

Research Progress Report

TITLE: Organic Apple Price in Response to Crop Size Supplied to the Market

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DATE: (period which report covers): October, 2005- September 2006

KEYWORDS: Market, price response, grade, crop size

ABSTRACT (Maximum of 250 words in length):

In this analysis, we study the organic apple price response to crop size supplied to the market. We use the sales data from November 10, 2003 to September 8, 2005, organized by the Wenatchee Valley Traffic Association, the most complete dataset available for WA apples. The apples are from both Wenatchee and Yakima, and the five biggest varieties, Red Delicious, Golden Delicious, Fuji, Gala, and Granny Smith, are analyzed, while the other varieties do not have enough data for the analysis.

During this period, the low grade apples (US Extra Fancy or lower) sold to market account for about 3.3% in volume and 2.6% in value. The crops sizes have a negative impact on prices generally. Especially, the crop size of the lower grade apples can have a negative impact on the price of higher grade apples for all varieties except Gala and Red Delicious, for which the impact is insignificant. However, based on the market elasticities, only Golden Delicious will benefit from a higher sales value if the lower grade apples are removed from the market, assuming zero cull values for these fruits. The sales gain will be less than \$10,000 over all.

OBJECTIVES:

1. To organize recent market price data for Washington organic apples including Red Delicious, Golden Delicious, Fuji, Gala and Granny Smith;
2. To estimate the percentage of low grades apples marketed in recent years;
3. To study the relationship between crop size of the lower grade apples and the price response of higher grade apples; and
4. To predict the price boosting in this year (or the future) by a reduction in lower grade supplies.

PROCEDURES:

1. Market packout data including prices and quantities are collected, organized, and aggregated over packaging styles.
2. The relevant grades for organic apples includes US#1 (very low in quantity), US fancy, US extra fancy, WA fancy, WA extra fancy, WA extra fancy #1, WA extra fancy #2, and WA extra fancy premium. The first three are considered low grades. We also classify all sizes into small (<125), larger (>88), and medium categories. The percentages of these lower grade and small size apples are calculated.
3. The inverse demand function approaches will be taken to conduct regression analysis using price as dependent variables and quantities and other impacting factors as explanatory variables.
4. Assume a few scenarios of crop size reduction of the lower grade apples, and calculate the price response for higher grade apples.
5. The results will be reported to growers in extension bulletin, growers' magazine, growers' conference and/or other appropriate outlets.

PROGRESS TOWARDS OBJECTIVE:

The project has been completed. We have achieved all the objectives listed in the proposal, followed the procedures in general with some modification based on the results.

Objective 1:

The most complete Washington organic apple sales data is collected from the Wenatchee Valley Traffic Association for the period of November 10, 2003 to September 19, 2005. Although many varieties are recorded in the dataset, some of the new ones have too few transactions and small quantities to be analyzed statistically. We only analyze and report the five biggest varieties: Red Delicious, Golden Delicious, Fuji, Gala, and Granny Smith. There are totally 17, 908 entries, each of which represents the total packout transactions of one size-grade apples sold with a particular package type, for a particular variety, and from a particular storage during the week.

The sizes in the dataset range from 30 to 198. We categorize apples into three sizes: the large size (80 and larger) accounts for 34.61% of total boxes, the middle size (88 to 125) accounts for 39.09% and the small size (138 and under) accounts for 26.30%. Grades appear in the data range from the lowest US#1, US Fancy (USF), US Extra Fancy (USXF), Washington Fancy (WAF), and Washington Extra Fancy #1 (WAXF#1) , #2 (WAXF#2), and Premium (WAXFP). Any grades lower than WAF are considered a low grade in this analysis. There are six different pack types: Tray Pack (TP), Bag (BG), Euro Pack (EU), Cell Pack (CP), Heavy Pack (HP) and Triwall (TW). There are also two types of storage, Controlled Atmosphere (CA) storage and the Regular (RG) cold storage.

Because the actual weight of each type of package is different, we convert all quantity units into a standard 42 pound box (thereafter referred to box). There are altogether 1,870,283 boxes of apples reported and the prices range from \$5.40/box to \$76.36/box with a weighted average of \$21.59/box.

Objective 2:

The low grade apples are marketed as fresh for each of the varieties (Table 1). For the five varieties over the two years, about 3.34% of apples are in grade US Extra Fancy or lower. Fuji has the highest percentage, 8.77%, in the lower grades, followed by Granny Smith, 4.31%, and the other three varieties each has less than 2% in the lower category. Because the prices of these grades are lower, the sale revenues they bring to the industry only account for 2.59% of the total. They range from 6.86% for Fuji down to 0.78% for Red Delicious.

