That may because some people who live in suburb prefer to buy food in local market. Admittedly, more organic stores are in favor of advertising organic foods during the fast extension period of organic foods.

Other farm products' prices may also influence the organic market price, and the results of the PPI are significant in all of the three models. The interaction of prices exists in agricultural products.

In conclusion, the positive relationship between non-organic terminal market price and organic terminal market price of fruits and vegetables gives farmers a guide that the two prices may have a homodromous change. To be specific, when there is no enough information about the prices of organic fruit and vegetables, they can predict the organic market price trend by non-organic market price. Seasons as a condition need to be considered in their plans. Meanwhile, there is no enough evidence to prove that the retail price of organic fruit and vegetables has the significant relationship with its market price. The premium price may indicate the information asymmetry between organic farms and organic stores. The market prices and retail prices of organic carrot, broccoli, and banana have the premium prices that can attract farmers to pursue more profits. It also provides an opportunity to organic groceries that they can sell organic fruit and vegetables by offering different prices and adopting different promotion methods.

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# APPENDICES

## Appendix A

U.S. organic food sales by category, 2005-14E

$ billion

| Years | Fruit and vegetables | Dairy | Beverages | Packaged/prepared foods | Breads and grains | Snack foods | Meat, fish, poultry | Condiments |
|---|---|---|---|---|---|---|---|---|
| **2005** | 5.369 (40.3%) | 2.14 (16.1%) | 1.657 (12.4%) | 1.627 (12.2%) | 1.36 (10.2%) | 0.561 (4.2%) | 0.256 (1.9%) | 0.341 (2.6%) |
| **2006** | 6.068 (39.0%) | 2.579 (16.6%) | 1.934 (12.4%) | 1.887 (12.1%) | 1.651 (10.6%) | 0.68 (4.4%) | 0.345 (2.2%) | 0.417 (2.7%) |
| **2007** | 6.932 (38.0%) | 3.081 (16.9%) | 2.302 (12.6%) | 2.164 (11.8%) | 1.949 (10.7%) | 0.84 (4.6%) | 0.476 (2.6%) | 0.522 (2.9%) |
| **2008** | 7.799 (38.0%) | 3.406 (16.6%) | 2.599 (12.7%) | 2.396 (11.7%) | 2.133 (10.4%) | 0.949 (4.6%) | 0.606 (3.0%) | 0.636 (3.1%) |
| **2009** | 8.658 (40.1%) | 3.373 (15.6%) | 2.587 (12.0%) | 2.498 (11.6%) | 2.21 (10.2%) | 0.972 (4.5%) | 0.618 (2.9%) | 0.675 (3.1%) |
| **2010** | 9.689 (41.4%) | 3.681 (15.7%) | 2.708 (11.6%) | 2.574 (11.0%) | 2.328 (9.9%) | 1.06 (4.5%) | 0.644 (2.8%) | 0.724 (3.1%) |
| **2011** | 10.844 (42.2%) | 4.028 (15.7%) | 2.921 (11.4%) | 2.768 (10.8%) | 2.48 (9.6%) | 1.163 (4.5%) | 0.724 (2.8%) | 0.783 (3.0%) |
| **2012E** | 12.145 (42.7%) | 4.308 (15.2%) | 3.203 (11.3%) | 3.02 (10.6%) | 2.671 (9.4%) | 1.331 (4.7%) | 0.846 (3.0%) | 0.888 (3.1%) |
| **2013E** | 13.55 (43.1%) | 4.663 (14.8%) | 3.506 (11.1%) | 3.325 (10.6%) | 2.896 (9.2%) | 1.517 (4.8%) | 0.986 (3.1%) | 1.001 (3.2%) |
| **2014E** | 15.06 (43.3%) | 5.071 (14.6%) | 3.839 (11.0%) | 3.683 (10.6%) | 3.157 (9.1%) | 1.724 (5.0%) | 1.141 (3.3%) | 1.122 (3.2%) |

Note: E=estimate. Source: USDA, Economic Research Service using data from Nutrition Business Journal.

