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WILL TOO MANY LOWER QUALITY FRUITS DAMAGE THE ORGANIC MARKET

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WILL TOO MANY LOWER QUALITY FRUITS DAMAGE THE ORGANIC MARKET

Introduction

A significant interest in organic tree fruit production has developed over the last 10 to 15 years. Total U.S. sale of organic food was about $13.8 billion for 2005, and is growing by nearly 20% annually (OTA, 2006). Fresh fruits and vegetables are the largest category of organic food sales domestically (Dimitri and Greene, 2002). Apples and pears are the dominating fruits grown in the Northwest.

The driving power for growers to convert from conventional production into organic production is the price premium that market provides for organic products. Unfortunately, it is observed that the price premium is becoming smaller, which brings about the question whether the organic production can be profitable. The organic apple and pear certified acreages in Washington State dropped since their peaks in 2002 with only a slight increase in 2006 (Granatstein and Kirby, 2006).

Several general discussions on organic fruit marketing have emerged recently. Some of the studies find the organic system for fruit was more profitable (Dimitri and Greene, 2002; Greene and Kremen, 2002), but this higher return is achieved only by a premium quality in the right market with the right marketing strategies (Parsons, 2005; Firth and Cubison, 2005; Estes and Smith, 1996; Thompson and Kidwell, 1998). The existing studies also claim that successful organic growers will choose suitable market channels among farmer's markets, local grocery stores, restaurants and wholesale markets as well as brokers and processors (Dimitri and Greene, 2002; Gaskell et al., 2000; Hansen et al., 2004). Processors of higher value products such as baby food may be able to offer better prices to producers for processing organic fruits. This brings the question of whether selling low grade organic fruits to processors instead of selling to

the fresh market will boost the price of higher grade fruits and bring higher profits to growers. Despite the existing studies on organic fruit marketing, the analysis of the marketing factor impact on the market price is rarely found. The goal of this paper is to empirically analyze the marketing factors affecting organic apple and pear prices in the Northwest. Specific objectives of this paper include, (1) investigating the general price response to some key physical attributes and marketing factors of fruits; (2) studying the seasonal effect on price; and (3) analyzing the price effect from a reduction in lower grade supplies.

Model and Data

We estimate an inverse demand function to reveal the price response to quantities and other factors for organic apples and pears. Hedonic price functions are incorporated in this case to measure a wide variety of commodity characteristics such as size and grade, based on Lancaster's (1966) theory that consumers take commodity characteristics as the fundamental sources of utility.

$$P_k = a_{k0} + a_{k1}D04 + a_{k2}D05 + a_{k3}DSM + a_{k4}DSL + a_{k5}DEU + a_{k6}DBG + a_{k7}DRG + \sum_{i=1}^{5} b_{ki}D_i + \sum_{j=1}^{5} c_{kj}D_j * DRG + \sum_{l=1}^{m} d_{kl}Q_l + \varepsilon_k$$

where k=1,2,…n and P_k and Q_l denote the price and quantity sold for grade k and l of a certain variety which has m grades totally. All other variables are dummy with D04 and D05 for 04/05 and 05/06 crop years; *DSM* and *DSL* for medium (original size 88 to 125) and large sizes (size 80 and larger); *DEU* and *DBG* for Euro pack and bag pack types; and *DRG* for fruits from regular cold storage. We leave 03/04 crop year, small size (135 and under), tray pack, and fruits from controlled atmosphere (CA) storage as the default.

The fruit prices are highly seasonal. We include additional five seasonal dummy variables to allow flexibility. They are bimonthly dummies, D_1, D_2, D_3, D_4, and D_5 for September/October, through May/June, leaving July/August as default. Each of the bimonthly dummies is also included in combination with the *DRG*, so that the seasonality effect is allowed to be different for apples from the regular storage versus from CA storage.

Weekly shipment data from November 10, 2003 to August 28, 2006 for apples and from August 23, 2004 to August 28, 2006 for pears are provided by the Wenatchee Valley Traffic Association. We analyze the five biggest apple varieties and three top pear varieties. Over the three year period, the largest apple variety is Gala, accounting for 29.80% of the total quantity, followed by Red Delicious, Fuji, Golden Delicious, and Granny Smith. The dominating pear variety is D'Anjou, accounting for 74.34%, followed by Bartlett, and Bosc. There are 31,130 entries for apples, and 4,453 for pears, by week and by grades/size/pack/storage categories.

