THE POULTRY PUBLICITY PUZZLE: AN APPLICATION OF ADVERTISING AUDIENCE ESTIMATION TECHNIQUES TO THE ANALYSIS OF DEMAND FOR CHICKEN DURING CONTAMINATION PUBLICITY

by

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STATEMENT BY AUTHOR

This thesis has been submitted in partial fulfillment of requirements for an advanced degree at The University of Arizona.

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ABSTRACT

Publicity about food contamination can depress demand, causing lost producer revenue. TV and print news coverage of bacteriological contamination of chicken in the U.S. provides a setting for estimating the inverse demand for chicken from 1982 to 1991. A beta binomial audience exposure distribution is used to estimate net reach and average frequency of exposure to contamination publicity. Quantities are adjusted for trading-day variation.

Because data interval length affects demand and media coverage estimates, three separate models (weekly, monthly, and quarterly) are estimated and the results are compared. For each unit increase in the weekly frequency of publicity, prices were depressed by 1.2 percent, leading to a $760 million retail loss to the chicken industry, under one-quarter of one percent of revenues over ten years. The demand for chicken is more elastic in the short run, suggesting that inventory effects are stronger than habit.

CHAPTER 7. IMPLICATIONS, LIMITATIONS, AND SUGGESTED FUTURE RESEARCH

The results presented in the last chapter suggest two dominant implications. First, demand for chicken is more elastic in the short run than in the long run. Weekly and monthly prices were more sensitive to changes in quantity than quarterly prices were. Second, the frequency of chicken contamination news stories did influence demand in the weekly model, but the chicken market is large enough that the loss in revenues is relatively small.

Retail chicken sales were approximately $716 million lower with contamination publicity than the model indicates they would have been without publicity. Wholesale losses to producers over the same ten year period were $190 million. In spite of the size of these losses, they are small relative to total wholesale and retail sales. During 1987, the top year of news coverage impact, the losses are approximately 0.7% of retail sales and 0.46% of wholesale sales. For the entire period of 1982-1991 losses associated with contamination coverage are less than one-fourth of one percent.

Several factors may be responsible for the small influence of publicity relative to market size. One factor that distinguishes chicken contamination from other food safety publicity incidents is the responsibility of the consumer. Since proper cooking and handling techniques considerably lessen the risk of disease from contaminated poultry, response to contamination publicity may be less intensive than for other publicity incidents such as Alar-contaminated apples, for example. On a related note, salmonella *illness may be perceived as a small risk to overall health* by consumers both because the risk of death is small and because consumers can take steps to avoid being exposed.

Second, the highest average frequency of stories in any given week was near two. If advertising research, suggesting that a minimum of three exposures are needed to change purchase behavior, is applicable to chicken contamination publicity then the coverage did not reach the frequency threshold needed to cause a meaningful change in behavior. Other food and product safety incidents such as Tylenol poisonings, Alar on apples, and benzene contamination of Perrier may have produced a greater impact on demand because the coverage was repeated more frequently. The chicken contamination story may have gotten less attention because media gatekeepers realized that the risk posed to human health by salmonella was not large enough to justify more frequent coverage.

Third, publicity did not interrupt consumer switching from beef to chicken. Per-capita chicken consumption continued to rise through the 1980's. Consumers seem aware that chicken provides a low-cost source of protein compared to other meats (Linden 1990), and this price effect may dominate fairly low-level safety concerns. If chicken contamination had been responsible for widespread deaths and if these fatalities had received more frequent coverage, the poultry industry might have been more affected.

The findings suggest that demand for chicken was relatively firm in spite of contamination publicity.

7.1 Implication of Flexibility Estimates

The flexibility estimates in table 7.1 suggest that shorter-term chicken demand is more elastic than longer-term demand. Removal of the time trend variable from the model causes flexibility estimates to fall by as much as 75 percent.

Table 7.1, Comparison of Flexibility Estimates by Period and Whether Trend is in the Model. (Standard errors in parentheses).

