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# Differences in Strawberry Demand Based on Region, Season, and Strawberry Type

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## Abstract

This study analyzes consumer demand premiums for organic and local strawberries in different United States regions. Seasonal market power is also examined for each region, illustrating the seasonal and regional viability of new strawberries. The price premium for organic strawberries varies by region. The premium for local strawberries is not statistically significant for any region but may reflect a lack of data. Market power of varying degrees exists outside of peak strawberry season, indicating economic viability for new strawberry varieties with seasonality differences. Combining the premium and market power analyses gives strawberry producers important information about entering new markets.

**Keywords:** fresh market, market power, price premium, product differentiation, season extension, strawberry

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## Introduction

In 2020, strawberry production was valued at more than $2 billion and accounted for 13% of the total U.S. fruit market (Yeh et al., 2023). Between 1980 and 2018, availability of strawberries grew from 2.0 to 8.4 pounds per capita, an increase of 320% (Li et al., 2019). This study estimates the supply and demand for strawberries in different regions in the United States. We test for changes in demand depending on attributes, such as organic, and estimate seasonal market power in regional strawberry markets.

Consumer demand for strawberries is strong for various reasons. Strawberries are associated with multiple health benefits as a nutritional fresh food containing high levels of fiber, vitamins, and other nutraceuticals with antioxidant and anti-inflammatory properties (Samtani et al., 2019). Additionally, since the early 1980s, U.S. strawberry researchers and producers successfully increased strawberry availability through plant breeding efforts, advanced production techniques, season expansion technologies, and sophisticated post-harvest and transportation infrastructure. In 1980, fresh strawberries were available five to six months out of the year and cost about $2.67 per pint when adjusted for inflation (U.S. Bureau of Labor Statistics, 2024). In 2023, domestically grown strawberries were available year round at an average of $2.80 per pint, a minimal increase in price despite substantial growth in production. In real terms (converting to 2023 dollars using the Federal Reserve Bank's Implicit Price Deflator), processing strawberry prices in 2023 have risen 10% relative to their 2010 price, and fresh market strawberries have risen 13% relative to their 2010 price (see Figure 1).

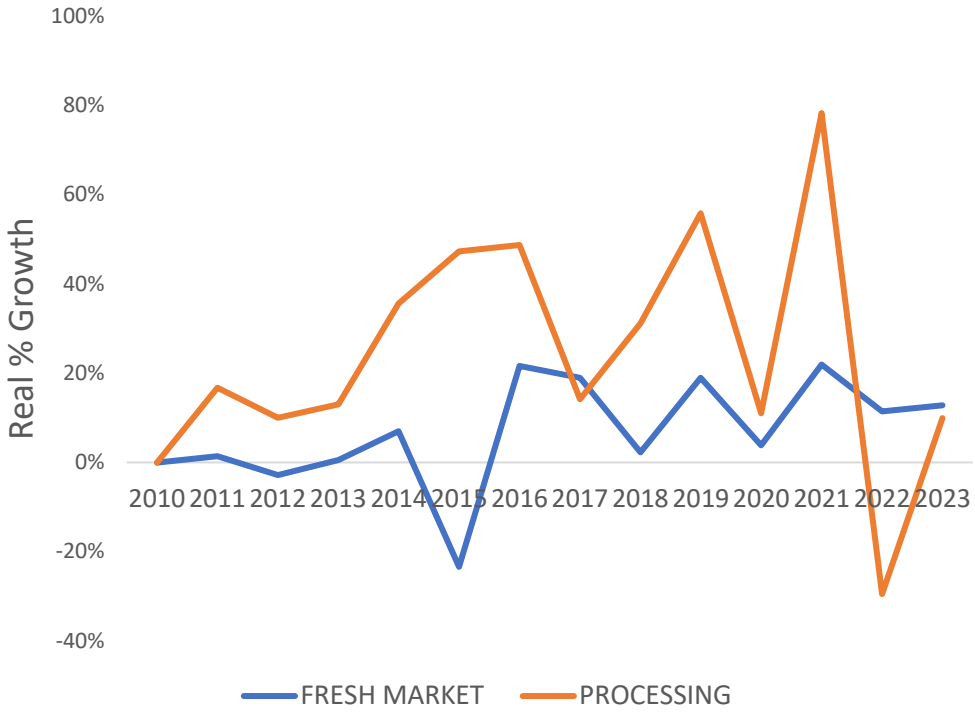


**Figure 1.** Real Price Growth from 2010 to 2023 in U.S. Strawberries

Source: USDA-NASS (2024)

The United States produces about 2.4 billion pounds of strawberries annually, ranking second in the world behind China, and accounts for 13% of global production (Yeh et al., 2023, UNFAO, 2024). About 91% of US strawberries are produced in California between March and November (Yeh et al., 2023). Another 8% of the crop is produced in Florida between December and March. Other strawberry-producing regions, such as the Pacific Northwest (PNW), Midwest, South Atlantic, and Northeast, together produce less than 1% of the total U.S. strawberry crop and supply local direct and processed wholesale markets (Samtani et al., 2019; Yeh et al., 2023).

