DEPARTMENT OF AGRICULTURAL ECONOMICS

Beef Demand Determinants: A Research Summary

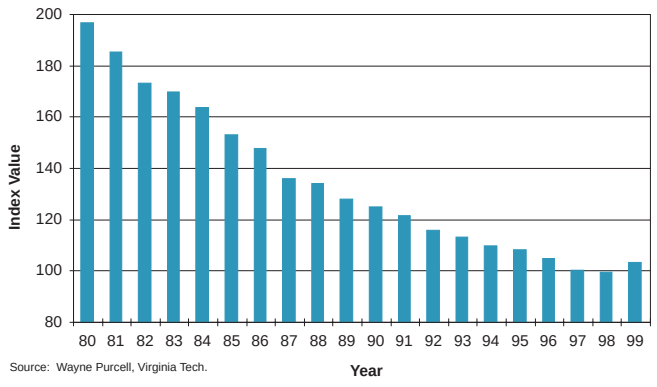
Ted C. Schroeder
Professor of Agricultural Economics

Thomas L. Marsh
Assistant Professor of Agricultural Economics

James Mintert
Professor of Agricultural Economics

Although beef demand improved modestly in 1999, 20 years of declining demand has plagued the beef industry. Inflation-adjusted retail beef prices were collapsing at the same time per capita consumption was declining. The result, beef demand declined precipitously from 1980 through the late 1990s. For example, Purcell's beef demand index indicates 1998 Choice retail beef prices were 50 percent lower than they would have been if beef demand had been held constant at its 1980 level (Figure 1). If the beef industry is to successfully improve long-run beef demand, individual beef demand determinants must be quantified. This study was designed to determine the major factors causing beef demand to shift over time.

Figure 1. *Choice Retail Beef Demand Index, 1980-1999 (1997=100).*



Source: Wayne Purcell, Virginia Tech.

Defining Beef Demand

One challenge facing the beef industry is a poor understanding of beef demand and its determinants. Part of the problem is confusion over terminology. Economists differentiate between two related, but distinctly different, terms; 1) quantity demanded and 2) demand. A meaningful discussion of beef demand requires a clear distinction between these two terms.

Quantity demanded refers specifically to the quantity of beef consumers will purchase at a given beef price, holding all other factors constant. On the other hand, demand, also referred to as a demand curve, is a schedule of beef quantities consumers will purchase over a range of beef prices.

A shift in beef demand occurs when the entire beef demand curve shifts up (demand increase) or down (demand decrease). Changes in beef price or the quantity of beef consumed do not cause the beef demand curve to shift. Rather, changes in other factors, such as prices of competing meats (e.g., pork or poultry), demographics (e.g., income, age distribution, etc.), or health or food safety concerns cause the beef demand curve to shift. When beef demand increases (i.e., shifts up), say as a result of an increase in the price of poultry that causes consumers to substitute beef for poultry, the result is higher beef prices at any level of beef consumption than prior to the demand shift. Conversely, when beef demand decreases (i.e., shifts down) beef prices are lower at any beef consumption level than prior to the demand shift.

Because there is considerable confusion surrounding demand, it is useful to stipulate what beef demand is not.

Beef demand is not per capita beef consumption. Per capita consumption *is* beef production (net of changes in cold storage, imports, and exports) divided by population. Observing per capita consumption over time without consideration of price provides little information regarding beef demand.

Beef demand is not beef's relative share of total meat consumption. This share concept simply reflects production of beef relative to production of competing meats and does not include information regarding prices.

Finally, beef demand is not the share of consumer income spent on beef. Consumer income level affects beef demand, but changes in the share of consumer income spent on beef do not provide a measure of whether beef demand is increasing or decreasing since changes in income alone can cause changes in the share of consumer income spent on beef, even if beef demand remains unchanged.

Since many beef demand determinants, as well as beef production, change at the same time, it is impossible to accurately assign relative demand shifts to individual demand determinants through casual observation of trends and beef demand shifts. As a result, a meat demand system was estimated using quarterly time series data over the 1982 to 1998 period. The system included factors accounting for prices of competing meats and total consumer expenditures, changing consumer demographics, food safety problems, health information, and seasonality. The impacts of individual demand determinants on beef demand were calculated each year from 1992 through 1998 (i.e., in-sample), and 1999 (i.e., out-of-sample).

