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Analysis of Marketing Margins in the U.S. Lamb Industry

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Factors affecting marketing margins were identified and assessed using a relative price spread technique. Margins were disaggregated into slaughter-to-wholesale and wholesale-to-retail for a more complete understanding. Marketing costs, concentration, demand, and price were used to explain variations within these margins. Results showed that packer concentration had a significant effect on margins. Forces of supply and demand (as represented by production and market price) and changes in marketing costs also explained the variation in margins. A higher degree of price transmission from slaughter-to-wholesale level was observed in comparison to the wholesale-to-retail level.

Background

Prompted by a request from thirteen senators, including then Senator Bentsen of Texas and Senator Simpson of Wyoming, a Justice Department investigation of the lamb industry was launched in 1991. In a June 6 response to Simpson's request for the Justice Department probe, Assistant Attorney General W. Lee Rawls said the Department would look at "the apparently growing margin between wholesale and retail prices and what, if any, structural conduct or other factors may account for that increasing margin (Dixon)."

Mergers and acquisitions of slaughter plants during 1986 and 1987 brought about structural changes in the meat packing sector. ConAgra was most actively involved with mergers of Monfort, E.A. Miller, and Val Agri. Excel added Sterling and Schuyler to its organization. Substantial increases were evident in the top four firm share (IBP, ConAgra, Excel, and National Beef) of slaughter between 1982 and 1987. Four firm concentration ratios for steer and heifer slaughter rose from 41.4 to 64.0 percent over the 1982–87 period; those for box beef production rose from 59.1 to 82.3 percent; those for hog slaughter rose from 35.8 to 56.0; and finally, those for sheep and lamb rose from 43.6 to 65.9 percent (Packers and Stockyards Administration).

Given such historical characteristics, the meat packing industry has been the focus of research related to the impact of structure on firm behavior, particularly with respect to pricing or market power (Hayenga, Dieter, and Montoya; Menkhaus, St. Clair, and Ahmaddaud; and Ward). Based on the interest by the Justice Department in the lamb industry, the objectives of this paper are twofold: (1) to identify and assess factors affecting marketing margins in the lamb industry, and (2) to measure the extent of price transmission among the different levels of the lamb marketing chain. Few studies exist in the literature pertaining to analysis of marketing margins for lamb. This study attempts to fill this void and serve as a basic starting point for a more complete understanding of the process for price determination in the lamb industry.

Current Situation

Real retail prices of lamb have been relatively constant since 1985, around $130/cwt on a live weight basis; however, wholesale and slaughter prices of lamb have fallen in real terms (Figure 1). Consequently, slaughter-to-retail price margins have increased from under $40/cwt in 1978 to just over $90/cwt in 1990. To help identify the source of the increases in this margin over time, the slaughter-to-retail price margin can be decomposed into the slaughter-to-wholesale margin and the wholesale-to-retail margin. The real slaughter-to-wholesale

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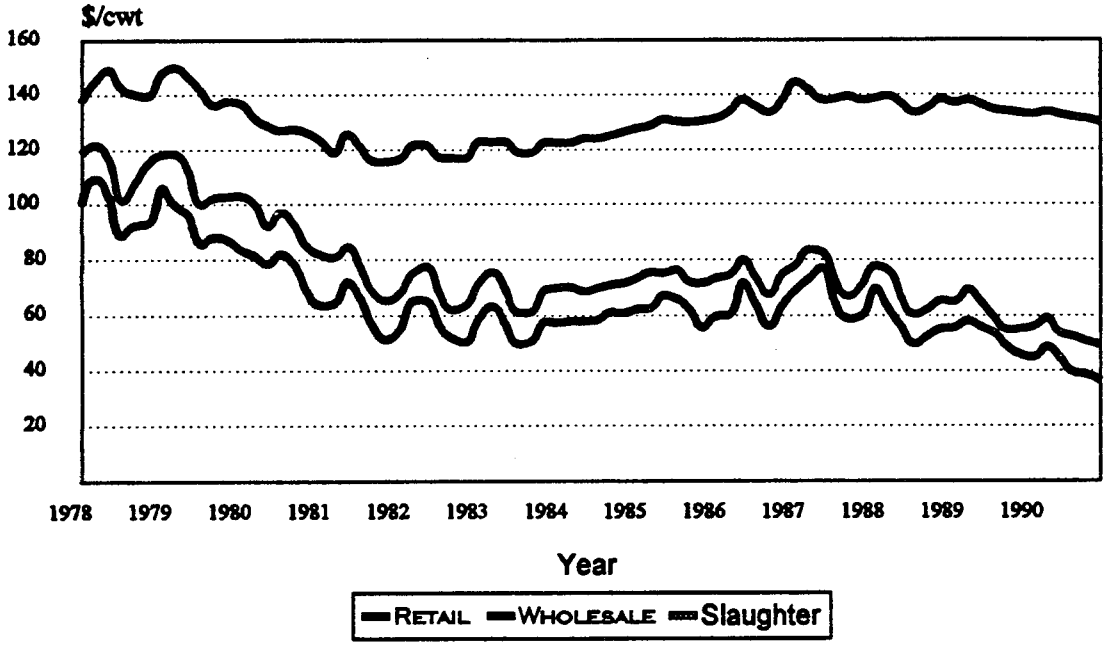