Often, challenges to strawberry production are economic in nature, specifically, low access to affordable skilled labor and high production costs. While strawberry prices are up 13% since 2010, agricultural input costs are up almost 25% (see Figure 2) (BEA, 2024). In addition to rising production costs, U.S. producers are also affected by imports of strawberries, primarily from Mexico, which put downward pressure on domestic prices (Suh, Guan, and Khachatryan, 2017). From 2020 to 2023, strawberry imports into the United States rose 35% (see Figure 3). In 2023, 588 million pounds of fresh strawberries, 355 million pounds of frozen strawberries, and 95 million pounds of prepared/preserved strawberries were imported (USDA-ERS, 2024).

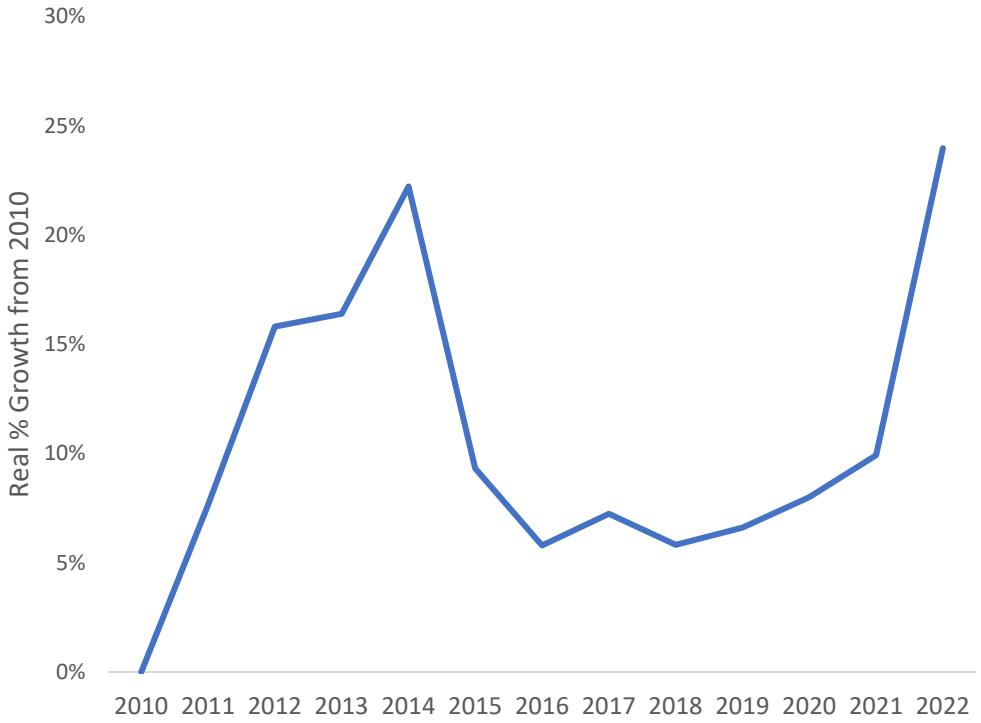


**Figure 2.** Real Composite Farm Production Expenses Growth from 2010, in the United States

Source: Bureau of Economic Analysis (2024)

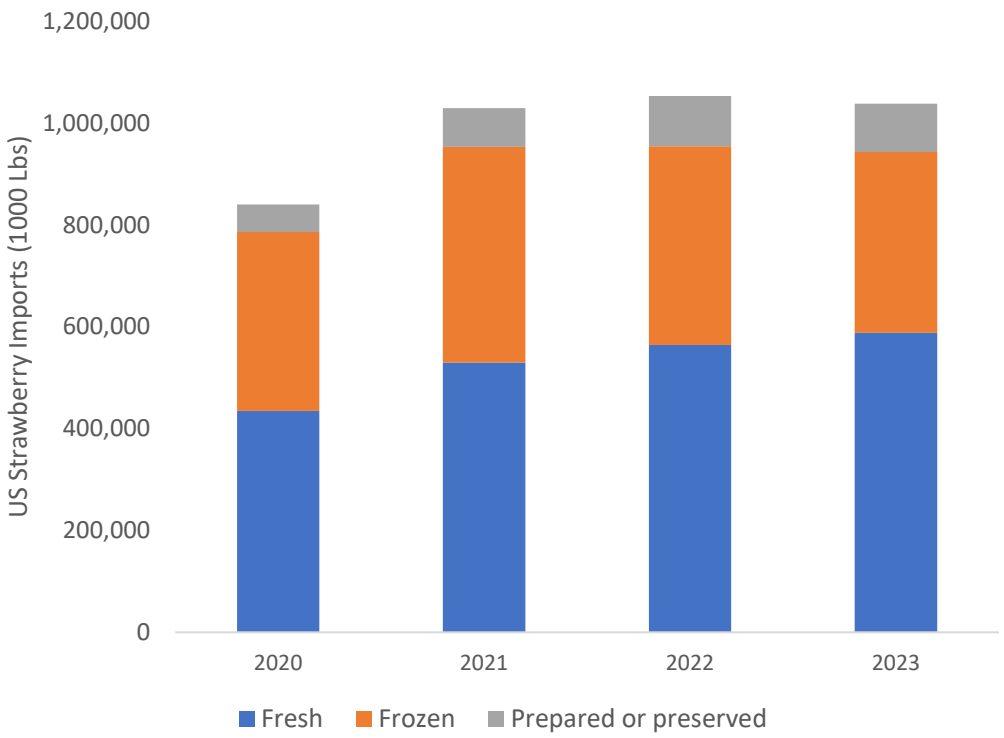


**Figure 3.** U.S. Imports of Strawberries by 2020-2023

Source: USDA-ERS (2024)