Beef Demand Model Results

Model results indicate beef demand is inelastic with respect to beef price and that pork and poultry are weak substitutes for beef. From 1982 to 1998, on average, beef quantity demanded declined 0.61 percent given a 1 percent increase in beef price. Responses to competing meat price changes were much smaller as beef quantity demanded increased 0.04 percent and 0.02 percent, given a 1 percent increase in retail pork and poultry prices, respectively. These elasticity estimates indicate relative prices matter, however, per capita beef consumption is not highly responsive to changes in pork and poultry prices. Moreover, beef expenditures represent a progressively smaller proportion of total consumer expenditures. This implies beef demand will become even more inelastic (i.e., quantity demanded will be less responsive to price changes) in the future. As a result, consideration should be given to devoting resources to research focusing on quality (especially tenderness) measurement. This will ensure consumer demand is more often satisfied by making it easier for consumers to select the quality product they are seeking.

Expenditures Impact On Beef Demand

Beef demand is highly responsive to changes in total per capita expenditures on all goods. Changes in total per capita expenditures occur when personal disposable income increases, consumer willingness to spend income increases, or a combination of the two. Consumer willingness to spend a larger proportion of total income has been an important source of economic growth for the U.S. economy in recent years. For example, consumer expenditures rose from less than 90 percent of disposable income in the early 1980s to near 98 percent by 1999. The impact of growth in consumer expenditures on beef demand can be measured by the percentage increase in beef prices attributable to expenditure growth, with beef quantity held constant. Demand model results indicate beef prices increased about 3.6 percent annually as a result of increases in per capita total expenditures. This means beef demand was a major beneficiary of increasing consumer expenditures, but if consumers choose to increase savings in the future (in lieu of consumption), or if disposable income declines, it will have a negative impact on beef demand.

Food Safety Recalls Impact On Beef Demand

Beef demand declines when beef food safety recalls occur. Beef recalls averaged 2.1 per quarter from 1982 to 1998, but the number of recalls varied across quarters and years. For example, beef recalls ranged from 4 to 8 per quarter during 1998. Through the 1982 to 1998 period the number of Food Safety Inspection Service (FSIS) recalls were relatively few in number and their impact on beef demand was generally small. But the demand model results indicate a large increase in beef recalls leads to a significant downward beef demand shift. The beef industry cannot afford to be passive and simply react to food safety problems after they occur. Rather, the industry needs a proactive food safety program to minimize the negative impact on beef demand associated with FSIS recalls.

Health Information Impact

Health information linking cholesterol and heart disease weakened beef demand, from 1982 through 1998, by about 0.60 percent annually. As more articles are published supporting the linkage between cholesterol and heart disease, beef demand declines modestly, whereas pork and poultry demand actually increase. Importantly, the negative impact of heath information on beef demand increased over the study period.

There are several implications to be derived from the linkage between articles that publicize heart disease risk and cholesterol and their subsequent negative impact on beef demand. First, dietary guidelines for consumers on cholesterol restricted diets that include beef need to be broadly disseminated. This type of program has already been developed with beef checkoff funding and these results suggest it should continue. Second, additional research that better identifies the relationship between heart disease and cholesterol by cholesterol type and source could be useful. As a result, consideration should be given to funding additional research on the cholesterol-heart disease linkage and disseminating results within the medical community and among consumers. Finally, the industry must continue to strive to produce healthy, nutritious beef products.

Changing Consumer Demographics

Changing demographics suggest consumers are placing more emphasis on how quickly meat items can be prepared for consumption. The percentage of females in the labor force rose from 52 percent in 1982 to 60 percent in 1998. As a greater proportion of females enter the labor force, less time is available for at-home food preparation. Declining time available for food preparation had a negative effect on beef demand, but a positive effect on poultry demand. Beef demand declined an average of 1.3 percent annually over the 1992 through 99 period as a result of increasing female labor force participation. Assuming consumer demand for convenience is related to female labor force participation, these results indicate the poultry sector benefited over time by offering more convenient products to consumers. At the same time, beef demand suffered as time allocated for food preparation declined and the beef industry failed to offer consumers high quality, convenient, easy-to-prepare beef products.

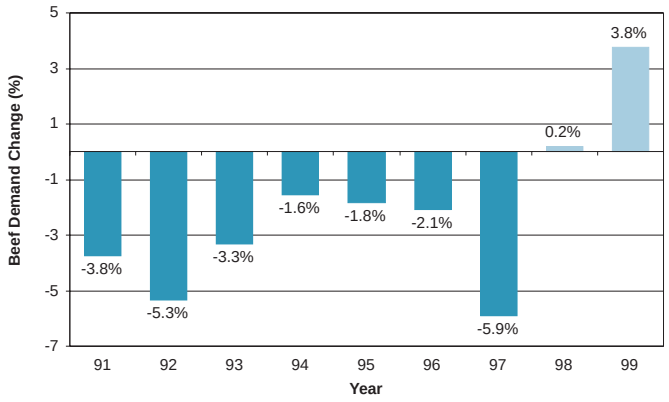
The lesson for the beef industry is twofold. First, it confirms the need for the beef industry to commit resources to research and development of innovative, consumer friendly, easy to prepare beef items suitable for sale in supermarkets. Recent new product development successes reinforce the value of devoting beef checkoff funds to product development research. Second, the industry must recognize that as consumers place higher and higher values on their time, demand for food consumed away from home will increase. This means new product development should also target products consumers purchase in a wide variety of dining establishments, ranging from low-priced fast food restaurants to high-priced white table cloth establishments.

