



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search  
<http://ageconsearch.umn.edu>  
[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

# **The Effect of Market Segmentation on Consumer Welfare: The Case of Organic and Conventional Fruits and Vegetables**

Brandon R. McFadden and Conner Mullally

Corresponding author: Brandon R. McFadden  
Department of Food and Resource Economics  
University of Florida  
Gainesville, FL 32611  
Tel: (352) 294-7654  
Fax: (352) 846-0988  
Email: [brandon.mcfadden@ufl.edu](mailto:brandon.mcfadden@ufl.edu)

**[This is an EARLY version of a working paper. DO NOT CITE!]**

Brandon R. McFadden and Conner Mullally assistant professors in the Food and Resource Economics Department at the University of Florida in U.S.A.

## **1. Introduction**

U.S. consumers eat less fruits and vegetables than recommended by dietary guidelines (Carlson & Frazão, 2014; Guenther, Juan, Lino, Hiza, Fungwe, & Lucas, 2009). Recent research estimated that merely 7%-18% and 5%-12% of consumers are meeting fruit and vegetable recommendations, respectively (Moore et al, 2015), and it is likely that the gap between recommended and actual intake of fruit and vegetable intake will increase in the future if current dietary patterns are maintained due to changes in U.S. demographic composition (McNamara, Ranney, Kantor, & Krebs-Smith, 1999). Increases in the gap between recommended and actual intake of fruit may result in higher obesity rates, as there is a negative relationship between fruit consumption and obesity (Lin & Morrison, 2002). There is little evidence that increased vegetable consumption decreases obesity (Lin & Morrison, 2002; Trudeau, Kristal, Li, & Patterson, 1998); however, this may be because potatoes and tomatoes account for more than half of all vegetable consumption (Lin, Wendt, & Guthrie, 2013; Guthrie & Lin 2014).

Consumption of fruits and vegetables is affected by socio-economic status (Rasmussen et al., 2006). Income is the most consistent correlate of the availability of more-healthy food in the home, and home food environment has a significant effect on youth fruit and vegetable intake (Ding et al., 2012). Low-income households spend significantly less on fruits and vegetables than higher income households, and marginal increases in income for lower income households are typically allocated to more essential food and nonfood items rather than fruits and vegetables (Blissard, Stewart, and Jolliffe, 2004). Therefore, for low-income households, marginal price reductions for fruit and vegetables may be a more effective way to increase consumption than marginal increases in income. Previous research has shown that reductions in price increase consumption of fruits and vegetables (French, 2003) and a meta-analysis that reviewed price

elasticity of demand for major food categories found that, on average, a 10% decrease in price would increase consumption of fruit and vegetables by 7% and 5.8%, respectively (Andreyeva, Long, and Brownell, 2010).

In 2000, the Secretary of Agriculture Dan Glickman announced the National Organic Program and stated, “For consumers who want to buy organic foods, the standards ensure that they can be confident in knowing what they are buying. For farmers, these standards create clear guidelines on how to take advantage of the exploding demand for organic products.”<sup>1</sup> The United States Department of Agriculture (USDA) Agricultural Marketing Service maintains the integrity of the “USDA Organic” seal, which first appeared in 2002. Market segmentation is an adjustment to a product due to heterogeneity in demand functions and is typically limited to manufactured and processed foods for agricultural products. However, the “USDA Organic” seal provides a reliable signal to consumers and allows for market segmentation of raw agricultural products based on production characteristics.

Economic theory would suggest that the market segmentation of conventional and organic agriculture products made it possible for consumers to self-select into the utility maximizing market. Thus, the “USDA Organic” seal theoretically increased the utility for consumers who preferred organic food, but did not have a reliable signal of production characteristics. Organic sales have increased from approximately \$15 billion in 2006 to approximately \$35 billion in 2014. Fruits and vegetables have represented the largest portion of organic sales and continue to. Demand for organic food is increasing year-over-year, and fruits and vegetables account for approximately 40% of organic food sales in any given year (USDA-ERS, 2014). Assuming that consumption of

---

<sup>1</sup> For a more detailed description about the history of state and federal organic regulations read Bones (1992) and Ellsworth (2001).

fruits and vegetables is fixed, conventional and organic fruits and vegetables are related in consumption. Thus, increased demand for fruits and vegetables in the organic market will likely affect prices and quantities in the conventional market.