The two marketing channels, direct-to-consumer fresh market sales and wholesale processing sales, have somewhat different cost factors and very different demand factors. Understanding the production costs and earnings of both direct marketed and wholesale processing is crucial to understanding the optimal strategies for producers to pursue given the economic forces, both on the supply/cost side and on the revenue/demand side. Growth in agricultural production costs (see Figure 2) have outpaced the price growth of strawberries (see Figure 1), leading to financial stress among U.S strawberry producers. Better understanding of consumer preferences with regard to strawberries will inform the development of differentiated products and potentially create value in the strawberry market (BEA, 2024, U.S. Bureau of Labor Statistics, 2024).

Product attributes contribute to value differentiation for many U.S. commodities. Labels for organic and locally produced food influences consumer willingness to pay for differentiated strawberry products (Chen et al., 2023). The premium for local strawberries may depend upon whether consumers view local strawberries as being fresher or higher quality (He et al., 2021). Also, new crop varieties and technological innovations have successfully extended the harvest seasons for many fruits.

Consumer preferences vary across regions. This paper analyzes differences in demand for fresh strawberries based on the type of strawberry, the season, and the region where it is sold. Furthermore, we estimate market power, which may serve as a proxy for viability and profitability

for producers entering those markets. Economic theory suggests that a lack of market power will lead to a lack of profitability. Therefore, while we do not estimate profitability directly, estimating market power is a strong determinant of profitability. Market power in agricultural supply chains in not uncommon, and it is often seasonal (Steen and Salvanes, 1999; Arnade and Pick, 2000; Richards, Patterson, and Acharya, 2001; Winfree et al., 2004; Acharya, Kinnucan, and Caudill, 2011; Sexton, 2013; Saitone and Sexton, 2017; Azzam and Dhoubhadel, 2022). Also, seasonality is important for commodities like strawberries that are difficult to store (Flaming, Marsh, and Wahl, 2007).

Recognizing the factors that contribute to market power for strawberry growers can be the basis for making production and marketing decisions. This analysis examines regional differences in the United States in the supply and demand of strawberries and looks at potential markets for strawberry producers.

## Methodology

Strawberry price fluctuates by region and season (see Figure 4), and organic fresh strawberries consistently have higher prices than conventional fresh strawberries (see Table 1). To determine the proportion of these price differences that are due to differences in supply or demand, a three-stage least squares regression analysis was performed to simultaneously estimate supply and demand for fresh strawberries and test for premiums associated with organic and/or local designations. This analysis allows us to determine whether price differences are largely due to supply (i.e., differences in cost) or to demand (i.e., differences in willingness to pay) and to avoid endogeneity problems that arise when only supply or demand are estimated. Consumer preference differences and market power differences were analyzed across regions using separate regressions for each region.

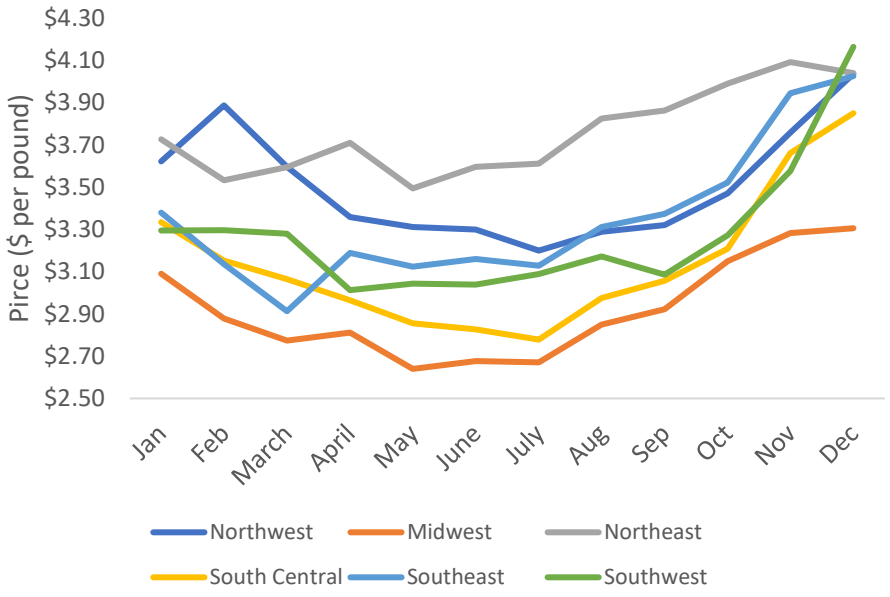


**Figure 4.** Strawberry Prices by Region and Season, 2010–2022, 2022 Real Dollars

Source: U.S. Bureau of Labor Statistics (2024)

**Table 1.** Strawberry Prices by Region and by Non-Organic and Organic Designations (2010–2022, in Real 2022 Dollars)

| | Northwest | Midwest | Northeast | South Central | Southeast | Southwest | Alaska | Hawaii |
|---|---|---|---|---|---|---|---|---|
| Non-organic | 3.01 | 2.64 | 3.24 | 2.76 | 3.05 | 2.84 | 4.06 | 4.73 |
| Organic | 4.47 | 3.89 | 4.98 | 4.02 | 4.13 | 4.14 | 5.60 | 6.18 |

Source: USDA-NASS (2021)

## Econometric Model

Weekly price and quantity data from the USDA Agricultural Marketing Service from 2010 to 2022 were used to perform the analysis. Weighted prices across stores were used for price, and number of stores serve as a proxy for quantity.[1] These data also give the date and region of the sale, package size, and whether or not the strawberries were organic or local.