Objective 3:

The inverse demand function approaches are taken to conduct regression analysis using price as dependent variables and quantities and other impacting factors, such as size, grade, crop year, storage type, package type and seasonality, as independent variables.

Using Fuji as an example, the details of the price response is explained in the following. For Fuji apple prices (Table 2), crop year 04/05 shows \$0.09 lower than the year before for the Washington Extra Fancy Premium. Medium sized apples have two to nine cents price premium over the small sized apples, and the large sized fruits have six to ten cents premium. The Euro Pack price premium can be as high as \$1.42 over the Tray Pack, while the Bagged apple prices are \$0.06 to \$0.24 lower than the Tray Pack.

The prices of each grade react to the quantity of own grade negatively, means there is an opposite relationship between the price and quantity of apples in each grade. The quantity of low grades (all grades in the US category) does have a negative effect on WAXFP and WAXF prices, the two highest priced fruits. A 1% increase in the total boxes of low grades apples causes 0.029% and 0.015% fall in WAXFP and WAXF1 prices, respectively.

We also observe that the prices of apples in Regular storage decrease about five cents each month since harvest, indicating the quality of the fruits decreases overtime without being kept in CA storage. This makes their prices to fall below the prices of apples from Controlled Atmosphere after four months of harvest.

When the seasonality effects are modeled and relaxing the linear time trend, the signs and magnitudes of the most coefficients remain similar. The quality decreasing issues for apples in regular storage are shown by the negative and increasing in size of the coefficients of combined seasonal and RG dummy variables. However, for apples in CA storage, prices actually increase over time caused by the fact that all the supply of fruits (organic or non-organic, apples or other fruits) reduces after early fall and prices go up. The seasonal patterns of prices are shown in Figure 1 for grades WAXFP and WAXF#1.

Table 3 reports the price responses for all the other four varieties for WAXFP, WAXF#1 and WAXF#2 only. We only highlight a few interesting results in the following. More details are provided in the technical report.

For all these varieties, the 04/05 crop year price is slightly lower than the year before. There were almost no WAF for all of the varieties and no WAXF#2 for Granny Smith, and Red Delicious. The large sized apples have price premiums over the small apples basically. The Euro Pack apples have a price premium over the regular Tray Pack apples, while the Bagged apple prices are lower than the Tray Pack in general.

The quantity of low grades does have a negative effect on high graded apple price for Granny Smith and Golden Delicious only, but not for Red Delicious and Gala.

Objective 4:

The 0.029 and 0.015 price elasticities for Fuji suggests that if low grade apples in crop year 04/05 are reduce by 1% which is 250 boxes, the prices of WAXFP and WAXF will increase by \$0.00015/lb, and \$0.00008/lb. This trade-off converts to a reduction in low grade apple sale of \$4109.32 (assuming not selling as cull but just disposing them), and a sale increase of WAXFP and WAXF in \$1067.20 and \$245.88, respectively. Therefore, market less low grade apples will not make the whole industry more profitable. Similarly, for Granny Smith, if low grade apples marketed in crop year 04/05 reduce by 1% which is 45 boxes, the price of WAXFP will increase by \$0.00008/lb. This trade-off will not make the whole industry more profitable.

For Golden Delicious, if low grade apples marketed in crop year 04/05 reduce by 1% which is 42 boxes, the price of WAXFP will increase by \$0.000096/lb. This trade-off will make the whole industry more profitable because the reduction in low grade apple sales of \$564.37 is less than the increase of WAXFP sale of \$662.94. The total sales gain of for this variety will then be \$9,857 if the entire low grade apples are removed from the market.

OUTPUTS

A report submitted to Wenatchee Valley Traffic Association

A report published on web: http://www.agribusiness-mgmt.wsu.edu/AgbusResearch/Apple_OrganicPrice.htm

A report submitted to WSU Wenatchee Extension

A short version submitted to the magazine American and Western Fruit Grower. The editor said he would try to make it into the next issue if space permits.