While a multi-market model has been used to examine the effects on price and quantity from an increase in demand for food markets related in consumption, to our knowledge a multi-market model had not been used to evaluate changes in consumer welfare from an increase in demand in market related in consumption. The purpose of this paper is to extend the multi-market literature by developing a model to examine the effects on consumer welfare from market segmentation of agricultural products. To determine the effects of increased demand in the organic market on the conventional market, we estimated a multi-market model for fruits and vegetables using the elasticities in the aforementioned studies.

## 2. Multi-Market Models Specifications

### *Basic Model*

Holding other factors constant, demand and supply for the conventional and organic markets can be represented by:

$$C_{D1} = c_D(P_c, P_o, \Delta_D),$$

$$O_{D1} = o_D(P_c, P_o, \Delta_D),$$

$$C_{S1} = c_S(P_c, P_o),$$

$$O_{S1} = o_S(P_c, P_o),$$

$$D_1 = C_{D1} + O_{D1},$$

$$S_1 = C_{S1} + O_{S1},$$

where  $C_{D1}$ ,  $O_{D1}$ ,  $C_{S1}$ , and  $O_{S1}$  are quantities demanded and supplied of conventional and organic food,  $P_C$  and  $P_O$  denote prices of conventional and organic, and  $\Delta_D$  represents a shift in demand for organic food from the availability of a segmented market, and the last two equations are market-clearing quantity identities. The equations of the model can be expressed in the form of elasticities by taking the logarithmic differentials. Taking the logarithmic differentials of the equations above gives us the following equations:

$$d \ln C_{D1} = \eta_c d \ln P_c + \eta_{co} d \ln P_o + \alpha_c,$$

$$d \ln O_{D1} = \eta_{oc} d \ln P_c + \eta_o d \ln P_o + \alpha_o,$$

$$d \ln C_{S1} = \varepsilon_c d \ln P_c + \varepsilon_{co} d \ln P_o,$$

$$d \ln O_{S1} = \varepsilon_{oc} d \ln P_c + \varepsilon_o d \ln P_o,$$

where  $\eta_c$ ,  $\eta_o$ ,  $\eta_{co}$ , and  $\eta_{oc}$  are own- and cross-price elasticities of demand,  $\varepsilon_c$ ,  $\varepsilon_o$ ,  $\varepsilon_{co}$ , and  $\varepsilon_{oc}$  are own- and cross-price elasticities of supply, and  $\alpha_c$  and  $\alpha_o$  are proportional demand shocks.

The percentage changes in prices and demand for conventional and organic markets can be determined from the logarithmic differential equations:

$$d \ln P_c = \frac{\alpha_c(\varepsilon_o - \eta_o) - \alpha_o(\varepsilon_{co} - \eta_{co})}{(\varepsilon_c - \eta_c)(\varepsilon_o - \eta_o) - (\varepsilon_{oc} - \eta_{oc})(\varepsilon_{co} - \eta_{co})},$$

$$d \ln P_o = \frac{\alpha_o(\varepsilon_c - \eta_c) - \alpha_c(\varepsilon_{oc} - \eta_{oc})}{(\varepsilon_o - \eta_o)(\varepsilon_c - \eta_c) - (\varepsilon_{co} - \eta_{co})(\varepsilon_{oc} - \eta_{oc})}.$$

