Agricultural Economics Research and Its Usefulness to Private Firms: Some Unsolicited Observations

Eugene Jones

Introduction

Agricultural economists are especially noted for conducting studies on the consumption behavior of U.S. consumers. For many decades, USDA nationwide food consumption surveys provided rich databases for agricultural economists to assess the nutritional content and quality of consumers’ diets. Research results emanating from these databases were informative and insightful with respect to consumer behavior. Further, the data utilized was comprehensive and the results eagerly anticipated.

The confluence of these forces led to an enhanced likelihood of such results being published in agricultural economics journals. In addition to nationwide food consumption databases, which are cross-sectional snapshots of Americans’ consumption at particular points in time, USDA has consistently collected and shared with agricultural economists’ annual data on food commodities. These time-series and cross-section databases have been used extensively by agricultural economists to estimate several parameters of interest, especially own-price, cross-price, expenditure, and income elasticities (Heien and Wessells, 1988; Heien and Pompelli, 1988; Gould, et al., 1990; Yen and Chem, 1992).

Because most databases available to agricultural economists lack disaggregated information on specific food commodities, elasticity parameters traditionally have been derived for food groups or aggregated food commodities (Gao, et al., 1994; Jones, et al., 1994; Park, et al., 1996). Indeed some researchers have taken aggregation to its highest level, aggregating hundreds of food commodities into a single category called “food.” (Huang, 1985). Elasticities are then derived for this broad category of food. As previously noted, these derived elasticities and other empirical results for broadly defined commodities have been published and discussed widely in professional circles of agricultural economists. Indeed it seems reasonable to conclude that these findings and discussions have added to the professionalism of agricultural economists.

While development of intellectual capital is undoubtedly a worthy accomplishment of agricultural research, this paper raises the issue as to whether this process has had positive spillover effects on the business decisions of private firms. Clearly, many research studies have emphasized the relevancy of reported results for the decision-making of private firms. For example, private firms are predicted to use own-price and cross-price elasticities to help establish pricing and marketing policies for their products (Green and Park, 1998; Jones, et al., 1994).

Other estimated values such as advertising elasticities and income elasticities are hypothesized to help firms plan effective marketing strategies (Coulibaly and Broersen, 1999; Ward, 1999; Jones and Ward, 1989; Ward, et al., 1985). After several months of observed behavior at a private firm, the author of this paper wishes to raise questions about the true relevancy of such results for private firms. Raising these questions, however, is not intended to plant a seed of criticism within the agricultural economics profession. Rather, questions are raised as a reflection of a sabbatical experience with a private supermarket firm and it is hoped that this discussion will help agricultural researchers re-think and perhaps re-frame their ideas in ways to produce studies that are even more relevant and useful to private firms.

As a matter of focus, this discussion draws from observed needs of supermarket managers, especially those at the category level. To provide some perspective, the thousand of products in a typical supermarket are segmented into categories and managed by personnel known as category managers. A few well-known categories include dairy, frozen foods, beer and wine, carbonated soft drinks and produce. From observations of category managers, it is apparent that they do not use price or income elasticities for aggregate commodities such as beer, breakfast cereals, cooking oil, ice cream, or milk. Given the environment in which supermarkets compete against
each other for customers on a daily or weekly ba-
sis, marketing strategies are developed within and
among product categories. For example, different
marketing and sales strategies are often developed
for classes of breakfast cereals (e.g., sugar-coated,
high-fiber and all-family) as well as for breakfast
cereals as part of a larger group of products (e.g.,
a group of breakfast foods such as eggs, sausage,
cereals, and frozen waffles). Moreover, because of
widely different consumption patterns among
groups of consumers within narrowly defined
geographic areas, marketing and sales strategies
differ not only among product classes but also
among stores and different consumer groups.

Differences in strategies and expected out-
comes as heretofore noted can lead one to ask
questions about the value of elasticities for aggre-
gate commodities. For example, can a price elas-
ticity for a product like milk be of value to a pri-
vate firm that knows it can sell a large volume of
low-fat milk in one geographic area and even a
larger volume of whole milk in another area of
close proximity? Additionally, can an elasticity of
demand for milk be useful when a private firm
knows it can sell large quantities of one-half per-
cent milk in one area, but near zero quantities in
another area of close proximity?