IMPACT (In what way has your work influenced organic agricultural practices, economics/marketing and environmental stewardship):

INSTITUTION: WSU

STATE: WA

FUNDING AMOUNT(S): \$7892 (CSANR)

Table 1. Quantities and Sales between November 2003 and September 2005

	Quantity	Percent Weight			Sale	Percent by Sale	
		Over all varieties	Low Grade	Small Size		Low Grade	Small Size
	(million pound)	(%)	(%)	(%)	(million \$)	(%)	(%)
Red Delicious	15.16	19.30	1.12	30.95	6.70	0.78	28.95
Granny Smith	9.59	12.20	4.31	27.29	5.19	2.73	21.72
Golden Delicious	14.29	18.19	1.72	22.91	7.35	1.20	17.98
Gala	23.47	29.88	1.66	34.70	12.46	1.36	28.84
Fuji	16.05	20.43	8.77	12.07	8.68	6.86	9.75
Total	78.56	100	3.34	26.30	40.38	2.59	21.86

Table 2. Fuji Apple Price Responses to Quantity and Other Attributes

	WAXFP	WAXF#1	WAXF#2	WAF	USXF
Constant	0.63***	0.63***	0.60***	0.74***	0.50***
DY(2004)	-0.092***	-0.021	-0.31	-0.080	0.038
DM	0.036*	0.091***	-0.012	-0.013	0.021*
DL	0.062***	0.098***	N/A	N/A	N/A
DEU	0.041***	0.061***	1.42***	1.04***	N/A
DBG	-0.15***	-0.059*	-0.24***	N/A	-0.0090
D1	0.17**	-0.12	N/A	N/A	0.20***
D2	-0.0069	-0.064	0.19	N/A	N/A
D3	0.085	-0.037	0.41***	-0.20**	-0.059***
D4	0.16**	0.061	0.42***	0.016	0.00044
D5	0.072	-0.091	0.43***	-0.0018	N/A
DRG	0.046	0.73***	-0.051	-0.10**	-0.032*
D1*DRG	N/A	-0.42**	N/A	N/A	N/A
D2*DRG	N/A	-0.71***	N/A	N/A	N/A
D3*DRG	-0.11***	-0.78***	-0.041	N/A	N/A
D4*DRG	-0.31***	-1.06***	-0.10	N/A	-0.089**
Q _{WAXFP}	-0.000020	-0.000026***	0.000002	0.000015	-0.000020***
Q _{WAXF#1}	-0.000040***	-0.000086***	-0.000023	-0.000059***	0.000000
Q _{WAXF#2}	0.000090***	0.000065***	-0.00014	0.00030***	0.00012***
Q _{WAF}	0.000087	0.00020***	-0.00013	-0.00041**	0.00020
Q _{LowGrade}	-0.000036***	-0.000030***	0.00014**	0.000081	-0.000096**
Number of observations	717	603	88	51	235
R ²	0.57	0.61	0.72	0.90	0.58

Note, ***, ** and * mean statistically significant at 1%, 5% and 10%, respectively.

Table 3. Price Responses to Quantity and Other Attributes for Gala, Reds, Golden and Granny

	WAXFP	WAXF#1	WAXF#2	WAXFP	WAXF#1	WAXF#2
Gala			Red Delicious			
Constant	0.75***	0.70***	0.56***	0.49***	0.45***	
DY(2004)	-0.08***	-0.12***	-0.20**	-0.073***	0.0056	
DM	0.07***	0.062***	0.037	0.055	0.11***	
DL	0.17***	0.12***	0.10***	0.043	0.097**	
DEU	0.09***	0.083***	0.28***	0.08***	0.16***	
DBG	-0.12***	-0.04**	0.30***	-0.0044	0.092**	
D1	-0.24***	-0.17**	-0.03	0.0059	-0.093*	
D2	-0.25***	-0.16***	N/A	-0.11	-0.13***	
D3	-0.22***	-0.09	0.21***	-0.028	0.0098	
D4	-0.11*	-0.00086	0.26***	-0.033**	0.007	
D5	-0.046	0.075	0.12	-0.014	0.024	
DRG	-0.07	-0.0042	0.073*	0.082	0.079*	
D1*DRG	0.11	0.095	N/A	-0.02	0.029	
D2*DRG	0.11	0.0059	N/A	N/A	N/A	
D3*DRG	0.078	-0.078	-0.19**	-0.092	-0.20***	
D4*DRG	N/A	N/A	N/A	-0.14*	-0.32***	
Q _{WAXFP}	0.000005	-0.000006***	-0.000025**	-0.000037***	-0.000037***	
Q _{WAXF#1}	-0.000002	-0.000006	0.000002	0.00003***	0.000006	
Q _{WAXF#2}	0.0001***	0.00008***	0.000000	N/A	N/A	
Q _{LowGrade}	0.000033	0.000028	0.00012***	-0.000058	-0.000057	
R ²	0.59	0.47	0.59	0.25	0.53	
Granny Smith			Golden Delicious			
Constant	0.88***	0.50***		0.42***	0.61***	0.46***
DY(2004)	-0.068***	-0.026		-0.058***	-0.043	-0.032
DL	N/A	N/A		0.20**	-0.0024	0.0085
DM	-0.02**	0.013		0.22**	N/A	N/A
DEU	0.037***	0.17***		0.03***	0.052*	0.12***
DBG	-0.22***	-0.10***		0.04	-0.092***	N/A
D1	-0.23***	-0.11		-0.12*	0.011	0.052
D2	-0.31**	0.049		-0.17**	-0.12**	N/A
D3	-0.18	0.11		-0.026	-0.063	0.19**
D4	-0.15	0.17**		0.042	0.022	0.36***
D5	-0.19	N/A		-0.0096	-0.086*	0.19*
DRG	0.064	0.28***		0.12*	0.01	0.083
D2*DRG	-0.018	-0.25**		N/A	0.043	N/A
D3*DRG	-0.13	-0.27***		-0.20***	-0.0081	-0.17
D4*DRG	N/A	-0.48***		-0.49***	-0.24***	N/A
Q _{WAXFP}	N/A	N/A		-0.000002	-0.000015***	-0.000009
Q _{WAXF#1}	0.000009	-0.000013***		-0.000054***	-0.0001***	-0.00011***
Q _{WAXF#2}	0.000008	-0.000046		0.000087***	0.00014***	0.000020
Q _{LowGrade}	-0.000036*	0.000024		-0.00014***	-0.000031	0.00013
R ²	0.52	0.35		0.39	0.33	0.40

