AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

EVALUATING INCENTIVE PAYMENT PROGRAMS THROUGH AGGREGATE PRODUCTION RESPONSE: THE CASE OF MOHAIR

James R. Conner, William K. Mathis, Robert R. Wilson*

INTRODUCTION

In 1966, leading agricultural economists indicated that production response under changing conditions would be a significant factor in agricultural policy, and recommended that research be directed accordingly [5, p. 5]. The purpose of this paper is to illustrate the use of production response relationships to indicate the effectiveness of government policy. One commodity for which this approach can be easily demonstrated is mohair, which is included in the National Wool Act and supported by production incentive payments. Thus, the response of mohair producers to changes in expected market price, government policy and other variables is estimated.

PRODUCTION RESPONSE

Changes in the amount of a product offered for sale from one time period to the next are usually thought to be caused by changes in the market price of the product. However, when the quantity of a product sold in a given time period is almost identical with the amount produced in that time period, and the amount produced in a given period is largely the result of plans made in earlier periods, producers are no longer able to react to changes in actual market prices but must react to changes in expected prices. Such reactions, in the form of changes in production and/or the amount of a product offered for sale, are termed supply response, production response, output response, or simply farmers' response to price [10, 12, 19, 20]. Regardless of the name used, the prevailing theme is that producers attempt to adjust production in response to what they expect market price or per unit revenue will be when they are ready to sell their product. In addition, the degree of certainty the producer attaches to his expectations is an important factor in his decision on the amount to produce in a given time period [13, 22].

Nerlove [19, 20, 21] suggests that there are three important considerations included in production response. First is the producer's formulation of expectations of prices, opportunity costs and production conditions. This formulation is probably unique to each producer, and an expectation model for an aggregation of producers which is constant over time is probably nonexistent. For most empirical studies, however, aggregate expectations are usually assumed to be some function of past conditions. The second consideration is that of the amount producers desire to produce, based on their expectations. This is a conceptual consideration because of limitations on the producer's ability to adjust to the desired level of production. Third is the producer's ability to adjust actual production to the desired level. This adjustment is limited by actual stocks on hand, acquisition and salvage prices of resources, and attainable expansion rates.

In recent years, much work has been done in the area of aggregate production response. These studies are generally of two types: (a) those involving aggregation of individual firm supply functions using cross-sectional data of one type or another, or (b) those using aggregated time series data. Earlier work of the first type includes an investigation by Hathaway of the effects of price supports on the dry bean industry in Michigan [11]. The most important recent work of the second type is that of Nerlove [19, 20, 21] in which he developed and used a unique price expectation model and a "dynamic" supply response model to estimate the elasticities of supply for several crops

* The authors are, respectively, research associate in the Institute of Statistics, Ford Foundation Fellow in the Department of Agricultural Economics and Sociology, and assistant professor in the Department of Agricultural Economics and Sociology and the Institute of Statistics, at Texas A&M University.

in the United States. The model developed by Nerlove has subsequently been used in several empirical studies, including those of Dean and Heady [6], Halvorson [10], and Hee [12]. Of all the studies mentioned, only Hathaway's used production response relationships as indications of the effectiveness of price support programs. However, several others have noted the reciprocal effect of price support and acreage control programs on the production response relationship.

COMMODITY CHARACTERISTICS

Mohair, the hair of the Angora goat, has been produced in the United States for about a century. The present industry is relatively small in comparison with many other agricultural commodities. The total number of producers does not exceed 12,000. United States mohair production has averaged about 18 million pounds annually over the last 40 years, with about 97 percent produced in Texas [28].

Virtually all the Angora goats in Texas are concentrated in the Central Texas and Edwards Plateau regions of the state. Angora goats are combined with beef cattle and/or sheep on nearly all ranches. Some goats are sold for slaughter, primarily for salvage or disposal purposes [23]. The technology of mohair production has changed little over time.[1]

Mohair marketing has changed little in 50 years [1, p. 3]. Producers sell or consign grease mohair to warehousemen, who in turn sell to one of a very few (5-10) handler-dealer firms. Handler-dealers sort or class, scour, comb and sell mohair to textile manufacturers. Warehousemen, dealers and manufacturers store considerable stocks, but there is very little storage by producers.

