Demand for Organic and Conventional Baby Food

Victoria S. LeBeaux, James E. Epperson, Chung L. Huang

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 in the stagnant industry. In order to examine the extent of this opportunity, information is needed regarding consumer demand. The L/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 healthfare 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 21.5 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

LeBeaux is former student, and Epperson and Huang are professors, Department of Agricultural and Applied Economics, University of Georgia, Athens.

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 cost 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 diners had captured 13 percent of the total baby-food market (measured in volume). Organic vegetables and fruits accounted for 6.7 percent and 4.3 percent of the market, respectively, while organic baby juice accounted for 2.3 percent. Prices for all categories of organic baby food declined during the study period. 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 preferences on baby-food consumption, while Maguire, Simon, 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 grocery stores and other specialty stores.

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

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 Muellbauer’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

\[
\begin{align*}
\mathbf{w}_i &= \mathbf{a}_i + \sum_{j} \mathbf{Y}_{ij} \ln p_{ij} + \mathbf{\beta}_i \ln (X_i / P_i) + u_i, \\
\end{align*}
\]

where at observation \( t \), \( w_i \) is the expenditure share of good \( j \), \( p_i \) is the price of good \( j \), \( X_i \) is total expenditure, \( u_i \) is the error term, and \( \ln \) is the natural logarithm. However, the nonlinear price index can sometimes complicate empirical estimation of a demand system; thus Deaton and Muellbauer (1980) substitute Stone’s Price Index, defined as

\[
\begin{align*}
\mathbf{w}_i &= \mathbf{a}_i + \sum_{j} \mathbf{Y}_{ij} \ln p_{ij} + \mathbf{\beta}_i \ln \left( X_i - \sum_{j} X_{ij} \ln p_{ij} \right) + u_i, \\
\end{align*}
\]

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

\[
\begin{align*}
w_{ij} &= \mathbf{a}_i + \hat{\mathbf{Y}}_{ij} \ln p_{ij} + \\
\end{align*}
\]

where \( \hat{\mathbf{Y}}_{ij} \) is the lagged budget share on the right-hand side:
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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 added 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, Botti-Andkomah, 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 21.5 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.

Previous Studies

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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 respondents 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.

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Theoretical Model

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\[ w_i = \alpha_i + \sum_{j=1}^{n} \beta_{ij} \ln p_j + \beta_i \ln (X_i / P) + u_i, \quad i = 1, \ldots, n \]

where at observation t, \( w_i \) is the expenditure share of good i, \( p_i \) is the price of good j, \( \ln X_i \) is total expenditure, \( \ln P \) is the log of the price index, and \( u_i \) is the translog price index. However, the nonlinear price index can often complicate empirical estimation of a demand system; thus Deaton and Muellbauer (1980) substitute Stone’s Price Index, defined as

\[ \ln P = \sum_{i=1}^{n} w_i \ln p_i. \]

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

\[ w_i = \alpha_i + \sum_{j=1}^{n} \beta_{ij} \ln p_j + \beta_i \ln (X_i / P) + u_i. \]

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 2001 is 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 calculated at the average sample means according to Equations 4–6 (Tables 3 and 4):

\[ \eta = \frac{1 + \beta_i}{w_i} \]

(4) Expenditure elasticity:

\[ e_{ij} = \frac{\partial \ln w_j}{\partial \ln w_i} - 1 \]

(5) Own-price elasticity:

\[ e_{ij}^c = \frac{\partial \ln w_i}{\partial \ln w_j} - 1 \]

(6) Cross-price elasticity:

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 manufacturers 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.

References


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

<table>
<thead>
<tr>
<th></th>
<th>Organic dinners</th>
<th>Conventional dinners</th>
<th>Organic fruits/ desserts</th>
<th>Conventional fruits/ desserts</th>
<th>Expenditures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organic dinners</td>
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<td>1.913**</td>
<td>0.245</td>
<td>-1.248</td>
<td>2.579</td>
</tr>
<tr>
<td></td>
<td>(.000)*</td>
<td>(.048)</td>
<td>(.702)</td>
<td>(.138)</td>
<td>(.255)</td>
</tr>
<tr>
<td>Conventional</td>
<td>0.143**</td>
<td>-0.154</td>
<td>0.003</td>
<td>-1.722***</td>
<td>1.730***</td>
</tr>
<tr>
<td>dinners</td>
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<td>(.377)</td>
<td>(.943)</td>
<td>(.000)</td>
<td>(.000)</td>
</tr>
<tr>
<td>Organic fruits/</td>
<td>-0.212</td>
<td>0.588</td>
<td>-3.110**</td>
<td>0.588</td>
<td>2.415</td>
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<td>desserts</td>
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<td>(.702)</td>
<td>(.702)</td>
<td>(.000)</td>
<td>(.295)</td>
</tr>
<tr>
<td>Conventional</td>
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<td>-0.436***</td>
<td>0.030**</td>
<td>-0.165**</td>
<td>0.590***</td>
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<td>fruits/desserts</td>
<td>(.000)</td>
<td>(.000)</td>
<td>(.000)</td>
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</tbody>
</table>