The empirical specification of the inverse supply function was calculated based on consideration of statistical significance, economic interpretability, and data availability using this formula:

$$ln(p_{it}) = \delta_s + \alpha_0\, ln(q_{it}) + \sum_{y=1}^{12} \alpha_y YEAR_t + \sum_{m=13}^{23} \alpha_m MONTH_t + \alpha_{24} FV_{t-1} + \alpha_{25} GAS_{t-1} + \alpha_{26} FERT_{t-1} + \alpha_{27} AGUN_{t-1} + \alpha_{28} PACK_{it} + \alpha_{29} ORG_{it} + \alpha_{30} LOCAL_{it} + \varepsilon_{it}^{S} \quad (1)$$

where $p_{it}$ represents the real price of strawberries for location *i* in time *t*, $q_{it}$ represents the number of stores. $YEAR_t$ represents year fixed effects and $MONTH_t$ is the month of the sale, which included every month but July. July was omitted because it had the lowest month fixed effect and presumably the least amount of monopoly or oligopoly power. $FV_{t-1}$ is the farmland value,[2] $GAS_{t-1}$ is the price of gas,[3] $FERT_{t-1}$ is the price of fertilizer,[4] and $AGUN_{t-1}$ is the unemployment rate in agriculture.[5] Farmland value, gas prices, fertilizer prices, and the unemployment rate in agriculture are used to estimate the costs associated with producing strawberries. Because of the lag between production decisions and sales, these four variables are lagged one year. $PACK_{it}$ is the size of the package in pounds. $ORG_{it}$, and $LOCAL_{it}$, are dummy variables equaling 1 if they were organic and/or local strawberries; $\varepsilon_{it}^{S}$ is a residual term.

These variables were chosen because they may impact production costs. For example, $FV_{t-1}$, proxies the cost of land and $GAS_{t-1}$, $FERT_{t-1}$, and $AGUN_{t-1}$ help account for production costs. $PACK_{it}$ is included because there are presumably cost differences associated with different

[1] The data is from USDA-AMS. The number of stores is sometimes used as a measure of output or quantity supplied (Bitler and Haider, 2011; Bonanno, 2012). Further, because the price is weighted by the number of stores selling at the price, the USDA is also (implicitly) using the number of stores as the measure of output.
[2] This is an index of average farm real estate value and can be found at https://www.nass.usda.gov/Publications/Todays_Reports/reports/land0821.pdf.
[3] The index for the price of gas can be found at https://fred.stlouisfed.org/series/CUSR0000SETB01.
[4] The index for the price of fertilizer can be found at https://fred.stlouisfed.org/series/PCU325311325311.
[5] Unemployment in the agricultural industry can be found at https://fred.stlouisfed.org/series/LNU04035109.

package sizes. Organic and Local strawberries may also have different cost structures. Year fixed effects control for costs that are trending.

The empirical specification of the demand function was as follows:

$$ln(q_{it}) = \delta_d + \beta_0\, ln(p_{it}) + \sum_{m=1}^{12} \beta_m YEAR_t + \beta_{13} FAO_t + \beta_{14} BANANAS_t + \beta_{15} ORANGES_t + \beta_{16} GROCERY_t + \beta_{17} WAGES_t + \beta_{18} PACK_{it} + \beta_{19} ORG_{it} + \beta_{20} LOCAL_{it} + \varepsilon_{it}^d \quad (2)$$

where $FAO_t$ is the Food and Agricultural Organization food price index. $BANANAS_t$ and $ORANGES_t$ represent the prices of bananas and oranges, respectively.[6] $GROCERY_t$ is grocery store advance retail sales,[7] $WAGES_t$ represents domestic aggregate wages,[8] and $\varepsilon_{it}^d$ is a residual term.

Variables in the demand equation were chosen because they represent determinants of demand and will impact the willingness to pay for consumers. $FAO_t$ represents the price of other food and can be seen as controlling for the relative price of strawberries compared with other food. Banana and Orange prices are included because those can be close substitutes for strawberries. $GROCERY_t$ shows an overall demand of grocery sales. The $GROCERY_t$ variable may be especially important because the data cover the COVID-19 pandemic, when there was a shift toward grocery stores and away from other retail sources. $WAGES_t$ is included to find the effect of income on consumer demand. Consumer demand may differ for package size, organic, or local strawberries due to tastes and preferences, so those variables are also included in the demand estimation. Year fixed effects were also included to control for other changes in demand.

In both the supply and demand specifications, all variables that represent dollar values were converted to December 2022 dollars (the last month of the dataset), and the natural log was taken for all continuous variables. Therefore, because both price and quantity are logged, the coefficient estimate in the regression represents the own-price elasticity of demand.