Mohair, a specialty textile fiber, is used principally in blends with other fibers in upholstery, drapery material and men's suits, and in knitted goods, particularly sweaters. The demand for mohair is, thus, affected by fashion changes and the development of artificial fibers and has been characterized over the past 40 years by widely fluctuating prices (Figure 1) [4, 28].

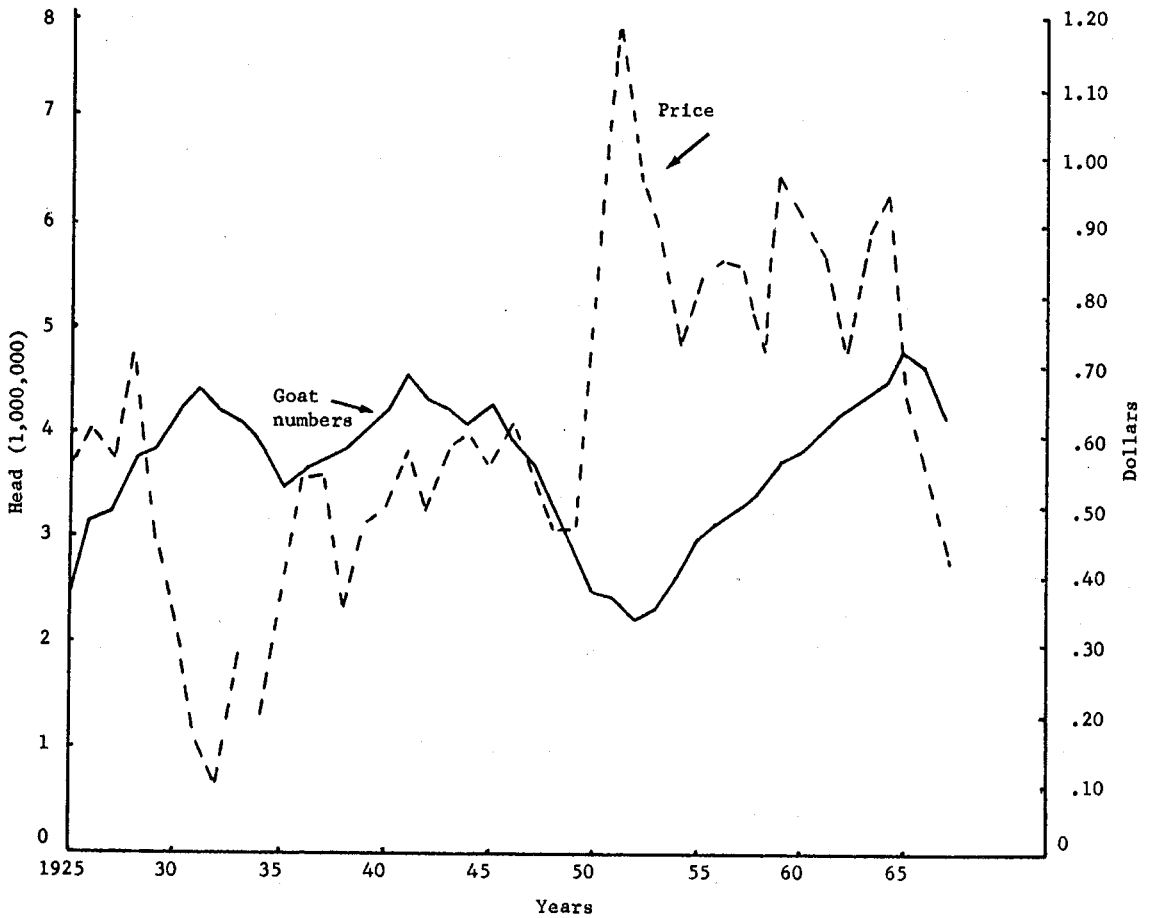

FIGURE 1. ANGORA GOAT NUMBERS AND MOHAIR PRICES IN CURRENT DOLLARS PER POUND, UNITED STATES, 1925-67

[1] See page 88.

