Business models for farming

A PRODUCE PRICE ANALYSIS OF REGIONAL OHIO VALLEY PRODUCE AUCTIONS

Presenting Author, Brad R. Bergefurd, The Ohio State University

Lead Author, Alex Butler, University of Kentucky

Author, Dr. Timothy Woods, University of Kentucky

bergefurd.1@osu.edu
(740) 289-3727
1864 Shyville Road
Piketon, Ohio 45661

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Abstract:

Produce auctions in the Ohio River Valley play an important role in the marketing of produce in the region. While smaller than urban-based terminal markets, these agriculture commodity aggregation points serve both local and regional buyers, providing access to wholesale markets otherwise too distant for smaller scale farmers in the area. Similar auctions have continued to start or expand throughout the Mid-South. The prices, quality, and quantity of the products distributed through these auctions vary throughout the marketing season and, subsequently, different kinds of buyers are attracted to bid. This study examines the evidence for structural market differences between early season, when prices are systematically higher, and peak season that can arise from different buyer needs relating to volume and distribution in local versus more regional outlets. Price and quantity records from two of the larger Kentucky auctions, the Fairview and Lincoln County Produce Auction are analyzed for seven different produce commodities during early and peak season. Four years of data are evaluated using structural difference regression equations to test for early versus peak temporal differences as well as specific auction effects. This information can assist produce auctions to establish market coordination with season extension and variously scaled market buyers.

Keywords: produce auction, local produce, wholesale, marketing

Introduction:

Around the Ohio River Valley and some of the Northeast, produce auctions play an integral role in the local and regional food system, having a significant contribution to

the area farmgate by acting as a horticultural aggregator for producers and buyers of various scale and product scope. Almost daily throughout the region buyers and sellers are making exchanges using the auctions to conduct business as either their primary market or as a supplementary market. **Image 1** shows the approximate geographic location of produce auctions in their corresponding states.

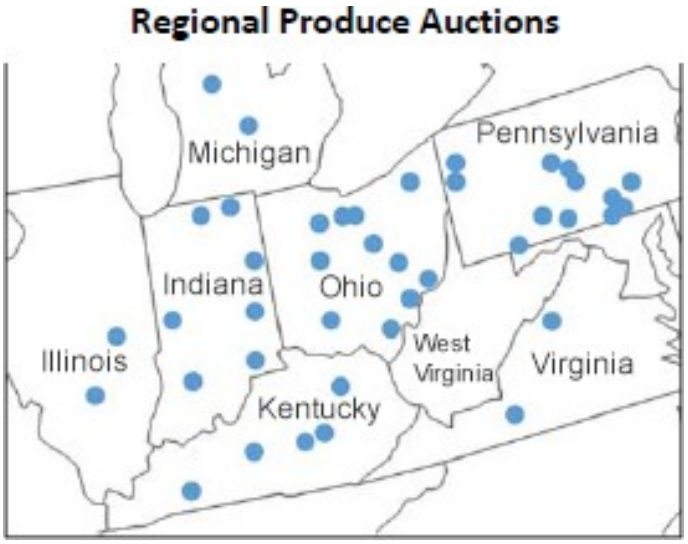

Image 1: This image represents the approximate geographic location of the regions produce auctions.

Source: the University of Kentucky, Center for Crop Diversification, Three-Year Average Prices & Quantities at Kentucky Produce Auctions: 2014-2016, June 2017

Kentucky has five produce auctions around the state with locations in Christian, Lincoln, Casey, Hart, and Bath counties that are responsible for over $5,000,000 worth of sales of mostly Kentucky producers (Wolff, Bechu, Woods, Butler, 2017). These produce auctions are intermediary markets serving as an aggregator for primarily local buyers and sellers. Aside from fruit and vegetables, these auctions sell floricultural products as well as conducting consignment auctions. Although Amish and Mennonite communities manage the operations, the auctions themselves operate like a typical English Auction where an auctioneer takes increasing bids for a product or "lot[1]" until only the highest bidder is willing to pay. The auctions will separate products into lots for more accurate

[1] A 'Lot' is terminology used by produce auctions to indicate the amount a bidder is purchasing. These are typically denoted by a lot number. (https://www.liveauctioneers.com/terminology)... An individual object or group of objects offered for sale at auction as a single unit. (https://www.sothebys.com/en/glossary)

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traceability in addition to aggregating, or grouping products, into the most efficient form of sale.

