What Are the Economic Welfare Effects of Local Food Marketing?

Exploring Impacts with the Case of Colorado Apples

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There is a growing public interest, and subsequently, polices and programs aimed to support of local food systems, including consumer education, relocalization efforts within communities, and promotional campaigns to influence buyers about some potential benefits of local foods. One driving motivation for such programs is the potential gains to farmers, consumers and local markets from more localized marketing networks. However, there have been few true examinations about what the restructuring of food markets may look like or mean to consumers and producers. This study begins to fill this gap with analysis of one fresh produce category, apples, with a particular look at Colorado markets, where some supplies still remain (from a much reduced industry that shrank in the face of global and domestic competition in the late 1990's).

Apples are one of the most valuable commodities in the United States. U.S. apple production was 95,340 million pounds in 2008, and was commercially valued at 221 million dollars in revenue, which accounted for 6.4% of world apple production. In 2008 apples were ranked third for consumption of fruits in the U.S., averaging 48 pounds per capita (ERS). Colorado's production numbers for 2007 were reported at 13 million pounds and the population of Colorado in 2007 was 4,888,736, so state production no longer could meet the state demand of 235 million pounds, but current production does represent a 5 to 6% of current fresh demand (if no Colorado apples are processed).

The majority of U.S. apples were marketed through a commercial marketing chain that connects growers, shippers, terminal markets (or international markets) and retail outlets. As state promotion and marketing programs have been widely adopted throughout the country (Colorado Proud, New Jersey Fresh, and South Carolina locally grown campaign), demands for local produce have increased significantly (Adelaja, Brumfield, and Lininger, 1990; Carpio and Isengildina-Massa, 2010). This movement has led to an increase in the derived demand for a more direct marketing chain from growers directly to consumers.

Given that apple producers can choose among different marketing channels, their net returns, marketing channel structure and performance of markets may change, subsequently affecting producer welfare. Moreover, as promotion and information influences consumers' preferences, consumer welfare may also be shifting with greater availability of local foods. Numerous studies have evaluated consumer interest in local foods, and generally find that consumers are willing to pay higher prices for locally grown food (e.g., Loureiro and Hine, 2002; Wang and Sun, 2003; Darby et al., 2008; Hinson and Bruchhaus, 2005; 2008; Hounshell, 2008; Hu, Woods, and Bastin, 2009; James, Rickard, and Rossman, 2009). However, only a few (e.g., Carpio and Isengildina-Massa, 2010a; 2010b) have examined the potential impacts to consumers and producers from increased labeling and availability of local foods. More importantly, there is no previous literature that has combined the shocks on both the demand and supply side to estimate the economic impact of market segregation in light of local food programs.

The objective of the paper is to explore the welfare changes as a result of (1) changes in prices and demanded quantities of Colorado labeled apples relative to domestically produced apples, and (2) changes in prices and supplied quantities of directly marketed apples relative to domestically produced apples marketed through major shipping points. The paper will develop a partial Equilibrium Displacement Model (EDM) for Colorado apples that can be used to analyze the impacts of local labeling by segmenting markets by estimation of increased consumer values due to regional-origin labeling with quality control on the demand side and segmenting markets by realizing differential costs and prices in marketing channels on the supply side.

For this analysis, we make a simplifying assumption that the national market is separated into two regions: the state of Colorado and the rest of the United States. Based on the separation of markets and the availability of data, consumers' willingness to pay will be used to estimate expected prices in the demand functions, while shipping point and terminal market prices will be used to proxy for relationships with the U.S. market on the supply side. Changes in consumer preferences will be used to represent demand shocks and the difference between direct marketed transaction costs and transaction costs to market through shipping points will serve as a proxy for supply shocks. Data on consumers' willingness to pay was obtained from a 2008 national survey (details in Onozaka and Thilmany, 2011). Data on shipping point prices, terminal market prices, transaction costs, quantities, and market shares are obtained from USDA/National Agricultural Statistics Service (NASS).

