Beef Demand and Its Response to the Beef Checkoff

Ronald W. Ward
Food and Resource Economics
University of Florida, Gainesville

Introduction

Over the period from 1987 through the first quarter of 2000, beef checkoff assessments totaled $968 million. Half of these funds may remain with the states to support local programs and the other dollars are used to fund the Cattlemen's Beef Promotion and Research Board programs. At the national level, the board spent approximately $337 million on direct generic promotions within the domestic U.S. market and another $100 million on consumer and industry information. About half of the promotions were for national television and the consumer information was for a variety of printed and supporting materials. State run programs should parallel these activities and be complementary with the national programs.

Recognizing that these assessments are on cattle producers, it is essential to measure any changes in beef demand that are attributed to the beef checkoff. Having reliable historical beef consumption data are essential to measuring these changes.

Beef Consumption Databases

Most economic analyses require analyzing actual market data to gain insight into the major factors driving demand. Drawing on recorded consumption data, mathematical and statistical models were used to measure the effect of each major factor that causes movements in the demand for beef. For example, how much does the demand for beef differ across income groups, age, education, employment, and promotions?

Conclusions about the role of any of the demand drivers will depend on the databases used.

It is desirable to have different data to replicate conclusions about the beef checkoff. Three independent databases are available for studying the domestic demand for beef. Two are based on consumer surveys, with information recorded across households and over time, and are referred to as the servings and meat purchasing data. Both series are collected and tabulated by the NPD Group, a private company specializing in consumer surveys. These data report in-home use and exclude away from home consumption. The third database is from aggregate market clearance information, giving average beef prices and volumes recorded on a quarterly basis.

Servings data report the number of servings of beef included in the household diet during a two-week period. Household information has been recorded by waves (bimonthly) since 1984 and includes household demographics, attitudes, health concerns, behavioral concerns, and the use of competing meat products.

The *purchasing data* include the actual pounds and prices of beef purchases along with the demographics of the household. These data cover the months since 1993 through early 2000, giving more than 50,000 observations for the analysis.

In direct contrast, the *market clearance* data capture total sales of beef at both the boxed beef and liveweight levels. It is the aggregate across all beef users and hence cannot be used to deal with household demographics. All beef is reflected in the data and, unlike the household data, it is more useful for measuring beef demand at the producer level.

It is important to recognize that when using statistical models across different data sets, the results will never be exactly the same. If the checkoff is truly having an impact on beef demand, one would expect to draw similar broad

conclusions while recognizing that the exact numbers will differ. Furthermore, there may be aspects of the promotion effects that are unique to each data set.

Beef Purchasing Model

Household beef consumption was measured as the pounds of beef purchased per household member in a two-week period. Some households did not include beef in their diet. Among those consuming beef, there was considerable variation in the pounds purchased.
Effects of prices, demographics, health concerns, and promotions on both the likelihood of consuming and the amount purchased were estimated.

The statistical models show the beef checkoff to have a positive and statistically significant impact on the retail purchases of beef. Also, the checkoff is shown to attract new consumers to the beef market and the impacts are statistically significant. Rather than reporting detailed statistics, Figure 1 easily illustrates the checkoff's impact on household beef purchases.

In Figure 1 the vertical axis shows the estimated pounds of beef purchased per household member in a two-week period for the typical household. On the bottom left axis are the retail prices, ranging from $1.5 to $2.5 per pound. Quarterly checkoff expenditures are shown on the bottom right axis, with the average expenditures being in the vicinity of $8 million. These checkoff expenditures include both promotions and consumer information activities at the national level.

The downward slope of the graph on the left side illustrates the declining demand for beef as prices increase. Moving from the left to right on the checkoff axis (right side), the graph is rising in direct response to increases in checkoff expenditures. The positive and statistically significant slope is direct empirical evidence that the beef checkoff is having a measurable impact on beef demand based on the household purchasing data.

To illustrate, consider the retail price of $2.49 per pound and promotions near $3 million, the per member purchases are estimated to be 2.38 pounds. Extending the checkoff dollars to $13 million, the pounds increase to 2.93, giving a .55 pound gain in demand. Based on the purchasing model, one could reasonably expect to see the maximum change of about one-half pound over the historical range of checkoff expenditures. Smaller changes in the checkoff obviously produce less change in the pounds purchased and, in general, the .55 pound gain is close to the outer limits of the checkoff impact on demand based on the meat purchasing data.