Figure 1. Real Lamb Prices (1982–84 = 100) at Slaughter, Wholesale, and Retail Levels, 1978–1990. (Source: USDA and Price Imputations)

spread for lamb decreased markedly over time, from a high of $22/cwt in late 1978 to a low of just under $6/cwt in mid-1989 and recovered to the $12/cwt range since that time (Figure 2). Over the same 1978–1990 period, the real wholesale-to-retail price margin for lamb has risen dramatically from about $19/cwt to nearly $80/cwt. On the basis of the slaughter-to-wholesale and the whole-

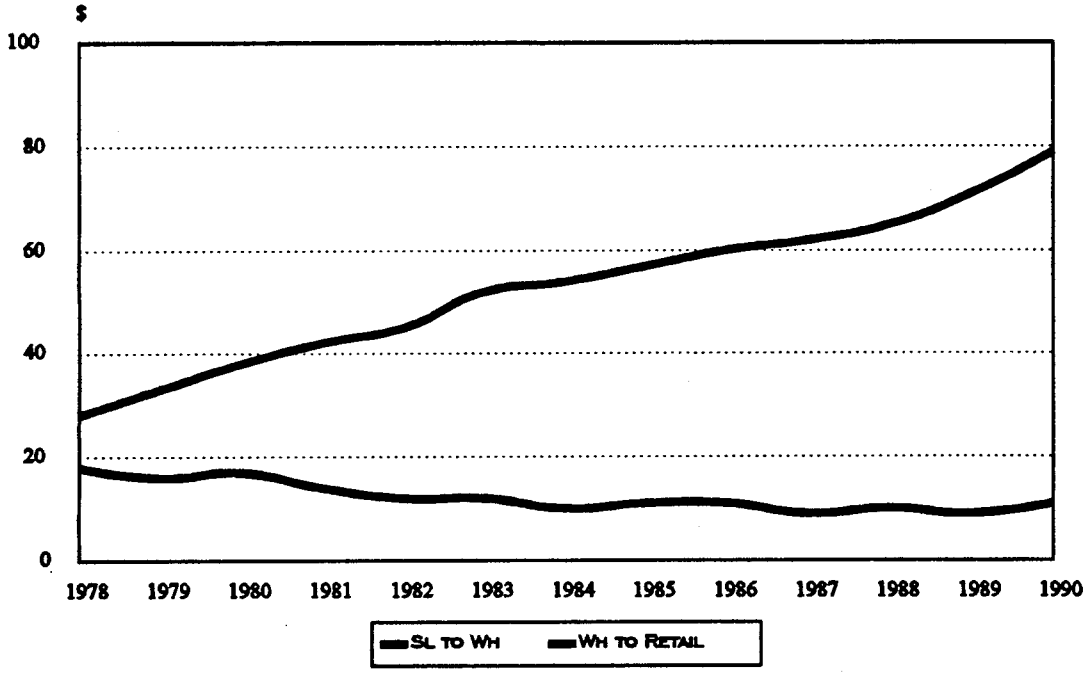

Figure 2. Lamb Marketing Margins for Slaughter (Sl) to Wholesale (Wh) and Wholesale to Retail, 1978–1990. (Source: USDA and Price Imputations)

sale-to-retail margins, the retailer segment receives the lion's share of the lamb dollar as exhibited in Figure 3.