Conceptual Framework

Equilibrium Displacement Model (EDM)

EDM is widely used in agricultural economics to measure the impacts of various food policy and marketing activities such as food origin labeling, new policies and local promotion campaign in improving social welfare and the distribution of the welfare. For example, Balagtas and Kreutzer (2007) evaluated the economic impacts of milk marketing orders for producers and consumers in organic and conventional milk markets. Lusk and Anderson (2003) used EDM to determine how Country-of Origin Labeling

(COOL) would affect the welfare of participants in the livestock sector, whereas Brester, Marsh, and Atwood (2004) estimated short-run and long-run effects of the COOL program on meat and livestock sectors. Thompson, Anders, and Herrmann (2005) used EDM to assess the direct and distributional effects of state-financed quality control and regional origin assurance programs. The EDM model used here is based on the model developed by Carpio and Isengildina-Massa (2010) to assess the welfare impact of a regional promotional campaign in South Carolina. Similar to their study, the market in this study is separated into two regions: the state of interest, Colorado (Region A) and the rest of the United States (Region B), which has a supply and demand relationship with the Colorado apple sector. The two-region model can be described as follows:

Region A (Colorado):

Demand:

(1) $$D_A^l = D_A^l(P_l, P_d, c_l)$$

(2) $$D_A^d = D_A^d(P_l, P_d, c_l)$$

Supply:

(3) $$S_A^l = S_A^l(P_l, P_d)$$

(4) $$S_A^d = S_A^d(P_l, P_d)$$

Region B (rest of the country):

Demand:

(5) $$D_B^d = D_B^d(P_d)$$

Supply:

(6) $$S_B^d = S_B^d(P_d)$$

Market-Clearing Conditions:

(7) $$D_A^l = S_A^l$$

(8) $$D_A^d + D_B^d = S_A^d + S_B^d$$

D_i^k is the demand for product k (k = l, d, where l denotes local product, d denotes domestic product) in region i (i = A,B). P_k is the price of product k, and c_l denotes the price difference related to assurances that consumers perceive through the local labeling efforts. It should be noted that this price differential could also be integrated with extra costs in the supply functions, but since the primary data used here is an analysis of consumer willingness to pay, this structure is more consistent with the empirical question. S_i^k is the supply for product k (k = l,d) in region i (i = A,B).

In this model, it is assumed that all the effects of the local marketing initiatives are concentrated in Colorado, and locally labeled products are only consumed in Colorado, which leads to the equation (7). However, the excess supply from Colorado can be sold in the domestic market as domestically produced apples. Also, in this model, we leave out imports from foreign countries, thus, the total domestic demand for fresh apples is assumed to be met by total domestic supply (equation (8)). Totally differentiating equations (1)-(8) yields:

(1') $$dln\left(D_A^l\right) = \varepsilon_A^{ll} dln(P_l) + \varepsilon_A^{ld} dln(P_d) + \gamma$$

(2') $$dln\left(D_A^d\right) = \varepsilon_A^{dl} dln(P_l) + \varepsilon_A^{dd} dln(P_d) - \frac{\omega_{AA}^{Dl}}{\omega_{AA}^{Dm}}\gamma$$

(3') $$dln\left(S_A^l\right) = \beta_A^{ll} dln(P_l) + \beta_A^{ld} dln(P_d)$$

(4') $$dln\left(S_A^d\right) = \beta_A^{dl} dln(P_l) + \beta_A^{dd} dln(P_d)$$

(5') $$dln\left(D_B^d\right) = \varepsilon_B^{dd}\ dln(P_d)$$

(6’) $dln(S_B^d) = \beta_B^{dd}\ dln(P_d)$

(7’) $dln(D_A^l) = \ dln(S_A^l)$

(8’) $\omega_{AT}^{Dd} dln(D_A^d) + \omega_{BT}^{Dd} dln(D_B^d) = \omega_{AT}^{Sd} dln(S_A^d) + \omega_{BT}^{Sd} dln(S_B^d)$

