Effects of Meat Recalls on Futures Market Prices

Jayson L. Lusk and Ted C. Schroeder

The number of meat recalls has increased markedly in recent years. This research examines the impact of beef and pork recall announcements on nearby daily live cattle and lean hog futures market prices, respectively. Results indicate medium-sized beef recalls that are of serious health concerns have a marginally negative impact on short-term live cattle futures prices. However, results are not robust across recall size and severity. This research suggests that if there is any systematic change in cattle and hog demand due to meat recalls, it likely occurs over an extended period of time and only in certain cases does it noticeably affect daily futures prices.

Key Words: beef demand, food safety, futures market, meat recall, pork demand

Recently, considerable attention has been directed at quantifying the effects of nonprice factors in meat demand studies. In an attempt to identify the causes of structural change in the beef industry (as reported by Moschini, 1991; Moschini and Meilke, 1989; and Eales and Unnevehr, 1988), numerous studies have examined factors such as food safety, health and nutrition, media, and advertising on meat demand.

For example, Kinnucan et al. (1997) found adverse health information had a strong negative influence on beef demand and a slightly negative influence on the demand for pork. Capps and Schmitz (1991) also observed cholesterol information was negatively associated with meat demand. In their investigation of the impact of brand and generic advertising on meat demand, Brester and Schroeder (1995) reported brand advertising had a significant effect on beef, pork, and poultry demand. They also found that poultry advertising negatively influenced beef and pork demand. These types of studies often employ aggregate consumption and retail data over extended periods of time [e.g., Kinnucan et al. (1997) used quarterly data from 1976–1993]. One exception to this approach is an analysis by Capps (1989), who examined the effects of advertising in demand analysis using scanner data. Due to the nature of the data and the construct of the analyses, the data may not reflect short-run changes in meat demand because they may be masked when performing aggregate time-series analysis. Short-run changes in meat demand are extremely important, especially to those involved in futures markets.

To determine short-run shifts in meat demand, Robenstein and Thurman (1996) examined the effect of health-related information on futures market prices. They evaluated the immediate impact of articles published in the *Wall Street Journal* on live cattle, feeder cattle, pork belly, and live hog futures prices. Robenstein and Thurman concluded futures markets had no discernable reaction to these public releases of information. Although they found no significant short-run impact of health-related articles, other health-related information might influence short-run changes in futures markets.

Recently, food safety concerns for meat products have escalated. Numerous food products have transmitted foodborne illnesses to consumers via a myriad of known and unknown foodborne pathogens (Centers for Disease Control and Prevention, 1999). Common meat foodborne bacteria include *Listeria monocytogenes*, *Escherichia coli* (*E. coli* O157:H7), and *Salmonella*.

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Recent research by Flake and Patterson (1999) examined the impact of health information and food safety on beef demand. A food safety information index was constructed by counting the number of Associated Press articles published on bovine spongiform encephalopathy (BSE), *E. coli*, and salmonellosis contamination in beef. Based on their findings, food safety concerns had a modest negative impact on meat demand.

Using quarterly time-series data from 1982–98, Schroeder, Marsh, and Mintert (2000) estimated the impact of the number of Food Safety Inspection Service (FSIS) meat recalls on meat demand. They found beef recalls significantly influenced beef demand. Their estimated elasticity was ! 0.0065, implying a 1% increase in the number of meat recalls was associated with a ! 0.0065% decline in beef demand. Although the estimated impact of beef recall events on beef demand was relatively small, in certain years when recall events increased markedly, demand for beef declined by more than 5% as a result of beef recalls.

Beef and pork recalls have the potential to adversely affect meat demand in the short run (i.e., day-to-day), in addition to the longer-run impacts identified in previous studies. An information shock such as a meat recall, if the event were an important short-run demand determinant, would be expected to cause a downward futures price movement as traders react to potential negative consumer response. The magnitude of the daily price movement would be expected to depend upon the severity of the recall, e.g., volume of meat recalled and likely health hazard consequence of consuming the product. Despite the potential importance of beef and pork recall events on daily cattle and hog futures market prices, no previous study has estimated their impacts.

Over the past 15 years, the number of meat recalls has risen. In 1982, there were only six beef and five pork FSIS recalls. This number increased to 18 beef and 19 pork recalls in 1999 [U.S. Department of Agriculture (USDA)/FSIS]. Figure 1 shows the number of FSIS recalls from 1982 through 1999. Some of the increased incidence of recalls is likely attributable to heightened public concern over foodborne illnesses, prompting closer regulatory scrutiny of meat product safety. For example, the first *E. coli* O157:H7 FSIS recall (beef's most common bacterial contamination problem) did not occur until 1988. However, since 1988, *E. coli*-related beef recalls have averaged over three per year. Understanding how futures markets behave when meat recalls occur is becoming increasingly important because of the rising number of product recalls.

The goal of this analysis is to quantify the effects of beef and pork recall announcements on daily live cattle and lean hog futures market prices, respectively. The magnitude of change in the futures market price as well as the length of time required for the price to return to its "normal" path following a product recall are examined. Factors hypothesized to be important in affecting magnitude and degree of persistence associated with a meat recall are the size of the meat recall and the severity of the recall (i.e., the amount of health concern associated with the recall). Our results indicate that, in general, pork and beef recall events have not systematically appreciably impacted daily lean hog and live cattle futures markets.

Data and Procedures

The recall data for this study were obtained from the USDA/FSIS. The data set contains over 500 observations resulting from all reported meat recalls from 1982 through 1999, and contains meat recalls for pork, beef, chicken, turkey, and other miscellaneous meat products. Reasons for recalls range from bacterial contamination and foreign material to mislabeling of the product. Meat in need of recall may be identified through self-inspection by meat packers or processors, as a part of FSIS tests, by FSIS field investigators, or by consumer complaints.

