Demand for Organic and Conventional Baby Food

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The organic segment of the food industry had sales of $17 billion in 2006, with an annual growth rate of 20 percent. The growth in organic baby food has paralleled the overall growth in organic foods. The organic niche for baby-food processors and retailers may continue to be a window of opportunity for increasing sales in an otherwise stagnant industry. In order to exam the extent of this opportunity, information is needed regarding consumer demand. The LA/AIDS model is used to estimate aggregate consumer responsiveness to changes in prices and expenditures. Results show that organic baby-food consumers are price sensitive—that is, they are willing to buy more organic baby food as prices continue to fall. However, our analysis also shows that as the market for organic baby food expands, there is less opportunity for growth than in the past.

In the United States, $3.7 billion of baby food was sold in 2006, an increase of only 3.1 percent from the previous year (Agovino 2007). In an effort to overcome the challenges presented by a stagnant birth rate, producers and retailers of baby food have focused attention on consumers, making every effort to create products which meet the standards of modern families. A prominent example of this trend has been the development of healthier foods. During the 1980s and 1990s, for example, manufacturers altered baby foods by removing refined sugar, salt, and chemically modified starch (Weiner 2004). Consumer demand for more nutritional products has also led to the production of organic baby food. Though scientific evidence supporting the superior nutritional value of organic products is lacking, consumers apparently perceive value in "organic" (Yiridoe, Bonti-Ankomah, and Martin 2005). The organic segment of the food industry had sales of $17 billion in 2006 with an annual growth rate of 20 percent (Organic Consumers Association 2007). The growth in organic baby food has paralleled the overall growth in organic foods. In 2006, $116 million was spent on organic baby food, an increase of 21.6 percent from the previous year (Agovino 2007).

For baby-food processors and retailers the organic niche may continue to be a window of opportunity for increasing sales in an otherwise stagnant industry. In order to examine the extent of this opportunity, information is needed regarding consumer demand. We present demand elasticities for organic versus conventional baby food and relate them to previous work, with implications regarding the future of the organic baby food market.

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Previous Studies

Several empirical-demand studies have been conducted which compare organic and conventionally prepared baby foods. An examination of the price differences between conventional and organic baby foods with respect to explanatory factors was undertaken by Harris (1997). Organic baby food was found to be worth 21 cents per jar more than conventional baby food. Consumers reportedly were willing to pay the premium for perceived healthier, better tasting, and more nutritious baby food.

Harris (1999) examined the relationship between baby-food consumption, attitudes about food safety, and socioeconomic characteristics of consumers. Of 91 households analyzed, 87 percent of the meal planners felt that the safety of the food they purchased was very important. Income was found to have a significant effect on baby-food consumption. Education had a negative impact on consumption. As concern for safety increased, purchases of baby food decreased.

Thompson and Glaser (2001) researched national consumer demand for organic and conventional baby food during the 1990s. During this decade, market shares of organic baby food rose and price premiums fell. By 1999 organic baby-food dinners had captured 13 percent of the total baby-food market (measured in volume). Organic vegetables and fruits accounted for 6.7 percent and 4.5 percent of the market, respectively, while organic baby juices accounted for 2.3 percent. Prices for all categories of organic baby food declined during the study pe-

riod. Results indicated that organic baby-food purchases were highly sensitive to the price of organic baby food. Own-price elasticities of conventional baby food, on the other hand, indicated much less sensitivity, with no significant own-price response found for several categories of conventional baby food. Calculated cross-price elasticities show that within a given category, the quantity purchased of the organic item was highly sensitive to a change in the price of the conventional counterpart. For example, an increase in the price of a conventional baby dinner would likely increase purchases of organic baby dinners. The reverse was not found to hold true: price changes of organic baby foods did not affect quantity consumed of conventional baby food. Most expenditure elasticities were found to be statistically indistinguishable from zero.

Maguire, Owens, and Simon (2004) undertook a hedonic analysis of the price premium for organic baby food. Results indicated that the price premium was 16–27 percent. Later, they collected information about the motivation behind organic baby-food purchases in a series of focus-group discussions with parents of young children Maguire, Owens, and Simon (2006). Over 80 percent of focus-group participants had fed their children processed baby food. When asked about the safety of conventional baby food, responses were mixed. For those who exclusively purchased organic, health-risk reduction was the primary motivation.