All the changes are in percentage terms (*dln*), ε_k^{ij} denotes the price elasticity between product *i* and product *j* in region *k*, and β_k^{ij} denotes the supply elasticity between product *i* and product *j* in region *k*. The demand and supply market share are denoted as ω_{kh}^{Di} and ω_{kh}^{Si} where *i* denotes either local (*l*) or domestic (*d*), and *k* denotes either regions A or B, and *h* represents the regions A, B, or the aggregate market (A+B) denoted as T. For example, ω_{AA}^{Dl} denotes the demand share of local product in region A within the regional market. The system of linear equations (1’)-(8’) can be written using matrix form as:

(9) $\mathbf{Ay} = \mathbf{x}$

where **A** is a 8 × *m* matrix that contains parameters on elasticities and market shares, **y** is the *m* × 1 vector of endogenous variables, and **x** is the 8 × 1 vector of exogenous variables. The changes in the endogenous variables due to the exogenous changes can be calculated by solving the linear equation (9) by multiplying both sides by $\mathbf{A}^{-1}$; $\mathbf{y} = \mathbf{A}^{-1}\mathbf{x}$.

Empirical Model

The conceptual model developed in the previous section is slightly modified in order to account for the available data. In addition, a number of assumptions are made for the conceptual model in order to implement the econometric model:

1) The domestic apple industry is considered to be perfectly competitive.
2) Colorado consumers are assumed to be risk neutral.

3) Domestic apple prices are lower than Colorado apples so that trade will take place.

4) The effects of the local marketing initiatives are assumed to be concentrated in Colorado.

5) The price of domestic apples is the same throughout the whole country.

6) Colorado apples and domestic apples are weakly separable.

7) Currently, Colorado exports a very small share of the state's apple crop, so exports from Colorado to the domestic market are not considered.

8) Technology, costs, and other factors are assumed to be constant.

9) The Colorado economy is a small part of the whole economy.

10) All shipping point prices are the same throughout the U.S.

11) All local apples that are consumed in Colorado are marketed through direct markets and shipping points.

12) Domestic apples (from other regions of the U.S.) can only be marketed through shipping points and cannot enter direct markets.

The empirical model is specified as follows;

Region A (Colorado)

Demand:

(1'') $$D_A^l = D_A^l(\delta_l, \delta_d, \propto)$$

(2'') $$D_A^d = D_A^d(\delta_l, \delta_d, \propto)$$

Supply:

(3'') $$S_A^F = S_A^F(P_F, P_S)$$

(4'') $$S_A^S = S_A^S(P_F, P_S)$$

(5'') $$S_A^{SA} = S_A^{SA}(P_F, P_S, P_l, P_d)$$

Region B (rest of the country)

Demand:

(6'') $$D_B^d = D_B^d(\delta_d)$$

Supply:

(7'') $$S_B^S = S_B^S(P_S)$$

Market-Clearing Conditions

(8'') $$D_A^l = S_A^F + S_A^{SA}$$

(9'') $$D_A^l + D_A^d + D_B^d = S_A^s + S_B^s + S_A^F$$

Price Relationships

(10'') $$P_d(1 + t_d) = P_l$$

(11'') $$P_S(1 + t_S) = P_F$$

The price parameters P_k, k=l, d are derived from different sources to estimate the demand and supply equations. For the demand equations, δ_k represents consumers' willingness-to-pay (WTP) for product *k* and the terminal market apple price (P_F) and shipping point apple price (P_S) determine the supply equations. In Colorado, the supply for directly marketed apples and shipping point marketed apples is a function of the terminal market apple price (P_F) and shipping point apple price (P_S). Let P_S^A be the apple price that is marketed in Colorado through shipping points. In equilibrium, the terminal market price is equal to the apple price that is reported through shipping points to Colorado, which means $P_F = P_S^A$. Taking transport and transaction costs into consideration, the relationship between terminal market price and shipping point price is $P_F = P_S^A = P_S(1 + t_s)$ where t_s is transport and transaction costs ratio from shipping points to the Colorado market.