Upon learning about the potential for unsafe meat, the FSIS conducts a preliminary investigation to determine if a recall is necessary. Once a recall is deemed necessary, the public is notified via a press release and a Recall Notification Report is issued.[1] All recalls in the data set are self-contained events; that is, no "related" recall events—where one batch of meat is recalled and then in a few days a second associated batch is also called back—occur in the data set during the 1982–1999 time period analyzed.

[1] There is some potential for information about a recall to "leak" out prior to being announced. However, the FSIS notes its goal is to "protect the public health by ensuring that potentially hazardous foods are removed from commerce as quickly as possible." How much information may be known prior to an announcement likely varies on a case-by-case basis. The individuals most likely to possess information about the recalls prior to announcement would be those employed by the meat packing plants and/or the USDA. Using such recall information to profit in the futures market would be considered insider trading, and is therefore illegal. We have examined daily price changes one and two days prior to the recall event and found results similar to those reported later in the article.

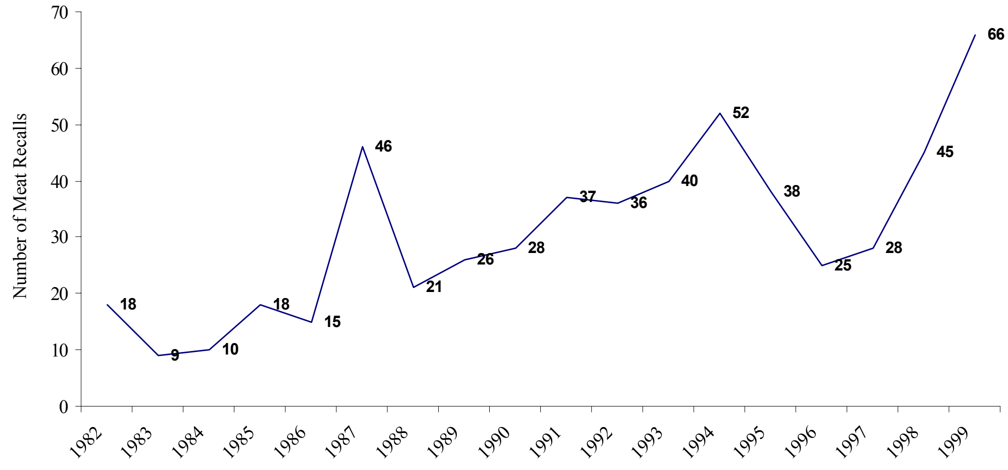


Figure 1. Number of FSIS meat recalls, 1982–1999

The recalls are identified by FSIS as being in one of three classes:

- Class 1, involving a health hazard situation where there is a reasonable probability that consumption of the product will cause serious, adverse health consequences or death;
- Class 2, involving a potential health hazard situation where there is a remote probability of adverse health consequences from the use of the product; or
- Class 3, involving a situation where the use of the product is not likely to cause adverse health consequences.

In this analysis we refer to Class 1 recalls as "serious," and Class 2 and Class 3 recalls as "non-serious." From 1982 through 1999, there were 158 beef recalls and 143 pork recalls. Of the total number of recalls, 98 beef and 90 pork recalls posed serious health concerns.

Additionally, each recall announcement includes the number of pounds recalled. Over the 1982–1999 study period, the size of the recalls ranged from zero pounds to over 4 million pounds.[2] With such a large range in the recall volumes, rather than using this variable as continuous, it was converted to five categorical variables that divided each meat type into one of five equal (by number of occurrences) recall size categories.

For beef, the size categories were segregated as follows: $size_1$ = less than 1,162 lbs., $size_2$ = between 1,162 lbs. and 4,516 lbs., $size_3$ = between 4,516 lbs. and 32,000 lbs., $size_4$ = between 32,000 lbs. and 175,288 lbs., and $size_5$ = greater than 175,288 lbs. Similarly, for pork, size categories were segregated as follows: $size_1$ = less than 635 lbs., $size_2$ = between 635 lbs. and 4,150 lbs., $size_3$ = between 4,150 lbs. and 14,400 lbs., $size_4$ = between 14,400 lbs. and 45,512 lbs., and $size_5$ = greater than 45,512 lbs.[3] Figures 2 and 3 provide summary statistics of the meat recalls.

Daily futures market prices for the live cattle and lean hog futures contracts were obtained from the Chicago Mercantile Exchange. To construct a continuous series, futures prices for each trading day in the nearby contract were used for the analysis. Because prices in the nearby contract month often become volatile, the price series was rolled over to the next futures contract on the first of each month in which a contract closed. Further, when calculating the daily futures price change, a price in one contract month was never subtracted from a price in another contract month. In other words, the effects of recall events were determined by examining daily price changes in a particular contract.

[2] There were several reported recalls, five beef and seven pork, where zero pounds of meat were recalled. Each of these instances occurred prior to 1987. It is unclear how a recall with zero pounds can be considered a recall. Because of the ambiguity of these events, we deleted these observations from the data set.

[3] The recall size categories for beef and pork are not equivalent because we used the distribution of recall pounds for each species to determine the size categories. Rather than construct a uniform size classification for both species, we constructed species-specific size categories. Specifically, the recall population was split into five equal-size categories for each species. Constructing the size categories in this manner avoids irrelevant size comparisons across species. We also conducted the analysis with three (small, medium, and large) size categories, rather than five. The same general conclusions were generated regardless of the construction of the size categories. These results are available from the authors upon request.