## Appendix B

Carrots' Data, 2008-2015.

| ITEMS / MONTHS | NonMar ($/40lb) | OrgMar ($/40lb) | OrgRe ($/lb) | Orgstor |
|---|---|---|---|---|
| Jan-08 | 19.12 | 37.23 | 2.24 | 1514 |
| Feb-08 | 14.90 | 25.73 | 2.18 | 2335 |
| Mar-08 | 15.75 | 32.93 | 2.07 | 3303 |
| Apr-08 | 20.15 | 41.73 | 2.20 | 2263 |
| May-08 | 16.72 | 31.50 | 2.38 | 2909 |
| Jun-08 | 16.74 | 29.84 | 1.97 | 1465 |
| Jul-08 | 16.23 | 30.27 | 2.43 | 1085 |
| Aug-08 | 15.62 | 35.85 | 1.99 | 217 |
| Sep-08 | 16.44 | 31.90 | 1.93 | 1248 |
| Oct-08 | 21.62 | 33.88 | 2.68 | 1399 |
| Nov-08 | 19.44 | 37.68 | 2.54 | 370 |
| Dec-08 | 16.60 | 31.64 | 2.62 | 401 |
| Jan-09 | 19.22 | 22.73 | 2.54 | 1989 |
| Feb-09 | 14.81 | 20.77 | 2.33 | 2181 |
| Mar-09 | 16.33 | 22.28 | 2.24 | 1780 |
| Apr-09 | 18.64 | 27.80 | 2.31 | 1334 |
| May-09 | 15.98 | 21.00 | 2.41 | 2835 |
| Jun-09 | 16.58 | 22.99 | 2.47 | 1396 |
| Jul-09 | 14.76 | 25.51 | 2.19 | 1025 |
| Aug-09 | 14.67 | 21.58 | 1.82 | 1201 |
| Sep-09 | 15.05 | 23.35 | 2.58 | 1033 |
| Oct-09 | 20.30 | 26.27 | 2.10 | 3035 |
| Nov-09 | 20.01 | 28.78 | 2.02 | 197 |
| Dec-09 | 19.40 | 26.56 | 2.09 | 395 |
| Jan-10 | 15.29 | 26.58 | 2.29 | 992 |
| Feb-10 | 14.40 | 25.14 | 2.21 | 1204 |
| Mar-10 | 19.69 | 28.55 | 2.43 | 868 |
| Apr-10 | 17.49 | 30.85 | 2.52 | 819 |
| May-10 | 18.50 | 19.10 | 2.58 | 1334 |
| Jun-10 | 18.26 | 19.90 | 2.96 | 624 |
| Jul-10 | 16.53 | 26.30 | 2.23 | 475 |
| Aug-10 | 14.80 | 31.01 | 2.07 | 313 |
| Sep-10 | 16.46 | 23.61 | 2.44 | 1715 |
| Oct-10 | 16.31 | 27.91 | 2.54 | 2347 |
| Nov-10 | 21.72 | 31.85 | 2.39 | 582 |
| Dec-10 | 25.33 | 41.96 | 2.34 | 1025 |