Estimates of monopoly and oligopoly power in the strawberry market were calculated according to the methods of Arnade and Pick (2000) and Winfree et al. (2004). Briefly, the market power estimate is equal to $\beta_0(e^{-\alpha_m} - 1)$, and the statistical significance of these values were calculated using the covariance matrix and the derivatives of the parameters used in the market power estimate.

[6] These prices can be found at https://fred.stlouisfed.org/series/PBANSOPUSDM and https://fred.stlouisfed.org/series/PORANGUSDM.
[7] The data can be found at https://fred.stlouisfed.org/series/RSGCSN.
[8] The data can be found at https://fred.stlouisfed.org/data/A576RC1.txt.

## Results and Discussion

Summary statistics of the variables are shown in Table 2. Of note is that the mean for LOCAL is only 0.862, indicating that, on average, less than 1% of the strawberries sold are denoted as local strawberries, which makes a robust statistical analysis of local strawberries difficult. It seems likely that the data are not identifying all of the local strawberries, at least not within the region. We acknowledge that due to specific labeling decisions, we may be underreporting local production to some degree.

**Table 2.** Summary Statistics

| Variable | Mean | St Dev | Min | Max |
|---|---|---|---|---|
| ln price | 1.230 | 0.301 | 0.086 | 2.314 |
| ln q | 5.725 | 1.874 | 0.000 | 9.961 |
| Constant | 1.000 | 0.00 | 1.000 | 1.000 |
| January | 0.058 | 0.234 | 0.000 | 1.000 |
| February | 0.076 | 0.265 | 0.000 | 1.000 |
| March | 0.102 | 0.303 | 0.000 | 1.000 |
| April | 0.109 | 0.312 | 0.000 | 1.000 |
| May | 0.115 | 0.318 | 0.000 | 1.000 |
| June | 0.115 | 0.319 | 0.000 | 1.000 |
| August | 0.099 | 0.299 | 0.000 | 1.000 |
| September | 0.079 | 0.269 | 0.000 | 1.000 |
| October | 0.061 | 0.239 | 0.000 | 1.000 |
| November | 0.038 | 0.190 | 0.000 | 1.000 |
| December | 0.029 | 0.167 | 0.000 | 1.000 |
| Farm value | 8.160 | 0.087 | 7.961 | 8.252 |
| Gas | 5.683 | 0.208 | 5.223 | 6.057 |
| Fertilizer | 6.027 | 0.190 | 5.740 | 6.486 |
| Ag unemployment | 9.111 | 3.641 | 3.600 | 21.300 |
| Pack | 1.264 | 0.441 | 1.000 | 2.000 |
| Organic | 0.335 | 0.472 | 0.000 | 1.000 |
| Local | 0.862 | 6.571 | 0.000 | 100 |
| FAO | 4.873 | 0.157 | 4.658 | 5.218 |
| Bananas | 7.169 | 0.082 | 6.977 | 7.430 |
| Oranges | 0.515 | 0.205 | 0.110 | 0.982 |
| Grocery | 4.184 | 0.077 | 4.005 | 4.429 |
| Wages | 9.213 | 0.089 | 9.048 | 9.358 |

Note: Year fixed effect variables are removed for brevity.

The three-stage least-squares estimates of the supply and demand system are presented in Table 3. Most of the statistically significant variables have signs consistent with economic theory, and many of the estimated parameters were statistically significant at the 1% level or better of type I error, based on asymptotically valid Z-statistics and a standard normal asymptotic distribution.

Many of the off-season months are positive and statistically significant in the supply estimation, indicating that supply is smaller in those months. Early- and late-season months are significant for all regions except the Midwest, and early-season months are not significant for the Northeast. The unemployment rate for the agricultural industry is statistically significant for the South Central and Southeast regions. ORGANIC is positive and significant in the supply estimation for every region, implying that part of the price increase for organic strawberries is due to the cost of production. LOCAL was only significant at the 95% level for the Southwest region, possibly due to limited availability of data on strawberries labeled as local.

On the demand side, the estimated own-price elasticities ranged from -2.40 to -8.60, implying that an increase of price by 1% reduces quantity demanded by 0.12% (-8.60 elasticity) to 0.42% (-2.40 elasticity), depending upon the region. FAO food prices, which serve as a proxy for substitute goods, are positively correlated with strawberry demand in all regions at the 95% level, indicating that as prices for substitutes increase, demand for strawberries rises as well. This finding is consistent with standard economic theory, suggesting strawberries are seen as a desirable alternative when other food becomes more expensive. Wages, a proxy for consumer purchasing power, have a negative impact on demand in five regions, suggesting that higher wages lead consumers to substitute strawberries with other, potentially more expensive, food products. The packaging size (PACK) variable was found to be negative and statistically significant across all regions, indicating a preference for smaller packages when priced equivalently per pound.

The coefficient on ORGANIC is positive and statistically significant at the 5% level for the Midwest, Northeast, and Southwest regions. This result implies consumers are willing to spend more for organic strawberries in these regions. In the Northeast, the estimate for ORGANIC is 2.33, implying that consumers are willing to pay 233% more for organic strawberries, which is a much larger estimate than other regions. LOCAL is not statistically significant for any regions, possibly due to a lack of data showing local strawberries.