The buyers and sellers that participate in this market channel vary widely in scale and scope, in addition to the frequency of their participation. A 2012 study conducted by the University of Kentucky Center for Crop Diversification found that 20% of Kentucky producers sold more than 10% of their products through the auctions (Ernst 2015). Producers often see benefits in using the auctions by way of a set day and time for delivery, product aggregation, and test marketing new products but have the risk of price uncertainty. Likewise, the broad range of buyers found participating in produce auctions include farmers' market vendors, food service providers, restaurants, on-farm markets, private citizens, produce wholesalers, and roadside produce vendors.

With season extension programs, such as the Environmental Quality Incentives Program (E.Q.I.P.), farmers are capable of utilizing an energy conservation benefit that reimburses the purchasing cost of a high tunnel. Kentucky's fruit and vegetable growers are frequently adopting high tunnels, more than 500 as of 2012[2], making it necessary for auction managers to coordinate with their producer base to ensure an organized market introduction. An unorganized influx of crops into the auction has the potential to create issues for producers, buyers, and the auctions as a business.

Examining structural breaks or "changes," is common amongst time series analysis with a tremendous amount of statistical analysis and econometric literature produced over the last 60 years (Perron 2006). Understanding price flexibilities as the market price response to product shortage and surpluses, within the horticulture industry, price flexibilities are often thought to be different throughout a season, but analysis of these data has been extremely limited. This study examines the evidence for structural market differences e between early season and peak season. During the early season, prices are systematically higher while during the peak season different buyer needs relating to volume and distribution in local versus more regional outlets reflect lower prices.

Price and quantity records from two of the more significant Kentucky auctions, the Fairview and Lincoln County Produce Auctions, are analyzed for seven different produce commodities during early and peak season. These auctions are the two primary Kentucky auctions and have the highest volume of transactions of fruit and vegetables. Four years of data are evaluated using structural difference regression equations to test for early

[2] https://www.nrcs.usda.gov/wps/portal/nrcs/main/ky/programs/financial/eqip/

versus peak temporal differences as well as specific auction effects. This information can assist produce auctions to establish market coordination between producers with season extension operations and variously scaled market buyers.