The National Wool Act, passed in 1954, provides for price support payments (actually production incentive payments) and requires producers to sell their mohair on the open market at whatever price they can obtain. If the average market price paid to all producers is below the support price, the government pays producers the difference at the end of each year. These incentive payments essentially guarantee the mohair producer a minimum price, which is announced 4 to 6 months in advance of the production year in question. There are no marketing quotas or other restrictions on total production. The main objective, stated in this act, is to affect total production, including production response to price changes [18].

THE MODEL

If the theory regarding producer response to expectations and degree of certainty of expectations is correct, total mohair production response after the advent of the price support program should be different from that prior to its enactment. Furthermore, the factors causing that difference should be identifiable and measurable.

Total production of mohair in any given year is equal to the number of goats clipped multiplied by the clip per goat (Figure 2). Several factors affect the number of goats clipped per year. These include producer's ability to adjust actual to desired numbers, expected total revenue from mohair, expected availability of native range forage, expected prices of wool and beef, and the reduction in uncertainty of producer revenues from mohair due to the incentive payment program. Clip is affected by breeding and selection practices over a long period and by the amount of range forage actually available in any one year.

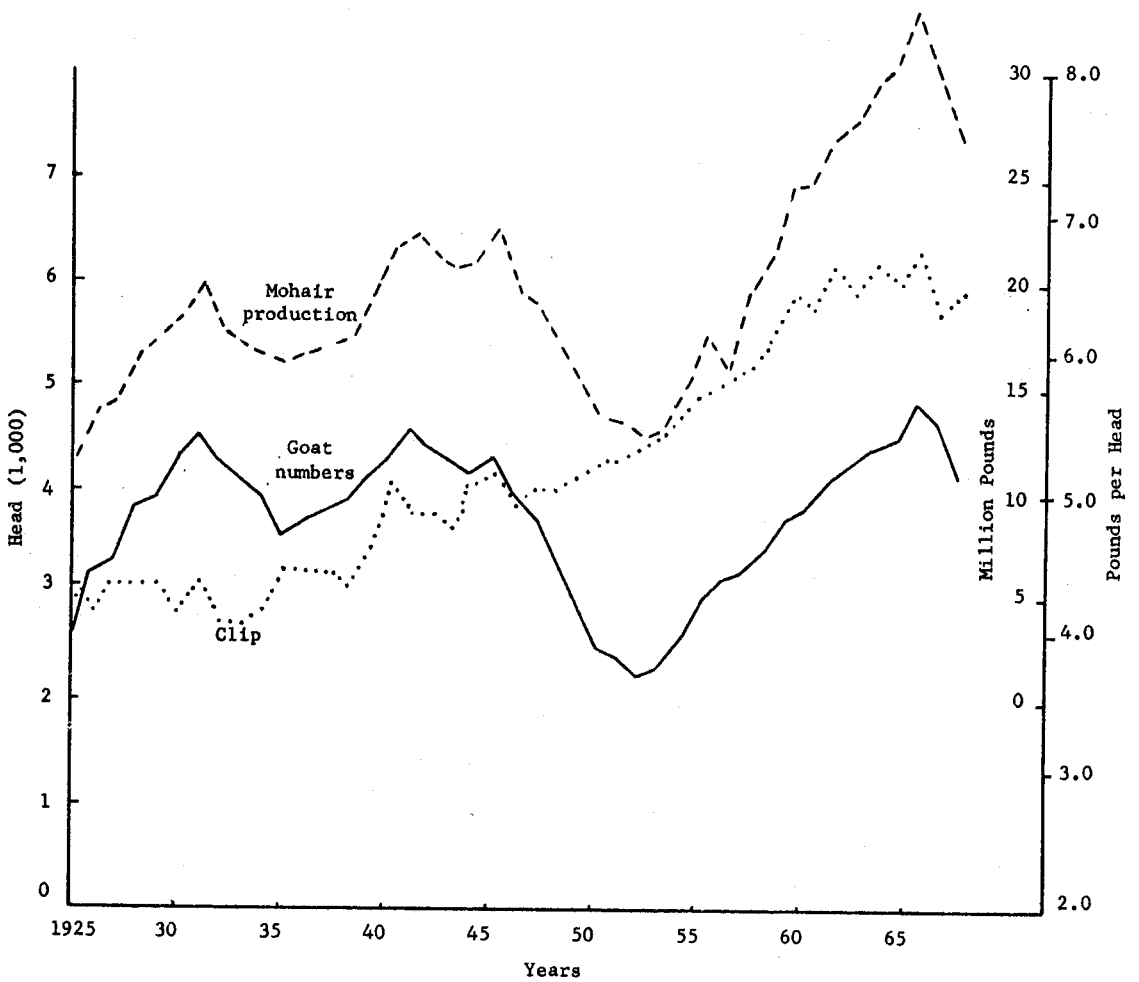

FIGURE 2. ANGORA GOAT NUMBERS, CLIP AND MOHAIR PRODUCTION, UNITED STATES, 1925-67

Variables and symbols used in this analysis are defined as follows:

Y_t = total mohair production in the United States in millions of pounds in year t [27, 28],

G_t^* = longrun equilibrium (desired) goat numbers in the United States in millions in year t,

G_t = actual number of goats clipped in the United States in millions in year t [27, 28],

C_t = average production of grease mohair per goat, in pounds, in year t [27, 28],

P_{t-1} = per unit total revenue expected from mohair in cents per pound in year t, assumed to be the deflated market price paid to producers in year t-1 [27, 28],

P_{t-1}^f = per unit total revenue expected from mohair during the free market period (1925-54), defined the same as P_{t-1} above, and zero thereafter,