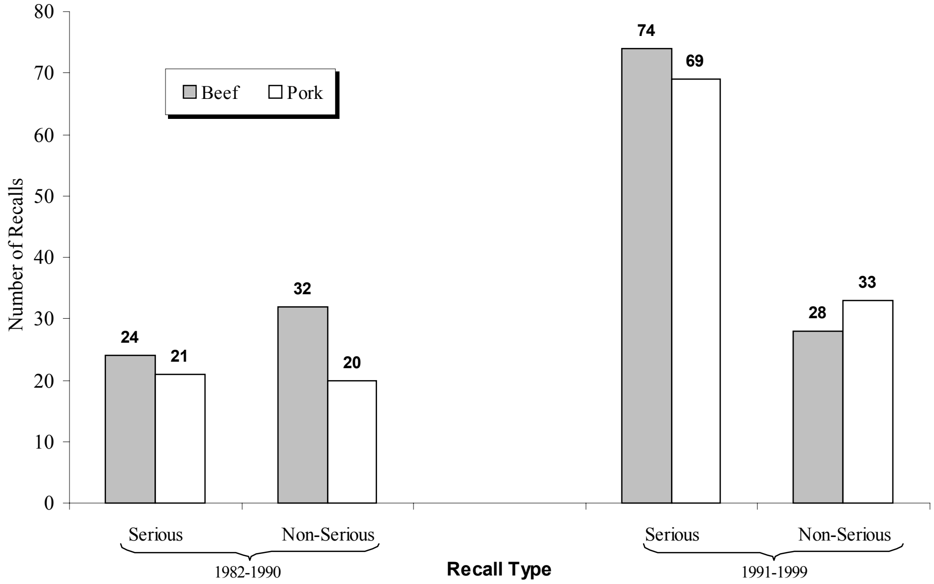
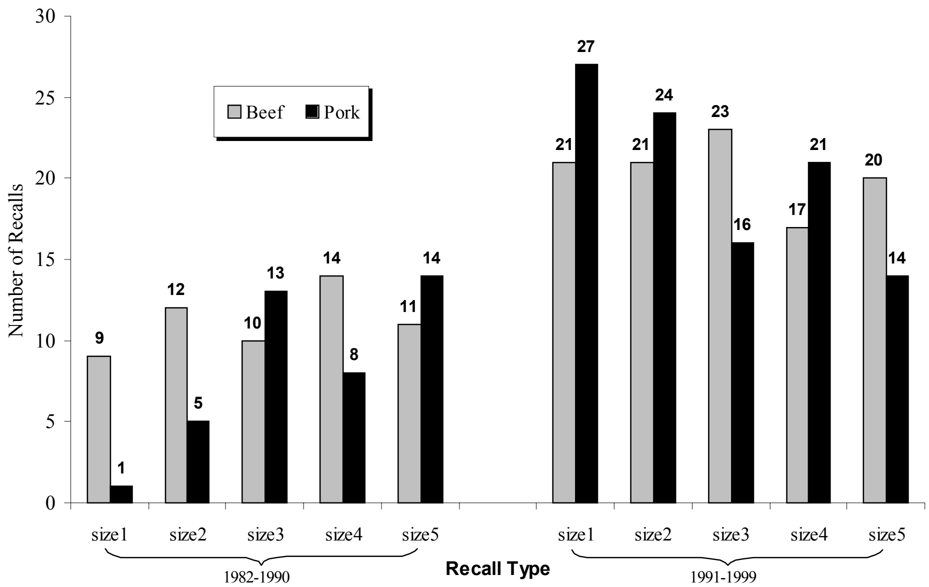


Figure 2. Meat recalls by commodity, severity, and date



size1 recalls = less than 1,162 lbs. for beef, and less than 635 lbs. for pork
size2 recalls = between 1,162 and 4,516 lbs. for beef, and between 635 and 4,150 lbs. for pork
size3 recalls = between 4,516 and 32,000 lbs. for beef, and between 4,150 and 14,400 lbs. for pork
size4 recalls = between 32,000 and 175,288 lbs. for beef, and between 14,400 and 45,512 lbs. for pork
size5 recalls = greater than 175,288 lbs. for beef, and greater than 45,512 lbs. for pork

Figure 3. Meat recalls by commodity, size, and date

Meat recalls are expected to adversely affect beef and pork demand. If consumers become uncertain of the safety of their food when a meat recall occurs, retail demand is likely to fall. In turn, derived demand for meat (i.e., live cattle and lean hog demand) is expected to decline. Meat product recalls likely erode all consumer confidence in meat from that species, regardless of whether the recall occurred on a regional or national basis. Most bacteria in meat products are not readily detectable by the consumer, and as such, consumers must assume the product is safe unless other information becomes available. Such information comes in the form of local and national recalls. Further, given the concentrated nature of the meat packing industry, meat from one plant may be distributed across many varied regions of the U.S., causing all consumers to become concerned about any specific recall event.

Futures traders, realizing the impact of product recalls on consumer demand, and knowing derived demand for meat will decline, are assumed to act on this change. Market efficiency hypotheses imply that the futures market price is the best determinant of expected price at some future date. Given that futures markets are efficient, traders incorporate all relevant information in today's expectation of the future price. If meat recalls are important demand determinants, recall information should be reflected in traders' expectations of the future price. Assuming a positively sloped industry supply curve, one would expect prices of meat to fall in the face of a meat recall because of the decline in consumer confidence.

In this study, we follow methods commonly employed in event study literature. In this type of analysis, an event is identified and prices during and after the event are compared to the previous equilibrium price. This methodology frequently has been used to examine the impact of market reports on futures prices (see, e.g., Carter and Galopin, 1993; Colling, Irwin, and Zulaf, 1997; or Schroeder, Blair, and Mintert, 1990).

Recently, event study analysis also has been used to examine impacts of the announcement of "green" marketing strategies on stock prices (Mathur and Mathur, 2000). In this case, the meat recall marks the "event." Here, the meat recall announcement is treated as potentially unexpected information introduced into the market at random points in time.

First, to determine whether meat recall events adversely affect futures prices, daily price changes over the entire 1982–1999 time period were examined.[4] Daily price changes when a meat recall was announced were compared to all other daily price changes. Because information about the recalls typically was not released at any routine time of day, there was the potential for an announcement to occur before or after trading on day *t*. If a recall was announced before the close of trading on day *t*, the relevant comparison is $P_t^S - P_{t-1}^S$, where *P* is the nearby futures price, *t* is day, and the superscript *S* represents the settlement price. However, if the recall was announced after trading on day *t*, the relevant comparison is $P_{t+1}^O - P_t^S$, where the superscript *O* represents the opening price.