Grades appear in the data range from the lowest US#1, US Fancy, US Extra Fancy (USXF), Washington Fancy (WAF), up to Washington Extra Fancy #1 (WAXF1), #2 (WAXF2), and Premium (WAXFP). Any apple grades lower than WAF are considered low grades. We do not consider any pear to be low grade because only two grades are marketed, WAF and US#1 with the latter to be the more popular grade.

All quantity units are converted into a standard 42 pound box for apples and 44 pound box for pears, although they are reported differently for different pack types. The prices range from $5.04/box to $77.78/box with a weighted average of $23.10/box for apples and from $7.04/box to $62.04/box with a weighted average of $23.93/box for pears. The low grade apples are currently marketed as fresh. For the five varieties over the three years, about 2.30% of apples are in grade US Extra Fancy or lower. Fuji has the highest percentage, 4.47%, in low grades,

followed by Granny Smith, 3.80%, and the other three varieties each has less than 3% in the lower category. Because the prices of these grades are lower, the sale revenues they bring to the industry only account for 1.56% of the total. They range from 3.12% for Fuji down to 0.58% for Red Delicious. (Table 1).

Results

The regression results are reported in Tables 2 and 3 separately with the former containing coefficients of physical attributes and the latter containing time and seasonal effects. Equations for grades with very few transactions are left out.

Price effect of the key physical attribute and market factors

In general, low prices are observed for low grades. Size also has a significant effect on high grade Fuji, Gala and Red Delicious apples. Medium sized apples have $0.08 to $0.19 price premiums over the small sized apples for various grades of each variety while large sized apples have typically $0.02 to $0.05 price premiums. Medium sized WAXF1 Fuji apples achieve the largest price premium compared to small sized ones. For the low grade apples, the size of the apple has no effect on the fruit price. Since low grade apples are sold at low prices, the size is not important. There is no size effect on almost all grades of Golden Delicious and Granny Smith apples, indicating that Golden Delicious and Granny Smith apple prices are not size sensitive.

Different from apples, the WAF grade of Bartlett and Bosc have no significant size effect. For those pears that do have size effects, pears have larger price premium from size than that of

apples. The large sized fruits have 6 cents price premium over medium sized ones. The large sized Bartlett US#1 pears maximize the price premium at $0.30 over small sized ones.

Pack type is also an important factor contributing to the price differentiation. For high grade apples, the Euro packs have a price premium of $0.04 to $0.37 over the regular tray packs, while the two package types have similar prices for low grade apples. On the contrary, most bagged apples have $0.06 to $0.22 lower prices than the corresponding regular tray packed ones. Apple packers, representing growers in most cases, should try best to replace their bagged supply by tray packs and promote more of the Euro packs.

However, this is not true for pears as the Euro pack pears are not necessarily more expensive than regular tray pack counterparts. The WAF D'Anjou price is $0.16 higher for Euro pack, but US#1 Bosc price is actually $0.08 lower. On the other hand, the bagged price is $0.14 to $0.36 higher than tray pack across all grades except for the WAFs of Bartlett and Bosc. Pear packers don't need to be concerned much about packages and can go with low packing cost methods.

Seasonal effects

The crop year 04/05 is definitely a bad year for apples as almost all grades of them exhibit at least 4 cents lower price than the year before. The price depressions are recovered more or less in the year 05/06. This price trend is also captured by pears as pears in the year 05/06 have at least 7 cents price premium over the base year of 04/05 except for variety of Bosc which has limited transactions over the two years.

The data features obvious seasonal pattern. In general, regularly (RG) stored fruits leave the market for several months between May and August. The Gala apples and Bartlett pears

show an early harvest in late August. CA stored fruits normally entered the market no early than November. We also observe that the prices of RG fruits tend to decrease later in the season after harvest from the negatively increased coefficients of combination of *DRG* and the seasonal dummy variables. To make it easier to understand, we present the seasonal patterns of prices for the top two grades WAXFP and WAXF1 for Fuji apples and WAF and US#1 for D'Anjou pears in Figures 1 and 2 as representatives.