P_{t-1}^s = per unit total revenue expected from mohair after the enactment of the incentive payment program (1955-67), assumed to be either the deflated market price paid to producers in cents per pound in year t-1 or the deflated support price for mohair in year t, whichever is larger, and zero during 1925-54,

P_{t-1}^{f+s} = per unit total revenue expected from mohair in cents per pound in year t for the entire period (1925-67), defined as $P_{t-1}^f + P_{t-1}^s$,

D = a zero-one variable, being 0 during the free market period and 1 for the years when the incentive payment program is in effect,

B_{t-1} = expected producer price for beef in year t, assumed to be the deflated price for Texas feeder steers in cents per pound in year t-1, [2. 24],

W_{t-1} = expected producer price for wool in year t, assumed to be deflated price for Texas wool in cents per pound in year t-1 [27, 28],

R_{t-1} = expected amount of rangeland forage available in year t, assumed to be the range and feed index for Texas in year t-1 [25, 26],

F_t = actual amount of rangeland forage available in year t, represented by the range and feed index for Texas in year t,

T = time, where the year 1925 is taken as 1 and following years are numbered consecutively through 43 for 1967,

γ = coefficient of adjustment relating desired goat numbers to actual goat numbers,

β_{ij} = true coefficient or a variable, where i = the equation number and j = the number of the variable in the equation,

b_{ij} = estimate of the true coefficient of a variable, i and j as defined for β_{ij} above,

e_t, u_t, N_t = disturbance terms, where $e_t = \gamma u_t + N_t$

R^2 = coefficient of multiple determination, and

d = Durbin-Watson "d" statistic.

Desired goat numbers are hypothesized to be determined as in equation (1):[2]

$$G_t^* = \beta_{10} + \beta_{11}P_{t-1} + \beta_{12}B_{t-1} + \beta_{13}W_{t-1} + \beta_{14}R_{t-1} + U_{1t}. \quad (1)$$

This model assumes that price and other factors remain constant and there are no government programs.

The relation between desired numbers and actual numbers can be written as:

$$G_t - G_{t-1} = \gamma(G_t^* - G_{t-1}) + N_t. \quad (2)$$

Substituting (1) into (2) gives:

$$G_t = \gamma\beta_{10} + \gamma\beta_{11}P_{t-1} + \gamma\beta_{12}B_{t-1} + \gamma\beta_{13}W_{t-1} + \gamma\beta_{14}R_{t-1} + (1 - \gamma)G_{t-1} + e_t. \quad (3)$$

Least squares estimates of

$$1-\gamma, \gamma\beta_{10}, \ldots, \gamma\beta_{14}$$

can be obtained by fitting equation (3) with appropriate data, thus, yielding estimates of

$$\gamma, \beta_{10}, \ldots, \beta_{14}.$$

Both short and long run elasticities of supply (aggregate goat numbers), with respect to expected price, can be computed from these estimates[3] [19, 20, 21].