Note, ***, ** and * mean statistically significant at 1%, 5% and 10%, respectively.

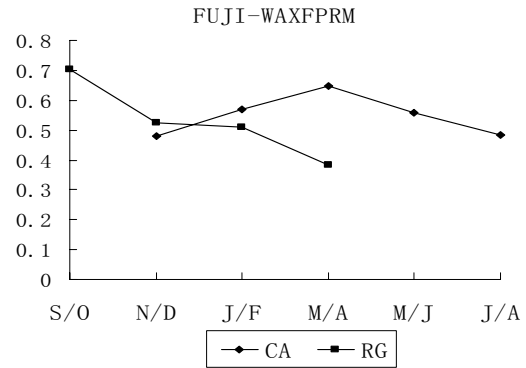
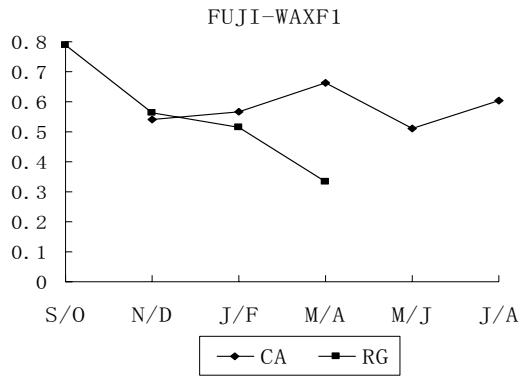


Figure 1. Fitted prices with seasonal effects for Fuji apples of two top grades.

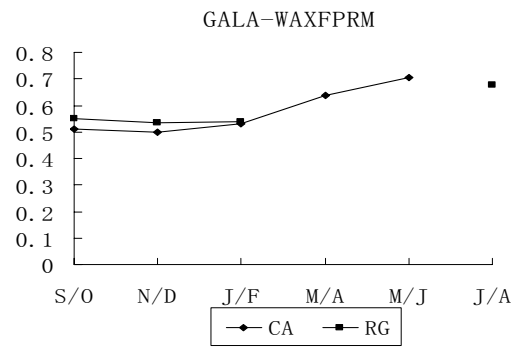
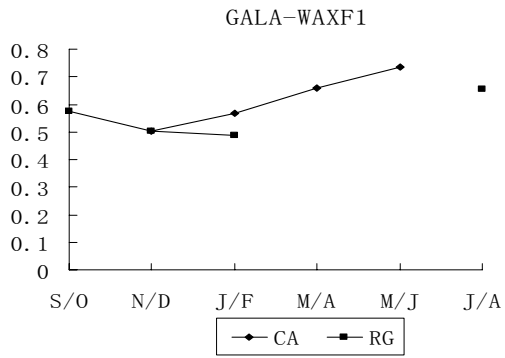


Figure 2. Fitted prices with seasonal effects for Gala apples of two top grades.