Because we cannot be certain about the exact time of the release of information during the day, we conduct the analysis considering both possibilities. That is, the dependent variable in the analysis is $P_{t+1}^O - P_{t-1}^S$, as shown in equation (1):

$$(1)\quad P_{t+1}^O - P_{t-1}^S = \beta_0 + \sum_{i=1}^{5} \beta_i size_{ti} + \sum_{i=1}^{5} \alpha_i serious_t \times size_{ti} + \gamma \Delta Mkt_{\Delta t} + \varepsilon,$$

where *P* is the nearby futures price, *t* is day, $size_{ti}$ denotes dummy variables that take the value of 1 if there was a given size recall (*i* refers to recall size categories as previously defined) in period *t* and 0 otherwise, $serious_t$ is a dummy variable that takes the value of 1 if the recall in period *t* was Class 1 and 0 otherwise, and β, α, and γ represent parameters to be estimated.[5]

Although the USDA reports three recall severity categories, we reclassified recalls into two groups: *serious* (Class 1) and *non-serious* (Class 2 and Class 3). The reclassification reduces the number of parameters to estimate and reduces multicollinearity between explanatory variables.[6]

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[4] Consistent with previous event study literature, we analyze daily price changes following an "event" (Carter and Galopin, 1993; Colling, Irwin, and Zulaf, 1997; Mathur and Mathur, 2000; Robenstein and Thurman, 1996; Schroeder, Blair, and Mintert, 1990). One could also conduct an analysis of intra-day price changes following recall events. The analysis presented here examines daily price changes only, and does not attempt to draw any inferences regarding the potential effects of meat recalls on intra-day futures price changes.

[5] The dependent variable could be formulated as percentage change or daily return to a futures contract, i.e., $\ln(P_t) - \ln(P_{t-1})$. Results are robust across alternative constructions of the dependent variable; thus discussion of the analysis is limited to the model using absolute price differences.

[6] We also conducted the analysis segregated by three severity classes and found the general results presented here are robust to the reclassification. Results of the alternative classification are available from the authors upon request.

If any meat recall places downward pressure on nearby futures prices the day after the recall, then all β_i and α_i will be less than zero. Since many recalls are small and involve inconsequential health concerns, β_1 or β_2 may not be statistically less than zero, but the signs of β_3 through β_5 should indicate the impact of sizeable recalls. Severity of a meat recall may be evaluated by testing the sign and statistical significance of α_i. Serious recalls of sizeable quantity cause a downward shift in futures prices if α_3 through α_5 are less than zero.

Finally, because changes in other commodity markets influence daily changes in live cattle or lean hog futures markets, $\Delta Mkt_{\Delta t}$ was added to the model. For this analysis, the foodstuff component of the Commodity Research Bureau (CRB) index was used, where ΔMkt is the daily change in the index of the foodstuff component ($\Delta Mkt_{\Delta t} = Mkt_t - Mkt_{t-1}$). If the live cattle or lean hog nearby futures prices tend to move in the same direction as other "foodstuff" futures prices, γ will be positive.[7]

Next, to determine effects of meat recalls over time, the futures price prior to the recall is compared to the price at specific dates after the recall. In an informationally efficient futures market, prices would react quickly to new information. However, at the time of a recall announcement, the impact of an event may not be fully known. For example, if illness or death results from tainted meat in a particular recall, this information may not be known until days after the initial announcement. In addition, follow-up details of the nature of the recall may be forthcoming over the next few days. Therefore, testing first the daily price movement after a recall should measure the impact of the original recall announcement.

Calculating the change in futures price several days after the recall allows us to test whether additional information may have entered the market. A model is formulated where the price difference k days after a recall announcement is dependent upon several independent factors, as shown in equation (2):

$$(2)\quad P^S_{t+k} - P^S_{t-1} = \beta_0 + \sum_{i=1}^{5} \beta_i size_{ti} + \sum_{i=1}^{5} \alpha_i serious_t \times size_{ti} + \gamma \Delta Mkt_{\Delta t} + \varepsilon,$$

where P is the nearby futures price, the superscript S indicates settlement prices, $k \in \{1, 2, ..., n\}$, t refers to the day of the recall, and all other variables are as previously defined. $\Delta Mkt_{\Delta t}$ represents changes in other foodstuff prices from time period t to time period k that may influence changes in the nearby live cattle or lean hog futures contracts ($\Delta Mkt_{\Delta t} = Mkt_{t+k} - Mkt_{t-1}$).

To minimize the effects of market movements associated with "Cattle on Feed" or "Hogs and Pigs" reports, any recall occurring one day before, during, or one day after a report was removed from the data set. Thus, 13 beef and five pork recalls were dropped from the data set. This reduces the number of beef and pork recall events to 145 and 138, respectively. If the futures price is unaffected by any meat recall announcement, then we should fail to reject the hypothesis that $\beta_i = \alpha_i = 0 \; \forall \, i$. At $k = 1$, the first day after a recall, effects are expected to be most pronounced. However, as time progresses, impacts of the recall are expected to decay. To determine when the effects cease to exist, the aforementioned hypothesis will be tested at various times, k.

Since dependent variables in equations (1) and (2) are bounded by "limit moves," estimation using ordinary least squares is inappropriate because it may lead to biased estimates. Live cattle futures prices cannot move by more than \$1.50/cwt in one day, and lean hog futures prices cannot move by more than \$2/cwt in one day. The double-limit tobit model accounts for the probability a "limit move" may occur, and the conditional mean of the dependent variable given a limit move does not occur (Greene, 2000).