For each figure, the price curve for RG has a down slope, indicating the quality of the fruits decreases over time without being kept in CA storage. The increasing coefficients for seasonal dummy variables alone in Table 3 indicate the prices for CA storage actually increase over time caused by the reduction in inventory after early fall. For example, the Fuji WAXFP seasonal dummy coefficients are 0.13, 0.15 and 0.18 for November/December, January/February, and March/April CA price, indicating the prices increase two cents every two months after the fall season. The CA curves in the right panel of Figure 1 show this upward slope from November to April. After April, the apple prices stagnate or even decrease. The pattern can be slightly different for each variety. For example, the CA prices keep going up all the time until the next harvest for Golden Delicious WAXFP apples. Compared to apples, pears usually have shorter storage life as we can see from the Figures 2, they usually disappear from market by June even those from CA storage, and have a sharp price drop for regular storage.

Price elasticity

Most prices are not elastic in response to quantity. One percent increase in quantity of the same grade causes Fuji price fall of 0.025, 0.022 and 0.19 percent for WAXFP, WAXF1, and USXF, respectively. This negative but inelastic relationship also holds for high grade of Golden

Delicious and Granny Smith. For Pears, there is a significant negative relationship between the price and quantity of US#1 D'Anjou and Bosc.

The quantity of low grade Fuji apples has a negative effect on WAXFP and WAXF1 prices, the two highest priced fruits. Again, the response is inelastic in that one percent increase in the total boxes of low grades apples only causes 0.029 and 0.025 percent fall in WAXFP and WAXF1 prices, respectively. These elasticities suggest that if low grade apples in crop year 05/06 reduce by 10% which is 440 boxes for the entire crop year, the prices of WAXFP and WAXF1 will increase by $0.0021/lb, and $0.00071/lb. This trade-off converts to a reduction in low grade apple sale of $9,122 (assuming not sold anywhere but just disposed), and a sale increase of WAXFP and WAXF1 of $12,050 and $7,650, respectively. For Fuji apples, market less low grade apples will make the whole industry more profitable. For other varieties, there is no clear evidence observed that lower grade quantities would affect higher grade prices. It does not help improve the revenue of the industry by reducing the low grade crop volume.

Summary

In this analysis, we find that organic apple and pear prices are risky from year to year, and price variation is larger for apples. Size has a significant effect on prices of most varieties and grades but not Golden Delicious or Granny Smith. The pears have a larger size price premium than apples. We also find that the Euro packs for organic pears is not necessarily sold at higher prices than traditional tray packs, and bags are not necessarily sold at lower prices. This suggests that the industry can try to pack more apples in Euro packs, and don't need to pay much effort in sizing apples in some varieties.

Both apple and pear prices are highly seasonal, with those from regular storage having a price drop and those from controlled atmosphere storage having a price rise up to early summer in general. Pears have been marketed for a shorter period than apples, although those from CA storage still enjoy a price increase by May/June for D'Anjou. More CA storages of pears are called for the industry.

The crop sizes have a slightly negative impact on prices only. The crop size of the lower grade apples has a negative impact on the price of higher grade apples for Fuji only. However, based on the market elasticities, only Fuji will benefit from a higher sales value if the lower grade apples are removed from the market, without considering the value of these fruits being sold to processors. The sales gain will be $105,781 in the crop year 05/06.

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Table 1. Quantities and Sales for Apples (2003-2006) and Pears (2004-2006).

	Quantity	Percent Weight			Sale	Percent by Sale	
		Over all varieties	Low Grade*	Small Size		Low Grade*	Small Size
	(million pound)	(%)	(%)	(%)	(million $)	(%)	(%)
Apple							
Fuji	27.49	19.65	4.47	14.57	16.56	3.12	10.55
Gala	41.69	29.80	1.20	34.29	23.55	0.95	27.65
Golden Delicious	24.73	17.68	2.55	22.04	13.58	1.68	17.30
Granny Smith	17.77	12.70	3.80	30.92	9.81	2.51	24.18
Red Delicious	28.21	20.17	0.89	34.42	13.31	0.58	31.54
Apple Total	139.89	100.00	2.30	27.88	76.81	1.56	20.86
Pear							
D'Anjou	22.34	74.34	83.26	15.26	11.98	85.55	10.62
Bartlett	5.39	17.94	83.94	6.94	2.99	88.97	4.42
Bosc	2.32	7.72	94.04	6.19	1.28	95.35	3.38
Pear Total	30.05	100.00	84.21	13.07	16.25	86.99	8.91

*"Low grade" for pears refers to US#1, not really a low grade.