The checkoff expenditures in Figure 1 are the combined effects of promotions and information programs kept in historical proportion. With the purchasing model, separate effects of the promotion and information programs were estimated. Generally, the consumer information programs were most effective in attracting new consumers into the market and had little additional effect on the poundage beyond bringing in more households. Whereas, the promotions showed the greater impact on the amount purchased once becoming a beef consumer. Since the demand responses to both type of checkoff programs are known, it is possible to calculate the relative gains attributed to the advertising and information activities. Using Figure 2, the marginal purchasing gains are shown with incremental increases in retail beef demand associated with fixed increases in the expenditures on either the promotions or information programs.

The left figure presents the marginal quantity gains attributed to increments in the promotion

programs. Gains from the informational efforts are shown in the right part of Figure 2. Since both charts are in equivalent units, they are comparable for evaluation purposes. On average, promotions totaled around $6 million and information activities equaled $2 million. Comparing the two charts from these midpoint levels, the model indicates that for additional expenditures the marginal gains from promotions are greater than those from the consumer and industry information programs.

The retail model establishes that households have responded to both the promotions and information programs with the payoff being greater from the promotions. Furthermore, the same graphs can provide guidelines as to the reallocation of dollars between the programs if that were necessary.

Beef Servings Model

Beef servings were measured with a household survey that is totally independent of the meat purchasing data. Statistical models were estimated showing the probability of becoming a beef consumer and the level of frequency of including beef in the household meals. Along with the promotions, differences in demand were measured across demographics, health concerns, prices, and consumer attitudes and behavior. Estimates for the effect of the checkoff on the number of servings are positive and statistically significant.

Similarly to Figure 1, Figure 3 depicts the demand for beef (servings) across retail prices and checkoff expenditure levels. If the checkoff had no effect on demand, the graph would be flat across the checkoff expenditures. Whereas, the positive slope seen in Figure 3 (right side) clearly points to an impact on retail beef demand.

Using the retail price of $2.49 in Figure 3, servings are shown to increase from 3.84 to 4.03 per household member in the two-week reporting period. Hence, beef demand is shown to increase by an estimated .20 servings, depending on the range of the checkoff expenditures.

A problem with the servings data is that the exact equivalence between a serving and pounds of beef is not known. However, the pound equivalent can be approximated by matching the pounds in Figure 1 with the servings in Figure 3. For the $2.49 retail price and a checkoff level of around $8 million, the demand measured from Figure 1 is 2.70 pounds and the servings value is 3.94 (Figure 3), giving an equivalence of one serving = .68 pounds. It is emphasized that this is an approximation and not a statistically derived number. Over the range of checkoff expenditures in Figure 3, the change in equivalent pounds would be .20 servings times the .68 pounds, or .136 pounds per household member. Note that these pounds are considerably less than those estimated with the beef purchasing data in Figure 1.

Using these estimated gains with the servings model, these results can be expressed in a liveweight equivalent value, drawing on accepted industry standards for conversions among the retail, boxed beef, and liveweight quantities. Retail pounds are converted to liveweight equivalent and retail prices are expressed in comparable liveweight dollars. Changes in the liveweight revenues can then be calculated over the range of checkoff expenditures in Figure 3. Furthermore, the promotion and information expenditures must be converted back to a near-equivalent assessment basis, using the value that promotions and information is 80 percent of the national budget and half of the total assessments are at the national level.

Table 1 shows the calculated marginal gains over a range of checkoff expenditures and the equivalent assessments. Since the equivalent servings to pounds is an approximation, other conversions using .50 and .40 are also shown. For a national assessment of $21 million per quarter and the equivalent national promotions of $8.4, the marginal rate-of-return to the beef checkoff ranges from 5.6 up to 9.6 based on the servings data.

While recognizing that the liveweight conversion is an approximation, the marginal gains are quite high. Even with the conversion issues, the servings model shows that under the most restricted assumptions the beef checkoff has had a positive and important economic impact on beef demand as derived with the beef servings model.

Market Clearance Model

The third approach was to directly measure the checkoff impact at the liveweight market level. The approach was to use a liveweight model to predict quarterly cattle prices while accounting for supplies of the major meats (beef, pork, and poultry), income, inflation, health concerns, and the beef checkoff promotions and information expenditures. Then the same cattle prices were predicted assuming that the national checkoff programs did not exist. Liveweight revenues with and without the beef checkoff efforts were then calculated. Producer returns were calculated over the full life of the program since 1987 with and without the beef checkoff.