Yearly Demand Shift Analysis

Understanding the relative importance of beef demand determinants required analyzing yearly demand shifts in detail. Demand shifts from 1992 through 1998 (in-sample) and 1999 (preliminary based on data available through December 1999) were disaggregated. The disaggregation consisted of estimating the vertical percentage shift in beef demand from one year to the next, holding per capita quantity at the previous year's level. The total vertical shift was allocated to demand shifts caused by changes in each variable in the model, as well as that portion of the demand shift not explained by the model.

This analysis revealed that beef demand declined every year from 1991 to 1997 with the magnitude of the vertical demand shift ranging from 1.6 percent in 1994 to more than 5 percent in 1992 and 1997 (Figure 2). *But*,

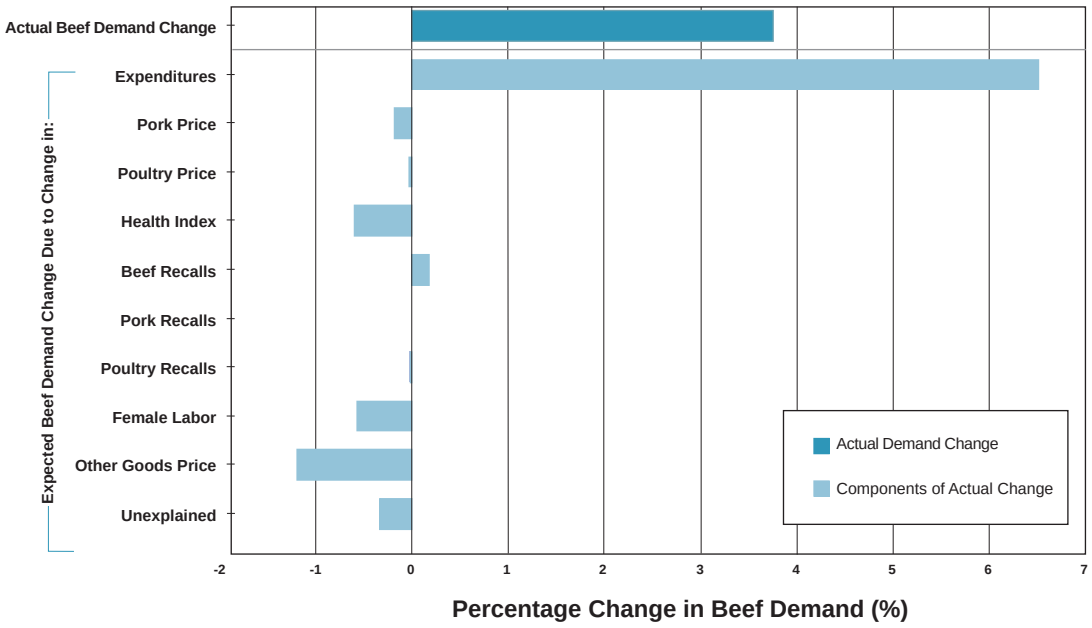
Figure 2. *Annual Percentage Change in Beef Demand, 1991-1999 (1999 K-State Projection as of December 1999).*



for the first time since prior to 1980, beef demand stabilized in 1998 relative to 1997 and, based on preliminary data, beef demand appears to have increased (by about 3.8 percent) in 1999 relative to 1998. Although noteworthy, the increase in beef demand in 1999 is modest and pales when compared to the cumulative magnitude of the demand decline that occurred from 1982 through 1997.

Figure 3 shows the projected effects of beef demand determinants on beef demand using preliminary data for 1999. From 1998 to 1999 beef demand appears to have increased by 3.8 percent. Interestingly, most of the economic fundamentals suggested beef demand would have declined from 1998 to 1999. That is, pork price, poultry price, the health information index, and female labor force participation all predicted a downward shift in beef demand in 1999. However, total consumer expenditures increased in 1999 and that provided a catalyst for beef demand to increase. Finally, less than 0.3 percent of the 1999 beef demand increase appears to have been caused by factors not included in the model.

Figure 3. *Actual Beef Demand Change and Expected Changes in Beef Demand Attributable to Factors in the Model, 1998 to 1999.*



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