Similarly, can an elasticity of demand for
beer be meaningful to a private firm when it
knows it can sell large quantities of lite beer in
one area, but much larger quantities of regular
beer in another area that is less than eight miles
away? Admittedly, many agricultural economists
have attempted to account for differences in pur-
chasing behavior due to factors such as education,
race, and region (Frazao, 1992; Nayga and Capps,
1992). However, a more fundamental question
that is raised in this paper is whether these socio-
economic factors can be meaningful when the unit
of analysis for the dependent variable is an aggre-
gated quantity. To help focus this discussion, the
purchasing behavior of shoppers around six su-
permarket stores in the Columbus, Ohio metro-
politan area is examined. Some perspective is
provided on these shoppers with the following
discussion of socioeconomic characteristics.

Socioeconomic Information by Store Location

Important economic and demographic infor-
mation for six stores is provided in Table 1. Spectra
Marketing provides these data and they include
all the households within the general shopping
area of a given store, usually a 3-mile radius.
These data are updated at least quarterly and Ta-
ble 1 reflects updates as of November 2000.
Stores 1, 2 and 3 make up a group of stores that
are best characterized as being surrounded by
low-income shoppers, while stores 4, 5 and 6 are
best characterized as being surrounded by high-
income shoppers. All of the stores are within close
proximity of one another, with a maximum dis-
tance of 20 miles between any two stores (stores 3
and 6). The second greatest distance between any
two stores is 17 miles (stores 4 and 6). For all
other store combinations, distances among then
decrease at a fairly rapid rate, reaching a mini-
imum of six miles (stores 2 and 3). These distances
are provided as background information for later
reference to elasticity differences among stores.

Relative to factors that are believed to have a
dominant influence on purchase decisions, education
and income, it should be noted that these factors are
more favorable for residents around higher-income
stores. An average of 58 percent of the households
surrounding higher-income stores has incomes
above $50,000, as compared to 31 percent of those
surrounding lower-income stores. Also, the percent
of households surrounding lower-income stores with
incomes less than $10,000 is more than double that
of households surrounding higher-income stores
with incomes less than $10,000.

Additionally, college graduates represent an
average of 38 percent of the prospective shoppers
for higher-income stores, but just 10 percent of
those for lower-income stores. Relative to race,
lower-income stores are shown to have shoppers
who are more heterogeneous than those for higher-
income stores. These and other socioeconomic
factors influence consumer purchase decisions and
my experience suggests that category managers
consider them when planning marketing strategies
for grocery products.

Aggregate Elasticities and
Their Possible Relevancy to Private Firms

As applied economists, we generate elastici-
ties for food commodities that are supposedly
relevant to shoppers, supermarket managers, pub-
lic policy officials, and other decision-makers. If,
for example, fairly inelastic price elasticities of
demand are estimated for breakfast cereals and
potatoes, then supermarket or category managers
<table>
<thead>
<tr>
<th>Education</th>
<th>College Graduate</th>
<th>Some College</th>
<th>High School Graduate</th>
<th>Some High School</th>
<th>Grade School</th>
<th>Others</th>
</tr>
</thead>
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<tr>
<td>White</td>
<td>59.2</td>
<td>83.6</td>
<td>76.2</td>
<td>76.2</td>
<td>73.5</td>
<td>73.5</td>
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<tr>
<td>Black</td>
<td>38.6</td>
<td>14.4</td>
<td>14.4</td>
<td>14.4</td>
<td>13.5</td>
<td>13.5</td>
</tr>
<tr>
<td>Other</td>
<td>2.1</td>
<td>2.0</td>
<td>2.1</td>
<td>2.1</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>Race</td>
<td></td>
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<td></td>
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<tr>
<td>Household Income</td>
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<td>19.4</td>
<td>20.2</td>
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<td>21.3</td>
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<td>13.5</td>
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<td>42.0</td>
<td>42.0</td>
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<td>13.5</td>
</tr>
<tr>
<td>Average</td>
<td>Store 1</td>
<td>Store 2</td>
<td>Store 3</td>
<td>Store 4</td>
<td>Store 5</td>
<td>Store 6</td>
</tr>
</tbody>
</table>

Table 1. Household Demographic Data for Six Store (by percentage).
are expected to be able to utilize these values to increase margins for their products and therefore realize higher revenue. However, since a typical supermarket sells many brands and varieties of breakfast cereals and potatoes and may not wish to increase margins on all products, such a market would be unlikely to find broad estimates useful. Indeed Gao, et al. acknowledged that their estimate of a -.38 price elasticity for potatoes is really for 42 different potato products: many varieties of canned, chips, dehydrated, fresh and frozen.