While the “USDA Organic” seal allowed consumers to self-select into the organic market, it is likely that consumption of fruits and vegetables remained constant. Thus, increases in consumption of organic fruits and vegetables must be offset by an equal decrease in consumption of conventional fruits and vegetables. The consumption constraint can be reflected as part of the proportional demand shocks and can be represented by  $S_c \alpha_c = -(1 - S_c) \alpha_o$ , where  $S_c$  is the consumption share of a conventional fruit or vegetable, and therefore we can say that  $\alpha_c = -(\frac{1-S_c}{S_c}) \alpha_o$ , which gives:

$$d \ln P_c = - \frac{(\frac{1-S_c}{S_c}) \alpha_o (\varepsilon_o - \eta_o) - \alpha_o (\varepsilon_{co} - \eta_{co})}{(\varepsilon_c - \eta_c)(\varepsilon_o - \eta_o) - (\varepsilon_{oc} - \eta_{oc})(\varepsilon_{co} - \eta_{co})},$$

$$d \ln P_o = \frac{\alpha_o (\varepsilon_c - \eta_c) + (\frac{1-S_c}{S_c}) \alpha_o (\varepsilon_{oc} - \eta_{oc})}{(\varepsilon_o - \eta_o)(\varepsilon_c - \eta_c) - (\varepsilon_{co} - \eta_{co})(\varepsilon_{oc} - \eta_{oc})}.$$

Lin et al. (2009) estimated demand elasticities and consumption shares for organic and conventional fruits and Kasteridis and Yen (2012) estimated demand elasticities and consumption shares for organic and conventional vegetables; both studies used data drawn from a 2006 Nielsen’s Homescan panel to estimate elasticities. Those elasticities and consumption shares are shown in Table 1. It was impossible to obtain own- and cross-price elasticities of supply for conventional and organic fruits and vegetables. Therefore, we assume unitary elasticity for own-price and cross-price elasticities of 0.5.

#### *Expanded Model*

A limitation to the *Basic Model* is the assumption that market segment responsible for the increase in consumption of organics and the market segment choosing not to participate in the organic market are homogenous. Fundamental to the concept of market segmentation is distinct demand functions that arise from demand heterogeneity (Dickson and Ginter, 1987). Previous research has

shown that there are characteristics of organic consumers that are significantly different than non-organic consumers. To account for the heterogeneity, we separate demand for conventional and organic fruits and vegetables for the market segment currently choosing to participate in the organic market (denoted by a superscript  $a$ ) and the market segment not participating (denoted by a superscript  $b$ ). Percent changes in prices with the markets segmented gives the following:

$$C_D^a = c_D^a(P_o, P_c, \Delta_D),$$

$$C_D^b = c_D^b(P_o, P_c, ),$$

$$O_D^a = o_D^a(P_o, P_c, \Delta_D),$$

$$O_D^b = o_D^b(P_o, P_c, ),$$

$$C_{S2} = c(P_o, P_c, ),$$

$$O_{S2} = o(P_o, P_c, ),$$

$$C_{D2} = C_D^a + C_D^b,$$

$$O_{D2} = O_D^a + O_D^b,$$

Taking the logarithmic differences gives:

$$d \ln C_D^a = \eta_c^a d \ln P_c + \eta_{co}^a d \ln P_o + \alpha_c$$

$$d \ln C_D^b = \eta_c^b d \ln P_c + \eta_{co}^b d \ln P_o$$

$$d \ln O_D^a = \eta_{oc}^a d \ln P_c + \eta_o^a d \ln P_o + \alpha_o$$

$$d \ln O_D^b = \eta_{oc}^b d \ln P_c + \eta_o^b d \ln P_o$$

$$d \ln C_{S2} = \varepsilon_c d \ln P_c + \varepsilon_{co} d \ln P_o,$$

$$d \ln O_{S2} = \varepsilon_{oc} d \ln P_c + \varepsilon_o d \ln P_o,$$

$$d \ln C_{D2} = \psi^a C_D^a + (1 - \psi^a) C_D^b,$$

$$d \ln O_{D2} = \varphi^a O_D^a + (1 - \varphi^a) O_D^b,$$

where  $\psi^a$  and  $\varphi^a$  are initial consumption mixes defined using the specific quantities of conventional and organic produce consumed by market segment  $a$ .