In addition, the supply for local apples marketed through shipping points (S_A^{SA}) is a function of terminal market apple prices (P_F), shipping point apple prices (P_S), consumer willingness to pay for local apples (δ_l), and consumer willingness to pay for domestic apples (δ_d). P_F and P_S determine whether to market directly or through shipping points. If $P_s > P_F/(1 + t_s)$, producers would choose to market through shipping points. Then processors need to decide whether it is economical to ship apples back to Colorado (since most are shipped to out-of-state, regional distribution points) or to other states (since we assume they will not be differentiated as Colorado grown once they are in wholesale channels). This depends on the relationship between local price (WTP) and domestic price (WTP). All apples in the rest of the country are assumed to be marketed through shipping points. The supply for apples marketed through shipping points in the rest of the country is a function of shipping point price (P_F).

In equilibrium, the demand for local apples in Colorado equals the supply in direct markets plus the supply of local apples marketed through shipping points, which means $D_A^l = S_A^F + S_A^{SA}$ (equation (8'')). In the equilibrium of the whole U.S. economy, total apple demands equals total apple supply (since we assume no imports of fresh apples in this case). Thus, total apple demand equals total apple supply (equation (9'')).

Data

Due to the lack of availability of local market price data and shipping point prices for Colorado apple, the Seattle terminal market price for Red Delicious apples and the Washington shipping point prices for Red Delicious apples was used to represent the locally marketed price and shipping point price for Colorado apple. The Washington Red Delicious apple is chosen due to the consistent availability of data in that series, the dominant position of Washington in the U.S. and Western region apple industry, and, the relatively short distance to Colorado compared to other major production regions.

The utilized production of apples in Colorado in 2007 was 13 million pounds (S_A), while the utilized production for the U.S. was 9,300 million pounds (S). The U.S. per capita consumption of apples in 2007 was 49.85 pounds, while the population of Colorado in 2007 was 4,888,736, and that of U.S. was 302,977,371 in 2007. Thus, the per capita annual consumption for Colorado and U.S. apples in 2007 was 244 million pounds (D_A) and 15,103 million pounds (D), respectively. Based on these estimates, the production and consumption of the rest of the country are calculated as 9,288 million pounds (S_B^s) and 14,860 million pounds (D_B^d).

Since there are no reported data on directly marketed apples in Colorado, the amount of directly marketed apples is calculated assuming apples are equivalent to the proportion of directly marketed fruits in Colorado. But, since direct marketing data is county based, we also used the concentration of fruit production in 4 counties as a way to arrive at our estimates. Three counties account for 90% of the total fruit production in Colorado ($23,192,000); Delta (ranked second with $8,851,000 in sales), Mesa (ranked first with $10,184,000 in sales), Montezuma (ranked third with $879,000 in sales), and Montrose (ranked fourth with $852,000 in sales). These four counties were thereby considered good representation for fruit production and marketing in Colorado.

But, information on the share sold through direct sales in these counties was also needed to arrive at our estimated. In 2007, 3.3% of agricultural products produced in Delta ($46,800,000) were sold directly to consumers ($1,529,000), 7.7% of agricultural products produced in Mesa ($61,230,000) were sold directly to consumers ($4,729,000), and 1.2% of agricultural products produced in Montuzema ($26,673,000) were sold directly to consumers ($311,000). Finally, approximately one percent of agricultural products produced in Montrose ($67,160,000) were sold directly to consumers ($605,000). Using the proportion of fruit production that was reported in each county and the share that was direct marketed as our weights, the proportion of directly marketed fruit is estimated to be 5.3%, which is equivalent to 0.685 million pounds (S_A^F). Then, we assume the amount of Colorado apples that are marketed through shipping points by subtracting directly marketed amount from total production, or 12.32 million pounds (S_A^s).