Table 2. Organic Apple and Pear Price Responses to Key Physical Attributes and Supplies.

	Constant	DSM	DSL	DEU	DBG	Q_{WAXFP}	$Q_{WAXF\#1}$	$Q_{WAXF\#2}$	Q_{WAF}	$Q_{LowGrade}$ [b]
Fuji-WAXFP	0.48***	0.094***	0.14***	0.056***	-0.12***	-0.024***	-0.0076***	0.011	-0.12**	-0.065***
Fuji-WAXF1	0.56***	0.19***	0.21***	0.042***	-0.0037	-0.001	-0.048***	0.0097	-0.052	-0.053***
Fuji-WAXF2	1.04***	0.15*	0.14*	0.37***	-0.014	0.022**	0.0073	0.041	-0.44**	0.0049
Fuji-USXF	0.58***	-0.0025	N/A	N/A	-0.016	-0.011*	-0.01	0.012	-0.39**	-0.11***
Gala-WAXFP	0.47***	0.093***	0.16***	0.14***	-0.062***	-0.0012	-0.0024	0.003	N/A	0.0062
Gala-WAXF1	0.41***	0.11***	0.16***	0.064***	-0.028	0.0012	-0.032	0.057***	N/A	-0.024
Gala-WAXF2	0.55***	N/A	0.17***	0.24***	0.21***	-0.0096***	-2.4E-4	-0.091*	N/A	0.046
Gala–USXF	0.45***	0.11	0.12	N/A	0.069	0.0032	-0.0031	0.018	N/A	-0.097
Gold-WAXFP	0.87***	-0.084	-0.072	0.066***	-0.22***	-0.014*	-0.031***	0.037***	0.051	-0.026
Gold-WAXF1	0.60***	0.072	0.075	0.10***	-0.03	-0.0047	-0.041**	0.03***	-0.076	-0.049
Gold-WAXF2	0.71***	0.011	N/A	0.089***	0.0018	0.0092	-0.079***	0.011	0.32**	-0.022
Gold-USXF	0.35***	0.13	0.17	0.24**	0.17	-0.0068	-0.012	0.035	-0.1	-0.01
Gran-WAXFP	0.86***	N/A	0.028***	0.077***	-0.16***	-0.016**	-0.004	-0.014	N/A	-0.017
Gran-WAXF1	0.52***	0.077	0.093	0.13***	-0.05	-0.0039	-0.032**	-0.0027	N/A	-0.0051
Gran-WAXF2	0.51***	0.13	0.12	0.17***	-0.026	0.0011	-0.0065	-0.057	N/A	-0.13
Gran-USXF	0.46***	-0.020	N/A	N/A	0.021	-0.0057	-0.0039	0.017	N/A	-0.13**
Red-WAXFP	0.52***	0.078***	0.085***	0.10***	0.036	-1.7E-5	-2.9E-6	0.0011***	N/A	5.5E-5
Red-WAXF1	0.44***	0.11***	0.11***	0.16***	0.097***	-8.7E-6	1.1E-7	0.0011***	N/A	-1.8E-5
Red-USXF	0.42***	-0.062	-0.014	N/A	0.082	-6.8E-7	-1.7E-5	0.0012**	N/A	-4.6E-4*
D'Anjou –WAF[a]	0.55***	0.17***	0.23***	0.16***	0.36***	N/A	N/A	N/A	0.029*	0.0017
D'Anjou - US#1	0.50***	0.19***	0.25***	-0.017	0.14***	N/A	N/A	N/A	0.021***	-0.026***
Bartlett -WAF	0.36***	-0.028	N/A	-0.0036	N/A	N/A	N/A	N/A	-0.071*	-0.0083
Bartlett - US#1	0.36***	0.24***	0.30***	0.033	0.18***	N/A	N/A	N/A	0.009	-0.011
Bosc -WAF	0.42***	N/A	0.021	-0.042	N/A	N/A	N/A	N/A	-0.18	-0.0019
Bosc - US#1	0.48***	0.12***	0.21***	-0.077**	0.34***	N/A	N/A	N/A	0.0049	-0.055**

Note: a The data range is from 2003-2006 for apple and 2004-2006 for pear

[b] Low grade quantity variable include US#1, US#2 and USXF for apple, and US#1 only for pear.