The percentage changes in prices and demand for conventional and organic markets can be determined from the logarithmic differential equations:

$$d \ln P_c$$

$$= \frac{(\frac{1-S_c}{S_c})\alpha_o(\varepsilon_o - \varphi^a\eta_o^a - (1-\varphi^a)\eta_o^b) - \alpha_o(\varepsilon_{co} - \psi^a\eta_{co}^a - (1-\psi^a)\eta_{co}^b)}{(\varepsilon_c - \psi^a\eta_c^a - (1-\psi^a)\eta_c^b)(\varepsilon_o - \varphi^a\eta_o^a - (1-\varphi^a)\eta_o^b) - (\varepsilon_{oc} - \varphi^a\eta_{oc}^a - (1-\varphi^a)\eta_{oc}^b)(\varepsilon_{co} - \psi^a\eta_{co}^a - (1-\psi^a)\eta_{co}^b)}$$

$$d \ln P_o$$

$$= \frac{\alpha_o(\varepsilon_c - \psi^a\eta_c^a - (1-\psi^a)\eta_c^b) + (\frac{1-S_c}{S_c})\alpha_o(\varepsilon_{oc} - \varphi^a\eta_{oc}^a - (1-\varphi^a)\eta_{oc}^b)}{(\varepsilon_o - \varphi^a\eta_o^a - (1-\varphi^a)\eta_o^b)(\varepsilon_c - \psi^a\eta_c^a - (1-\psi^a)\eta_c^b) - (\varepsilon_{co} - \psi^a\eta_{co}^a - (1-\psi^a)\eta_{co}^b)(\varepsilon_{oc} - \varphi^a\eta_{oc}^a - (1-\varphi^a)\eta_{oc}^b)}$$

It is likely that the market segment that chooses to spend a greater portion of their budget on food than necessary have less elastic demand. Moreover, it has been recognized that demand becomes less price elastic when a product satisfies a consumer's requirement more precisely (Chamberlin 3<sup>rd</sup> edition), and market segmentation is an adjustment to a product to more precisely represent a consumer's requirement (Smith, 1956). Thus, the implication is that the demand elasticities should be less elastic for organic consumers and can be represented by

$$\eta_e^a = \kappa \eta_e^b; 0 < \kappa \leq 1,$$

where  $\eta_e$  is an own- or cross-price elasticity of demand. After substitution, the percent changes in price can be represented by

$$d \ln P_c$$

$$= \frac{(\frac{1-S_c}{S_c})\alpha_o(\varepsilon_o - \varphi^a \kappa \eta_o^b - (1 - \varphi^a) \eta_o^b) - \alpha_o(\varepsilon_{co} - \psi^a \kappa \eta_{co}^b - (1 - \psi^a) \eta_{co}^b)}{(\varepsilon_c - \psi^a \kappa \eta_c^b - (1 - \psi^a) \eta_c^b)(\varepsilon_o - \varphi^a \kappa \eta_o^b - (1 - \varphi^a) \eta_o^b) - (\varepsilon_{oc} - \varphi^a \kappa \eta_{oc}^b - (1 - \varphi^a) \eta_{oc}^b)(\varepsilon_{co} - \psi^a \kappa \eta_{co}^b - (1 - \psi^a) \eta_{co}^b)}$$

$$d \ln P_o$$

$$= \frac{\alpha_o(\varepsilon_c - \psi^a \kappa \eta_c^b - (1 - \psi^a) \eta_c^b) + (\frac{1-S_c}{S_c})\alpha_o(\varepsilon_{oc} - \varphi^a \kappa \eta_{oc}^b - (1 - \varphi^a) \eta_{oc}^b)}{(\varepsilon_o - \varphi^a \kappa \eta_o^b - (1 - \varphi^a) \eta_o^b)(\varepsilon_c - \psi^a \kappa \eta_c^b - (1 - \psi^a) \eta_c^b) - (\varepsilon_{co} - \psi^a \kappa \eta_{co}^b - (1 - \psi^a) \eta_{co}^b)(\varepsilon_{oc} - \varphi^a \kappa \eta_{oc}^b - (1 - \varphi^a) \eta_{oc}^b)}$$

### 3. Results

Estimation of the multi-market models indicated that increased demand in the organic market does decrease the prices in the conventional market. Moreover, the *Expanded Model* gives more insight into the behavior of the market segments.