An adjustment model of this type seems reasonable for goat numbers because of the rather limited rate at which mohair producers can change the size of their herds. For the industry as a whole, the maximum attainable expansion rate is approximately 10 percent in any one year due to low birth rates and high death and/or culling rates [4, 23]. Likewise, attainable contraction rates for the industry are seriously limited because of the extremely weak market for slaughter goats [23].

Two alternative models were hypothesized to modify (1) by incorporating the effects of the incentive payment program. The first model assumes that producers react to the program itself and that they react differently to expected per unit total revenue after the advent of the incentive payment program:

$$G_t^* = \beta_{40} + \beta_{41}P_{t-1}^f + \beta_{42}P_{t-1}^s + \beta_{43}B_{t-1} + \beta_{44}W_{t-1} + \beta_{45}R_{t-1} + \beta_{46}D + U_{4t}. \quad (4)$$

The second model assumes that producers do not react differently to expected per unit total revenue under the program. This model assumes, however, that producers do react to the reduced uncertainty in revenue due to the program. This model is expressed as:

$$G_t^* = \beta_{50} + \beta_{51}P_{t-1}^{f+s} + \beta_{52}D + \beta_{53}B_{t-1} + \beta_{54}W_{t-1} + \beta_{55}R_{t-1} + U_{5t}. \quad (5)$$

Substituting (4) into (2) and fitting the resulting equation gives:

$$G_t = .49523 + \underset{(3.7)}{.00506}P_{t-1}^f + \underset{(4.6)}{.00789}P_{t-1}^s - \underset{(3.5)}{.02371}B_{t-1} + \underset{(17.8)}{.86767}G_{t-1} \quad (6)$$

$$R^2 = 0.918 \qquad d = 1.69$$

where the numbers in parentheses in this and succeeding equations are the ratios of the coefficients to their standard errors. The following estimates can then be obtained:

$$(1 - \hat{\gamma})_4 = .86767$$

$$\hat{\gamma}_4 = .13233$$

$$b_{40} = 3.74238$$

$$b_{41} = .03823$$

$$b_{42} = .05962$$

$$b_{43} = -.17917$$

Coefficients for W_{t-1} and R_{t-1} were not included in (6) or in any equations following because they did not contribute significantly to the regression, and W_{t-1}, B_{t-1} and P_{t-1} were highly correlated. Also, it was necessary to eliminate the variable D from (4) and (6) because it was highly correlated with P_{t-1}^s.

[2, 3] See page 88.

Although the difference between b_{41} and b_{42} above was about 36 percent, this difference does not appear to be significant at the .10 level in light of the 't' test for the difference between the combined coefficients .00506 (γb_{41}) and .00789 (γb_{42}) from (6). In addition, most of the difference between b_{41} and b_{42} can be attributed to the fact that P^{s}_{t-1} is actually an interaction term between the effects of expected per unit revenue and the significant effects of the program itself represented by D.

When (5) is substituted into (2) and the resulting equation is fitted, equation (7) is obtained:

$$G_{t-1} = .50799 + .00519P^{f+s}_{t-1} + .23090D$$
$$(3.8) \qquad (3.2)$$
$$- .02411B_{t-1} + .86319G_{t-1}$$
$$(3.5) \qquad (17.6) \qquad (7)$$
$$R^2 = 0.918 \qquad d = 1.64$$

This equation yields the following estimates:

$$(1 - \hat{\gamma})_5 = .86319$$
$$\hat{\gamma}_5 = .13681$$
$$b_{50} = 3.71310$$
$$b_{51} = .03793$$
$$b_{52} = 1.68774$$
$$b_{53} = -.17622$$

The similarities between $\hat{\gamma}_4$ and $\hat{\gamma}_5$, b_{40} and b_{50}, b_{41} and b_{51} and b_{43} and b_{53} should be noted. These similarities also indicate that there is not a significantly different production response to expected total per unit revenue under the incentive payment program. The relatively large size of the coefficient (b_{52}) for the variable D and the magnitude of the ratio of b_{52} to its standard error indicate a substantial reaction to the program itself. The absence of other known structural changes support these indications. In both (6) and (7), the Durbin-Watson 'd' statistics indicate no significant serial correlation among the residuals at the .1 level.[4] Furthermore, the relatively large R^2 values indicate that the equations are efficient estimators of G_t.