Modeling Approach for Price Spread Analysis

In the only previous study specifically related to lamb packer concentration, Menkhaus, Whipple, and Ward attempt to identify the impact of structural changes in the lamb slaughtering industry (measured by the number of firms or buyers as well as by packer feeding) on prices received by producers for lambs. Specifically, they modeled the price received by producers from lamb slaughtering firms as a function of the quantity of lambs slaughtered, the price of labor, the price of lamb carcasses, the number of plants (representing the number of buyers) and packer feeding as a percent of marketings. Annual data were collected on a state-level over the period 1972 to 1985. Their study suggested no statistical differences among lamb prices in a state with a few firms as compared to prices received by lamb producers in a state with several firms. Real prices were reduced on average by about $5.00/cwt where only one buyer existed.

A common approach to modeling price spread behavior is to assume that the margin is a combination of both percentage and constant absolute amounts (Waugh). This modeling approach has been applied to beef by Freebairn and Rausser, Arzac and Wilkinson, and Brester and Marsh. As pointed out by Gardner, the problem with this approach is that the relationship between farm and retail prices can be depicted accurately only if changes occur solely in supply or demand, not both. To make allowances for simultaneous changes in demand and supply conditions, we consider the *Relative Price Spread (RPS) Model* developed by Wohlgenant and Mullen.

Assuming profit maximization, firms are expected to provide marketing services to the point where the marginal value of these services (the price spread) equals marginal cost. Mathematically,

$$M = K(Q, C), \tag{1}$$

where M corresponds to the marketing margin or price spread; the function K represents the marginal cost of marketing services; Q represents the quantity of the agricultural commodity processed; and C is the vector of marketing input prices (*e.g.*, wage rates and energy costs). Wohlgenant and Mullen show that the specification given by equation (1) is tantamount to the following:

$$M = P_r K(Q, C/P_r), \tag{2}$$

where $M = P_r - P_f$, $\cdot$ P_r is the price of the retail product and P_f is the price of the farm out-

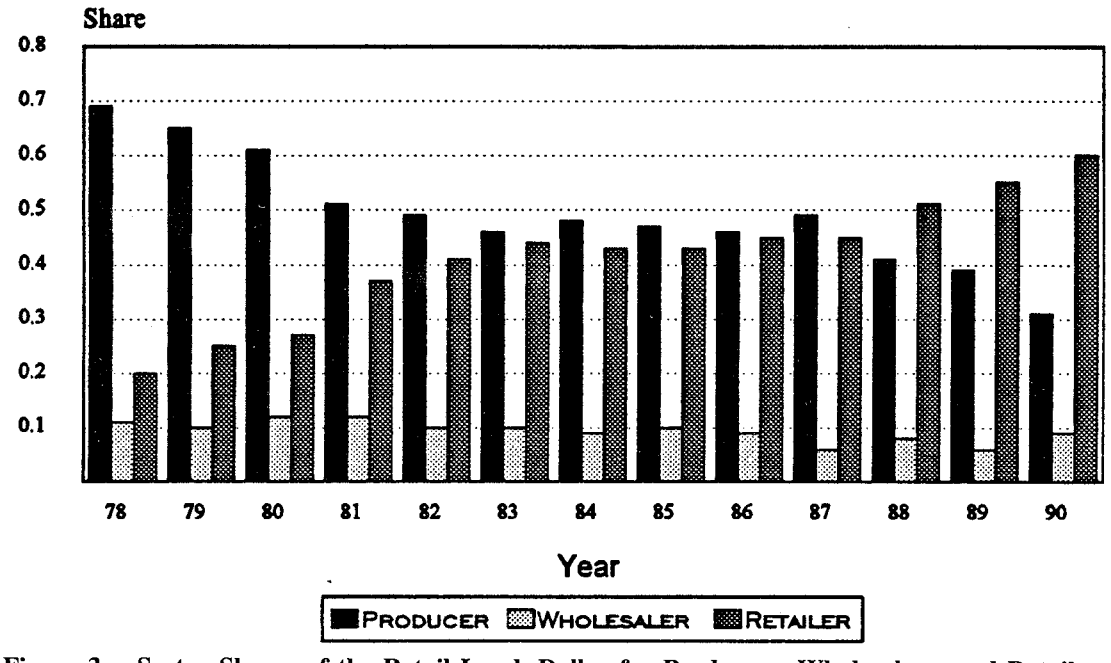

Figure 3. Sector Shares of the Retail Lamb Dollar for Producers, Wholesalers, and Retailers, 1978–1990. (Source: USDA, Price Imputations, and Calculations)