Estimates of seasonal market power are derived from the monthly parameter estimates and the demand elasticity. A value of 1 represents complete monopoly power, implying the price is set the same as a monopolist would price strawberries. While some of the market power estimations are greater than 1 (as illustrated in Figure 5), a value of 1 is within the statistical confidence interval, with the exception of November and December in the Southeast. Therefore, estimates are not statistically higher than monopoly power with two exceptions. The results show more market power in the U.S. strawberry market in months where supply is low. This finding implies that profitability may increase if strawberry producers could produce strawberries during those months. While there are some regional differences in market power, Figure 5 shows that most differentiation in market power is seasonal.

**Table 3.** SLS Estimation Results for Equation System

| Region | Northwest | | Midwest | | Northeast | | South Central | | Southeast | | Southwest | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Estimate** | **St. dev.** | **Estimate** | **St. dev.** | **Estimate** | **St. dev.** | **Estimate** | **St. dev.** | **Estimate** | **St. dev.** | **Estimate** | **St. dev.** |
| **Supply** | | | | | | | | | | | | |
| Quantity | 0.04 | (0.09) | -0.03 | (0.06) | < 0.01 | (0.04) | 0.01 | (0.05) | 0.07 | (0.06) | -0.06 | (0.03) |
| Constant | 29.18 | (20.88) | -13.16 | (17.86) | -6.60 | (12.63) | 15.05 | (11.98) | 50.91 | (31.05) | 11.44 | (14.30) |
| January | 0.43** | (0.13) | 0.15 | (0.13) | 0.12 | (0.07) | 0.34** | (0.08) | 0.35** | (0.12) | 0.22** | (0.08) |
| February | 0.39** | (0.09) | 0.15 | (0.12) | 0.08 | (0.05) | 0.28** | (0.05) | 0.28** | (0.10) | 0.20** | (0.06) |
| March | 0.26** | (0.06) | 0.10 | (0.09) | 0.03 | (0.03) | 0.16** | (0.04) | 0.16* | (0.07) | 0.11** | (0.04) |
| April | 0.16** | (0.04) | 0.06 | (0.05) | 0.03 | (0.02) | 0.12** | (0.02) | 0.16** | (0.06) | 0.05 | (0.02) |
| May | 0.10** | (0.02) | 0.01 | (0.02) | -0.02 | (0.01) | 0.03** | (0.01) | 0.03 | (0.02) | 0.02 | (0.02) |
| June | 0.04* | (0.02) | 0.01 | (0.02) | -0.01 | (0.01) | 0.01 | (0.01) | -0.01 | (0.02) | 0.01 | (0.01) |
| August | 0.08 | (0.04) | 0.08 | (0.04) | 0.05* | (0.02) | 0.10** | (0.03) | 0.12** | (0.04) | 0.03 | (0.02) |
| September | 0.14 | (0.08) | 0.11 | (0.07) | 0.09** | (0.04) | 0.17** | (0.05) | 0.22** | (0.06) | 0.06 | (0.03) |
| October | 0.22** | (0.09) | 0.17 | (0.11) | 0.14** | (0.05) | 0.28** | (0.08) | 0.34** | (0.10) | 0.12** | (0.04) |
| November | 0.38** | (0.12) | 0.27 | (0.18) | 0.23** | (0.09) | 0.47** | (0.13) | 0.61** | (0.20) | 0.19* | (0.08) |
| December | 0.51** | (0.18) | 0.26 | (0.21) | 0.25* | (0.11) | 0.51** | (0.14) | 0.51** | (0.14) | 0.30** | (0.11) |
| Farm Value | -3.47 | (2.48) | 1.67 | (2.12) | 0.96 | (1.53) | -1.69 | (1.43) | -5.99 | (3.76) | -1.19 | (1.70) |
| Gas | -0.07 | (0.15) | 0.08 | (0.17) | 0.01 | (0.09) | -0.11 | (0.10) | -0.40 | (0.23) | -0.05 | (0.12) |
| Fertilizer | -0.04 | (0.16) | 0.13 | (0.10) | 0.06 | (0.06) | 0.02 | (0.07) | -0.05 | (0.09) | < 0.01 | (0.07) |
| Ag Unemp. | < 0.01 | (< 0.01) | < 0.01 | (< 0.01) | < 0.01 | (< 0.01) | < 0.01* | (< 0.01) | -0.01** | (< 0.01) | < 0.01 | (< 0.01) |
| Pack | -0.13 | (0.12) | -0.20 | (0.15) | -0.19* | (0.09) | -0.11 | (0.08) | 0.06 | (0.19) | -0.20** | (0.06) |
| Organic | 0.45** | (0.09) | 0.34** | (0.12) | 0.40** | (0.05) | 0.40** | (0.07) | 0.51** | (0.13) | 0.32** | (0.05) |
| Local | < 0.01 | (< 0.01) | 0.03 | (0.02) | < 0.01 | (0.01) | < 0.01 | (< 0.01) | < 0.01 | (0.01) | < 0.01* | (< 0.01) |
| **Demand** | | | | | | | | | | | | |
| Price | -2.40** | (0.34) | -7.51** | (0.47) | -8.60** | (0.58) | -4.21** | (0.30) | -6.57** | (0.56) | -5.42** | (0.37) |
| Constant | 170.57** | (29.60) | 118.60** | (32.26) | 69.58* | (28.23) | 140.38** | (20.94) | 100.34** | (33.84) | 58.88* | (28.91) |
| FAO | 2.16* | (0.89) | 2.22* | (0.87) | 1.97* | (0.79) | 2.88** | (0.68) | 1.98** | (0.77) | 3.22** | (0.83) |
| Bananas | 0.96 | (0.76) | -0.60 | (0.86) | -0.48 | (0.69) | 0.82 | (0.51) | -2.56** | (0.82) | 0.68 | (0.64) |