| | | | | |
|---|---|---|---|---|
| Jan-11 | 22.18 | 35.89 | 2.41 | 2112 |
| Feb-11 | 18.51 | 30.27 | 2.27 | 2530 |
| Mar-11 | 17.93 | 32.33 | 2.34 | 1691 |
| Apr-11 | 18.33 | 38.42 | 2.36 | 940 |
| May-11 | 17.85 | 30.08 | 2.11 | 3108 |
| Jun-11 | 23.24 | 32.64 | 2.34 | 984 |
| Jul-11 | 17.12 | 27.77 | 2.10 | 2298 |
| Aug-11 | 17.45 | 25.62 | 2.21 | 1841 |
| Sep-11 | 16.56 | 28.54 | 2.45 | 2585 |
| Oct-11 | 16.21 | 27.13 | 2.17 | 2990 |
| Nov-11 | 20.44 | 33.18 | 1.97 | 3685 |
| Dec-11 | 21.13 | 41.77 | 1.86 | 1052 |
| Jan-12 | 15.96 | 36.74 | 2.34 | 2091 |
| Feb-12 | 14.11 | 24.31 | 2.13 | 2421 |
| Mar-12 | 16.54 | 28.08 | 2.10 | 5267 |
| Apr-12 | 15.82 | 35.17 | 2.26 | 1780 |
| May-12 | 16.82 | 25.93 | 1.88 | 2690 |
| Jun-12 | 21.10 | 33.05 | 2.14 | 2711 |
| Jul-12 | 17.49 | 35.00 | 2.31 | 1150 |
| Aug-12 | 16.24 | 31.39 | 2.10 | 2858 |
| Sep-12 | 17.79 | 37.24 | 1.87 | 2455 |
| Oct-12 | 16.58 | 30.64 | 2.21 | 2058 |
| Nov-12 | 17.25 | 29.06 | 2.21 | 1646 |
| Dec-12 | 16.31 | 29.65 | 2.19 | 1058 |
| Jan-13 | 27.33 | 40.76 | 2.08 | 1171 |
| Feb-13 | 18.55 | 36.21 | 2.51 | 556 |
| Mar-13 | 18.05 | 28.09 | 2.27 | 3436 |
| Apr-13 | 18.98 | 34.39 | 2.58 | 1626 |
| May-13 | 18.94 | 30.08 | 2.10 | 4326 |
| Jun-13 | 20.48 | 27.68 | 2.23 | 2015 |
| Jul-13 | 18.92 | 28.98 | 2.42 | 2059 |
| Aug-13 | 22.94 | 34.17 | 2.22 | 3144 |
| Sep-13 | 20.06 | 31.58 | 2.32 | 3862 |
| Oct-13 | 24.98 | 49.76 | 2.29 | 187 |
| Nov-13 | 24.45 | 46.99 | 2.31 | 338 |
| Dec-13 | 17.25 | 34.35 | 2.19 | 1795 |
| Jan-14 | 18.09 | 31.64 | 2.46 | 5071 |
| Feb-14 | 15.39 | 25.57 | 2.17 | 5182 |
| Mar-14 | 17.95 | 30.08 | 2.07 | 4195 |
| Apr-14 | 18.97 | 31.90 | 2.06 | 3914 |
| May-14 | 20.60 | 32.93 | 2.60 | 5992 |
| Jun-14 | 20.84 | 32.80 | 2.30 | 4201 |

| | | | | |
|---|---|---|---|---|
| Jul-14 | 18.07 | 23.19 | 2.40 | 2893 |
| Aug-14 | 20.34 | 28.27 | 2.54 | 5096 |
| Sep-14 | 23.16 | 38.34 | 2.42 | 1804 |
| Oct-14 | 18.72 | 39.15 | 2.55 | 2293 |
| Nov-14 | 19.95 | 40.52 | 2.54 | 2946 |
| Dec-14 | 18.04 | 39.36 | 2.25 | 773 |
| Jan-15 | 25.39 | 40.01 | 2.38 | 6253 |
| Feb-15 | 17.36 | 28.51 | 2.70 | 7763 |
| Mar-15 | 19.96 | 30.42 | 2.23 | 6817 |
| Apr-15 | 20.96 | 41.98 | 2.30 | 5090 |
| May-15 | 22.22 | 37.50 | 2.58 | 5172 |
| Jun-15 | 19.15 | 28.24 | 2.24 | 4040 |
| Jul-15 | 18.07 | 23.94 | 2.36 | 3834 |
| Aug-15 | 20.45 | 42.09 | 2.59 | 3318 |
| Sep-15 | 21.59 | 40.89 | 2.51 | 4244 |
| Oct-15 | 20.94 | 36.01 | 2.66 | 5025 |
| Nov-15 | 22.84 | 37.06 | 2.32 | 2197 |
| Dec-15 | 29.90 | 48.37 | 2.73 | 1901 |

Source: USDA, Agricultural Marketing Services.

## Appendix C

Broccoli's Data, 2008-2015.