Our paper makes several contributions to the current literature. Harris (1999) used survey data to examine the effect of consumer preference on baby-food consumption, while Maguire, Simons, and Owens (2006) used focus groups. Neither of these research methods takes into account actual purchase choices, information retailers need when making inventory decisions. Harris (1997) and Thompson and Glaser (2001), which took into account previous purchase decisions through the use of scanner data, used data from the 1980s and 1990s, which is somewhat dated. Not only does this time-frame predate recent expansions in the market, it precedes the implementation of the USDA National Organic Program. Additionally, their data consist only of supermarket purchases, which is problematic since many organic purchases are made in health food and other specialty stores. Maguire, Owens, and Simon (2004), while recent, is limited to a single cross section from only two U.S. cities, representing less than one percent of the U.S. population of children under one year of age. Our research, on the other hand, is not restricted by any of the aforementioned limitations of time, type of data, or location. Our analysis is drawn from nationally collected scanner data with observations as recent as 2005 which will be useful in identifying the current trends in the market.

Theoretical Model

Deaton and Muelbauer's Almost Ideal Demand System (AIDS) has been used in many empirical studies (Buse 1994). Following Taljaard, Alemu, and van Schalkwyk (2004) the AIDS model can be specified as

$$(1)\quad w_{it} = \alpha_i + \sum_j^n \gamma_{ij} \ln p_{jt} + \beta_i \ln(X_t / P_t) + u_{it},$$
$$i = 1,\ldots,n,$$

where at observation t, w_{it} is the expenditure share of good i, p is the price of good j, $\ln X_t$ is total expenditure, u_{it} is the error term and $\ln P_t$ is the translog price index. However, the nonlinear price index can often complicate empirical estimation of a demand system; thus Deaton and Mulbauer (1980) substitute Stone's Price Index, defined as

$$(2)\quad LnP = \sum_{i=1}^n w_{it} \ln p_{it} \cdot$$

This substitution, however, has been shown to cause simultaneity of w_{it} (the dependent variable) within the model (Eales and Unnevehr 1988). Thus the final LA/AIDS equations used for estimation include lagged budget shares (w_{it}) on the right-hand side:

$$(3)\quad \begin{aligned} w_{it} = \alpha_i = \sum_j^n \gamma_{ij} \ln p_{jt} = \\ \beta_i(\ln X - \sum_{i=1}^n w_{it-1} \ln p_{it}) + u_{it} \cdot \end{aligned}$$

Data Description

ACNielsen Homescan data were used for this study. The data are unique in that each panelist was supplied with a scanner device that he/she used at home to record grocery items purchased at any grocery or other type of store throughout the study period. Purchase information used for this study is from

the period 1998–2005. The organic baby-food purchases made from 2002–2005 are identified using the national organic-claim identification system. Prior to that date there was no national certification system for organic foods, so identification of organic foods from 1998 through 2001is according to product description. Quantities are expressed in ounces; expenditures and prices are expressed in cents paid per ounce.

The data for this study consist of 150,000 observations. Use of such a large dataset in econometric analysis can yield results with misleading levels of statistical significance. To avoid this problem, data were randomly sampled twelve times, at a rate of approximately 1,000 observations per sample. SAS was used to run the LA/AIDS model for each sample, and elasticities were calculated from averaged parameter estimates and standard errors.

Thompson and Glaser (2001) used two distinct groupings of baby food. The first compared organic and conventional fruits/desserts, and organic and conventional dinners (Table 1); the second compared organic and conventional varieties of fruits, vegetables, juices, and cereals (Table 2). The same groupings have been used in this study for purposes of comparison and to illustrate trends in the organic baby-food market (Tables 3 and 4).

Results and Implications

The expenditure, own-price, and cross-price elasticities for the LA/AIDS model are calculated at the average sample means according to Equations 4–6 (Tables 3 and 4):

(4) Expenditure elasticity: $\eta_i = 1 + \beta_i / w_i$,

(5) Own-price elasticity: $e_{ii} = (\gamma_{ii}/w_i) - \beta_i(w_j/w_i) - 1$,

(6) Cross-price elasticity: $e_{ij} = (\gamma_{ij} / w_i) - \beta_i(w_j/w_i)$ for $i \neq j$.

Expenditure elasticities were significant and positive for several categories of organic baby food, including fruits, dinners, and fruits/desserts. The fact that the expenditure elasticities of these organic goods are higher than those for their conventional counterparts implies that given an increase in the budget share of these types of baby foods, consumers will allocate a higher share of the budget to organics. The juice category was the only instance in which the conventional product exhibited a significant elasticity while the organic product did not. Cross-price elasticities were not found to be significant for any category. Significant own-price elasticities were found for organic baby foods in all categories, although at relatively small magnitudes. Most own-price elasticities were only slightly larger than unity in absolute value, a notable change from the findings of Thompson and Glaser (2001) (Tables 1 and 2). These results can be attributed to the increase in available organic products on the market. Since implementation of national organic-certification standards, the supply of organic foods has increased substantially. As supply expands to meet demand, price premiums tend to fall or flatten, and consumers are not as sensitive to price changes of organic baby food or substitute goods.