put. The empirical analogue of (1) or (2) is then given by:

$$(3) \quad M_t = b_1 P_{rt} + b_2 P_{rt} Q_t + b_3 IC_t + e_t,$$

where M_t corresponds to the price spread for lamb, P_{rt} is the retail price of lamb (\$/lb), IC_t represents the index of marketing costs for lamb, and Q_t is the per capita quantity of lamb produced. The operational specification in equation (3) differs from the traditional markup pricing hypothesis, given by the following equation:

$$(4) \quad M_t = a_0 + a_1 P_{rt} + a_2 IC_t + v_t.$$

The RPS Model (given by (3)), in contrast to the traditional markup pricing model given by (4), assumes no *fixed* relationship between the price spread and the retail price. The RPS Model also contains no intercept.

The RPS model is consistent with the theory of food price determination (Gardner). This specification suggests that shifts in retail demand and farm supply have two possible paths of influence on the price spread, either in terms of changes in quantity of output and/or retail price. Increases in the farm-level output and increases in relative marketing costs, according to neoclassical theory, are expected to lower the farm-retail price ratio (P_f/P_r); however, the farm-retail price ratio also may be expressed as $[1 - (M_t/P_r)]$. Consequently, increases in output and increases in the relative marketing costs would lead to increases in the relative price spread.

For the analysis of price margin behavior in the U.S. lamb industry, the farm-to-retail margin was disaggregated into two components: (1) slaughter-to-wholesale margin (M_{sw}), and (2) wholesale-to-retail margin (M_{wr}). The slaughter-to-retail margin (M_{sr}) can be considered an identity ($M_{sr} = M_{sw} + M_{wr}$).

Before applying the underlying framework to each of the respective margins, the RPS Model was first augmented to account for three unique factors indigenous to the lamb industry. First, the effects of lamb packer concentration were analyzed by including the four-firm lamb concentration ratio as an exogenous variable[1] in the M_{sw} relationship. Individual firm concentration data were not available for the entire study period, otherwise seemingly more appropriate measures of market power (*i.e.*, Herfindahl indices) and regional considerations would have been used in the analysis. Instead, a slope shifter variable for four-firm concentration was used post-1985 to allow for influences due to the presence of a dominant firm (ConAgra). Thus, the emergence of ConAgra as a dominant firm through major acquisitions gives rise to the hypothesis that the coefficient associated with this variable would be positive. However, an alternative hypothesis is that the coefficient associated with the concentration slope shifter variable is negative due to the capturing of economies of scale attained by market share growth.

The second augmentation was to adjust the margins to allow for potential seasonal influences (*i.e.*, Easter and Rosh Hoshana holidays). Finally, a trend variable was included to account for changes in technology over time. Inclusion of these variables yields the following *Augmented Relative Price Spread (ARPS) Model* for the analysis of lamb price margins:

$$(5) \quad M_{swt} = \beta_1 YEAR_t + \beta_2 P_{wt} + \beta_3 P_{wt} * CONS_t + \beta_4 ICW_t + \beta_5 TOP4_t + \beta_6 CONC_t + v_{1t},$$

and

$$(6) \quad M_{wrt} = \alpha_1 YEAR_t + \alpha_2 P_{rt} + \alpha_3 P_{rt} * CONS_t + \alpha_4 ICR_t + v_{2t}.$$