An equation for clip is needed to estimate total mohair production. The effects of breeding and selection were assumed to be a function of time, and range forage availability was represented by the variable F:

$$C_t = 3.57888 + .77589F_t + .00155T^2$$
$$(3.5) \qquad (28.8) \qquad (8)$$
$$R^2 = .959 \qquad d = 1.42$$

Total mohair production is given by:

$$Y_t = G_t \cdot C_t \qquad (9)$$

The longrun elasticity (LE_p) of mohair production with respect to expected per unit revenue can be calculated with the estimate of b_{51} from (7) in the following manner:

$$LE_p = \frac{\partial Y}{\partial P} \cdot \frac{P}{Y}$$
$$= b_{51}C \cdot \frac{P}{GC}$$
$$= \frac{.03793P}{G}$$

For the free-market period, 1925-54, mean long run elasticity is .932. Mean long run elasticity for the 1955-67 period, with the incentive payment program, is .773.

Short run elasticity (SE_p) of mohair production with respect to expected per unit revenue is calculated with $\hat{\gamma}_5 b_{51}$ from (7) as follows:

$$SE_p = \frac{\partial Y}{\partial P} \cdot \frac{P}{Y}$$
$$= \hat{\gamma}_5 b_{51}C \cdot \frac{P}{GC}$$
$$= \frac{.00519P}{G}$$

Mean short run elasticity for the first period is .128, and for the second period is .106. Both short and long run elasticities for the free-market period, compared with those for the period under the program, indicate that producers were relatively less responsive to changes in expected revenue after the program was enacted.

[4] See page 89.

CONCLUSIONS

The Incentive Payment Program

The results of the preceding statistical analysis indicate that the incentive payment program for mohair has probably achieved its stated objective of stimulating annual aggregate mohair production. Equation (7) shows that total production response may be affected significantly by the reduction in uncertainty of revenue due to the price support program. In addition, there does not appear to be a large difference between producer response to expected per unit revenue during the period under the incentive payment program and response prior to the program. The effects of the program are illustrated graphically in Figure 3. The line showing goat numbers estimated with the Program effects included (equation 7) lies quite close to the line depicting actual goat numbers. When the effects of the program are removed from (7), estimated goat numbers are substantially below actual numbers, with the exception of two years.

Goat numbers increased steadily from 1952 to an all-time high in 1965, the longest period of increase since 1925. This trend occurred in spite of widely fluctuating beef prices and below average market mohair prices (deflated) for 7 years. It seems plausible to conclude, therefore, that the mohair incentive payment program was largely responsible for the continuation of this trend by reducing uncertainty of producer revenues. It may also be inferred that, because the incentive payment program has assisted producers in stabilizing mohair production at fairly high levels in spite of lower than average market prices, the competitive position of mohair is relatively stronger than it would have been otherwise. That is, because of the program, buyers of mohair are being supplied with large, stable quantities at low prices. Furthermore, producers are probably more reluctant to substitute more risky alternatives for mohair production.

The Analytical Technique

This paper has illustrated the use of production response relationships for estimating the effectiveness of incentive payment programs. When applying this technique, however, extreme care should be taken to obtain estimators of the parameters that are known to have desirable properties.

Changes in the technology of production, both in the commodity in question and in competitive enterprises, and other changes that would affect relative factor costs must be accounted for in the production response model. In addition, when the commodity in question is sold by producers in distinct grades or classes at different prices, or if the commodity is sold in several markets where the price difference between markets is not entirely due to differences in transportation cost, care must be taken to insure that the price expectation model adequately reflects these differences. Such differences may necessitate the breaking up of the aggregate production response model into several models.