The estimated liveweight model showed the checkoff programs to have a positive and statistically significant impact on demand at the producer level.

From 1987 through the first quarter of 2000, total revenues back to cattle producers were

predicted to be $321.18 billion. These revenues were estimated to drop to $314.72 billion without the beef checkoff , giving a difference of $6.46 billion as shown in Figure 4. The $6.46 billion represents the added revenues directly attributed to the beef checkoff.

Next, for the same period, all checkoff assessments were totaled as illustrated in Figure 4. Subtracting the assessments from the total gains and then dividing by the same assessments gives an estimated rate-of-return of 5.67 to the beef checkoff. On average, for each dollar spent on the checkoff assessments, an additional 5.67 net gain to producers was estimated. This rate-of-return is similar to what has been shown in prior analyses. Also, the rate is comparable to the marginal gains derived using the beef servings model presented in Table 1. Using two independent methods for calculating the benefits of the beef checkoff leads to very similar conclusions, recognizing again that the results will never be exactly the same using different databases and models. While the rate-of-return is impressive, it is comparable to what has been shown previously and to that seen for many other commodities.

It is equally important to put these gains in perspective. The model predicted a gain of $6.46 billion over what would have existed in the absence of the beef checkoff. This $6.46 billion compared to the total producer revenues of $314 billion without the checkoff represents a two percent increase in producer revenues directly attributed to the beef checkoff. Hence, while the rate-of-return is high, the total gains are quite small when put in perspective to the industry size.

Conclusions

Using three separate databases and different modeling techniques, the resulting estimates consistently point to the effectiveness of the U.S. beef checkoff programs. Analyses at the

household level show positive and significant responses to the promotions and information programs. Liveweight results show rates of return to the beef programs that have consistently been near the five plus range over time. The reliability of the conclusions are important and three separate methods of analysis show that U.S. consumers have responded to the beef promotions and supporting materials.

The same models also show the effects of other demand drivers, accounting for health concerns, demographics, eating behavior and attitudes, concerns about calories, etc. Demand changes due to many of these factors cannot be prevented, yet the checkoff does provide the beef industry with a marketing tool to respond to these observed changes.

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Table 1. Calculated marginal gains to the checkoff based on the beef servings model.

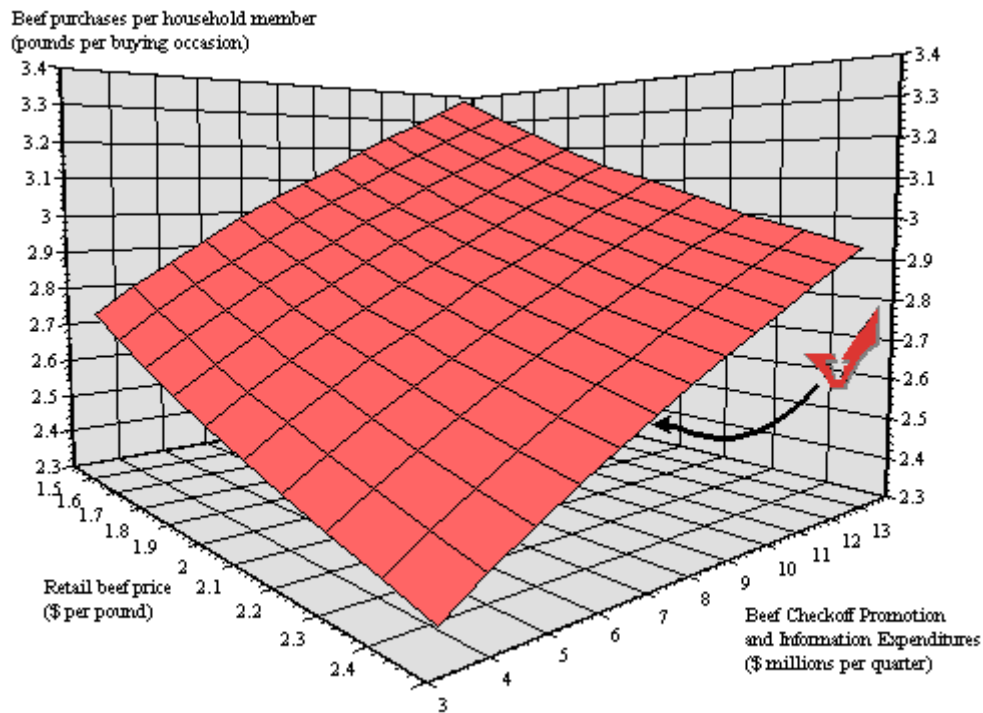| Assessments ($ millions/qtr)	National Promotions ($ million/qtr)	Marginal Gain to $ million increases Servings Pound Equivalent =.40	Marginal Gain to $ million increases Servings Pound Equivalent =.50	Marginal Gain to $ million increases Servings Pound Equivalent =.68
12.648	5.060	7.329	9.162	12.460
16.863	6.750	6.339	7.923	10.776
21.079	8.430	5.681	7.102	9.658
25.295	10.120	5.205	6.506	8.848
29.511	11.800	4.838	6.048	8.225
33.727	13.490	4.546	5.682	7.728