Since price changes in equations (1) and (2) (with $k = 1$) are two days apart (bounded by limit moves of \$3/cwt for live cattle and \$4/cwt for lean hogs), a double-limit tobit will be used if a sizeable number of limit moves occurred in the dependent variable; otherwise, ordinary least squares is appropriate.

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[7] Selecting an index to control for "other" market movements presents a challenge between choosing an index that is too close to modeling the same price series in the analysis (e.g., having a near identity) and using an index that is too general and does not reflect relevant market movements. We felt an appropriate index falling in between these two extremes was the CRB foodstuffs index because the meat product futures being modeled are likely to respond to general foodstuff economic conditions. More specifically, the CRB food index is an unweighted geometric mean of lard, butter, soybean oil, cocoa, corn, Kansas City wheat, Minneapolis wheat, sugar, hog, and steer spot market price relatives. Naturally there are other supply and demand shocks that influence futures price changes. We have included the CRB index to attempt to control for such market movements; however, there are likely other factors that influence live cattle and lean hog futures prices. Controlling for all these movements would represent an extensive undertaking beyond the scope of this analysis. Because the study period spans 18 years and we examined over 100 recall events, the effects of other supply and demand shocks should be averaged out.

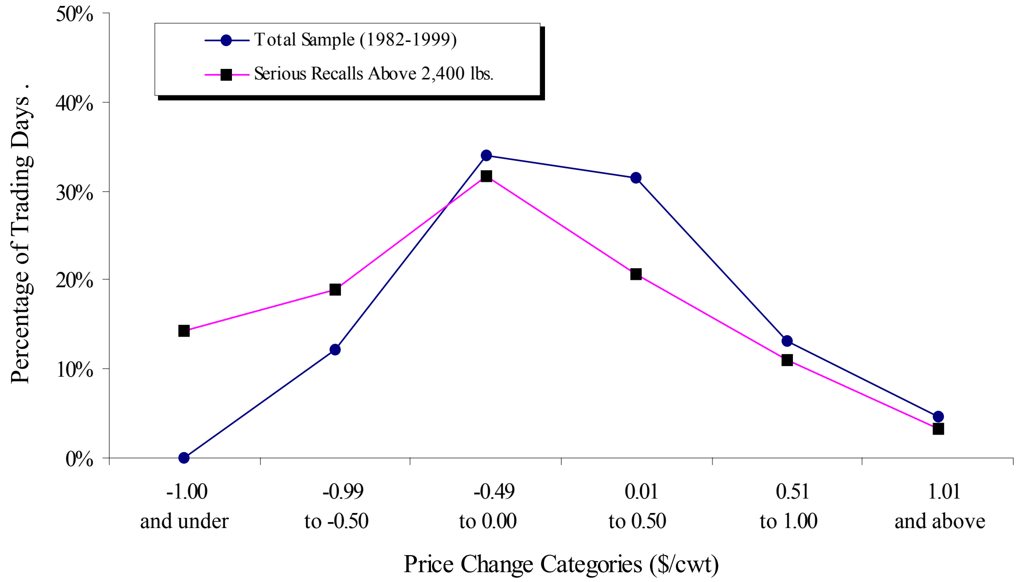

Figure 4. Percentage distribution of daily changes in nearby live cattle futures prices, typical days and one day after a beef recall, 1982–1999

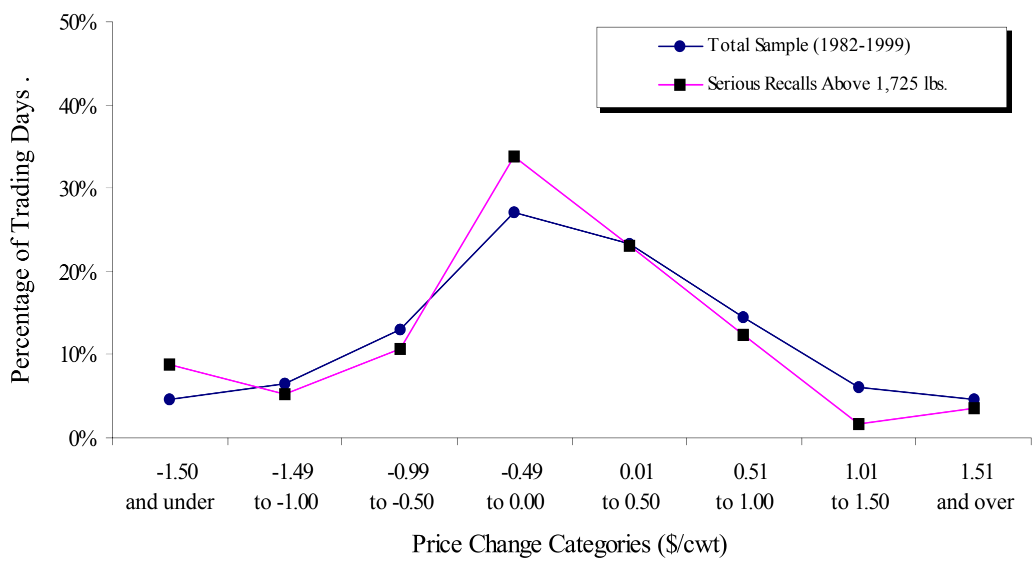

Figure 5. Percentage distribution of daily changes in nearby lean hog futures prices, typical days and one day after a pork recall, 1982–1999

Results

Figures 4 and 5 compare the total sample (1982–1999) of daily price changes in nearby live cattle and lean hog futures prices, respectively, to the daily futures price changes when relatively large serious meat recalls were announced. To illustrate the impact of recall size and seriousness, figures 4 and 5 only include serious recalls that are sizeable—in the upper two-thirds of the size distribution (greater than 2,400 lbs. and 1,725 lbs. for beef and pork, respectively).

As seen from figure 4, the percentage of trading days in the two most negative price change categories is higher for the recall distribution than for the total sample of live cattle daily price changes.