Table 3. Yearly and Seasonal Effect of Price for Organic Apple and Pears

	D04	D05	D1	D2	D3	D4	D5	DRG	D1* DRG	D2*DRG	D3* DRG	D4*DRG	D5* DRG
Fuji-WAXFP	-0.11***	0.04***	0.0062	0.13*	0.15**	0.18***	0.15**	N/A	0.23***	0.008	-0.054***	-0.14***	N/A
Fuji-WAXF1	-0.11***	0.01	0.035	-0.085	-0.03	0.011	-0.06	0.79***	-0.75***	-0.76***	-0.86***	-0.96***	-1.01***
Fuji-WAXF2	-0.61***	-0.18***	-0.19	-0.37***	-0.47***	-0.46***	-0.29**	N/A	-0.29**	-0.17**	-0.12**	-0.26***	-0.014
Fuji-USXF	-0.13***	0.014	N/A	0.011	N/A	0.12***	N/A	N/A	0.22***	N/A	-0.062**	-0.17***	N/A
Gala-WAXFP	-0.12***	0.0006	0.062	0.048	0.084	0.11*	0.13*	0.20***	-0.19**	-0.20***	-0.25***	-0.38***	N/A
Gala-WAXF1	-0.11***	0.018	0.00003	0.12*	0.14*	0.22***	0.30***	0.22***	-0.12	-0.26***	-0.31***	-0.40***	N/A
Gala-WAXF2	-0.35***	0.018	N/A	-0.0066	N/A	-0.013	-0.093	0.32***	-0.23**	-0.32***	-0.48***	-0.45***	N/A
Gala–USXF	-0.11***	0.015	N/A	-0.10***	-0.064*	0.0064	0.021	N/A	-0.091***	-0.0036	-0.02	-0.20**	N/A
Gold-WAXFP	-0.17***	-0.035***	-0.18***	-0.2***	-0.15***	-0.1***	-0.072***	0.15	-0.057	-0.12	-0.19*	-0.51***	N/A
Gold-WAXF1	-0.15***	-0.085***	-0.035	-0.086**	-0.064*	-0.035	-0.05	0.08*	-0.005	-0.07	-0.12**	-0.27***	-0.16
Gold-WAXF2	-0.21***	-0.052**	-0.34***	-0.2**	-0.13**	0.013	0.059	N/A	0.35***	0.033	-0.0046	N/A	N/A
Gold-USXF	-0.14***	-0.061	-0.21	-0.12*	-0.079	-0.071	0.068	N/A	0.26*	0.042	0.011	N/A	N/A
Gran-WAXFP	-0.076***	0.011	-0.16***	-0.29***	-0.20***	-0.17***	-0.20***	N/A	-0.012	0.039	-0.039***	-0.11***	N/A
Gran-WAXF1	-0.04***	-0.04***	N/A	-0.038	0.030	0.067	0.088	0.17*	-0.1*	-0.14	-0.19**	-0.35***	-0.38***
Gran-WAXF2	N/A	N/A	N/A	N/A	N/A	0.071**	0.0027	N/A	-0.092*	-0.072*	-0.035	0.035	N/A
Gran-USXF	-0.15	-0.058**	0.23***	0.051	N/A	0.066**	0.11	N/A	-0.13**	-0.018	-0.021	-0.15**	-0.059
Red-WAXFP	-0.16***	-0.038***	0.041	-0.15***	-0.054***	-0.036**	-0.00069	N/A	0.025	0.14*	-0.0031	-0.069	N/A
Red-WAXF1	-0.12***	-0.035***	0.067**	-0.035	-0.019	-0.014	0.022	N/A	-0.039	0.0015	-0.070***	-0.19***	N/A
Red-USXF	-0.13***	0.024	0.047	N/A	0.14	0.053	0.044	N/A	0.14	0.13	-0.12	N/A	N/A
D'Anjou -WAF	N/A	0.11***	N/A	-0.40***	-0.33***	-0.30***	N/A	N/A	-0.38***	-0.039	-0.11***	-0.056*	N/A
D'Anjou - US#1	N/A	0.095***	N/A	-0.2***	-0.12**	-0.17***	-0.10*	0.13**	-0.28***	-0.11*	-0.19***	-0.17**	N/A
Bartlett -WAF	N/A	0.16***	-0.012	N/A	-0.0048	N/A	N/A	0.19***	-0.17*	-0.21***	-0.38***	N/A	N/A
Bartlett - US#1	N/A	0.066***	-0.036	N/A	-0.1***	-0.055**	-0.057	0.044	-0.068	-0.16***	-0.054	N/A	N/A
Bosc -WAF	N/A	-0.0068	N/A	N/A	0.0024	-0.15	N/A	N/A	N/A	-0.12***	-0.16	0.047	N/A
Bosc - US#1	N/A	0.0016	0.11	0.014	N/A	-0.19***	N/A	N/A	-0.039	-0.041	-0.11***	-0.05	N/A