M_{ijt} is the i-to-j price spread for lamb in \$/cwt (*ith* price equivalent in live slaughter weight terms minus *jth* price equivalent in live slaughter weight terms) for bimonthly period t; *YEAR* is actual year minus 1978, representing a proxy for structural or technical change over this period; P_{rt} and P_{wt} are retail and wholesale price equivalents in live slaughter weight terms, respectively; $CONS_t$ represents bimonthly consumption of lamb per capita; $TOP4_t$ is the four-firm concentration ratio (percent) for the lamb packing industry; $CONC_t$ is a slope shifter for *TOP4* for 1986 through 1990 (equivalent to *DV*TOP4* where *DV* is a dummy variable equal to 1 after 1985 and 0 otherwise); *ICR* is an index of retail marketing costs for lamb, 1982 = 100 (simple average of index of earnings of grocery store employees and producer price index of energy); and *ICW* is an index of wholesale marketing costs, 1982 = 100 (simple average of index of meat packing plant employee earnings and producer price index of energy). All prices and cost indices are deflated by the *CPI* (1982–1984 = 100). Prices were also seasonally adjusted to reduce short-term fluctuations. The focus of this study is to analyze structural changes in margins over the study period, as opposed to intra-year movements. A basic four component smoothing technique, described by Pindyck and Rubinfeld,

[1] A debt of gratitude is due the American Sheep Industry Association for pulling together bimonthly data for the four-firm concentration ratio for lamb packing; these data were virtually unavailable elsewhere.

was used for seasonal adjustment. The four components are long-term trend, seasonal trends, cyclical trends, and irregular components. As such, the margins are based on seasonally adjusted real prices.

Under the assumption that supply is perfectly inelastic for a given bimonthly period, a seemingly unrelated regression (SUR) procedure is workable. Random and/or unavailable exogenous variates may affect M_{sw} and M_{wr} apart from the specified predetermined variables. Consequently, the disturbance terms of the equations may be contemporaneously related. Given that the exogenous variables are not the same in each relationship, gains in estimation efficiency can be expected with the SUR procedure relative to the use of ordinary least squares (Kmenta).

The empirical specification for this study differs from that developed by Wohlgenant and Mullen in that: (1) slaughter-to-retail margins are empirically decomposed into slaughter-to-wholesale and wholesale-to-retail segments; (2) margins are based on seasonally adjusted prices; (3) packer concentration is incorporated in the slaughter-to-wholesale specification with allowance for single firm market or economies of scale; and (4) the models are estimated as a system to capture gains in efficiency.

Data

Bimonthly data across the 1978 to 1990 time period were employed in this analysis. Production, slaughter price, wholesale price, and some retail price data were obtained from *Livestock and Meat Statistics* and *Livestock and Poultry Outlook and Situation,* both published by the USDA. Information pertaining to marketing costs and the Consumer Price Index (CPI) were obtained from *Employment and Earnings of the United States,* published by the U.S. Department of Labor, and the *Economic Report of the President.* All lamb prices are adjusted to a live slaughter-weight basis. Units for reported slaughter, wholesale, and retail prices are heterogeneous. Prices were converted to a live slaughter-weight basis using a conversion described by Williams, Capps, et al. This conversion allows for direct application of results to producers.

The USDA stopped reporting lamb retail prices in May/June 1981. The American Sheep Industry Association (ASI) contracted the services of a private firm to collect retail price information beginning in 1987. Retail price determination methods varied somewhat between USDA and ASI, but the ASI determination are the best available source for the latter time period. There is no consistent price series available for the data gap, either public or private. To circumvent this data availability problem, Purcell suggests the integration of retail prices through 1980 with wholesale prices beyond 1981 together with the use of intercept shifters to account for the abrupt change in price levels after 1981. This method assumes that retail price is directly determined by wholesale price, which as discussed may or may not be the case due to the possibility of imperfect competition at both levels.

Retail prices in this study for the period gap were imputed from an auxiliary regression according to the following:

$$(7) \qquad NPLAMB_t = g(TREND_t, (TREND_t)^2, SX2_t, SX3_t, SX4_t, SX5_t, SX6_t, NPWHOLE_t),$$

where

TREND	=	0 if year, 1 if year 2, *j*-1 if year *j*;
SX2-SX6	=	set of seasonal dummy variables corresponding to bimonthly periods beginning with March/April; May/June; July/August; September/October; and November/December respectively
$TREND^2$	=	square of *TREND* to account for a possible nonlinear relationship;
NPLAMB	=	nominal retail price of lamb; and,
NPWHOLE	=	nominal wholesale price of lamb.