For a lower level of aggregation, Jones, et al. derived elasticities for five classes of cereals: private label, top ten brands, instant, snack, and other brands. These classes, why not nearly as aggregated as “all-cereals” utilized in many studies, are still too broad for most category managers. Category managers recognize that there are differences in price elasticities among cereal classes such as sugarcoated cereals that appeal to kids, high-fiber cereals that appeal to adults, and all-family cereals that appeal to everyone. Further, most managers are well aware of differences in elasticities within cereal classes by brands (e.g., sugar-coated frosted flakes vs. sugar-coated cheerios).

As an indication of the limited value of aggregate elasticities for a product category like cereals, Jones, et al. found major differences in price elasticities for five classes of cereals. For the six stores listed in Table 1, shoppers of the three lower-income stores were found to be far more price sensitive than those of the three higher-income stores. Moreover, significant differences were found in the way shoppers allocate their expenditures among the five classes.

Private-label cereals represented a much larger proportion of cereal sales for lower-income shoppers than for higher-income shoppers (4.1 percent vs. 2.1 percent). The cereal class identified as other brands, mainly high-fiber and often higher-priced cereals, constitutes much larger proportions of total purchases for higher-income shoppers. These differences in purchase patterns, particularly among stores of close proximity, point to the limited value of aggregate elasticities for cereals. Even though category managers offer identical prices at stores within close proximity of one another, these pricing decisions are not guided by some naive notion regarding common elasticities. On the contrary, recognized differences in elasticities by store and product type guide in-store promotions and the selection of products for shelf stocking.

To keep the focus on cereals, promotion efforts to boost the sales of private label and high-fiber cereals would result in private label being displayed more prominently in lower-income stores and high-fiber cereals being displayed more prominently in higher-income stores. While these different marketing strategies may lead to results that economists wish to aggregate, it is unlikely that the realized sales response for any two classes of products will approximate that which would be suggested by an aggregate elasticity. Indeed the overall price elasticity of demand for cereals for a given time period, say a year, is really a function of the type and frequency of cereal classes that are promoted through price reductions and other marketing mechanisms. That is, retailers and food manufacturers can influence price elasticities by changing the frequency of product promotions. As agricultural economists, our research on cereals and other products would be more valuable to private firms if we would attempt to segment them into meaningful product groups or classes.

As another example of the limited value of an aggregate elasticity, consider differences in milk consumption for the six stores in Table 1. For a sixty-five week period of June 1997 through July 1998, differences in the percentages of milk sales for the three lower-income and three higher-income stores ranged from a low of 7.5 percent for one percent milk to a high of 29.7 percent for whole milk. Specifically, 1-percent milk represented 16.5 percent of milk purchases for higher-income shoppers as compared to 9.0 percent for lower-income shoppers. By comparison, whole milk represented 43.1 percent of milk purchases for lower-income shoppers as compared to 13.4 percent for higher-income shoppers.

For other milk products, skim milk represented 26.9 percent of milk purchases for higher-income shoppers as compared to 7.6 percent for lower-income shoppers. Neither income group consumed large quantities of one-half percent milk, but both groups consumed near equal proportions of 2 percent milk (36.4 percent vs. 36.1 percent for lower- and higher-income groups respectively). Given these disparities in purchases by store coupled with the fact that milk is often used as a loss leader for supermarkets to generate store traffic, it is imperative that category managers gain access to disaggregated milk elasticities for store-level planning. Admittedly, few agricultural economists would have access to store-level data. However,
Whenever agricultural economists do gain access to disaggregated data for products, a special effort must be made to estimate elasticities for each product class. Indeed a recent article by Green and Park (1998) is a step in this direction.