| ITEMS / MONTHS | NonMar ($/40lb) | OrgMar ($/40lb) | OrgRe ($/lb) | Orgstor |
|---|---|---|---|---|
| Jan-08 | 19.12 | 37.23 | 2.24 | 1514 |
| Feb-08 | 14.90 | 25.73 | 2.18 | 2335 |
| Mar-08 | 15.75 | 32.93 | 2.07 | 3303 |
| Apr-08 | 20.15 | 41.73 | 2.20 | 2263 |
| May-08 | 16.72 | 31.50 | 2.38 | 2909 |
| Jun-08 | 16.74 | 29.84 | 1.97 | 1465 |
| Jul-08 | 16.23 | 30.27 | 2.43 | 1085 |
| Aug-08 | 15.62 | 35.85 | 1.99 | 217 |
| Sep-08 | 16.44 | 31.90 | 1.93 | 1248 |
| Oct-08 | 21.62 | 33.88 | 2.68 | 1399 |
| Nov-08 | 19.44 | 37.68 | 2.54 | 370 |
| Dec-08 | 16.60 | 31.64 | 2.62 | 401 |
| Jan-09 | 19.22 | 22.73 | 2.54 | 1989 |
| Feb-09 | 14.81 | 20.77 | 2.33 | 2181 |
| Mar-09 | 16.33 | 22.28 | 2.24 | 1780 |
| Apr-09 | 18.64 | 27.80 | 2.31 | 1334 |
| May-09 | 15.98 | 21.00 | 2.41 | 2835 |
| Jun-09 | 16.58 | 22.99 | 2.47 | 1396 |
| Jul-09 | 14.76 | 25.51 | 2.19 | 1025 |
| Aug-09 | 14.67 | 21.58 | 1.82 | 1201 |
| Sep-09 | 15.05 | 23.35 | 2.58 | 1033 |
| Oct-09 | 20.30 | 26.27 | 2.10 | 3035 |
| Nov-09 | 20.01 | 28.78 | 2.02 | 197 |
| Dec-09 | 19.40 | 26.56 | 2.09 | 395 |
| Jan-10 | 15.29 | 26.58 | 2.29 | 992 |
| Feb-10 | 14.40 | 25.14 | 2.21 | 1204 |
| Mar-10 | 19.69 | 28.55 | 2.43 | 868 |
| Apr-10 | 17.49 | 30.85 | 2.52 | 819 |
| May-10 | 18.50 | 19.10 | 2.58 | 1334 |
| Jun-10 | 18.26 | 19.90 | 2.96 | 624 |
| Jul-10 | 16.53 | 26.30 | 2.23 | 475 |
| Aug-10 | 14.80 | 31.01 | 2.07 | 313 |
| Sep-10 | 16.46 | 23.61 | 2.44 | 1715 |
| Oct-10 | 16.31 | 27.91 | 2.54 | 2347 |
| Nov-10 | 21.72 | 31.85 | 2.39 | 582 |
| Dec-10 | 25.33 | 41.96 | 2.34 | 1025 |
| Jan-11 | 22.18 | 35.89 | 2.41 | 2112 |
| Feb-11 | 18.51 | 30.27 | 2.27 | 2530 |
| Mar-11 | 17.93 | 32.33 | 2.34 | 1691 |

| | | | | |
|---|---|---|---|---|
| Apr-11 | 18.33 | 38.42 | 2.36 | 940 |
| May-11 | 17.85 | 30.08 | 2.11 | 3108 |
| Jun-11 | 23.24 | 32.64 | 2.34 | 984 |
| Jul-11 | 17.12 | 27.77 | 2.10 | 2298 |
| Aug-11 | 17.45 | 25.62 | 2.21 | 1841 |
| Sep-11 | 16.56 | 28.54 | 2.45 | 2585 |
| Oct-11 | 16.21 | 27.13 | 2.17 | 2990 |
| Nov-11 | 20.44 | 33.18 | 1.97 | 3685 |
| Dec-11 | 21.13 | 41.77 | 1.86 | 1052 |
| Jan-12 | 15.96 | 36.74 | 2.34 | 2091 |
| Feb-12 | 14.11 | 24.31 | 2.13 | 2421 |
| Mar-12 | 16.54 | 28.08 | 2.10 | 5267 |
| Apr-12 | 15.82 | 35.17 | 2.26 | 1780 |
| May-12 | 16.82 | 25.93 | 1.88 | 2690 |
| Jun-12 | 21.10 | 33.05 | 2.14 | 2711 |
| Jul-12 | 17.49 | 35.00 | 2.31 | 1150 |
| Aug-12 | 16.24 | 31.39 | 2.10 | 2858 |
| Sep-12 | 17.79 | 37.24 | 1.87 | 2455 |
| Oct-12 | 16.58 | 30.64 | 2.21 | 2058 |
| Nov-12 | 17.25 | 29.06 | 2.21 | 1646 |
| Dec-12 | 16.31 | 29.65 | 2.19 | 1058 |
| Jan-13 | 27.33 | 40.76 | 2.08 | 1171 |
| Feb-13 | 18.55 | 36.21 | 2.51 | 556 |
| Mar-13 | 18.05 | 28.09 | 2.27 | 3436 |
| Apr-13 | 18.98 | 34.39 | 2.58 | 1626 |
| May-13 | 18.94 | 30.08 | 2.10 | 4326 |
| Jun-13 | 20.48 | 27.68 | 2.23 | 2015 |
| Jul-13 | 18.92 | 28.98 | 2.42 | 2059 |
| Aug-13 | 22.94 | 34.17 | 2.22 | 3144 |
| Sep-13 | 20.06 | 31.58 | 2.32 | 3862 |
| Oct-13 | 24.98 | 49.76 | 2.29 | 187 |
| Nov-13 | 24.45 | 46.99 | 2.31 | 338 |
| Dec-13 | 17.25 | 34.35 | 2.19 | 1795 |
| Jan-14 | 18.09 | 31.64 | 2.46 | 5071 |
| Feb-14 | 15.39 | 25.57 | 2.17 | 5182 |
| Mar-14 | 17.95 | 30.08 | 2.07 | 4195 |
| Apr-14 | 18.97 | 31.90 | 2.06 | 3914 |
| May-14 | 20.60 | 32.93 | 2.60 | 5992 |
| Jun-14 | 20.84 | 32.80 | 2.30 | 4201 |
| Jul-14 | 18.07 | 23.19 | 2.40 | 2893 |
| Aug-14 | 20.34 | 28.27 | 2.54 | 5096 |
| Sep-14 | 23.16 | 38.34 | 2.42 | 1804 |
| Oct-14 | 18.72 | 39.15 | 2.55 | 2293 |
| Nov-14 | 19.95 | 40.52 | 2.54 | 2946 |
| Dec-14 | 18.04 | 39.36 | 2.25 | 773 |