MODEL	WEEKLY ß	MON 1 ß	MON 2 ß	MON 3 ß	QUARTERLY ß	
	OLS	OLS	DHRYMES	HATANAKA	DHRYMES	OLS
With Time Trend	-.162 (.061)	-.487 (.147)	-.407 (.132)	-.452 (.147)		-2.299 (.538)
Without Time Trend	-.061 (.024)	-.109 (.054)	-.173 (.076)		-1.369 (.341)	-.367 (.149)

It is difficult to compare flexibility estimates with previous work because other studies have used data from different years and different market levels. Thus, there is no consensus of findings to suggest whether chicken demand is less or more elastic as the data interval lengthens. A recent scanner study (Capps 1989) suggests that weekly elasticity of demand for chicken is near -0.65, while the flexibility estimated here is smaller in absolute value (-0.162) implying a weekly elasticity of -6.1. Only Marion and Walker (1978) found as large a weekly elasticity. The implied monthly elasticities range from -2.05 to -2.45), larger than the range given by previous studies in table 2.1 (-0.10 to -.60). Quarterly elasticities are also larger than most previous studies.

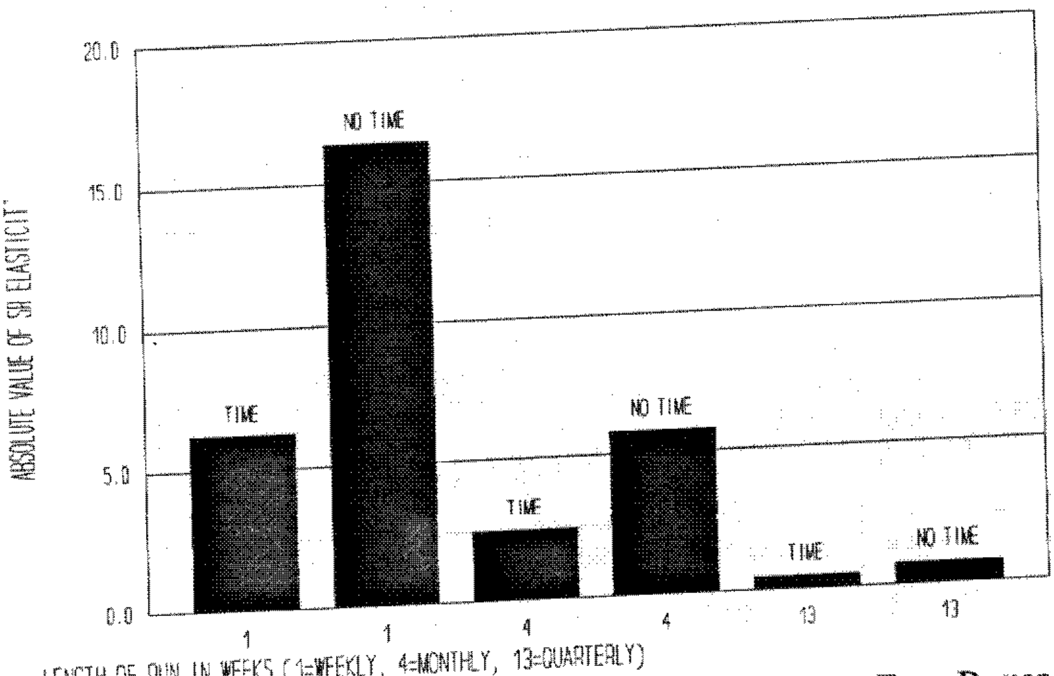

Figure 21, Absolute Values of Estimated Elasticities Show Shorter-Term Demand is More Elastic.

Figure 21 shows the absolute values of the lower limit to the elasticities (calculated by taking the reciprocal of the flexibilities) from table 7.1. Weekly demand is more elastic than monthly or quarterly demand, suggesting that inventory effects predominate. These results are consistent with Capps and Nagya's 1990 (p. 499) observation that, for most foods, "generally inventory demand tends to dominate habits in the short term."

Implied long-run flexibilities are shown in table 7.2. Each implied long-run flexibility is smaller than its companion short-run flexibility in table 7.1. These seem more comparable in magnitude to past research. For example, Wohlgenant and Hahn's 1982 long-run elasticity for monthly chicken demand was -0.3, implying a flexibility of approximately -3.3 which is near two of the three monthly estimates in table 7.2. However, Wohlgenant and Hahn found that habit effects predominate in the demand for chicken while these results suggest otherwise.