In the same way, the consumption of local apples in Colorado was calculated using the proportion of local food sales through all channels within the U.S. (0.0168), which is equal to the proportion of direct crop and livestock sales through all channels divided by all crop and livestock revenues in the U.S. for 2007. This results in an estimate of 4 million pounds (D_A^l) in local Colorado apples consumers, and consumption of other U.S. apples in Colorado is the remaining 240 million pounds (D_A^d). Because the consumption of local apples is through both direct markets and shipping points, we estimated shipping point market flows by subtracting $S_A{}^F$ from $D_A{}^l$, which leaves 3.41 million pounds ($S_A{}^{SA}$).

The market share parameters values we need to estimate for the EDM are calculated as follows:

(9) $$w_{AT}^{Dd} = \frac{Colorado\ consumption - colorado\ consumption\ of\ local\ apple}{U.S.consumption}$$

(10) $$w_{AT}^{Dl} = \frac{colorado\ consumption\ of\ local\ apple}{U.S.\ consumption}$$

(11) $$w_{BT}^{Dd} = 1 - w_{AT}^{Dd} - w_{AT}^{Dl}$$

(12) $$w_{AA}^{Dl} = \frac{colorado\ consumption\ of\ local\ apple}{Colorado\ consumption}$$

(13) $$w_{AA}^{Dd} = 1 - w_{AA}^{Dl}$$

(14) $$w_{AA}^{DF} = \frac{colorado\ consumption\ of\ directly\ marketed\ apple}{Colorado\ consumption}$$

(15) $$w_{AA}^{Ds} = 1 - w_{AA}^{DF}$$

(16) $$w_{AA}^{D,SA} = \frac{colorado\ consumption\ of\ local\ apple\ \ t\square roug\square\ s\square ipping\ points}{Colorado\ consumption}$$

(17) $$w_{AT}^{Ss} = \frac{Colorado\ production - Colorado\ directly\ \ marketed\ apple}{U.S.production}$$

(18) $$w_{BT}^{Ss} = \frac{the\ rest\ of\ the\ country\ production}{U.S.production}$$

(19) $$w_{AT}^{SF} = 1 - w_{AT}^{Ss} - w_{BT}^{Ss}$$

(20) $$w_{AA}^{SF} = \frac{Colorado\ directly\ marketed\ apple}{Colorado\ supply\ \ of\ \ local\ consumed\ apple}$$

(21) $$w_{AA}^{S,SA} = 1 - w_{AA}^{SF}$$

Demand elasticities are calculated using willingness to pay data from a 2008 national survey (details of methodology and results available in Onozaka and Thilmany Mcfadden, 2011). Based on demand elasticities reported in previous literatures and the average apple retail price reported by the USDA AMS in 2007 ($1.15/lb), the domestic price level (WTP) was assumed to be $1.20/lb and the premium for local apples was estimated as $0.20. Elasticities of demands are calculated based on consumers' willingness to pay for local and domestic apples and the market share estimates derived from a national sample in the 2008 study. Within the survey, choice experiments were conducted asking respondents' choices on sets of apples that varied by labels, prices and production locations. Panel mixed logit models were used to estimate individual-level WTP (Onozaka and Thilmany Mcfadden, 2011). The market share was derived as the share of respondents who was WTP for the specified apples at various price points, and the own price elasticities are calculated using the formula:

$$(22) \qquad \varepsilon_h^{ii} = \frac{\Delta Market\ Share\ i}{\Delta WTPi} * \frac{WTPi}{Market\ Share\ i}$$

where the WTP was set to $1.20 for local apples and $1.00 for domestic apples. The cross-price elasticities are calculated using:

$$(23) \qquad \varepsilon_h^{ij} = \frac{\Delta Market\ Share\ i}{\Delta WTPj} * \frac{WTPj}{Market\ Share\ i}$$

at the same price levels. The distribution of estimated individual-level WTP among Colorado consumers compared against respondents from the remainder of the U.S. were not found to be significantly different, thus, domestic own price elasticities in Colorado and the rest of the country are set equal.