Note: The data range is from 2003-2006 for apple and 2004-2006 for pear

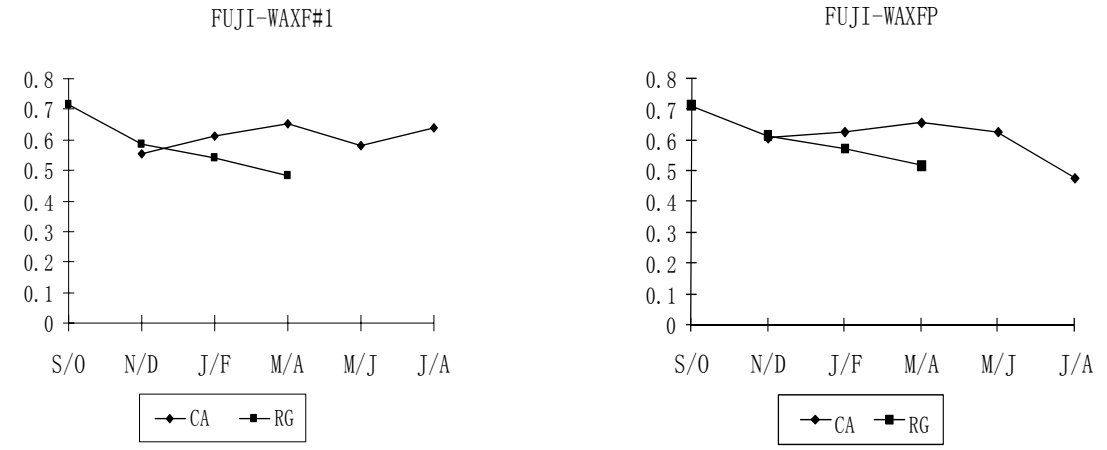

Figure 1. Fitted prices with seasonal effects for Fuji apples of two top grades.

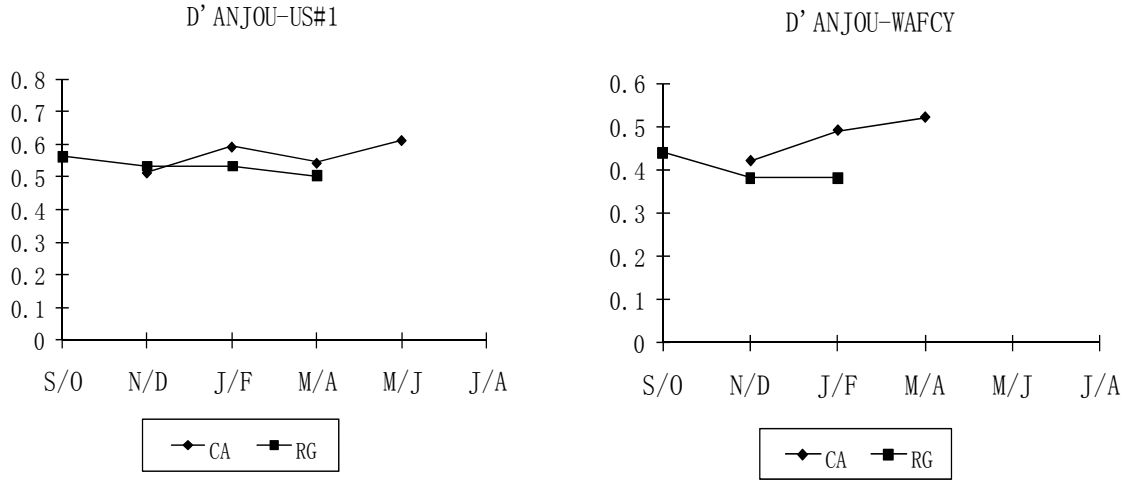

Figure 2. Fitted prices with seasonal effects for D'Anjou pears.