| | | | | |
|---|---|---|---|---|
| Jan-15 | 25.39 | 40.01 | 2.38 | 6253 |
| Feb-15 | 17.36 | 28.51 | 2.70 | 7763 |
| Mar-15 | 19.96 | 30.42 | 2.23 | 6817 |
| Apr-15 | 20.96 | 41.98 | 2.30 | 5090 |
| May-15 | 22.22 | 37.50 | 2.58 | 5172 |
| Jun-15 | 19.15 | 28.24 | 2.24 | 4040 |
| Jul-15 | 18.07 | 23.94 | 2.36 | 3834 |
| Aug-15 | 20.45 | 42.09 | 2.59 | 3318 |
| Sep-15 | 21.59 | 40.89 | 2.51 | 4244 |
| Oct-15 | 20.94 | 36.01 | 2.66 | 5025 |
| Nov-15 | 22.84 | 37.06 | 2.32 | 2197 |
| Dec-15 | 29.90 | 48.37 | 2.73 | 1901 |

Source: USDA, Agricultural Marketing Services.

## Appendix D

Banana's Data, 2008-2015.

| ITEMS / MONTHS | NonMar ($/40lb) | OrgMar ($/40lb) | OrgRe ($/lb) | Orgstor |
|---|---|---|---|---|
| Jan-08 | 13.80 | 20.06 | 0.74 | 3532 |
| Feb-08 | 15.90 | 20.59 | 0.79 | 2514 |
| Mar-08 | 19.65 | 23.91 | 0.75 | 860 |
| Apr-08 | 18.86 | 24.00 | 0.74 | 295 |
| May-08 | 18.57 | 24.73 | 0.84 | 232 |
| Jun-08 | 17.68 | 24.21 | 0.84 | 531 |
| Jul-08 | 16.15 | 23.10 | 0.80 | 526 |
| Aug-08 | 16.05 | 23.72 | 0.90 | 1089 |
| Sep-08 | 16.51 | 23.06 | 0.80 | 693 |
| Oct-08 | 16.75 | 23.69 | 0.85 | 2536 |
| Nov-08 | 16.52 | 23.79 | 0.86 | 555 |
| Dec-08 | 16.45 | 23.76 | 0.80 | 1552 |
| Jan-09 | 16.79 | 23.79 | 0.77 | 1310 |
| Feb-09 | 18.51 | 24.21 | 0.77 | 1201 |
| Mar-09 | 17.80 | 23.38 | 0.81 | 2473 |
| Apr-09 | 17.78 | 23.59 | 0.87 | 1272 |
| May-09 | 17.30 | 23.45 | 0.78 | 3435 |
| Jun-09 | 16.39 | 23.35 | 0.95 | 931 |
| Jul-09 | 16.39 | 23.38 | 0.83 | 2066 |
| Aug-09 | 16.16 | 23.06 | 0.84 | 1244 |
| Sep-09 | 16.59 | 23.21 | 0.89 | 2304 |
| Oct-09 | 15.59 | 23.84 | 0.74 | 2364 |
| Nov-09 | 15.64 | 25.75 | 0.78 | 1266 |
| Dec-09 | 15.70 | 25.89 | 0.72 | 1642 |
| Jan-10 | 15.74 | 25.70 | 0.83 | 1310 |
| Feb-10 | 16.30 | 25.54 | 0.89 | 1936 |
| Mar-10 | 16.58 | 23.90 | 0.81 | 1375 |
| Apr-10 | 16.27 | 22.96 | 0.79 | 2775 |
| May-10 | 16.07 | 22.86 | 0.80 | 1695 |
| Jun-10 | 17.35 | 22.49 | 0.81 | 1098 |
| Jul-10 | 17.51 | 22.62 | 0.83 | 599 |
| Aug-10 | 16.66 | 22.72 | 0.77 | 1057 |
| Sep-10 | 16.35 | 23.19 | 0.74 | 1610 |
| Oct-10 | 16.73 | 23.46 | 0.84 | 2661 |