On the supply side, elasticities are calculated as:

$$(24) \qquad \beta_A^{ij} = \omega_{AA}^{Di}(\rho_i\beta + \tau) - \delta_{ij}\tau \qquad i=S,F,SA$$

$$(25) \qquad \beta_B^{ij} = w_{BB}^{Di}(\rho_i\beta + \tau) - \delta_{ij}\tau \qquad i=S,F$$

Aggregate own-price elasticities of supply (β=1.00) for apples were obtained from Chavas and Cox (1995). Expansion elasticities for locally marketed apples are assumed to be equal to 1 (ρ_F =1) following the approach taken by Carpio and Isengildina-Massa

(2010). Apples marketed through shipping points have expansion elasticities that are recovered from equation (13):

(26) $\rho_S = (1 - \rho_F * \omega_{AA}^{DF})/(1 - \omega_{AA}^{DF})$=1.00

(27) $\rho_{SA} = (1 - \rho_F * \omega_{AA}^{SF})/(1 - \omega_{AA}^{SF})$=1.00

The elasticity of transformation (τ = 1.80) was chosen to ensure local marketed apples and apples marketed through shipping points are substitutes (following Carpio and Isengildina-Massa (2010)). δ_{ij} is the Kronecker delta ($\delta_{ij} = 1$ when *i*=*j*; $\delta_{ij} = 0$ when *i*≠*j*) (James and Alston, 2002).

The premium associated with WTP ($0.20) for local apples with respect to domestic apple was assumed to be an exogenous shock (γ) because the production source was not known before local labels were established and promoted. Here we assume:

(28) $$\gamma = -\frac{\text{Premium}}{\text{domestic price}} * \varepsilon_A^{ll}$$

Based on the chosen premium ($0.20) and the average retail price in 2007 ($1.15), the transport and transaction costs ratio from domestic market to local market is calculated as:

(29) $\mathrm{t_d} = \mathrm{P_l}/\mathrm{P_d} - 1 = (1.15 + 0.20)/1.15 - 1 = 0.174.$

As mentioned earlier, the Seattle terminal market price is used as a proxy for Colorado's local market price (through wholesale channels) and Washington's shipping point price is used as a proxy for Colorado shipping point price. Thus, the transport and transaction costs ratio is calculated as:

(30) $t_s = P_F/P_S - 1 = 0.493/0.438 - 1 = 0.126.$

All the parameters used in the model are summarized in Table 1.

Results

The price, quantity and producer surplus changes due to new local labeling efforts and promotions are presented in table 2. Two scenarios were considered. The first scenario was assuming "fixed supply", which analyzed the effects in the very short run when suppliers could not react to the increase in demand (a realistic assumption given apples are tree crops with slower supply responses). In this scenario, the increase in producer surplus was only due to the price change. The second scenario was "elastic supply", which analyzed the effects in a relatively long run when suppliers could react to the shocks in demand. In this scenario, both the prices and quantities adjusted to demand shifts.

On the demand side, in short run, consumer's willingness to pay for Colorado produced apples would increase 54.90% and quantity demanded would increase 23.18% given assumed market conditions and information derived from the 2008 consumer study. When the supply was assumed to be elastic, consumer's willingness to pay for Colorado produced apples would increase by only 22.94% and quantity demanded would increase 3.47%. In the long run, consumer's preference for domestic apples would decrease relative to local apples (from 37.50% to 5.64% for U.S. apples compared with a decline from 54.90% to 22.94%). One finding of note is that the demand for domestic apples in both scenarios also increased (46.12% and 19.47%), possibly due to the fact that Colorado production could no longer meet statewide demand.