## References

- Andreyeva, Tatiana, Michael W. Long, and Kelly D. Brownell. "The impact of food prices on consumption: a systematic review of research on the price elasticity of demand for food." *American journal of public health* 100, no. 2 (2010): 216-222.
- Blisard, William Noel, Hayden Stewart, and Dean Jolliffe. *Low-income households' expenditures on fruits and vegetables*. Washington, DC: US Department of Agriculture, Economic Research Service, 2004.
- Bones, G. G. (1992). State and Federal Organic Food Certification Laws: Coming of Age. *NDL Rev.*, 68, 405.
- Dickson, P. R., & Ginter, J. L. (1987). Market segmentation, product differentiation, and marketing strategy. *The Journal of Marketing*, 1-10.
- Ding, Ding, James F. Sallis, Gregory J. Norman, Brian E. Saelens, Sion Kim Harris, Jacqueline Kerr, Dori Rosenberg, Nefertiti Durant, and Karen Glanz. "Community food environment, home food environment, and fruit and vegetable intake of children and adolescents." *Journal of nutrition education and behavior* 44, no. 6 (2012): 634-638.
- Ellsworth, J. (2001). The History of Organic Food Regulation.
- French, Simone A. "Pricing effects on food choices." *The Journal of nutrition* 133, no. 3 (2003): 841S-843S.
- Moore, L. V., Dodd, K. W., Thompson, F. E., Grimm, K. A., Kim, S. A., & Scanlon, K. S. (2015). Using Behavioral Risk Factor Surveillance System data to estimate the percentage of the

population meeting US Department of Agriculture Food Patterns fruit and vegetable intake recommendations. *American journal of epidemiology*, 181(12), 979-988.

Rasmussen, Mette, Rikke Krølner, Knut-Inge Klepp, Leslie Lytle, Johannes Brug, Elling Bere, and Pernille Due. "Determinants of fruit and vegetable consumption among children and adolescents: a review of the literature. Part I: quantitative studies." *International Journal of Behavioral Nutrition and Physical Activity* 3, no. 1 (2006): 22.

Smith, W. R. (1956). Product differentiation and market segmentation as alternative marketing strategies. *The Journal of Marketing*, 3-8.

U.S. Department of Agriculture, Economic Research Service (USDA-ERS). 2014b. "Organic Agriculture, Organic Market Overview." Available online: <http://www.ers.usda.gov/topics/natural-resources-environment/organic-agriculture/organic-market-overview>.

Table 1. Demand Elasticities Used in Models

Product	Uncompensated Elasticities			
	$\eta_c$	$\eta_o$	$\eta_{co}$	$\eta_{oc}$
Apples	-0.83	-1.06	0.10	0.03
Bananas	-0.70	-3.19	1.13	0.23
Grapes	-0.49	-3.54	0.15	0.05
Oranges	-0.57	-0.92	0.07	0.03
Strawberries	-0.50	-0.36	-0.06	-0.02
Other Fruits	-0.85	-0.01	0.23	0.04
Carrots	-0.77	-1.85	0.07	0.12
Onions	-0.89	-1.90	0.05	0.08
Potatoes	-1.20	-2.77	0.08	0.15
Tomatoes	-0.81	-1.86	-0.05	-0.21
Other Vegetables	-0.91	-1.81	-0.03	0.70

Note: The uncompensated elasticities and percent of consuming households in this table were obtained via Lin et al. (2009) and Kasteridis and Yen (2012).