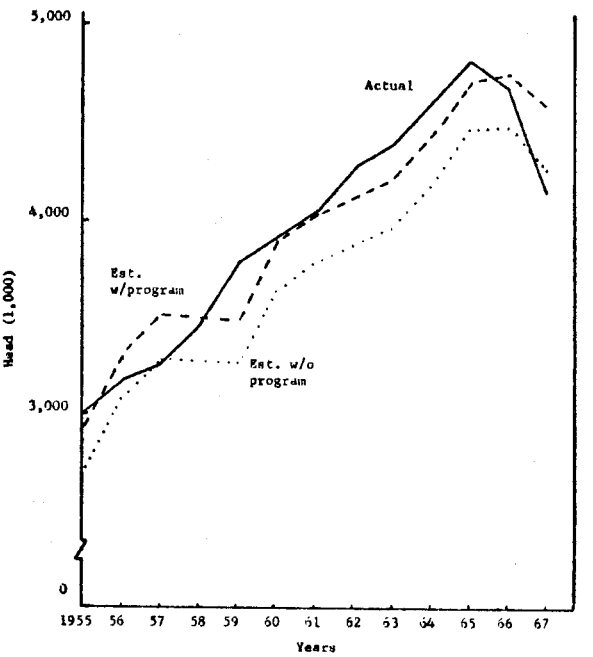

FIGURE 3. ANGORA GOAT NUMBERS, ESTIMATED WITH MODEL INCLUDING INCENTIVE PAYMENT PROGRAM AND ESTIMATED WITH MODEL EXCLUDING INCENTIVE PAYMENT PROGRAM, UNITED STATES, 1955-67

FOOTNOTES

[1] The per head clip (pounds of mohair produced per goat per year) has increased an average of 0.05 pound per year over the past 40 years. Most of this increased weight, however, has been in coarse hair, oil and grease rather than in the desirable market product, fine hair [1].

[2] P_{t-1} is defined to be the expected total revenue per unit. It can be represented as coming from a Nerlove expectation model of the form

$$P^*_t - P^*_{t-1} = \lambda (P_{t-1} - P^*_{t-1})$$

when P^*_t and P^*_{t-1} represent expected total revenue per unit in years t and t-1, respectively and P_{t-1} is the actual price received in t-1. Our assumption is that $\lambda = 1$ which implies that $P^*_t = P_{t-1}$.

[3] Our results should be qualified somewhat. First it is well-known that least squares estimators of the parameters are biased in small samples [8, 9, 14, 15, 16]. Furthermore, except in certain cases the least squares estimators are not consistent [3, 8, 9, 16]. One such case is when the adjustment model is specified as

$$G^*_t = a + \Sigma\, b_i X_{it} + \mu_t \qquad \text{(a)}$$

$$G_t - G_{t-1} = \gamma(G^*_t - G_{t-1}) + v_t \qquad \text{(b)}$$

and X_{it} are independent variables. Substituting (a) into (b) and subtracting G_{t-1},

$$G_t = a\gamma + \gamma\Sigma\, b_i X_{it} + (1 - \gamma)G_{t-1} + (\gamma\mu_t + v_t) \qquad \text{(c)}$$

If the disturbance of (c) is such that μ_t and v_t are distributed with mean zero and with no serial dependence, then the estimators of the combined coefficients of (c) will be consistent and will tend asymptotically to maximum likelihood estimators. They will be asymptotically normally distributed and the usual tests of hypotheses could be used as (inexact) approximations. This case is one in which the lagged dependent variable G_{t-1} is independent of the distribution $\gamma\mu_t + v_t$.

In case the lagged dependent variable is not independent of the disturbance in (a), the least squares estimators will be inconsistent and hence biased even in large samples. Other properties of such estimators are unknown and usual hypothesis tests can be in error. Equations (4) and (5) (of the test above) were estimated by least squares and the Durbin-Watson test applied to their residuals. The disturbances of these relations appeared serially correlated and the fit of the equations appeared poor.

Since there may be serial correlation in the disturbances of equations (4) and (5) the least squares estimators may not be consistent. Some question could be raised as to the appropriateness of a distributed lag model as opposed to a serial correlation model in this case [9]. Of course, it is well known that serial correlation may result from the exclusion of relevant variables, which may include lagged dependent ones [3, 16]. Further investigation of the model should be made along these lines using tests for specification error of Griliches [9] and more appropriate estimators [7, 8, 9].