For this regression imputation, nominal prices for the periods January/February of 1978 through March/April of 1981 and the period January/February of 1987 through March/April of 1991 were used as observations for the dependent variable, resulting in 46 observations. The regression results (*t*-values are given in parentheses) were as follows:

$$(8) \quad NPLAMB = \underset{(10.70)}{60.048} + \underset{(11.89)}{6.289}*TREND + \underset{(0.81)}{0.035}*TREND^2 + \underset{(0.40)}{0.471}*SX2 + \underset{(2.28)}{2.787}*SX3 + \underset{(3.10)}{3.904}*SX4 + \underset{(4.18)}{5.294}*SX5 + \underset{(4.58)}{5.687}*SX6 + \underset{(5.51)}{0.412}*NPWHOLE$$

The R^2 value for the above relationship was .9946. Using the above relationship and the values for the explanatory variables for the period of the data gap, thirty-four imputations for the nominal retail price of lamb were estimated. The imputed prices were then deflated by the CPI (1982–1984 = 100) and seasonally adjusted. These imputations represent the best available alternative to actual price information. Imputations were only used for missing periods. Descriptive statistics of the continuous variables for all models are given in Table 1.

Empirical Results

SUR estimates corrected for first-order serial correlation for the ARPS models are shown in Tables 2 and 3. The non-parametric runs test was used to diagnose serial correlation problems, because the Durbin-Watson statistic (DW) is not valid for models without intercepts (Draper and Smith). The SHAZAM 7.0 software package was used for estimation purposes. The significance level chosen for this analysis is 0.10.

Strictly speaking, the goodness-of-fit statistics (R^2) are also not valid in models without intercepts. Nevertheless, the ARPS model accounts for roughly 62 percent of the variation in the marketing margin between the slaughter and wholesale levels, and 96 percent of the variation between the wholesale and retail levels.

For the ARPS model pertaining to M_{sw}, equation (5), the change in the marketing margin due to a unit change in wholesale price is given as

$$\text{(9)} \qquad \frac{\partial M_{sw}}{\partial P_w} = \hat{\beta}_2 + \hat{\beta}_3 * CONS = 0.0331$$

and the change in the marketing margin due to a unit in quantity is given as

Table 2. SUR Regressions Analysis of Slaughter-to-Wholesale Lamb Price Spread

Variable	Parameter Estimate[a]	t-Statistic	Elasticity
Year	−.1788	−1.13	
P_w	−.0283	−.52	
P_w*Cons	.1209*	1.73	
ICW	.0609*	3.23	.4299
Top4	.1079*	1.38	.5209[b]
Conc	−.0330	−1.22	.3616[c]
Rho	.2243*	1.84	
P_w Effect	.0331		.2108
R^2 = .6169	Runs Test: Normal Statistic = −1.43		

[a]Asterisk (*) indicates statistical significance at the .10 level.
[b]Elasticity for packer concentration pre-1986.
[c]Elasticity for packer concentration post-1985.

$$\text{(9a)} \qquad \frac{\partial M_{sw}}{\partial CONS} = \hat{\beta}_3 * P_w = 0.0939$$

at the sample means (Table 2). The effects of wholesale price, consumption, the index of marketing costs, and packer concentration all have the expected positive signs. The presence of a dominant firm, ConAgra in the lamb industry after 1985 had no statistically significant impact on the slaughter-to-wholesale margin.

The estimated relationship provides empirical evidence that the forces of supply and demand (as represented by the interactive effects of quantity and market price at the wholesale level), marketing costs, and packer concentration are significant determinants of the slaughter-to-wholesale marketing margin. The results indicate at the sample means that a 10 percent increase in marketing costs leads to a 4.3 percent increase in the slaughter-to-wholesale margin; a 10 percent increase in wholesale price results in a 2.1 percent increase in the margin; and a 10 percent increase in concentration post-1985 gives rise to a 3.6 percent increase in M_{sw}.