On the supply side, in short run, direct market prices would decrease 0.014% and shipping point prices would decrease 12.61%. When the supply was assumed to adjust to changes in demand, direct market prices would increase 12.81% and shipping point prices would increase 0.21%. This suggested that in long run, direct market prices would increase relative to shipping point prices. In long run, the Colorado supply dedicated for direct markets would increase 23.03%, while the Colorado supply marketed through shipping points would decrease 10.01%.

Changes in Colorado producer surplus associated with increased local labeling were used to measure the effects of local marketing promotions on Colorado apple suppliers. The results revealed that in short run, producer would lose $300, but in the long run, producers would gain $0.263 million. But, it should be noted that this is just one of many fresh produce crops that would likely be affected by the broadly defined Colorado Proud program, so it simply serves as a representative market analysis.

Discussion and Conclusion

This paper employed an equilibrium displacement model (EDM) to explore the welfare changes due to new labeling efforts and promotional campaigns highlighting the availability of locally grown products (both in direct markets and within more conventional marketing channels). In particular, the changes are derived as a result of changes in prices and demanded quantities of Colorado labeled apples relative to domestically produced apples, as well as changes in prices and supplied quantities of directly marketed apples relative to more conventionally marketed apples through major shipping points.

The results showed that, in the long run, consumers would shift their demand toward local apples due to increased promotion and markets that implement local labeling. Increases in Colorado's production of apples would be marketed more directly relative to the volume marketed through shipping points due to those demand shocks. In the short run, producers would lose $300, while in the long run, producers would increase overall supply to capture $263,000 in increased surplus.

These results are interesting for several reasons. As a complement to work done by Carpio and Isengildina-Massa, it shows there may be long term gains to producers as they strategically position some of their produce to more localized markets, thereby justifying local promotion programs. However, there may be a short-run downside, even with support from consumers. Moreover, this conceptual framework does not consider the broader picture: is this a zero-sum game for U.S. fresh produce suppliers? Or does it grow consumer confidence and buying power dedicated to fresh produce? These questions lead us to a discussion of the limitations of this study.

One limitation of the study is the overly simple assumption that global markets do not matter. To derive a EDM that could be solved with available data, this was necessary at this point, but it is our intention to address that limitation in future research. Also, we only consider apples, even though most state marketing programs for local foods cover the full array of food products. This explains why these welfare changes are much smaller than those reported by Carpio and Isengildina-Massa, but we chose apples as a specific market to advance their efforts. Their work had to use parameter estimates that were more simplified in terms of market channels (not allowing directly marketed produce to vary from products offered in more conventional markets), which is a limitation given Onozaka et al's results that WTP does vary by where consumers shop.

Apples are also an interesting product line to begin with because they are one of the most commonly consumed fruits, can be held in cold storage so that year-round consumption may be possible in most locales nationwide, but supply responses in various locales would be slowed by the slow supply response inherent in tree crops.

This research could be extended in several ways. First, it appears necessary to take supply shocks into consideration, considering the difference between direct marketed transaction costs and shipping point marketed transaction costs. This is important given concerns about market inefficiencies from more fragmented markets. Second, conducting a simulation of consumer surplus changes which would help to analyze the whole set of welfare changes and the distribution of welfare changes among producers and consumers. In addition, sensitivity analysis with respect to elasticities, demand and supply weights, demand shocks, and transaction costs ratios would mitigate the limitations of using so many parameters from older studies focused on different market dynamics, and help us to learn more about market relationships.

Nonetheless, this paper contributes to the literature by providing insights on how strong consumer responses to local produce offerings (albeit among a relatively small set of buyers) may affect market dynamics. By allowing for segregated markets, akin to what occurs more formally with organic produce, this conceptual framework provides a method analyze welfare in an increasingly differentiated food system.