Table 2. Basic Model Results

Product	Demand Shock	% Change in Price		% Change in Consumption	
	$\alpha_o$	$d \ln P_c$	$d \ln P_o$	$d \ln C_{DI}$	$d \ln O_{DI}$
Apples	5.0	-0.71	2.59	-4.15	2.23
Apples	10.0	-1.42	5.18	-8.30	4.47
Bananas	5.0	0.28	1.18	-3.87	1.32
Bananas	10.0	0.56	2.35	-7.74	2.63
Grapes	5.0	-0.45	1.15	-4.61	0.92
Grapes	10.0	-0.89	2.29	-9.22	1.85
Oranges	5.0	-0.94	2.84	-4.26	2.36
Oranges	10.0	-1.89	5.67	-8.53	4.73
Strawberries	5.0	-1.81	4.37	-4.36	3.46
Strawberries	10.0	-3.61	8.73	-8.72	6.93
Other Fruits	5.0	-0.93	5.37	-2.98	4.91
Other Fruits	10.0	-1.85	10.74	-5.95	9.82
Carrots	5.0	-0.60	1.83	-4.42	1.53
Carrots	10.0	-1.19	3.66	-8.84	3.07
Onions	5.0	-0.57	1.80	-4.41	1.52
Onions	10.0	-1.15	3.61	-8.82	3.04
Potatoes	5.0	-0.38	1.36	-4.44	1.17
Potatoes	10.0	-0.76	2.73	-8.87	2.34
Tomatoes	5.0	-0.73	1.93	-4.51	1.56
Tomatoes	10.0	-1.47	3.86	-9.01	3.13
Other Vegetables	5.0	-0.62	1.73	-4.49	1.42
Other Vegetables	10.0	-1.25	3.47	-8.99	2.84

Note: The above results follow from the assumed model parameter values:  $\varepsilon_c = \varepsilon_o = 1$ ,  $\varepsilon_{co} = \varepsilon_{oc} = 0.5$ ,  $\psi^a = 0.2$ ,  $\varphi^a = 0.95$ , and  $S_c = 0.95$ .

Table 3. Expanded Model Results  $k=1$ 

Product	Demand Shock	% Change in Price		% Change in Consumption of Conventional by Segment		% Change in Consumption of Organic by Segment		% Change in Consumption	
	$\alpha_o$	$d \ln P_c$	$d \ln P_o$	$d \ln C_D^a$	$d \ln C_D^b$	$d \ln O_D^a$	$d \ln O_D^b$	$d \ln C_{D2}$	$d \ln O_{D2}$
Apples	5.0	-0.71	2.59	-4.15	0.85	2.23	-2.77	-0.15	1.98
Apples	10.0	-1.42	5.18	-8.30	1.70	4.47	-5.53	-0.30	3.97
Bananas	5.0	0.28	1.18	-3.87	1.13	1.32	-3.68	0.13	1.07
Bananas	10.0	0.56	2.35	-7.74	2.26	2.63	-7.37	0.26	2.13
Grapes	5.0	-0.45	1.15	-4.61	0.39	0.92	-4.08	-0.61	0.67
Grapes	10.0	-0.89	2.29	-9.22	0.78	1.85	-8.15	-1.22	1.35
Oranges	5.0	-0.94	2.84	-4.26	0.74	2.36	-2.64	-0.26	2.11
Oranges	10.0	-1.89	5.67	-8.53	1.47	4.73	-5.27	-0.53	4.23
Strawberries	5.0	-1.81	4.37	-4.36	0.64	3.46	-1.54	-0.36	3.21
Strawberries	10.0	-3.61	8.73	-8.72	1.28	6.93	-3.07	-0.72	6.43
Other Fruits	5.0	-0.93	5.37	-2.98	2.02	4.91	-0.09	1.02	4.66
Other Fruits	10.0	-1.85	10.74	-5.95	4.05	9.82	-0.18	2.05	9.32
Carrots	5.0	-0.60	1.83	-4.42	0.58	1.53	-3.47	-0.42	1.28
Carrots	10.0	-1.19	3.81	-8.83	1.17	2.79	-7.21	-0.83	2.29
Onions	5.0	-0.57	1.81	-4.41	0.59	1.50	-3.50	-0.41	1.25
Onions	10.0	-1.15	3.62	-8.82	1.18	3.01	-6.99	-0.82	2.51
Potatoes	5.0	-0.38	1.36	-4.44	0.56	1.17	-3.83	-0.44	0.92
Potatoes	10.0	-0.76	2.73	-8.87	1.13	2.35	-7.65	-0.87	1.85
Tomatoes	5.0	-0.73	2.01	-4.51	0.49	1.42	-3.58	-0.51	1.17
Tomatoes	10.0	-1.47	4.01	-9.02	0.98	2.84	-7.16	-1.02	2.34
Other Vegetables	5.0	-0.62	1.70	-4.49	0.51	1.49	-3.51	-0.49	1.24
Other Vegetables	10.0	-1.25	3.39	-8.98	1.02	2.98	-7.02	-0.98	2.48