As another illustration of the limited value of aggregate elasticities, consider beer purchases among the six stores in Table 1. For marketing purposes, beer is often segmented into six classes: premium, super premium, imports, popular/budget, specialty and microbrews. For these product classes, major differences exist in the purchasing patterns of higher- and lower-income shoppers. Import purchases represent an average of 13.6 percent of beer purchases for shoppers of the three higher-income stores, but just 4.5 percent of purchases for shoppers of the three lower-income stores. At another extreme, popular/budget beer represents an average of 26 percent of beer purchases for the three lower-income stores, but just 10 percent of purchases for the three higher-income stores. Similar disparities exist between the purchases of microbrews in higher- and lower-income stores. While the aforementioned differences in beer purchasing patterns can perhaps be explained by income and education differences among shoppers, it should also be noted that differences in purchasing patterns for beer can be observed even when income and education are quite comparable. Indeed internal analyses conducted for the supermarket chain during my sabbatical suggest that ethnicity and race influence beer purchases just as much as education and income.

As shown in Table 1, household incomes and education are quite comparable across the residents who patronize stores 1 and 2. Significant differences, however, do exist in the racial mix of the populations. Blacks represent 39 percent of the shoppers surrounding store 1, but just 14 percent of those shoppers surrounding store 2. Undoubtedly, these differences lead to sharp differences in the purchasing patterns for beer. Among the premium class of beer, the top two brands, budweiser and bud light, represent 29 percent of total beer sales for both stores. Yet Budweiser represents 19.9 percent of beer sales in store 2, but just 10.5 percent in store 1.

By contrast, bud light represents 19.8 percent of beer sales in store 1, but just 9.7 percent in store 2. These differences become even sharper when regular and light beer sales are compared for the top four brands of premium beers (the top four includes the addition of coors light and miller light). In addition to purchase differences emanating from race, purchase patterns for beer also differ significantly by ethnicity. That is, when income, race and education levels are practically identical, ethnicity differences can lead to widely different purchasing patterns. Simply stated, variations in beer purchases are determined by factors that are far too localized to render meaning to an aggregate elasticity. Given this reality, supermarket managers can maximize beer sales only if disaggregated elasticities are provided them for each class of beer within a narrowly defined geographic area.

Marketing Methods of Category Managers

Based on the preceding discussion, one might be inclined to argue that elasticity differences for a few products in a few stores in Columbus, Ohio are insufficient to invalidate the usefulness of elasticities in signaling the sales response that can be expected for a given price change. For example, if retailers know that milk faces a price elasticity of demand of a negative 1.4, they would also know that a 10 percent price reduction would lead to a 14 percent increase in quantity sold.

Now assuming the existence of an aggregate elasticity of the stated magnitude, retailers would still need to know which type of milk to stock in each store. For example, does this elasticity imply sales of 800,000 gallons of skim milk, 900,000 gallons of 1 percent, 1 million gallons of 2 percent, etc.? Does an aggregate elasticity for milk imply that each type of milk will realize a 14 percent increase in sales over its base level? If so, it requires category managers simply to make promotion stocks a function of baseline stocks. In reality, each type of milk faces a different elasticity of demand and if retailers adequately stocked all classes of milk across all stores and then added resulting sales, it would be a true miracle if total sales approximated a 14 percent response. Indeed a recent study by Akbay (2000) shows that lower-income consumers are more sensitive to changes in milk prices than higher-income consumers. This suggests that milk promotion requires retailers to have some knowledge of elasticity measures by product type as well as by store type. Indeed as retailers plan milk and other promotions within areas of close proximity, they implement uniform price reductions across all stores as a matter of
policy, and not as a matter of belief in a common
gate elasticity. Evaluations of sales responses are done
with respect to specific product classes and spe-
cific store locations. Simply stated, variability in
milk sales by store and milk type would render an
aggregate elasticity as virtually meaningless.

Although it has been argued that supermar-
tket managers find limited, if any, value in aggreg-
gate elasticities, they do pay attention to sales
responses that result from promotion efforts. These
efforts, as heretofore stated, are for spe-
cific products and specific package sizes and the
lingo used is “lift” as opposed to “elasticity.”
Consider a retail supermarket that wishes to in-
crease sales and revenue by promoting breakfast
cereals. Clearly, the hundreds of brands and
package sizes will make it impossible to promote
all cereals. Further, promotion is generally done
in cooperation with manufacturers and few
manufacturers wish to promote their products
concurrently with those of their competitors.
This forces category managers to select an ad-
vertising and promotion strategy.

