The Impact of Technology on Ground Beef Production and Prices

J. Ross Pruitt
David P. Anderson

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The Impact of Technology on Ground Beef Production, Prices, and U.S. Beef Imports

Perhaps the one thing that Americans are addicted to is a hamburger. One of the biggest restaurant trends of the last couple of years have been gourmet hamburger restaurants, from upscale dining to food trucks. U.S. ground beef consumption accounts for over half of total beef consumption and is also included in a variety of products from tacos to chili (Greene 2012; National Cattlemen's Beef Association 2009, 2012; Peel, 2012). Despite the slow economic recovery that has been occurring over the past few years, quick-service restaurants focusing on serving quality hamburgers have been expanding across the country.

Although ground beef accounts for over half of total beef consumption, it accounts for approximately a quarter of the beef produced from each steer or heifer carcass (Nold, 2012) and a much larger percentage of harvested cows. Although the number of cattle in the U.S. has declined since the 1970s, increased efficiency has contributed to an increase in total U.S. beef production. The primary source of lean ground beef is not from feedlot finished cattle, but from mature dairy and beef cows and bulls slaughtered each year and from imported lean beef trimmings. Supplies of mature cows and bulls are limited compared to feedlot finished cattle as an average of 6.3 million cows and bulls have been slaughtered under federal inspection annually since 2000 compared to 27.4 million steers and heifers.

The U.S. imports annually the equivalent of about 10 percent of its domestic beef production. The bulk of beef imports are trimmings destined for ground beef. Imports have filled the even shorter supply of beef in the U.S. due to declining herds that began in the late

2000s with high feed costs and financial losses and then ramped up with historic droughts in the Southern Plains.

The lean finely textured beef (LFTB) process was developed to increase the percent leanness of relatively fatty beef trim (items after removal of major cuts from carcass). The overall value of a beef carcass was increased due to production of LFTB and allowing for consumers to experience near constant prices of products like hamburgers. Following media stories on LFTB, referred to as "pink slime," in March 2012, consumers rejected the beef product with immediate implications for the U.S. beef supply chain. This paper examines the effects of these negative news stories on ground beef prices with some implications for beef imports.

The use of lean finely textured beef (LFTB) increases the amount of recoverable beef from a carcass and has been a practice used by the U.S. beef industry since the 1990s (Rabobank, 2012; Pruitt and Anderson, 2012). Increased efficiency and heavier carcasses contributed to a 13% increase in U.S. Federally Inspected (FI) beef production as total U.S. cattle inventory has fallen by over 10% since the early 1990s. While cattle dressed weights increased during this period, mature cow and bull dressed weights did not increase as rapidly as feedlot finished steer and heifer weights. This distinction is important as the primary source of lean ground beef trimmings is from slaughter cows and bulls, not feedlot finished cattle. Supplies of mature cows and bulls are limited compared to feedlot finished cattle as an average of 6.5 million cows and bulls have been slaughtered under U.S. Federal Inspection annually since the early 1990s compared to 27.2 million steers and heifers. Currently available supplies of mature cows and bulls are further constricted as the U.S. cattle herd experiences a period of expansion.

Ground beef accounts for over half of U.S. beef consumption (Greene, 2012; National Cattlemen's Beef Association, 2012; Peel, 2012, Rabobank, 2014), in part due to the

convenience it offers consumers. The increased demand for ground beef combined with a declining supply of mature breeding stock created the opportunity to develop technology such as LFTB to increase recoverable lean beef while affording consumers desired convenience resulting in part from changes in the labor force (Capps, Tedford, and Havlicek, 1995; McGuirk et al., 1995; Binkley, 2006; Tonsor, Mintert, and Schroeder, 2010). Approximately a quarter of the beef produced from an individual carcass are beef trimmings (Nold, 2012), and technologies such as LFTB increase this yield.

Additional ground beef production occurs from the grinding of chucks and rounds of feedlot finished animals. However, market economics dictate how much of the chuck or round augments lean ground beef trimmings. With recent development of value-added cuts to the chuck primal, the opportunity cost of grinding chucks has increased. As the price of the round primal approaches the price of 90CL trimmings, the economic incentive to convert round primals into ground beef increases. However, the round is not as lean as beef from mature cows and bulls which U.S. consumers have expressed preferences for (Lusk and Parker, 2009).