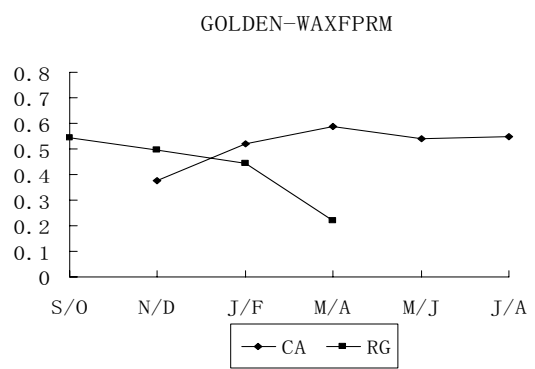
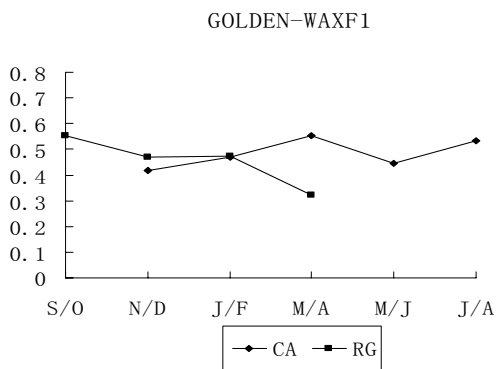


Figure 3. Fitted prices with seasonal effects for Golden Delicious apples of two top grades.

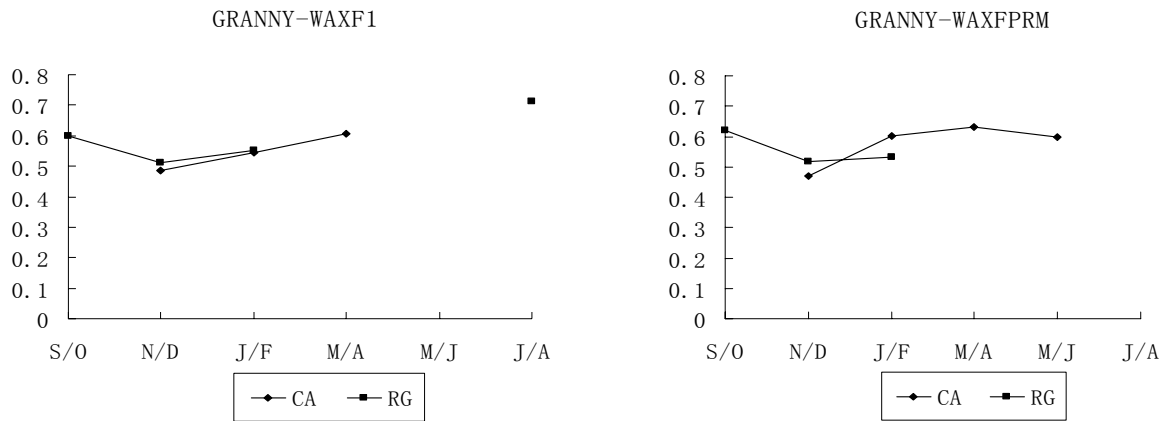


Figure 4. Fitted prices with seasonal effects for Granny Smith apples of two top grades.

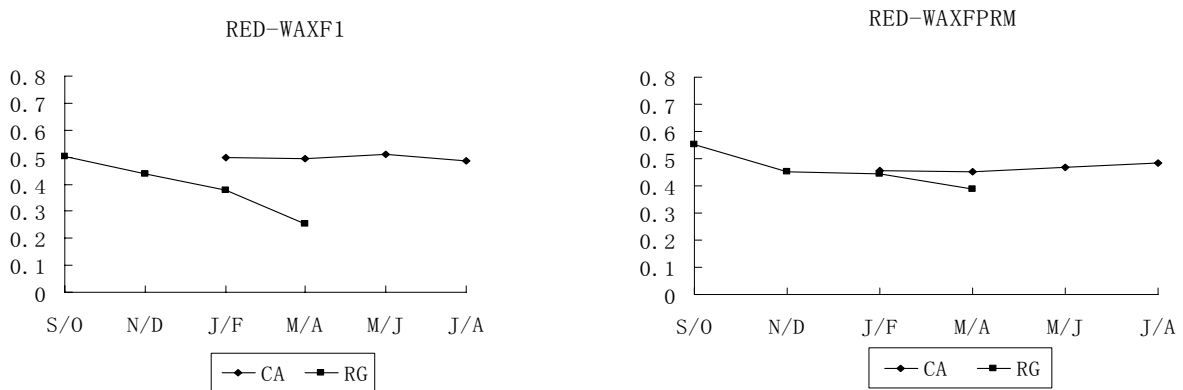


Figure 5 Fitted prices with seasonal effects for Red Delicious apples of two top grades.