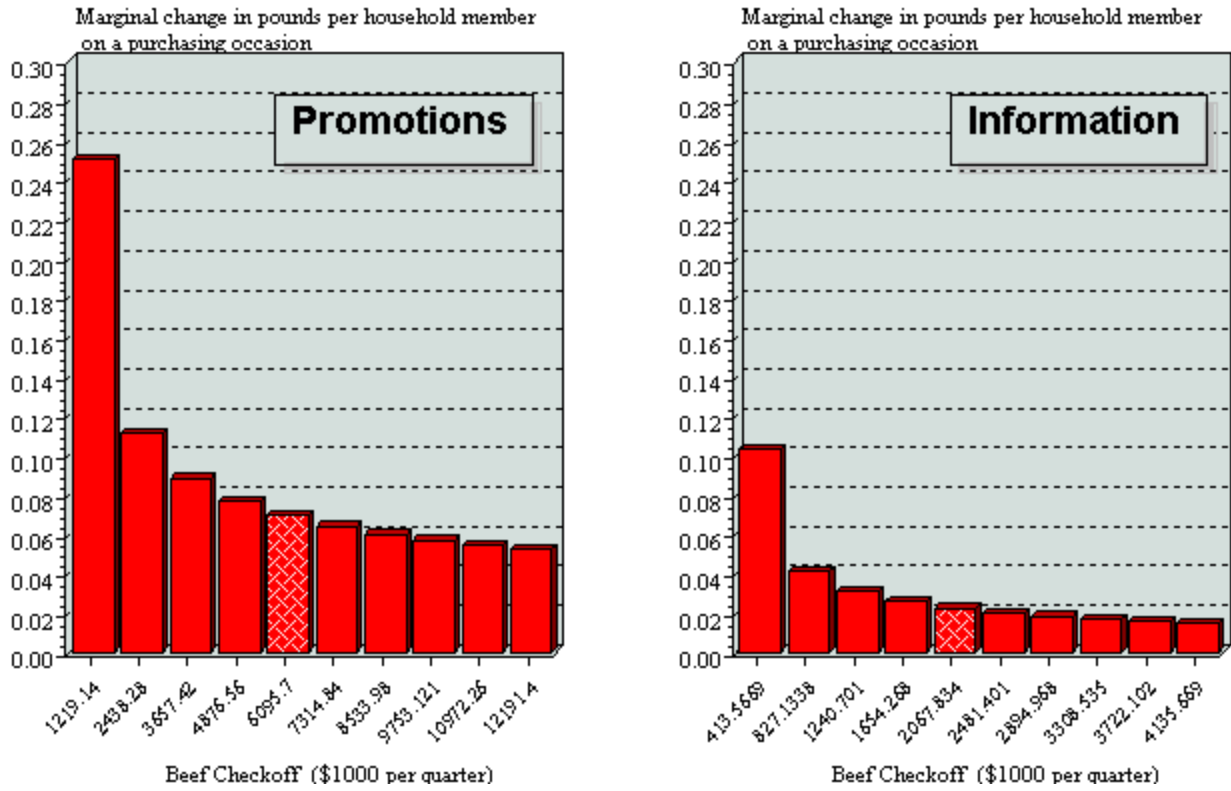Figure 1. Beef demand based on the household purchasing data.