Table 7.2, Implied Long-run Flexibilities of the Estimates in Table 7.1

MODEL	WEEKLY ß/(1-λ)	MON 1 ß/(1-λ)	MON 2 ß/(1-λ)	MON 3 ß/(1-λ)	QUARTERLY ß/(1-λ)	
	OLS	OLS	DHRYMES	HATANAKA	DHRYMES	OLS
With Time Trend	-1.51	-3.48	-2.23	-3.05	-5.11 OLS	
Without Time Trend	-.61	-.94	-.70		-1.50	-1.02

Figure 22 plots the implied long-run elasticities associated with the flexibilities shown in table 7.2. Again, results suggest that the shorter the data interval, the more elastic the demand for chicken will be. Unlike the results of previous inverse demand studies, no evidence of a U-shaped relationship between time and elasticities is noted.

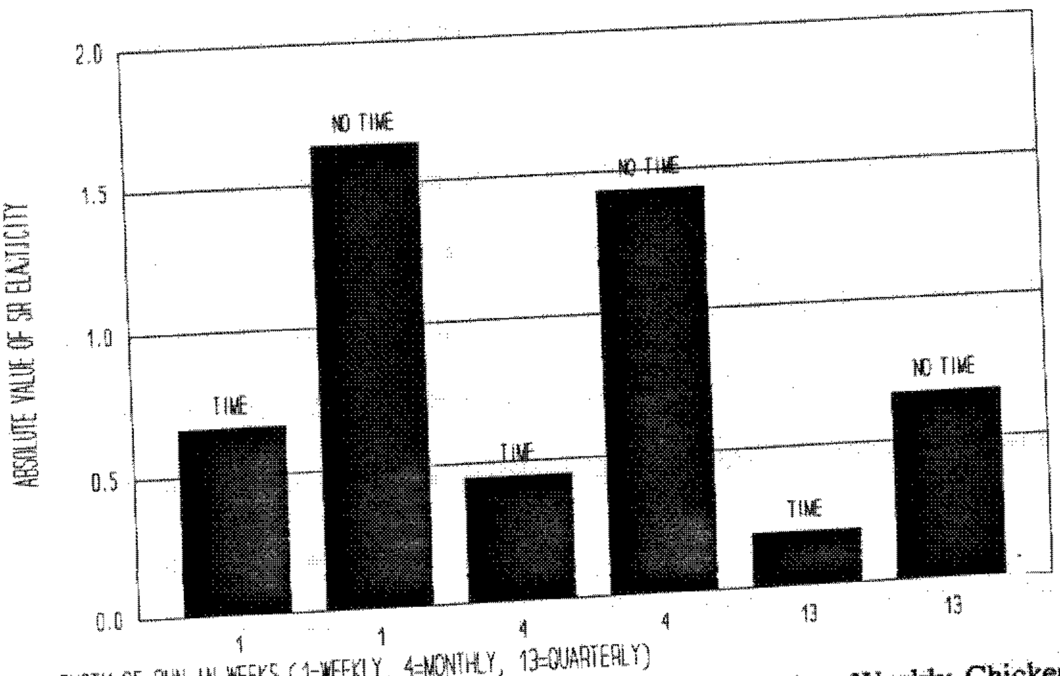

Figure 22, Absolute Values of Implied Long-Run Elasticities: Weekly Chicken Demand is More Elastic than Monthly or Quarterly.

Several possible reasons may explain the difference between the results shown here and those reported by others. First, chicken was the only good in the model, while other research has used beef, pork, and other foods to obtain elasticity estimates. Second, this study controlled for weekly and monthly trading-day variation but other studies, except for McNulty and Huffman (1992), did not. Third, many of the monthly demand studies and every weekly study used cross-sectional data whereas this study used aggregate market data. Fourth, several of the other short-term studies used retail prices and quantities while this study used an intermediate wholesale price and liveweight quantity. Finally, the other studies of weekly, monthly, and quarterly chicken demand used periods other than 1982-1991.