Although the controversy caused by news stories broadcast by ABC News on March 7th and 8th, 2012 (Avila, 2012a, 2012b), were less about food safety than consumers' lack of knowledge about food production systems, consumer concerns were still valid. Much of the concern focused on the use of ammonium hydroxide as a processing aid to deter the growth and spread of *Escheria coli* O157:H7 and other pathogens. Some of the concern stemmed from the presence of LFTB in the federal school lunch program which fed the hysteria as a vulnerable population was exposed to a publicly deemed questionable product. The pejorative "pink slime" further undermined public confidence in its belief of the food being safe which the major concern of consumers (Lusk and Briggeman, 2009).

Although the use of ammonium hydroxide is "generally recognized as safe" by the U.S. Food and Drug Administration as a processing aid, its use was highlighted by celebrities and the media. Andrews (2012) highlights the media attention starting in 2008 that occurred on LFTB and Beef Products Incorporated (BPI) 2008 and food safety concerns regarding *E. coli* O157:H7. Van Ravenswaay and Hoehn (1991), Verbeke and Ward (2001), Dahlgran and Fairchild (2002) provide examples of negative media coverage on demand for apples, meat, and chicken, respectively. The presence and reach of social media added a different dimension to the traditional media stories of LFTB by spreading not only awareness, but also misinformation. Beardsworth and Keil (1996) state that public reaction to media coverage follows five patterns: 1) a lack of awareness or concern about the potential food risk factor; 2) news about the potential food risk factor and public sensitization,; 3) public concern increases as risk factor becomes major interest of media and public debate; 4) public response with typically an avoidance of the food; and 5) public concern decreases as a new equilibrium is reached. All of these steps were present in the LFTB situation. It is also possible that once Beardsworth and Keil's (1996) stage five has been reached that the food product may be reintroduced to the marketplace and acceptance by consumers. This has started to occur with LFTB given recent media stories (Bunge and Gee, 2014; Korn, 2014), but spokespersons for the companies are very sensitive to preventing a hysteria similar to 2014 from occurring.

While the media can create food product scares, it also provides consumers access to peer-reviewed medical research that can improve nutrition and overall health levels. Increased awareness of heart disease, cholesterol, and atherosclerosis had a negative impact on certain types of food products including red meat (Brown and Schrader, 1990; Chern, Loehman, and Yen, 1995; Adhikari et al., 2006). The majority of studies using the so-called "cholesterol index"

were based on results from using the Medline database of English language medical journals as opposed to traditional media. Tonsor, Mintert, and Schroeder (2010) state that emerging information on nutrition and meat consumption would be first stated in medical journals, but the media eventually passes this information on to consumers through medical correspondents in addition to consumer consultations with medical professionals. Positive information on food products has also been conveyed through producer funded check-off advertising efforts (Wohlgenant, 1993; Brester and Schroeder, 1995; Kaiser, 2014).

Consumer preferences for production practices, food safety and their reactions to food safety events are well documented in the literature. Methods to study these events include conjoint analysis (Lusk and Parker, 2009) to best-worst scaling (Lusk and Briggeman, 2009; Lusk and Parker, 2009) to event studies (Henson and Mazzocchi, 2002; Lusk and Schroeder, 2002; Detre and Gunderson, 2012). Use of demand modeling systems have also been used to analyze how consumer demand responds to food safety or media events (Piggott and Marsh, 2004; Mazzocchi, 2006; Tonsor, Mintert, and Schroeder, 2010; Tonsor and Olynk, 2011; Yadavalli and Jones, 2014). Our paper improves upon the effort of Yadavalli and Jones (2014) who studied aggregate red meat and poultry demand by focusing on the inputs needed to produce LFTB: 50% and 90% chemically lean ground beef trim

Data

Price and production data were obtained from the U.S. Department of Agriculture's Agricultural Marketing Service (USDA AMS). Information on the prices of 90% chemically lean ground beef trim (90CL), 50% chemically lean ground beef trim (50CL), primal values of the chuck and round. Quantity information was also obtained from USDA AMS for each of these commodities. Pricing information on lean ground beef imported from Australia and New Zealand were also

obtained from USDA AMS. Slaughter information was also obtained for FI steer and heifer slaughter as well as mature cow and bull slaughter.