Figure 2. Marginal gains attributed to promotions and information activities.
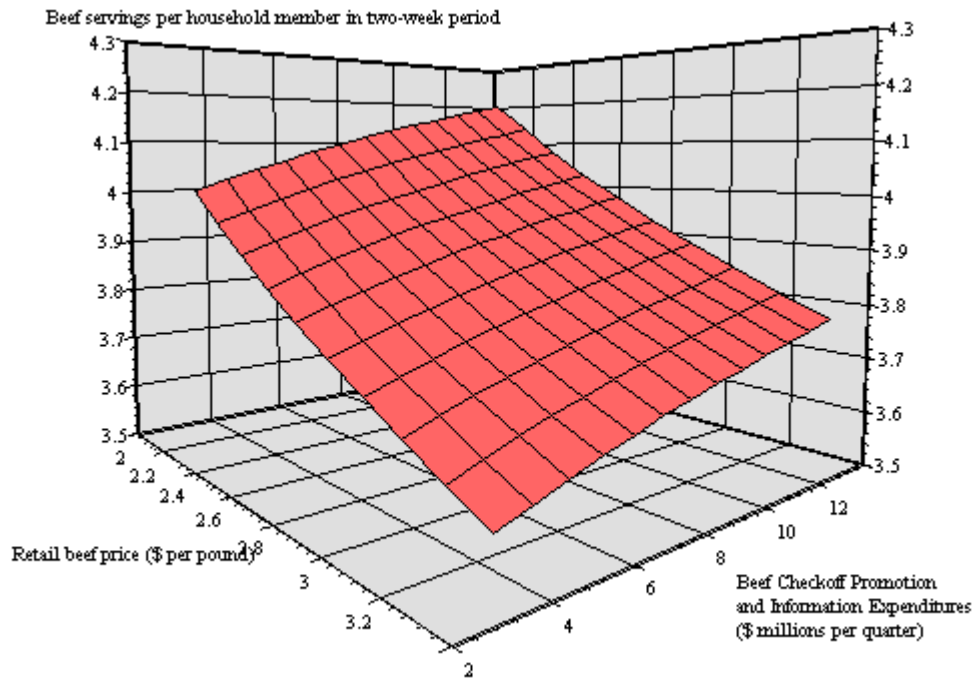

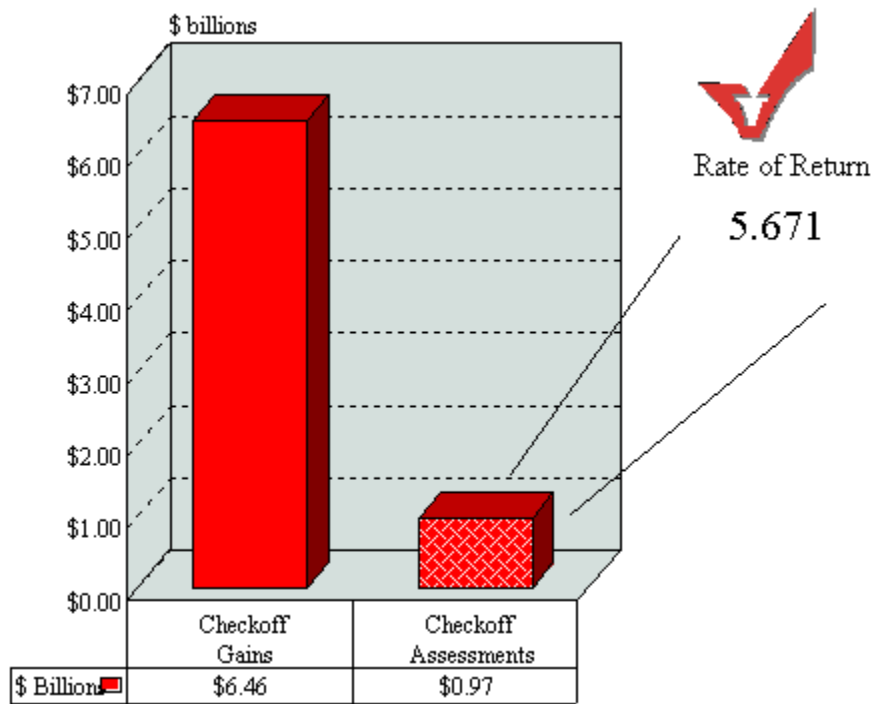Figure 3. Beef demand measured with the beef servings model.

Figure 4. Estimated rate-of-return to the beef checkoff
using the liveweight market clearance database.

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