Note: The above results follow from the assumed model parameter values:  $\varepsilon_c = \varepsilon_o = 1$ ,  $\varepsilon_{co} = \varepsilon_{oc} = 0.5$ ,  $\psi^a = 0.2$ ,  $\varphi^a = 0.95$ , and  $S_c = 0.95$ .

Table 4. Expanded Model Results  $k=0.75$ 

Product	Demand Shock	% Change in Price		% Change in Consumption of Conventional by Segment		% Change in Consumption of Organic by Segment		% Change in Consumption	
	$\alpha_o$	$d \ln P_c$	$d \ln P_o$	$d \ln C_D^a$	$d \ln C_D^b$	$d \ln O_D^a$	$d \ln O_D^b$	$d \ln C_{D2}$	$d \ln O_{D2}$
Apples	5.0	-0.82	2.98	-4.26	0.98	2.61	-3.19	-0.07	2.32
Apples	10.0	-1.64	5.96	-8.53	1.96	5.22	-6.37	-0.14	4.64
Bananas	5.0	0.33	1.43	-3.97	1.38	1.65	-4.47	0.31	1.34
Bananas	10.0	0.67	2.85	-7.93	2.76	3.30	-8.94	0.62	2.68
Grapes	5.0	-0.53	1.42	-4.65	0.47	1.22	-5.04	-0.55	0.90
Grapes	10.0	-1.05	2.83	-9.30	0.94	2.44	-10.09	-1.11	1.81
Oranges	5.0	-1.08	3.24	-4.37	0.84	2.74	-3.02	-0.20	2.45
Oranges	10.0	-2.16	6.48	-8.73	1.69	5.48	-6.03	-0.40	4.90
Strawberries	5.0	-1.96	4.72	-4.48	0.70	3.76	-1.66	-0.34	3.49
Strawberries	10.0	-3.92	9.43	-8.96	1.39	7.51	-3.32	-0.68	6.97
Other Fruits	5.0	-0.99	5.42	-3.43	2.09	4.93	-0.09	0.98	4.68
Other Fruits	10.0	-1.98	10.85	-6.87	4.18	9.86	-0.19	1.97	9.36
Carrots	5.0	-0.70	2.19	-4.48	0.69	1.89	-4.15	-0.35	1.59
Carrots	10.0	-1.41	4.38	-8.97	1.38	3.78	-8.29	-0.69	3.18
Onions	5.0	-0.68	2.16	-4.47	0.70	1.87	-4.17	-0.33	1.57
Onions	10.0	-1.36	4.32	-8.95	1.40	3.75	-8.34	-0.67	3.14
Potatoes	5.0	-0.45	1.66	-4.49	0.67	1.50	-4.67	-0.36	1.19
Potatoes	10.0	-0.91	3.33	-8.99	1.35	2.99	-9.34	-0.72	2.37
Tomatoes	5.0	-0.86	2.30	-4.56	0.58	1.92	-4.10	-0.45	1.62
Tomatoes	10.0	-1.73	4.61	-9.13	1.16	3.85	-8.21	-0.90	3.24
Other Vegetables	5.0	-0.74	2.09	-4.55	0.60	1.77	-4.30	-0.43	1.47
Other Vegetables	10.0	-1.48	4.18	-9.10	1.20	3.55	-8.60	-0.86	2.94