Table 1. Descriptive Statistics of Continuous Variables[a]

Variable	Mean	Median	Std. Dev.	Minimum	Maximum
M_{sw} ($/cwt)	12.10	11.71	2.89	5.98	19.91
P_w	77.70	72.10	17.46	49.50	121.80
Cons (lbs/cap)	.508	.510	.041	.419	.604
ICW	85.41	85.35	17.08	63.27	114.61
Top4	58.41	55.90	10.82	43.60	76.50
P_r	134.4	131.60	8.64	115.70	150.00
ICR	85.67	87.83	16.35	63.20	111.43
M_{wr}	54.33	54.58	15.04	23.54	81.94
P_s	65.00	60.90	15.88	36.40	109.60

[a]All prices and margins have been adjusted to a live slaughter weight basis, P_s is slaughter price, and all other variables are as defined in the text.

Table 3. SUR Regressions Analysis of Wholesale-to-Retail Lamb Price Spread

Variable	Parameter Estimate[a]	t-Statistic	Elasticity
Year	4.3081*	18.70	
P_r	.0650*	1.52	
P_r*Cons	.1180*	1.72	
ICR	.1382*	3.52	.2179
Rho	.4304*	4.31	
P_r Effect	.1249		.3090
R^2 = .9578	Runs Test: Normal Statistic = −1.23		

[a]Asterisk (*) indicates statistical significance at the .10 level.

For the ARPS model pertaining to the wholesale-to-retail marketing margin, equation (6), the change in the marketing margin due to a unit change in retail price is given as

$$\frac{\partial M_{wr}}{\partial P_r} = \hat{\alpha}_2 + \hat{\alpha}_3 * CONS = 0.1249 \tag{10}$$

and the change in marketing margin due to a unit change in consumption is given as

$$\frac{\partial M_{wr}}{\partial CONC} = \hat{\alpha}_3 * P_r = 0.1586 \tag{10a}$$

at the sample means (Table 3). Again as expected, the coefficients associated with retail price, consumption, and marketing costs were positive. A 10 percent increase in marketing costs gives rise to a 2.2 percent increase in the margin; and a 10 percent increase in retail price leads to a 3.1 percent increase in the wholesale-to-retail margin. The trend measure, corresponding primarily to structural and technical changes taking place in the marketing channel (*e.g.*, food away from home; improvements in meat processing technology) was statistically significant for the wholesale-to-retail margin, but not for the slaughter to wholesale margin.

Price Transmission

The extent of price transmission between given levels in the lamb industry is calculated from the ARPS Models utilized in this study and can be expressed as the *Elasticity of Price Transmission (EPT)* between those levels. The EPT indicates the responsiveness of the price at one level in the industry to changes in the price at a lower level in the industry. The EPT is calculated as the ratio of the relative change in price at one level to the relative change in price at the lower level. In this analysis, the EPT is the percentage change in the price of the more processed product divided by the percentage change in the price of the less processed product. From the ARPS Models, it is possible to compute the EPT's for the slaughter-to-retail level, the slaughter-to-wholesale level, and the wholesale to retail level. For example, substituting the appropriate price differences for the margin variable M_{sw} in equation (5), we get

$$\hat{P}_w - \hat{P}_s - \hat{\beta}_1 YEAR + \hat{\beta}_2 P_{wt} + \hat{\beta}_3 P_w * CONS_t + \hat{\beta}_4 ICW_t + \hat{\beta}_5 TOP4_t + \hat{\beta}_6 CONC_t. \tag{11}$$

Rearranging,

$$\hat{P}_w = \frac{1}{1 - \hat{\beta}_2 - \hat{\beta}_3 * CONS} (\hat{P}_S + \hat{\beta}_1 YEAR + \hat{\beta}_4 ICW_t + \hat{\beta}_5 TOP4_t + \hat{\beta}_6 CONT_t). \tag{12}$$

Therefore,

$$\frac{\partial \hat{P}_w}{\partial \hat{P}_s} = \frac{1}{1 - \hat{\beta}_2 - \hat{\beta}_3 * CONS}. \tag{13}$$

Consequently, the elasticity of price transmission from the slaughter to wholesale level is

$$E\hat{P}T_{sw} = \frac{\partial \hat{P}_w}{\partial \hat{P}_s} * \frac{P_s}{P_w} = \left(\frac{1}{1-\hat{\beta}_2-\hat{\beta}_3 * CONS}\right) * \frac{P_s}{P_w} \tag{14}$$