7.2 What the Media Estimates Suggest

Gross impressions and net reach of chicken contamination publicity did not explain any significant variation in price. However, average frequency of exposure lagged one week was of small, but significant, explanatory power. A unit change in the previous week's average frequency was associated with a 1.2 percent price drop in the weekly model. Further analysis of the weekly data reveals that coverage effects wore off within approximately two weeks.

In the monthly model, the significance of the last period's average frequency varied according to the estimation procedure used to correct for serial correlation. With the Dhrymes variance procedure, a unit change in lagged media frequency was associated with a 2.4 percent change in price. Lagged average frequency was not significant under the Hatanaka two-step method or the original OLS specification. Average frequency was not significant in the quarterly model. The results suggest that the impact of contamination publicity could have lasted two months at most, but probably lasted about two weeks.

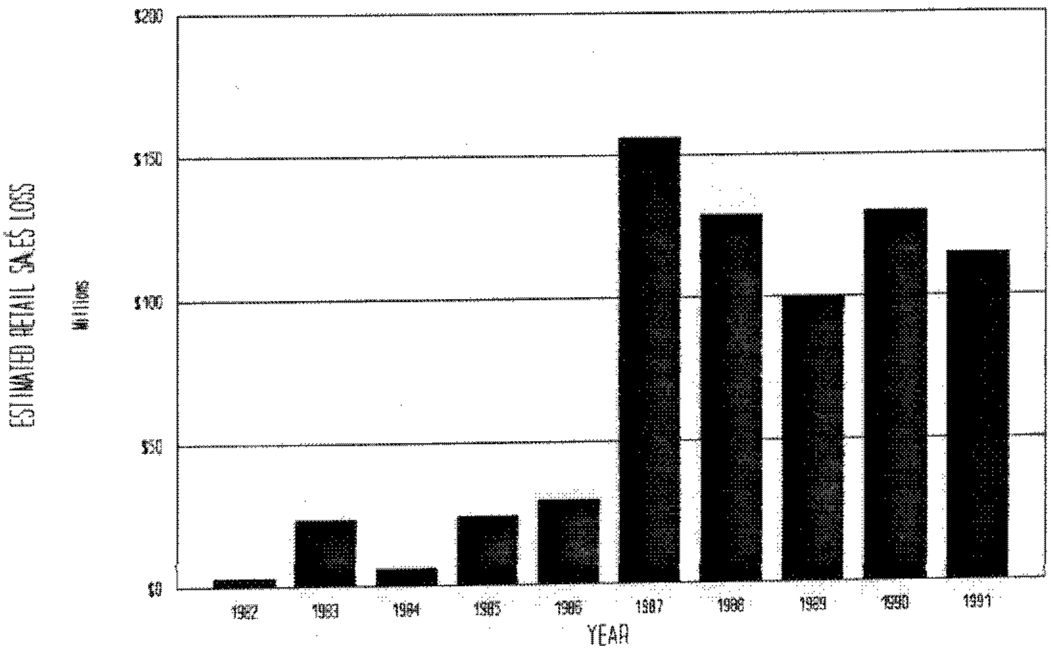

Figure 23, Contamination News Coverage Was Associated With a $716 Million Drop in Retail Sales, 1982-1991.

The sales impact of contamination publicity on the wholesale chicken market from 1982-1991 was an estimated loss of $190 million. Retail sales were depressed by $716 million over the same time. Figures 23 and 24 show the estimated retail and wholesale losses by year to the industry.