**Table 3 (cont.)**

| Region | Northwest | | Midwest | | Northeast | | South Central | | Southeast | | Southwest | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Estimate** | **St. dev.** | **Estimate** | **St. dev.** | **Estimate** | **St. dev.** | **Estimate** | **St. dev.** | **Estimate** | **St. dev.** | **Estimate** | **St. dev.** |
| **Demand** | | | | | | | | | | | | |
| Oranges | -0.64* | (0.32) | -0.69* | (0.34) | -0.06 | (0.29) | -0.32 | (0.21) | 0.29 | (0.32) | -0.35 | (0.27) |
| Grocery | -0.92 | (0.93) | -2.00 | (1.06) | -0.83 | (0.88) | -1.51* | (0.71) | -1.53 | (0.95) | -0.71 | (0.88) |
| Wages | -19.23** | (3.08) | -10.88** | (3.44) | -5.62 | (3.02) | -15.51** | (2.31) | -7.41* | (3.69) | -6.86* | (3.04) |
| Pack | -1.71** | (0.11) | -3.42** | (0.13) | -3.65** | (0.15) | -2.07** | (0.08) | -3.95** | (0.15) | -2.20** | (0.10) |
| Organic | -0.04 | (0.14) | 0.97** | (0.19) | 2.33** | (0.23) | 0.19 | (0.12) | 0.35 | (0.20) | 0.68** | (0.16) |
| Local | -0.01 | (0.01) | 0.23 | (0.15) | 0.03 | (0.09) | < 0.01 | (0.01) | 0.02 | (0.04) | < 0.01 | (< 0.01) |
| $R^2$ - Supply | 0.642 | | 0.585 | | 0.764 | | 0.705 | | 0.652 | | 0.628 | |
| $R^2$ - Demand | 0.224 | | 0.395 | | 0.278 | | 0.394 | | 0.425 | | 0.315 | |
| Observa-tions | 1,407 | | 1,438 | | 1,515 | | 1,494 | | 1,408 | | 1,575 | |

Notes: *denotes statistical significance at the 95% level. **denotes statistical significance at the 99% level.

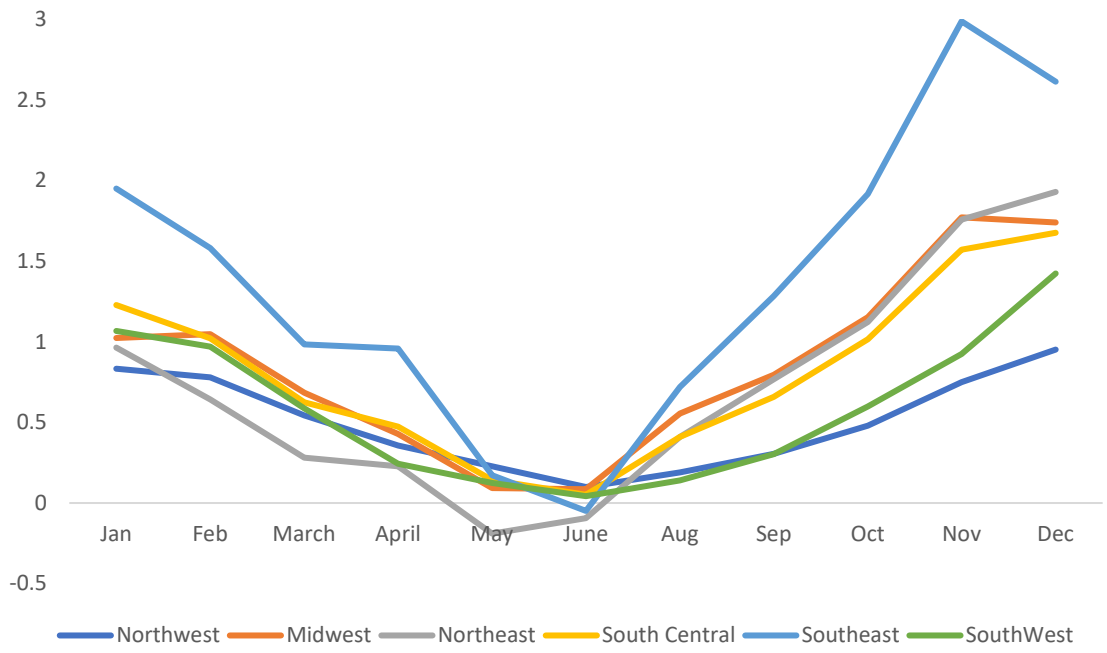


**Figure 5.** Market Power Estimates for U.S. Strawberries by Region and Month, 2010–2022

## Policy Implications

The results of this study offer several significant policy implications for agricultural policy, market regulation, and support for strawberry producers. Policy makers can leverage these four policy recommendations to support strawberry producers, enhance market competitiveness, and promote consumer welfare.