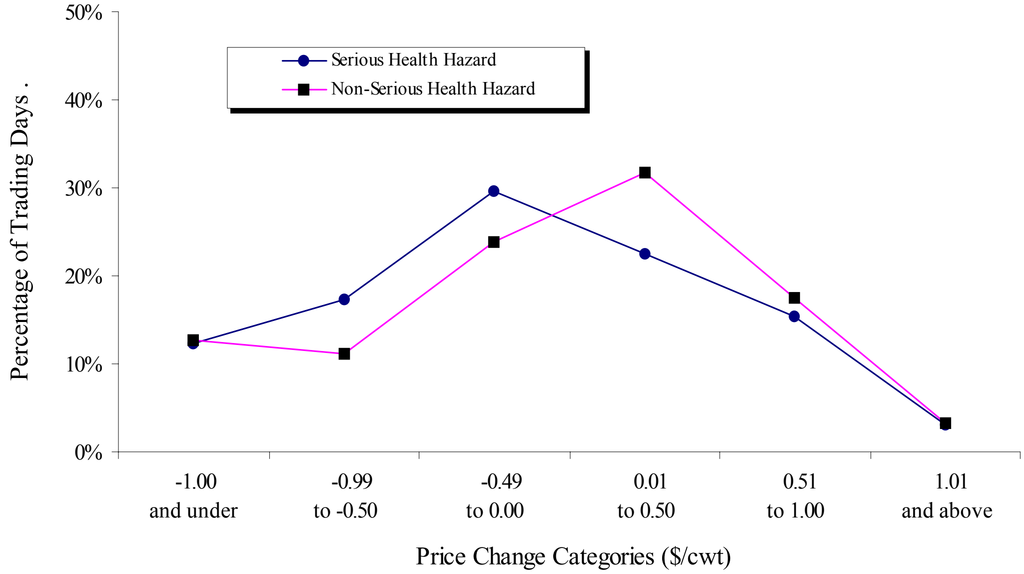

Figure 6. Percentage distribution of changes in nearby live cattle futures prices one day after a beef recall announcement, by severity, 1982–1999

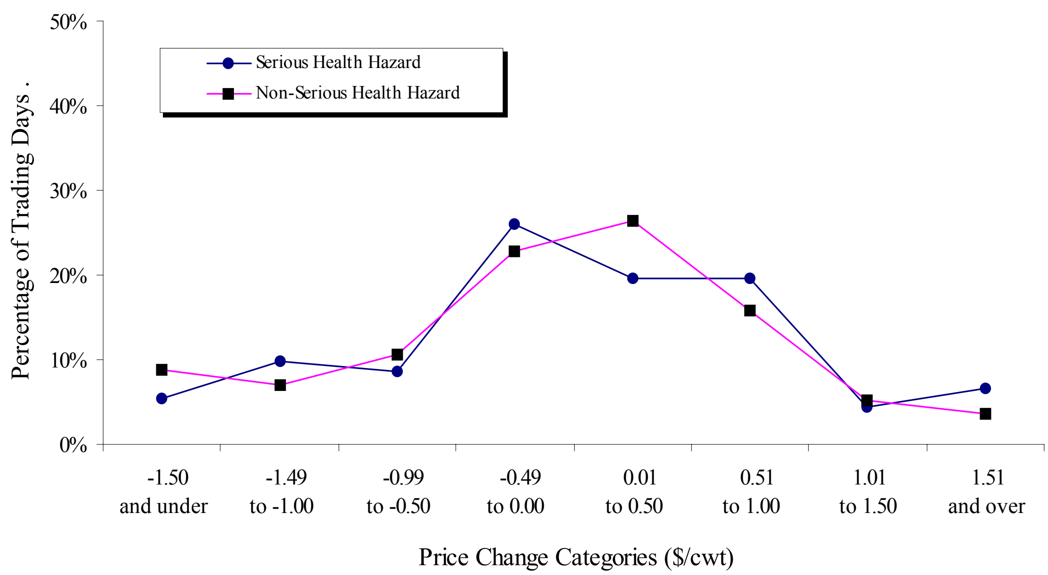

Figure 7. Percentage distribution of changes in nearby lean hog futures prices one day after a pork recall announcement, by severity, 1982–1999

Further, there is a lower percentage of trading days in all positive price change categories for the beef recall distribution than for the total sample. These two findings together indicate that sizeable beef recalls of serious health concern have the tendency to cause a downward shift in nearby live cattle prices. As shown in figure 5, the daily price change distribution for large serious pork recalls is not noticeably different from the daily price change distribution for the total sample.

Figures 6 and 7 illustrate the effects of beef and pork recall severity on daily changes in live cattle and lean hog futures prices, respectively. Figures 6 and 7 only include price changes after a meat recall announcement. For the live cattle futures contract, downward price movements occurred more frequently for serious beef recalls than for non-serious recalls. In addition, positive price movements occurred less frequently for the serious recall distribution than for the non-serious recall distribution. For the lean hog futures contract, the distributions of daily price changes for serious and non-serious pork recalls are virtually indistinguishable.

To test whether size and severity of meat recalls statistically affect live cattle and lean hog futures prices, equations (1) and (2) are estimated for beef and pork recalls. For reference, the dependent variable in table 1 is the daily price change (opening price in $t+1$ minus settlement prices in t ! 1) in the nearby live cattle futures contract from 1982–1999.

The only beef recall events statistically affecting live cattle futures prices are associated with $size_3$ recalls. Surprisingly, $size_3$ recalls have both negative and positive effects on daily price changes depending upon whether the recall was associated with a serious health concern. The estimated $size_3$ (*serious* coefficient indicates futures prices were \$0.41/cwt lower when there was a serious $size_3$ recall than when there was no serious $size_3$ recall. However, the $size_3$ recall coefficient, which includes both serious and non-serious recalls, is statistically significant and positive. Strictly interpreted, this result reflects an increase in futures prices when a non-serious $size_3$ recall was announced.