As a first step, these managers must ascertain
the range of products offered by the manufacturers
as well as the level of funds being made available
for promotion. From this range of products and
available funds, category managers must select a
promotion strategy that fits within the retailer’s
overall revenue and sales objectives. This is ac-
complished by examining the historical lifts for
the available range of products. The magnitude of
these lifts will depend upon a number of factors,
but key among them are in-store promotions,
package size, and advertisement size, especially
that in newspapers and free standing inserts. Final
product selections for any promotion will be dic-
tated by historical lifts, promotion funds, store-
level socioeconomic characteristics, and the
sales/profit objectives of the retailer. Critical to an
assessment of historical lifts is recognition of the
influence of package size. For example, there is
not a single lift for Kellogg Frosted Flakes, but
there are separate lifts for 25-ounce, 20-ounce and
15-ounce boxes of Frosted Flakes.

Marketing managers clearly understand the
role socioeconomic factors play in the success or
failure of product promotion. For example, manag-
ers know the promotion of sugarcoated cereals has
its highest probability of success in stores that are
surrounded by households with high percentages of
school-aged children. Similarly, promotion of high-
fiber cereals has its highest probability of success
in stores surrounded by high-income households
and an age distribution that is skewed toward mid-
dle age and older. However, there are also factors
that marketing managers do not clearly understand
and therefore cannot implement optimal plans to
execute their marketing programs. For example,
what are the factors that explain widely different
consumption and purchasing patterns for consum-
ers in reasonably close proximity of one another?
Why, for example, does one-half percent milk
barely sells in Ohio, but sells extremely well in
Pennsylvania? Why are Ohio and West Virginia
consumers more prone to purchase light than regu-
lar beer? Why is Pepsi the leading soft drink in
Ohio and West Virginia when coke is the largest
seller in practically every other state? Should re-
tailers with establishments in Ohio and West Vir-
ginia promote light beer more heavily in other
states in which they operate on the premise that
consumers in other states simply lag behind Ohio-
ans and West Virginians? Or, are consumers in
these two states atypical and consumers in other
states more representative of the norm? Answers to
these types of questions would undoubtedly prove
more valuable to category managers than measures
of aggregate elasticities.

As a final observation, category managers
have come to understand that promotion is often
more successful for complementary groups of
products than for a single or limited number of
products. This means that a promotion effort for a
complementary set of outdoor barbecue prod-
ucts—franks, hamburger patties, ketchup, mus-
tard, buns, relish—is likely to be more successful
for each product than a promotion effort for any
one or two of these products. Observations sug-
gest that consumers are simply more responsive
when they are provided a wider range of products
from which to make their selections. Perhaps no
individual consumer response is any greater, but a
greater number of consumers respond. With refer-
ence to an earlier example of breakfast cereals
being promoted as part of a group of breakfast
foods, it can be concluded that higher sales of ce-
reals are realized because they are advertised
within a complementary group. Further, these
complementarities among breakfast cereals and
other breakfast foods will vary widely among
product classes of cereals. In essence, an aggre-
gate elasticity for cereals will provide little guid-
ance to category managers.
Summary and Conclusions

Agricultural economists are known for conducting applied and practical research. Readily available data sets have been utilized to estimate elasticity parameters for commodities such as bread, milk, pasta, potatoes, breakfast cereals and even "food." Estimated own-price parameters for these commodities suggest changes in sales or purchases that will result for given changes in price. For large geographic areas, such as the United States, these elasticities may indeed approximate quantity-price relationship. However, most private firms make business decisions for more narrowly defined geographic areas such as a city, county, or state, even though they often operate within larger geographic areas. Thus, for all practical purposes, aggregate elasticities do not serve to inform the business decisions of private firms.

With recognizable constraints placed on the ability of agricultural economists to acquire disaggregate data, it is certainly understandable why aggregate elasticities have become the norm. These estimates, however, must not be over generalized as having significant value for the decision making of private firms, but must be interpreted, at best, as approximate measures of price-quantity relationships for large geographic areas. As scanner data and other firm-level data become available, agricultural economists must make a special effort to provide elasticity estimates at the product and market area — however narrowly defined. Further, agricultural economists must attempt to address some of the apparent anomalies of observed consumer behavior. Retailers are struggling to understand and stay ahead of consumer trends and they are receptive to research studies that shed insights on these issues. As applied and practical scientists, we can gain credibility with private firms by producing studies that are indeed relevant to their business decisions. From the perspective of supermarket retailers, we will know we are producing relevant results when research dollars are redirected from marketing research firms such as IRI and Nielsen to departments of agricultural economics.

References