| Nov-10 | 16.79 | 23.15 | 0.78 | 1031 |
| Dec-10 | 16.98 | 23.68 | 0.76 | 1292 |
| Jan-11 | 17.82 | 23.36 | 0.80 | 689 |
| Feb-11 | 18.88 | 23.53 | 0.85 | 630 |
| Mar-11 | 18.78 | 24.62 | 0.80 | 912 |

| | | | | |
|---|---|---|---|---|
| Apr-11 | 18.73 | 24.80 | 0.81 | 1526 |
| May-11 | 18.53 | 23.85 | 0.88 | 745 |
| Jun-11 | 18.06 | 23.35 | 0.84 | 1177 |
| Jul-11 | 17.38 | 22.96 | 0.89 | 1059 |
| Aug-11 | 17.15 | 23.43 | 0.84 | 1596 |
| Sep-11 | 17.07 | 23.75 | 0.83 | 2875 |
| Oct-11 | 16.83 | 23.37 | 0.78 | 2157 |
| Nov-11 | 16.91 | 23.49 | 0.80 | 1598 |
| Dec-11 | 16.78 | 24.00 | 0.84 | 1812 |
| Jan-12 | 16.81 | 23.97 | 0.85 | 1651 |
| Feb-12 | 18.28 | 24.18 | 0.77 | 1281 |
| Mar-12 | 19.66 | 24.77 | 0.80 | 1208 |
| Apr-12 | 18.28 | 24.77 | 0.82 | 1290 |
| May-12 | 17.42 | 24.05 | 0.78 | 1164 |
| Jun-12 | 17.25 | 24.35 | 0.77 | 1621 |
| Jul-12 | 17.41 | 24.67 | 0.81 | 1140 |
| Aug-12 | 17.20 | 23.96 | 0.76 | 2315 |
| Sep-12 | 17.15 | 25.31 | 0.80 | 1634 |
| Oct-12 | 17.18 | 24.55 | 0.73 | 1832 |
| Nov-12 | 17.21 | 24.23 | 0.75 | 1809 |
| Dec-12 | 17.30 | 24.11 | 0.77 | 1145 |
| Jan-13 | 17.54 | 24.34 | 0.82 | 2432 |
| Feb-13 | 17.15 | 24.86 | 0.78 | 2112 |
| Mar-13 | 16.91 | 24.72 | 0.79 | 1581 |
| Apr-13 | 16.76 | 24.74 | 0.79 | 2782 |
| May-13 | 16.92 | 24.38 | 0.81 | 2051 |
| Jun-13 | 16.72 | 24.21 | 0.85 | 1054 |
| Jul-13 | 16.56 | 24.87 | 0.74 | 1122 |
| Aug-13 | 16.64 | 24.55 | 0.76 | 1316 |
| Sep-13 | 16.56 | 24.68 | 0.79 | 1879 |
| Oct-13 | 16.63 | 24.91 | 0.76 | 208 |
| Nov-13 | 16.62 | 24.83 | 0.82 | 1843 |
| Dec-13 | 16.71 | 25.03 | 0.79 | 1122 |
| Jan-14 | 16.79 | 25.12 | 0.78 | 3860 |
| Feb-14 | 17.04 | 25.04 | 0.77 | 2353 |
| Mar-14 | 17.11 | 24.23 | 0.75 | 1380 |
| Apr-14 | 17.00 | 23.87 | 0.79 | 1698 |
| May-14 | 16.77 | 24.03 | 0.83 | 1824 |
| Jun-14 | 16.89 | 24.18 | 0.81 | 2535 |
| Jul-14 | 16.98 | 24.58 | 0.74 | 1117 |
| Aug-14 | 16.90 | 24.02 | 0.77 | 2993 |
| Sep-14 | 16.96 | 24.30 | 0.77 | 2290 |
| Oct-14 | 17.04 | 24.28 | 0.77 | 2795 |
| Nov-14 | 17.10 | 24.12 | 0.82 | 934 |
| Dec-14 | 16.83 | 23.81 | 0.83 | 1777 |