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Table1. Parameter Values Used for Model of Colorado Locally Marketed and Shipping Points Marketed Apple

Parameter Values	**Local Marketed (*i*=*F*)**	**Shipping Point Marketed(*i*=*S*)**
Demand		
Prices (P_l) ($/lb)	1.40	
Prices (P_d) ($/lb)	1.20	
CO aggregate quantity demanded (D_A) (mil.lbs.)	243.703	
REST aggregate quantity demanded (D_B^d) (mil.lbs.)	14859.718	
CO consumption of local apple (D_A^l) (mil.lbs)	4.1	
CO consumption of domestic apple (D_A^d)	239.604	
Market Shares		
w_{AT}^{Dd}	0.0159	
w_{AT}^{Dl}	0.0003	
w_{BT}^{Dd}	0.9839	
w_{AA}^{Di}	0.0028	0.9972
w_{AA}^{DSA}	0.0140	
w_{BB}^{Di}	--	1
w_{AA}^{Dl}	0.0168	
w_{AA}^{Dd}	0.9832	
Elasticities of Demand		
Colorado&Colorado(ε_A^{ll})	-0.040	
Colorado&Domestic(ε_A^{ld})	0.659	
Domestic&Domestic(ε_A^{dd})	-0.020	
Domestic&Colorado(ε_A^{dl})	0.854	
Domestic&Domestic(ε_B^{dd})	-0.020	
Demand shock (γ)	0.00667	
Supply		
Aggregate own price elasticity of supply(β)	1.00	
Elasticity of transformation(τ)	-1.80	
Expansion Elasticity(ρ_i)	1.00	1.00
Prices (P_i) ($/lb)	0.493	0.438
CO aggregate quantity supply (S_A) (mil.lbs.)	13	
REST aggregate quantity supply (S_B^S) (mil.lbs.)	9287.6	
CO directly marketed (S_A^F) (mil.lbs)	0.685	
CO shipping point marketed (S_A^S) (mil.lbs)	12.315	
CO SP marketed local consumed (S_A^{SA}) (mil.lbs)	3.415	
Market Shares		

w_{AT}^{Si}	0		0.0013
w_{AA}^{SF}		0.1670	
w_{AA}^{SSA}		0.8330	
w_{BT}^{Si}	--		0.999
Elasticity of supply for			
Colorado grown(β_A^{Fi})	1.798		-0.002
Colorado grown(β_A^{Si})	-0.798		1.002
Colorado grown ($\beta_A^{SA,i}$)	-0.011		-0.011
Colorado grown ($\beta_A^{SA,l}$)		-0.011	
Colorado grown ($\beta_A^{SA,d}$)		-0.011	
Other States grown(β_B^{Si})	--		1
Transfer Costs Ratio			
t_d		0.173	
t_s		0.126	

In the short run, producers cannot react to an increase in demand by increasing quantity supplied. The increase in producer surplus is due only to the price change. It's calculated using the following equation:

$$\Delta PS = \Delta P_F * D_A^l$$

In the long run, producers can correspondent to the changes of retail price (WTP). The changes in producers' surplus are calculated using the following equation:

$$\Delta PS = \Delta P_F * D_A^l + \frac{\Delta P_F * \Delta D_A^l}{2}$$

Table 2. Price, Quantity, and Producer Surplus Changes

Variables	Fixed Supply	Elastic Supply
	γ = 0.00667	γ = 0.00667
$\%\Delta D_A^l$	23.1804	3.4654
$\%\Delta D_A^d$	46.1194	19.4659
$\%\Delta D_B^d$	-0.7499	-0.1128
$\%\Delta S_A^F$	0	23.0332
$\%\Delta S_A^S$	0	-10.0118
$\%\Delta S_A^{SA}$	0	-0.4576
$\%\Delta S_B^S$	0	0.2107
$\%\Delta\ P_l$	54.8955	22.9392
$\%\Delta\ P_d$	37.4955	5.6392
$\%\Delta\ P_F$	-0.0140	12.8107
$\%\Delta\ P_S$	-12.6140	0.2107
ΔPS (mil.$)	-0.0003	0.2634