Because of the interaction between size and seriousness, the net effect of these two findings suggests a medium-sized beef recall of serious health concern was associated with a \$0.12/cwt decline in nearby live cattle futures prices. Whether this amount is economically significant is addressed later in this section.

It is unclear why serious $size_3$ recalls affect nearby live cattle futures prices, but $size_4$ and $size_5$ serious recalls do not. While one would expect market participants to be more concerned with larger recalls, our results do not support this hypothesis. In general, there does not appear to be a strong relationship between the meat recall occurrences and daily changes in live cattle futures prices. As expected, estimates for the ΔMkt variable show nearby live cattle futures prices are positively affected by price changes in other foodstuff prices.

Table 2 reports results of several hypotheses tests from equations (1) and (2). Joint F-tests do not support the hypotheses that nearby live cattle futures prices are influenced by (*a*) large recall, (*b*) serious recall, or (*c*) large, serious recall announcements. Although figure 2 indicates the price change distribution following a recall announcement is shifted leftward as compared to the price change distribution of all trading days, estimates from equation (1) suggest differences between the two distributions are not statistically significant. Furthermore, based on estimates from equation (2) (see hypotheses test results in table 2), in the days following a recall announcement, no further recall information influences the live cattle futures market.

Table 3 shows results of equation (1) for the lean hog futures contract. All recall events were statistically insignificant. The only variable having a statistically significant influence on daily changes in lean hog futures prices was ΔMkt, the variable representing changes in other foodstuff market conditions. Results of several hypotheses tests are presented in table 4. Pork recall announcements, of all size and severity, do not appear to appreciably impact lean hog futures prices. In addition, from equation (2) estimates, meat recall information, potentially introduced several days after the initial announcement, did not have a significant influence on nearby lean hog futures prices.

Given the results in tables 1–4, it appears the impacts of meat recalls on futures prices are not large from a statistical standpoint. However, these results say little about the economic significance of recall events. In other words, the estimated effects may be economically large, but the data too noisy to produce statistically significant results (McCloskey, 1985).

To explore this issue, two questions were addressed: (*a*) What is the economic impact of a change in futures prices implied by the coefficient estimates reported in tables 1 and 3? and (*b*) How do the sizes of coefficient estimates reported in tables 1 and 3 compare to "typical" changes one might expect in the market?

First, the point estimates reported in tables 1 and 3 imply meat recalls may influence futures prices by as little as \$0.01/cwt or by as much as \$0.30/cwt (note coefficient estimates must be interpreted in light of interaction effects). The average price change after a recall, predicted by the regression results (in absolute value), is \$0.08/cwt for beef and \$0.19/cwt for pork.

Of interest is how these estimated price changes might impact a trader's economic standing. Assuming a futures price of \$67/cwt (the sample average for live cattle) and given a contract size of 40,000 lbs., a \$0.10/cwt change in the futures price results in a \$40 change in the value of one futures contract, or a 0.15% increase or decrease in contract value,

Table 1. Effects of Beef Recall on Daily Price Changes in Nearby Live Cattle Futures Prices, All Trading Days, 1982–1999

Variable	No. of Recalls	Parameter Estimate [a]	Std. Error	Variable	No. of Recalls	Parameter Estimate [a]	Std. Error
Constant	—	0.024**	0.010	$size_1$ (*serious*	23	0.145	0.301
$size_1$	29	!0.078	0.268	$size_2$ (*serious*	20	!0.038	0.264
$size_2$	29	0.074	0.219	$size_3$ (*serious*	13	!0.408*	0.245
$size_3$	29	0.284*	0.164	$size_4$ (*serious*	18	0.057	0.252
$size_4$	29	!0.114	0.199	$size_5$ (*serious*	16	0.019	0.246
$size_5$	29	0.011	0.183	ΔMkt	—	0.039**	0.007

Notes: * and ** denote statistical significance at the 10% and 5% levels, respectively. Dependent variable = $P^O_{t\%1}$ & $P^S_{t\&1}$; number of observations = 4,642; R^2 = 0.01; Durbin-Watson statistic = 1.68.
[a] Parameter estimates were obtained from ordinary least squares regression; there was only one "limit move."

Table 2. Results of Hypotheses Tests of Impacts of Beef Recall Announcements on Live Cattle Futures Prices

Influence of . . .		Hypothesis Test [a]	*F*-Statistic	*P*-Value
Equation (1):	Large recall announcements	$\beta_3 = \beta_4 = \beta_5 = 0$	1.11	0.35
	All serious recall announcements	$\alpha_i = 0$ œ i	0.62	0.69
	Serious recall announcements of sizeable quantity	$\alpha_3 = \alpha_4 = \alpha_5 = 0$	0.94	0.42
	All recall announcements	$\alpha_i = \beta_i = 0$ œ i	0.44	0.93
Equation (2):	All recall announcements (k = 1)	$\alpha_i = \beta_i = 0$ œ i	0.51	0.88
	All recall announcements (k = 2)	$\alpha_i = \beta_i = 0$ œ i	0.75	0.67
	All recall announcements (k = 3)	$\alpha_i = \beta_i = 0$ œ i	0.78	0.65

[a] Refer to text equations (1) and (2) for notational definitions.