| | | | | |
|---|---|---|---|---|
| Jan-15 | 17.08 | 23.98 | 0.72 | 4814 |
| Feb-15 | 18.65 | 24.88 | 0.74 | 5580 |
| Mar-15 | 18.91 | 24.55 | 0.78 | 5467 |
| Apr-15 | 17.78 | 24.60 | 0.76 | 5104 |
| May-15 | 17.45 | 24.68 | 0.74 | 6038 |
| Jun-15 | 17.34 | 24.44 | 0.76 | 4856 |
| Jul-15 | 17.50 | 25.23 | 0.77 | 5994 |
| Aug-15 | 17.53 | 25.10 | 0.74 | 6321 |
| Sep-15 | 17.27 | 25.01 | 0.74 | 5548 |
| Oct-15 | 16.92 | 24.97 | 0.73 | 5980 |
| Nov-15 | 16.87 | 24.99 | 0.77 | 3986 |
| Dec-15 | 16.76 | 24.72 | 0.75 | 3657 |

Source: USDA, Agricultural Marketing Services.

## Appendix E

Producer Price Index for farm products

| Group | Farm products | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Item | Fruits & melons, fresh/dry veg. & nuts | | | | | | | |
| Base | 198200 | | | | | | | |
| Years | 2008 to 2015 | | | | | | | |
| Months Years | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
| Jan | 177.9 | 151.6 | 166.1 | 183.3 | 155.1 | 181.6 | 178.1 | 198.5 |
| Feb | 158.4 | 144.1 | 166.6 | 219.6 | 149.2 | 161.8 | 176.6 | 179.1 |
| Mar | 167.7 | 145.1 | 205.4 | 186.9 | 157.2 | 181.3 | 173.2 | 174.8 |
| Apr | 159.9 | 150.7 | 188.9 | 163.1 | 155.1 | 165.8 | 176.7 | 178.3 |
| May | 157.2 | 130.2 | 171.8 | 146.2 | 152.3 | 173 | 177.1 | 185 |
| Jun | 165.1 | 146.4 | 141.8 | 165.8 | 155.6 | 170.3 | 185.6 | 176.3 |
| Jul | 148.1 | 136.1 | 150.7 | 159 | 150.2 | 170.5 | 173.8 | 174.2 |
| Aug | 140.7 | 135.2 | 146.4 | 155.9 | 155 | 193.8 | 174.1 | 179.6 |
| Sep | 155.4 | 136.4 | 146.2 | 165.8 | 156.3 | 181.5 | 173.7 | 190.2 |
| Oct | 152.8 | 156.9 | 140.8 | 161.1 | 148.1 | 186.5 | 180.8 | 192.5 |
| Nov | 159.1 | 157.1 | 145.8 | 173.7 | 160.4 | 183.2 | 194.7 | 201.1 |
| Dec | 148.9 | 170.6 | 172.8 | 164.1 | 158.6 | 172.4 | 195.7 | 211.1 |

Source: USDA, Agricultural Marketing Services.

# VITA

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The Factors Influencing Terminal Market Prices of Organic Vegetables & Fruits: Illustrated by the Examples of Carrot, Broccoli, and Banana

Major Professor: Wanki Moon