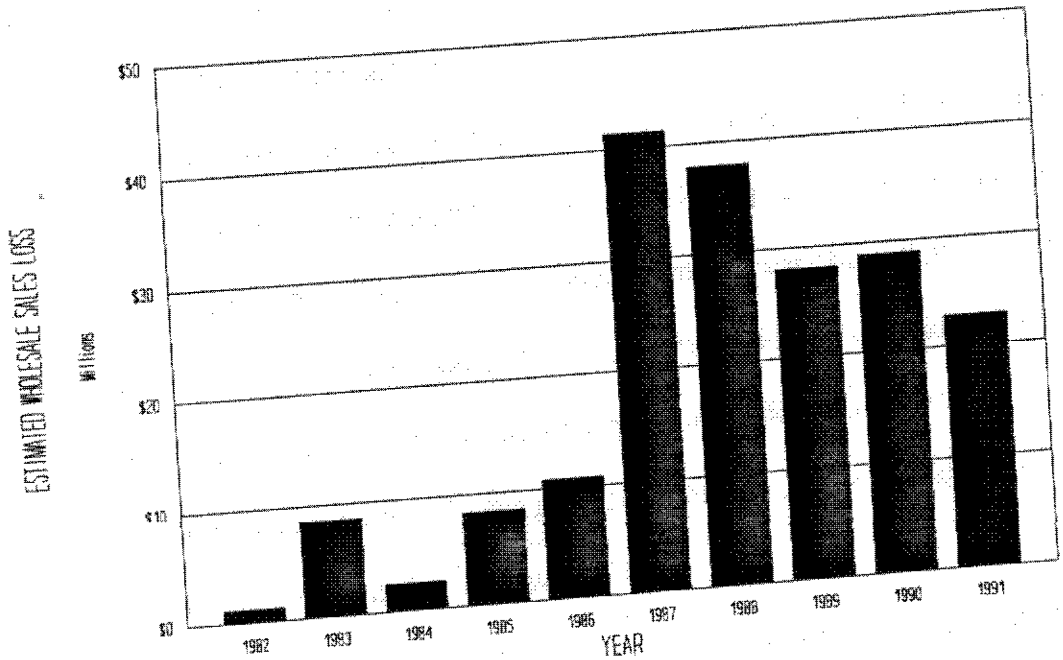

Figure 24, Contamination News Coverage Was Associated With a $190 Million Drop in Wholesale Producer Revenues, 1982-1991.

The average frequency of exposure estimates message repetition but does not provide information about aggregate audience. Since average frequency is magnitude-free, a story in a small, local newspaper could have the same effect on price as a national television news story. Average frequency acts like a dummy variable in this sense, except that it can take on continuous values greater than one. However, the average frequency measure contains more information than a dummy variable because it can test the theory that frequency is an important measure of publicity impact. The article-counting approach, while a cruder measure of the frequency of coverage, is similar to average frequency except that counting ignores audience overlap and assumes that the entire audience was exposed to every article.

Contamination publicity led to a decrease in short-term demand. The specification of media variables in this study took advantage of marketing sales response theory and advertising exposure distributions to create media impact variables that were more soundly grounded in information theory than past approaches in food safety publicity studies. When these better specified media variables were added to an inverse demand model that relied on economic theory, the resulting model was able to test implications of economic theory and information theory.

Finally, recall from the discussion in Chapter 4 that the range of information response phenomena are not, in theory, linear. Use of a model that is linear in information may mask important characteristics of information response. These and other limitations to the model will be considered next.

7.3 Limitations

One of the chief limitations was that no cross commodities were used. Most studies of chicken demand have used the prices or quantities of beef, pork, and fish *because there is much evidence* that changes in prices of other meats influence the demand for chicken. Turkey consumption has grown more rapidly than chicken consumption during the last decade and, as another competitive meat, turkey should have been included in the analysis. However, weekly data were unavailable for these other goods. The weekly model was used as the base analysis because it corresponds to the purchase cycle for chicken, permitting the most reliable estimates of media parameters.

A simultaneous equation system would have permitted the estimation of supply and demand. It is possible that such a model would have been a better representation of the poultry industry's short-run equilibrium. A demand systems approach would have allowed broader tests of demand theory.

The budget constraint on the research limited the quality and availability of the data. Use of private computerized information databases could have shortened the time needed to do the article search and widened the final story list. The exclusion of radio and local television coverage probably reduced publicity exposures significantly. Another limitation was that a better income variable (such as weekly expenditures) was not available. While private firms publish weekly consumer income and expenditure data, none were available for free. Retail prices for chicken are available from single source data firms and might have been preferable to the wholesale prices of boneless skinless breast meat that were used.