*Support for Organic Strawberry Production*

The price premiums for organic strawberries for some regions indicate a strong consumer willingness to pay for organic products. Policy makers could consider expanding subsidies or offering tax incentives for organic certification for growers wishing to implement organic practices and cater to strong demand for organic strawberries. Programs that help lower the cost of organic farming methods—such as grants for organic pest control, soil management, and plant nutrition—could lower the entry barriers for smaller farms. Additionally, outreach programs educating farmers on the long-term profitability of organic strawberries, especially in regions like the Northeast, could further encourage organic supply.

*Promoting Market Access for Off-Season Strawberries*

The study highlights the potential for producers to exercise market power and increase profitability during off-season months when strawberry supply is low. Policy makers could incentivize the development and adoption of new strawberry varieties and methods for use in off-season conditions, extending the domestic strawberry supply and smoothing out seasonal price fluctuations. Additionally, investment in greenhouse or controlled-environment agriculture (CEA) infrastructure could enable year-round production, mitigating the effects of seasonal market power and stabilizing consumer prices.

*Addressing Local Strawberry Production Challenges*

The lack of significant evidence showing consumer demand for local strawberries and limited data on local strawberry sales suggest a need for policy intervention to bolster local agricultural markets. Policy makers can enhance consumer awareness of locally grown produce through labeling initiatives like "local" or "regional" certifications that emphasize the benefits of supporting local farms, such as fresher produce and reduced carbon footprints. Additionally, providing financial support to local farmers via grants or low-interest loans for infrastructure improvements, such as cold storage or transportation logistics, could increase the supply and visibility of local strawberries in retail markets.

Expanding farm-to-school or farm-to-institution programs could also serve as a reliable market for local strawberries, including processed fruit. These programs encourage public institutions, such as schools, hospitals, and universities, to procure locally grown fruits and vegetables, creating a stable demand for local strawberries.

*Addressing Data Gaps in Local Food Markets*

The lack of significant results for local strawberries likely stems from limited data on their market presence. Investments in more robust data collection systems that track the sales, prices, and quantities of local produce across regions would allow for more targeted agricultural policy interventions and provide valuable insights for farmers and retailers. Establishing a standardized reporting system for local food markets could help policy makers and researchers better understand the dynamics of local agriculture and craft more effective policies to promote local farming.

## Discussion

The results of this study offer several important implications for both producers and policy makers in the U.S. strawberry market. First, the price premium for organic strawberries suggests a robust consumer demand for organic products across some regions, which aligns with broader trends toward health-conscious food choices. This finding underscores the opportunity of organic strawberry farming, particularly when sold in Northeast markets, where consumers demonstrate a high demand and therefore a willingness to pay substantially more for organic products. However, the lack of significance for local strawberries in most regions may indicate that consumers either

do not prioritize locally grown strawberries or there is insufficient data on local strawberry production. More granular data on local strawberry production and sales could provide better insights into whether local strawberries command a premium in specific regions. However, while the data on local strawberries may be insufficient, it could also be a weak signal that consumers would not discount strawberries from other regions.

The inelastic demand for strawberries across regions, coupled with the substantial price premiums for organic varieties, indicates that producers may be able to charge higher prices without significantly reducing sales. These factors are especially relevant in off-peak seasons, where supply limitations result in greater market power and higher profitability. Producers may benefit from extending the growing season or investing in new strawberry varieties that can be cultivated during these off-peak months. This practice could increase profitability by capitalizing on market power during periods of low supply, as indicated by the significant market power estimates in certain regions, suggesting that if it is agronomically feasible, it may be profitable for growers to develop off-season varieties.

Conversely, the competitive nature of the peak-season strawberry market suggests limited room for price increases during these months. Producers face stiff competition, and the data indicate that retail markets are highly competitive, certain times of the year. The low levels of market power during peak months may suggest that efforts to differentiate products, either through organic certification or other means, may be necessary to maintain profitability.

The study's findings on packaging preferences also provide valuable insights for retailers. The negative coefficient for package size indicates that consumers prefer smaller packaging, which could reflect concerns over waste or a desire for fresher products. Retailers may want to consider offering smaller packaging options, especially in regions where this preference is more pronounced.

## Conclusions

The data show consistently higher prices across all regions for organic strawberries over conventionally produced strawberries. When estimating supply and demand, the results show that increases in price for organic strawberries are due to a combination of supply and demand issues, and depend on the region. An increase in consumer demand for local strawberries is not statistically significant for any region. However, this finding may be due to a lack of data on local fresh strawberries. These results have direct implications for growers.

The results also show that there is market power of varying degrees in the off season for strawberries in every region except the Midwest. Because market power can be a proxy for economic profits, there are opportunities for generating market power for strawberries produced outside of typical harvest seasons. Conversely, the data seem to imply that the retail market is quite competitive during the peak season, which may have implications for the future production of strawberries and the viability of new strawberry varieties that produce strawberries during the off season.

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