* Values are in parentheses.
**Statistically significant at the 0.01 level. ***0.05 level, and **0.10 level. Source: Thompson and Glaser (2001).
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1. Expenditure elasticity: $$\eta = 1 + \beta_i / w_i$$
2. Own-price elasticity: $$\epsilon_i = (q_i / w_i) - (\beta_i / w_i) - 1$$
3. Cross-price elasticity: $$\epsilon_{ij} = (q_i / w_i) - (\beta_{ij} / w_i)$$ 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 charge 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.

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**References**


Union, Utah July 9–11.


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* Values are in parentheses.

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

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

<table>
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<tr>
<th>Organic fruit</th>
<th>Conv. fruit</th>
<th>Organic vegetable</th>
<th>Conv. vegetable</th>
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<th>Conv. juice</th>
<th>Organic cereal</th>
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*P values are in parentheses.

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

An Examination of Consumers’ Rankings of the Dietary Recommendations

Patricia E. McLean-Meyinasse and Anetra L. Harbor

The results suggest that when given the opportunity to assign importance rankings to nine dietary recommendations, consumers rank the recommendation for daily intake of fruits and vegetables the highest. Additionally, the ranking for fruit and vegetable intake is uniform for all three racial groups: Caucasians, African-Americans, and other races. However, about 69 percent of the 1,300 consumers agree or strongly agree that there are so many dietary recommendations about healthy ways to eat that it is hard to know what to believe.

The Dietary Guidelines for Americans, initially published in 1980 and at five-year intervals since, are designed to provide consumers with science-based recommendations to promote healthier food choices and physical activity. Thus at each five-year interval the dietary recommendations have incorporated any new scientific findings or societal issues regarding diet and health. Most recently, the recommendations have been reflecting scientific evidence linking diet, weight gain, and reduced physical activity to life-threatening diseases such as cardiovascular diseases, type-2 diabetes, hypertension, osteoporosis, and certain types of cancers. As the U.S. overweight and obesity rates have risen over the past two decades, the Guidelines now contain specific recommendations for diet, weight status, and physical activity.

At their core, the 200! Guidelines recommend that individuals “consume a variety of nutrient-dense foods and beverages from within and among the basic food groups while choosing foods that limit the intake of saturated and trans fats, cholesterol, added sugars, salt, and alcohol” (Dietary Guidelines 2005). Expanded recommendations suggest that consumers do the following: (1) use salt or sodium in moderation or that they limit daily intake to about one teaspoon or 2,300 milligrams per day; (2) choose a diet that is low in fat, saturated fat, and cholesterol by reducing total fat intake to between 20 and 35 percent of calories; (3) choose a variety of fruits and vegetables from all five vegetable subgroups (dark green, orange, legumes, starchy vegetables, and other vegetables); (4) choose fiber-rich fruits, vegetables, and whole grains very often; (5) consume at least two servings of dairy products daily; and (6) maintain a healthy weight by decreasing calories from foods and beverages and by increasing physical activity (Dietary Guidelines 2005).

Despite the health benefits embedded in the dietary recommendations and rapid weight gains in a large percentage of the population in the United States and the rest of the world, research continues to indicate that the recommended daily intake levels often fall below the dietary guidelines. This finding has led some researchers to suggest that either consumers do not understand the guidelines or they are having difficulties incorporating them into their fast-paced lifestyles, which often involve eating away from home (Atienza et al. 2008; Baker and Wardle 2003; Larson et al. 2008; Marantz, Bier, and Alderman 2008; Shepherd and Towlery 1992; Striegel-Moore et al. 2006; Trudeau et al. 1998; Woflf and Nestle 2008). To address these issues, researchers have been using creative intervention strategies such as personal digital assistants (PDAs) to expand nutritional knowledge and track dietary intake. For example, Atienza et al. (2008) used PDAs to track vegetable and whole-grain intake and found that consumers recorded higher intake levels for these food groups when recorded on PDAs than on paper. As use of cellular telephones, text messaging, ipods, and MP3 players grows in the future, these technologies could enhance the delivery and assessment of nutritional information to the public (Atienza et al. 2008).

Baker and Wardle (2003) also observed that in spite of the widely known health benefits from eating fruits and vegetables, the general public has