By similar reasoning,

$$E\hat{P}T_{wr} = \frac{\partial \hat{P}_r}{\partial \hat{P}_w} * \frac{P_w}{P_r} = \left(\frac{1}{1 - \hat{\alpha}_2 - \hat{\alpha}_3 * CONS}\right) * \frac{P_w}{P_r}. \tag{15}$$

As stated previously, the slaughter-to-retail margin is an additive identity of the other two margins,

$$M_{sr} = M_{sw} + M_{wr}. \tag{16}$$

From this information, the elasticity of price transmission from slaughter-to-retail can be measured by

$$E\hat{P}T_{sr} = \frac{\partial \hat{P}_r}{\partial \hat{P}_s} * \frac{P_s}{P_r}. \tag{17}$$

But,

$$\frac{\partial \hat{P}_r}{\partial \hat{P}_s} = \frac{\partial \hat{P}_r}{\partial \hat{P}_w} * \frac{\partial \hat{P}_w}{\partial \hat{P}_s}. \tag{18}$$

Therefore,

$$E\hat{P}T_{sr} = \left(\frac{\partial \hat{P}_r}{\partial \hat{P}_w} * \frac{\partial \hat{P}_w}{\partial \hat{P}_s}\right) * \frac{P_s}{P_r} = E\hat{P}T_{sw} * E\hat{P}T_{wr} \,. \tag{19}$$

An EPT value of one suggests an equal response transmission from the lower to higher level. This type of response would be consistent with perfect competition. An EPT value close to zero suggests virtually no transmission of price signals from the lower to the higher level in the industry. This type of response could be considered a symptom of imperfect competition. Therefore, a value of close to one is expected for a near-perfect competition segment. A value close to zero is expected for a segment where price competition is avoided and non-price competition is the main strategy.

For the lamb industry, the model results indicate an EPT from slaughter-to-wholesale of 0.87, from wholesale-to-retail of 0.65, and from slaughter-to-retail of 0.57. So, price changes at the producer/feeder level, *ceteris paribus,* are almost fully transmitted to the wholesale level, representative of a perfect competition situation. Price changes are not well transmitted between wholesale and retail levels. The potential causes for this breakdown in price transmission include: (1) low level of lamb volume handled by most retailers; (2) the lack of importance retailers attach to marketing lamb; and (3) non-price competition as an important competitive strategy for retailers.

Closing Remarks

Price margin behavior in the lamb industry was analyzed at various levels of the marketing chain. There has been little previous work done with respect to lamb margins. Problems with data availability are a potential explanation for lack of effort in the lamb margin area. This study was able to overcome some data deficiencies through the assistance of the American Lamb Council. Retail price deficiencies were handled by using price imputations, which seemingly are the best available alternative at least for this work. The ARPS Model allowed for an analysis of the transmission of price between various levels in the lamb industry and helped identify and measure the impacts of several key determinants of price margins in the lamb industry. These determinants include supply and demand conditions (as represented by movements in price and output), marketing costs, seasonality, and packer concentration. Conclusions from this analysis are:

- *There exists a high degree of price transmission from the slaughter to the wholesale level; however, a much lower degree of transmission exists from the slaughter to the retail level and from the wholesale to the retail level.* Factors associated with the breakdown from lower levels to retail include: (1) low volume of lamb handled by most retailers, (2) lamb being a small percentage of fresh meat case, (3) lack of importance retailers attach to handling lamb, and (4) non-price competition as the main competitive strategy in the retail food industry.
- *Traditional economic factors, including the forces of supply and demand (as represented by production and the market price) and changes in marketing costs help explain the variation in margins at each level.*
- *Changes in packer concentration were statistically significant in affecting price margins.* Increases in concentration of the top four firms had a positive effect on price margins. Packer consolidation by the market leader, ConAgra, during the post-1985 era had a negative effect on margins, though not statistically significant.
- *The slaughter-to-retail and wholesale-to-retail price margins exhibit a significant upward trend.*
- *Impacts of market concentration on prices and margins warrant continued investigation.* Though our results provide evidence to indicate that concentration exerts a negative effect on slaughter prices, additional studies and more detailed data are necessary to more fully examine the effect of concentration. The number of firms in a national market may not be a fair representation of the number of firms in a given regional market. Since many regions may contain only one or two packers, research regarding the impacts of packer concentration on the lamb industry needs to account for the regional concentration of lamb packing as well.

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