An indicator variable was also included in the analysis for the presence of media stories on LFTB. This variable coincides with the presence of stories starting in March 2012 that were broadcast (Avila, 2012a, 2012b). While there were other stories as indicated in Andrews (2012), these events did not have the impact of stories broadcast in March 2012.

The basic model is a fairly simple one using weekly 50 and 90 percent lean prices and volumes with a variable for the news event. Weekly prices and volumes are employed to more closely tie the event' impact to the data. Monthly data may be too long a period to capture the full impact of the news stories. In a departure from much of the event study literature, this paper uses meat prices and volumes. Much of the other literature uses company stock prices and draws more from the finance and business literature.

Results

The 50 and 90 percent lean ground beef prices were transformed into first differences. The differences were estimated as a function of the lagged dependent variable, weekly dummy variables beginning with the week of the ABC news stories and continuing for 12 weeks, the change in 90 percent lean price and 50 percent lean volume. The 50 percent lean model (Table 2) indicated that volume and lagged price were statistically significant. The news story events were significant and negative for weeks 5 and weeks 9-11. The results indicate that it took some weeks for the full effect of the news stories to build up. While price recovered briefly, prices broke sharply lower later in the period. The significant lag length does fit with the timeline of businesses announcing they would no longer use the product. It may also fit with contract and

purchase deliveries that may have already been in the system. The model also estimates that there is some interaction between 50 and 90 percent lean beef.

The relatively low r-square suggests that there are some other factors at work in the 50 percent lean prices. The data indicate this may be the case later in the time period studied as supplies of cattle and beef declined and beef prices rose dramatically. Retail outlet purchasing patterns may be at work as well as prices of other beef cuts like chucks and rounds.

The results indicate that the news stories had no significant impact on 90 percent lean prices. The signs are as expected given that the process increases the supply of extra lean beef to augment 90 percent lean supplies.

Summary

This paper examines the impact of news stories on ground beef prices. The results indicate that negative news effects were important factors in declining prices. The work suggests several areas for further exploration. One is some other modeling techniques to better account for more of the variation in the data. The incorporation of several more beef products into a set of equations might yield more insight. In addition, further exploration of the demand for various beef cuts and ground products relative to the overall demand for beef would likely yield more complete results.

Table 1. Descriptive Statistics for 90 and 50 Percent Lean Ground Beef Prices and Volumes.

	90L Volume Lbs.	90L Price $/cwt	50L Volume Lbs.	50L Price $/cwt
Mean	3,924,521	193	3,388,644	88
Std. Dev.	992,367	43.21	1,366,728	23.04
Min.	1,238,231	124	112,291	43
Max.	3,829,905	300	7,495,534	159

Table 2. Model Results for the Impact of News Events on 50 Percent Chemical Lean Beef

Variable	Coefficient	P-Value
50 Lean t-1	0.416	0.000*
News 1	-2.731	0.545
News 2	-3.069	0.498
News 3	-1.601	0.724
News 4	-3.097	0.494
News 5	-17.458	0.000*
News 6	-0.325	0.944
News 7	14.938	0.001*
News 8	9.888	0.031*
News 9	-9.900	0.032*
News 10	-10.866	0.017*
News 11	-10.467	0.022*
News 12	4.628	0.312
50 Lean Vol.	-0.001	0.000*
90 Lean Price	0.264	0.004*
R^2	0.745	

Table 3. Model Results for the Impact of News Events on 90 Percent Chemical Lean Beef

Variable	Coefficient	P-Value
90 Lean t-1	0.665	0.000*
News 1	-0.801	0.693
News 2	-1.385	0.496
News 3	-0.365	0.858
News 4	-0.158	0.938
News 5	2.769	0.182
News 6	2.620	0.199
News 7	-1.244	0.545
News 8	-0.368	0.859
News 9	0.004	0.998
News 10	2.021	0.325
News 11	0.975	0.635
News 12	0.623	0.758
90 Lean Vol.	-0.001	0.006*
50 Lean Price	0.084	0.000*
R^2	0.864	

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