Data

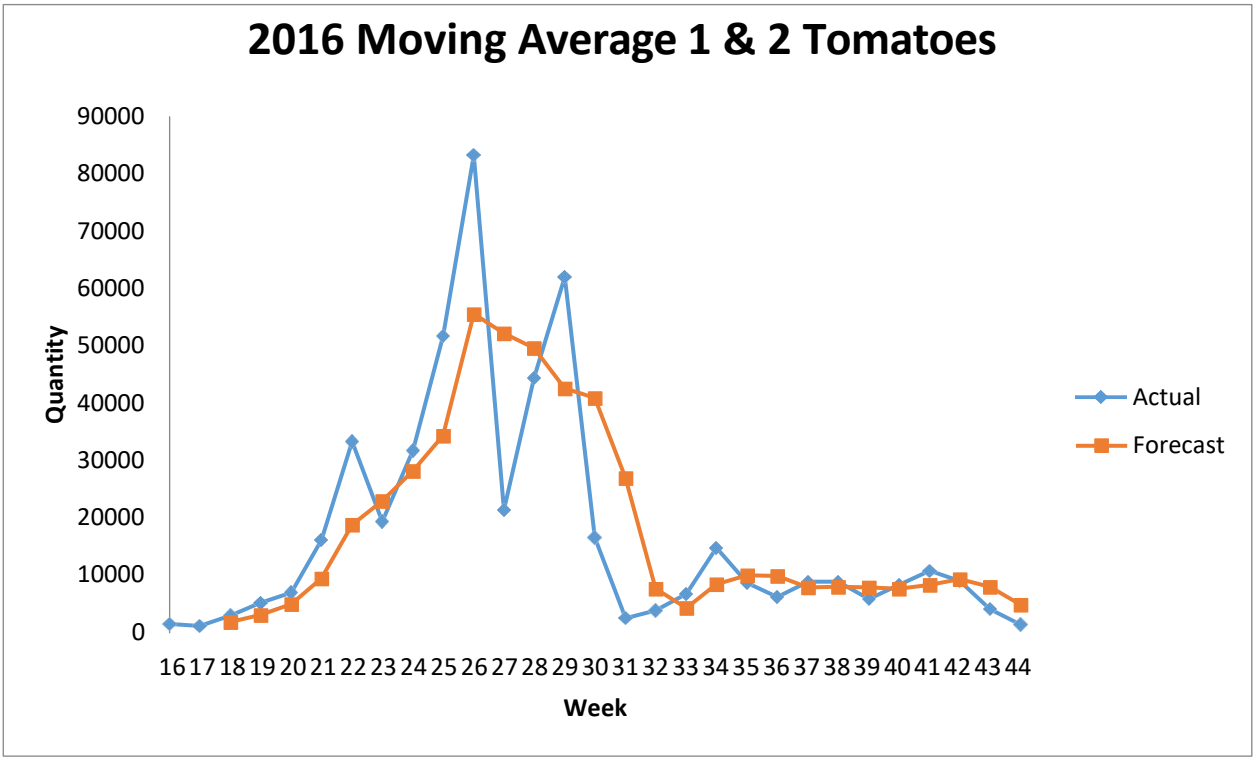
Kentucky Produce Auction transactions include products ranging from fruit and vegetables to floriculture and hay. After each auction, the manager sends the daily report to The University of Kentucky, Center for Crop Diversification to summarizing the description of each product, the quantity sold, the unit of volume or mass, the highest price, the average price, and the lowest price.

Fairview and Lincoln County Produce Auctions were chosen for this analysis as they are the two largest auctions in the state and sold a combined $5.3 million in commodities during the 2016 season (Wolff, Bechu, Woods, Butler 2017). The distance between these two auctions is approximately 200 miles, which is assumed to be a great enough distance to prohibit arbitrage or other forms of market manipulation which could negatively affect the results of this study.

This study examines seven different wholesale products from 2014 to 2017 including Grade No. 1 and Grade No. 2 tomatoes, small and canner tomatoes, sweet corn, watermelon, apples, peppers, and cantaloupe. These particular crops were chosen to conduct the model due to their uniformity in season long sales and product volume which contributed to adequate study sample size. Other crops sold have short seasonality and low sales volumes. Transforming the raw data showed many irregularities in temporal terms (sometimes auctions are open every other day, and sometimes they're open every day) and in spatial terms (between both auctions varieties, quality, size, and packaging can be different.)

To determine the parameters of the early and peak portions of the season a three-week moving average of the individual commodities quantity was conducted. When the actual quantities have achieved three consecutive weeks above the moving average, this indicates the end of the early season. Conversely, when the actual quantity falls below the moving average for 3 weeks then the end of peak season is indicated. The seasonal

distinction is further represented in Graph 1 where peak season starts on week 20 and ends on week 32.



Graph 1: This graph shows the weekly and three-week moving average in 2016 for Grade No.1 and Grade No. 2 Tomatoes at the Fairview auction.

Methodology

The model used to conduct this study was explicitly designed to measure the s effect of quantity on price during the early and peak portions of the marketing season for the individual commodities. Because of its convenient properties such as measuring elasticity (Hill, Griffiths, Judge, & Reiman, 2001) and popularity when examining demand functions, a Log-

Log Model was chosen to perform the regression. After making this determination the final stage of cleaning the data is to execute logarithmic transformation for price and quantity and to assign a dummy variable for early and peak season. With this transformation, we can see the direct impact of the variation of quantity on the variation of price in percentage form, or the elasticity of the variables.