Table 3. Effects of Pork Recall on Daily Price Changes in Nearby Lean Hog Futures Prices, All Trading Days, 1982–1999

Variable	No. of Recalls	Parameter Estimate [a]	Std. Error	Variable	No. of Recalls	Parameter Estimate [a]	Std. Error
Constant	—	0.008	0.014	$size_1$ (*serious*	25	0.013	0.592
$size_1$	28	0.198	0.560	$size_2$ (*serious*	16	0.479	0.391
$size_2$	26	!0.269	0.307	$size_3$ (*serious*	17	!0.145	0.366
$size_3$	29	0.299	0.280	$size_4$ (*serious*	17	!0.441	0.376
$size_4$	28	0.146	0.293	$size_5$ (*serious*	13	!0.173	0.374
$size_5$	27	0.042	0.260	ΔMkt	—	0.110**	0.011
				sigma [b]	—	0.970	0.010

Notes: ** denotes statistical significance at the 5% level. Dependent variable = $P^O_{t\%1}$ & $P^S_{t\&1}$; number of observations = 4,628; Durbin-Watson statistic from OLS regression = 1.63.
[a] Parameter estimates were obtained from a double-limit tobit model; there were a total of 14 "limit moves."
[b] Sigma is the disturbance standard deviation from the tobit likelihood function.

Table 4. Results of Hypotheses Tests of Impacts of Pork Recall Announcements on Lean Hog Futures Prices

Influence of . . .		Hypothesis Test [a]	*F*-Statistic	*P*-Value
Equation (1):	Large recall announcements	$\beta_3 = \beta_4 = \beta_5 = 0$	0.47	0.70
	All serious recall announcements	$\alpha_i = 0$ œ i	0.66	0.65
	Serious recall announcements of sizeable quantity	$\alpha_3 = \alpha_4 = \alpha_5 = 0$	0.60	0.61
	All recall announcements	$\alpha_i = \beta_i = 0$ œ i	0.66	0.76
Equation (2):	All recall announcements (k = 1)	$\alpha_i = \beta_i = 0$ œ i	1.21	0.27
	All recall announcements (k = 2)	$\alpha_i = \beta_i = 0$ œ i	0.91	0.52
	All recall announcements (k = 3)	$\alpha_i = \beta_i = 0$ œ i	0.60	0.82

[a] Refer to text equations (1) and (2) for notational definitions.

depending upon the trader's position in the market. Alternatively, a $0.35/cwt change in the futures price results in a 0.52% change in the value of the futures contract(s) held. For these ranges of price movements, the change in the value of the futures contract(s) appears, in percentage terms, rather small.

To address the second question, we examined the distribution of daily changes in live cattle and lean hog futures prices from 1982 through 1999. Over 80% of the daily live cattle price changes during this period were greater than $0.10/cwt, and over 50% were greater than $0.35/cwt. With regard to the lean hog futures contract, over 88% of the 1982–1999 daily price changes were greater than $0.10/cwt, and over 66% were greater than $0.35/cwt. Taken together, these results suggest traders routinely experience futures price changes in excess of the movements potentially caused by meat recalls. In sum, our findings imply that meat recalls have little influence on live cattle and lean hog futures prices, both statistically and economically.

Implications and Conclusions

Identifying shifts in meat demand has been a heavily discussed topic in recent years. Much of the research in this area has focused on long-run changes in meat demand due to health-related information, media reports, or advertisement. Product recalls by meat processors also have the potential to influence meat demand, both in the short and long run. The number of meat recalls has increased over the past 15 years. With the publicity of recent meat contamination events, the public is becoming more concerned with the safety of beef and pork. Public awareness of the number of recalls and the risk associated with the occurrence likely reduces consumer confidence when a recall occurs.

This study has examined the short-run impact of beef and pork recalls on nearby live cattle and lean hog futures market prices, respectively. In general, daily live cattle and lean hog futures prices were not significantly affected by beef and pork recall announcements. Results indicate that medium-sized beef recalls of severe health consequence may negatively influence live cattle futures prices; however, the potential impact is economically small. Graphical analysis tends to lend some support to this finding. Nevertheless, the result that beef recall announcements influence nearby live cattle futures prices is not robust across weight classifications or severity.

In general, both beef and pork recalls have marginal impacts on daily futures market prices at most. Intuitively, one might expect live cattle and lean hog futures prices to respond to meat recall events; however, there are a number of reasons why no relationship exists. It is possible that changes in meat demand occur at a slow rate and thus are not reflected in one- or two-day changes in futures market prices. Perhaps the impacts of recalls on meat demand are more cumulative in nature and gradually reduce market demand over time instead of causing notable short-run declines.

It may also be that meat recalls have a larger influence on disaggregated meat products such as boneless beef (which is used to produce ground beef) than on aggregate products such as cattle or hogs. Alternatively, futures markets may not react to meat recalls because consumers already perceive some distribution of risk in meat consumption, and the market has already incorporated this information. In this case, recall events do not alter consumers' perceptions of risk, but are simply a realization of an event consumers expect from a perceived recall distribution.

Finally, there is the chance that only very large recalls affect consumer demand for beef, and thus traders' demand for live cattle. At the same time, these sizeable recalls may invoke a supply response resulting in a leftward shift in supply. Given the following assumptions—annual beef production = 25.7 billion lbs./year, operating days/year = 261, elasticity of beef demand = ! 0.57, price of live cattle = $67/cwt, and no demand response—a 4.47 million pound recall (the largest beef recall in the data set) would result in a $5.33/cwt, $1.06/cwt, and $0.25/cwt increase in live cattle futures price if all tainted beef were recalled in one day, week, or month, respectively.

However, this result only holds for the most extreme cases. For example, the largest $size_4$ recall would only induce a $0.01/cwt shift in supply assuming all meat was recalled in one month (the most likely assumption). Yet, one cannot rule out the possibility that only large recalls affect consumer demand and these same events are the only recalls to invoke a significant supply response, which in effect might leave the futures price unchanged.[8]

Regardless of the reason, meat recall information is apparently not a large concern to futures market participants. Our results imply traders are oblivious

[8] We credit an anonymous reviewer for the last two explanations.

to the information, our models cannot detect the market reaction, or there is no perceived relationship between live cattle and lean hog demand and meat recalls in the short run. However, futures traders are not likely to be ignorant of important market forces. If live cattle or lean hog demand is adversely affected by meat recalls, it is presumed this change is gradual.

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