Conclusion

This paper examines price and income elasticities for organic baby food. Supplies of organic foods have increased dramatically over the last ten years and have become more affordable. The results of this analysis suggest that consumers of organic baby food are not as sensitive to price changes of organics as they once were. Continued efforts by baby-food manufactures and retailers to expand production of these products while affording consumers attractive prices, may not lead to dramatically increased purchase levels. Future research in this area should examine the affect of other marketing labels such as "all natural" which may rival organic for consumer appeal, providing another window of opportunity for the food industry.

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Table 1. Organic and Conventional Elasticities at Sample Means, 1992–1996.

	Organic dinners	Conventional dinners	Organic fruits/ desserts	Conventional fruits/ desserts	Expenditures
Organic dinners	-2.489*** (.000)[a]	1.913** (.048)	0.245 (.702)	-1.248 (.138)	2.579 (.255)
Conventional dinners	0.143** (.004)	-.0154 (.377)	0.003 (.943)	-1.722*** (.000)	1.730*** (.000)
Organic fruits/ desserts	-0.212 (.850)	0.588 (.702)	-3.110** (.002)	0.588 (.702)	2.416 (.293)
Conventional fruits/desserts	-0.029*** (.000)	-0.436*** (.000)	0.039*** (.000)	-0.165*** (.000)	0.590*** (.000)

[a] P values are in parentheses.

***Statistically significant at the 0.01 level, ** 0.05 level, and * 0.10 level.

Source: Thompson and Glaser (2001).

Table 2. Organic and Conventional Elasticities at Sample Means, 1996–2000.

	Organic fruit	Conv. fruit	Organic vegetable	Conv. vegetable	Organic juice	Conv. juice	Organic cereal	Conv. cereal	Expenditures
Organic fruit	-2.543 (.000)[a]	4.434 (.234)							-4.768 (.454)
Conv. fruit	0.065 (.234)	-0.026 (939)							0.490 (.451)
Organic vegetable			-1.548*** (.000)	-1.930* (.080)					5.444 (.243)
Conv. vegetable			-0.064 (.139)	-0.735** (.045)					1.960 (.231)
Organic juice					-5.161*** (.000)	1.471 (.670)			-1.156 (.961)
Conv. juice					0.011 (.772)	-0.362 (.379)			3.188 (.285)
Organic cereal							0.296 (.623)	3.295*** (.000)	5.294 (.375)
Conv. cereal							0.524*** (.000)	-0.171 (.823)	-3.070 (.361)

[a] P values are in parentheses.
***Statistically significant at the 0.01 level, ** at the 0.05 level and * at the 0.10 levels.
Source: Thompson and Glaser (2001).

Table 3. Organic and Conventional Elasticities at Sample Means, 1998–2005.

	Organic dinners	Conventional dinners	Organic fruits/ desserts	Conventional fruits/ desserts	Expenditures
Organic dinners	0.976***	-0.071	-0.204*	-0.076	1.114**
	(.000)[a]	(.203)	(.085)	(.406)	(.004)
Conventional dinners	-0.199	-1.196**	-0.081	-0.208	1.271
	(.140)	(.006)	(.186)	(.207)	(.233)
Organic fruits/ desserts	-0.224**	-0.223	-1.179***	-0.173	1.317*
	(.011)	(.301)	(.000)	(.614)	(.010)
Conventional fruits/desserts	-0.271	-0.209	-0.168	-0.638**	1.318
	(.407)	(.721)	(.323)	(.003)	(.254)

[a] P values are in parentheses.
***Statistically significant at the 0.01 level, ** at the 0.05 level and * at the 0.10 levels.

Table 4. Organic and Conventional Elasticities at Sample Means, 1998–2005.

	Organic fruit	Conv. fruit	Organic vegetable	Conv. vegetable	Organic juice	Conv. juice	Organic cereal	Conv. cereal	Expenditures
Organic fruit	-1.011***	0.083							1.056*
	(.002) a	(.186)							(.079)
Conv. fruit	-0.006	-0.499							0.916**
	(.744)	(.103)							(.032)
Organic vegetable			-1.040***	0.244					0.690
			(.000)	(.539)					(.101)
Conv. vegetable			0.076	-1.254					1.053
			(.324)	(.204)					(.800)
Organic juice					-1.029**	0.008			1.131
					(.004)	(.106)			(.385)
Conv. juice					-0.089	-0.949			1.002***
					(.646)	(.549)			(.000)
Organic cereal							1.010**	0.011	0.679
							(.003)	(.376)	(.621)
Conv. cereal							0.301	-1.183*	0.814*
							(.142)	(.007)	(.009)

[a] P values are in parentheses.
***Statistically significant at the 0.01 level, ** at the 0.05 level and * at the 0.10 levels.