To study price as a function of quantity, a multiple regression must be conducted with the objective of testing whether the coefficients in "peak" and "early" season are different. The equation used in this study is represented below:

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$$\text{Ln}(P_t) = \beta_1 + \beta_2 D_t + \beta_3 \ln(P_t) + \beta_4 \ln(Q_t)$$

Where:

$\text{Ln}(P_t)$ logarithm of price at the time T

$\text{Ln}(Q_t)$ logarithm of quantity at the time T

D_t the dummy variable:

$D_t = 1$ if early season

$D_t = 0$ if peak season

it is important to thoroughly examine all regressions and compare coefficients of the multiple regression. During the early season, the linear equation is:

$$\ln(P) = (a_1 + a_2) + (b_1 + b_2) \times \ln(Q)$$

while the equation for peak season is: $\ln(P) = a_1 + b_1 \ln(Q)$.

This study analyzed Fairview and Lincoln auctions separately as it is assumed the auctions are not entirely homogenous and some unmeasurable may affect the outcome.

Results and Interpretation

Based on primary observations more than half the crops selected indicate some level of significance in the relationship between quantity and price over time. Interestingly, some crops like sweet corn at both auctions and apples at Lincoln County, which are rarely produced using seasonal extension operational practices, show no significance in the relationship between quantity and price over time.

The price flexibilities of the crops show individualized results. For instance, prices for Fairview and Lincoln grade 1 and 2 tomatoes and canning tomatoes are more flexible during the peak season than in the early season. Fairview apples and peppers prices are more flexible in the early season. The data suggests that when prices are more flexible in the early season, quantityhas a significant effect on price illustrating that a sudden influx of product into the market may erode price.

Peppers are often a commodity grown using seasonal extension operations (Reeves 2016) and in both Fairview and Lincoln, having some level of significance in the

relationship between quantity and price over time, early season prices are more flexible than price in the peak season. This being the case gives cause to the idea that commodity entry into these markets may need to be examined closely in the near future to prevent producers from being unable to capitalize on the potential for a premium price in the early season.

Conclusion

Ohio Valley produce auctions have been an active market for area producers for many years and are often continuing to improve operation to better meet the needs of their participants. Though they are managed and operated by Amish communities the auctions work with the University of Kentucky to provide valuable information to producers and buyers. This information is now able to be used to conduct research to better understand Kentucky's horticulture industry in addition to helping those whom operate within it.

With Ohio Valley fruit and vegetable producer's rapid adoption of season extension operational practices, it is critical to examine these markets and the behavior of their commodities. If to many producers invest in season extension techniques and produce similar crops with the intention of capitalizing on early season price premiums, price flexibilities could make purchasing more difficult.

Little has been done to examine the price flexibility of commodities at producers auctions. For this paper a multiple log0log regression analysis was conducted measuring the relationship quantity has on price during the early and peak portions of the marketing season. Seven commodities from Fairview and Lincoln County Produce Auctions were examined with this model using four years of data collected from the University of Kentucky Center for Crop Diversification.

This analysis was conducted to determine if there is evidence of structural market differences between early season, when prices are systematically higher, and peak season that can arise from different buyer needs relating to volume and distribution in local versus more regional outlets. Structural market differences are evident in this analysis as indicated by price flexibilities of commodities like Peppers and Small Cantaloupe. The same is not the case for all crops as represented by sweet corn which has a somewhat flat and consistent quantity throughout the marketing season.

This information can be valuable to both produce auctions and their participants. With further analysis the auctions can use this information to determine at what level of

early season quantities can prices hold their early season premium. Adequate market coordination between producers with season extension production practices and various scaled buyers is critical to keep the early market premiums from eroding.

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