Note: The above results follow from the assumed model parameter values:  $\varepsilon_c = \varepsilon_o = 1$ ,  $\varepsilon_{co} = \varepsilon_{oc} = 0.5$ ,  $\psi^a = 0.2$ ,  $\varphi^a = 0.95$ , and  $S_c = 0.95$ .

Table 5. Expanded Model Results  $k=0.50$ 

Product	Demand Shock	% Change in Price		% Change in Consumption of Conventional by Segment		% Change in Consumption of Organic by Segment		% Change in Consumption	
	$\alpha_o$	$d \ln P_c$	$d \ln P_o$	$d \ln C_D^a$	$d \ln C_D^b$	$d \ln O_D^a$	$d \ln O_D^b$	$d \ln C_{D2}$	$d \ln O_{D2}$
Apples	5.0	-0.98	3.52	-4.42	1.16	3.12	-3.76	0.05	2.78
Apples	10.0	-1.95	7.03	-8.84	2.32	6.24	-7.51	0.09	5.56
Bananas	5.0	0.41	1.81	-4.12	1.76	2.16	-5.68	0.58	1.77
Bananas	10.0	0.83	3.62	-8.24	3.51	4.32	-11.36	1.16	3.53
Grapes	5.0	-0.65	1.86	-4.70	0.60	1.70	-6.61	-0.46	1.28
Grapes	10.0	-1.31	3.71	-9.40	1.20	3.39	-13.22	-0.92	2.56
Oranges	5.0	-1.27	3.79	-4.51	0.99	3.24	-3.52	-0.11	2.90
Oranges	10.0	-2.53	7.57	-9.01	1.97	6.48	-7.04	-0.22	5.80
Strawberries	5.0	-2.14	5.12	-4.62	0.76	4.10	-1.80	-0.31	3.80
Strawberries	10.0	-4.28	10.25	-9.24	1.52	8.20	-3.60	-0.63	7.61
Other Fruits	5.0	-1.06	5.48	-3.92	2.16	4.95	-0.10	0.94	4.70
Other Fruits	10.0	-2.12	10.96	-7.84	4.32	9.90	-0.19	1.89	9.40
Carrots	5.0	-0.86	2.73	-4.58	0.85	2.42	-5.15	-0.24	2.04
Carrots	10.0	-1.73	5.45	-9.15	1.69	4.85	-10.31	-0.47	4.09
Onions	5.0	-0.83	2.69	-4.57	0.86	2.40	-5.19	-0.22	2.02
Onions	10.0	-1.67	5.38	-9.14	1.72	4.81	-10.38	-0.45	4.05
Potatoes	5.0	-0.57	2.14	-4.58	0.85	2.00	-6.00	-0.24	1.60
Potatoes	10.0	-1.14	4.27	-9.15	1.70	4.00	-11.99	-0.47	3.21
Tomatoes	5.0	-1.05	2.86	-4.65	0.71	2.46	-5.09	-0.36	2.08
Tomatoes	10.0	-2.11	5.71	-9.29	1.41	4.91	-10.18	-0.73	4.16
Other Vegetables	5.0	-0.91	2.62	-4.63	0.74	2.30	-5.39	-0.34	1.92
Other Vegetables	10.0	-1.82	5.25	-9.26	1.48	4.61	-10.78	-0.67	3.84

Note: The above results follow from the assumed model parameter values:  $\varepsilon_c = \varepsilon_o = 1$ ,  $\varepsilon_{co} = \varepsilon_{oc} = 0.5$ ,  $\psi^a = 0.2$ ,  $\varphi^a = 0.95$ , and  $S_c = 0.95$ .