Further reservations about adjustment models include Mundlak's argument that the adjustment model is so restrictive in mathematical form that it may impose a model on the data that is inconsistent with maximizing behavior of comparative statics [17].

[4] It is well-known that the Durbin-Watson test is severely biased in the presence of lagged dependent variables [3, 7, 9]. There appears to be some disagreement as to the severity of the bias, however, Fuller and Martin [7] report that of seven distributed lag models in which an iterative procedure calculated nonzero autocorrelation coefficients (four had calculated autocorrelation coefficients larger than 0.7) there was only one case in which the Durbin-Watson statistic, based on ordinary least squares estimation, suggested any serial correlation. That one model exhibited a Durbin-Watson statistic in the inconclusive range. The other six were in the acceptance region and some of these suggested that the autocorrelation coefficient would be different in algebraic sign from those calculated with the iterative procedure.

Christ [3], on the other hand, recognizes the bias in the Durbin-Watson statistic when lagged dependent variables are present, but suggests the use of the upper rejection limit of the zone of inconclusiveness as an appropriate test statistic. That is reject H_0: autocorrelation = 0 if $d < d_u$, where d_u is the upper rejection limit. It is clear that the Christ test procedure would accept quite often if Fuller and Martin are correct.

REFERENCES

1. Black, W.E., "Marketing Texas Mohair," Paper presented at Edwards County Mohair Marketing and Preparation Field Day, Rocksprings, Texas, Jan. 16, 1968.

2. Chicago Daily Drovers Journal, *Year Book of Figures,* Drovers Journal Publishing Company, Chicago, 1925-40.

3. Christ, C.F., *Econometric Models and Methods,* Wiley, New York, 1966.

4. *Commodity Marketing Corporation,* "Potential Market Outlets for Mohair," mimeographed, Washington, 1952.

5. "Conclusions and Recommendations of the Cooperative Interrregional Seminar on National Agricultural Policy Research," Airlie House, Warrenton, Virginia, Sept. 26-27, 1966.

6. Dean, G.W. and E.O. Heady, "Changes in Supply Response and Elasticity in Hogs," *Journal of Farm Economics,* 40:845-60, Nov. 1958.

7. Fuller, W. and J. E. Martin, "The Effects of Autocorrelated Errors on the Statistical Estimation of Distributed Lag Models," *Journal of Farm Economics,* 43:71-82, Feb. 1961.

8. Goldberger, A.S., *Econometric Theory,* Wiley, New York, 1964.

9. Griliches, Z., "Distributed Lags: A Survey," *Econometrica,* 55:16-49, Jan. 1967.

10. Halvorson, H.W., "The Response of Milk Production to Price," *Journal of Farm Economics,* 40:1101-13, Dec. 1958.

11. Hathaway, Dale E., *The Effects of the Price Support Program on the Dry Bean Industry in Michigan,* Michigan State College Agricultural Experiment Station Tech. Bul. 250, April 1955.

12. Hee, Olman, "The Effect of Price on Acreage and Yield of Potatoes," *Agricultural Economics Research,* 10: 131-41, Oct. 1958.

13. Hubbard, J.W., "An Appraisal of the Farmer Knowledge Situations Investigated by the Interstate Managerial Survey," *Journal of Farm Economics,* 38:496-509, May 1956.

14. Hurwicz, L., "Least Squares Bias and Time Series," Chap. 15 of *Statistical Inference in Dynamic Economic Models,* T.C. Koopmans, (ed.) Cowles Comm. Mono. 10, Wiley, New York, 1950.

15. _____, "Prediction and Least Squares," Chapter 7 of *Statistical Inference in Dynamic Economic Models,* T.C. Koopmans, (ed.) Cowles Comm. Mono. 10, Wiley, New York, 1950.

16. Johnston, J., *Econometric Methods,* McGraw-Hill, New York, 1960.

17. Mundlak, Y., "Long Run Coefficeints and Distributed Lag Analysis, A Reformulation," *Econometrica,* 35: 278-293, April 1967.

18. "National Wool Act of 1954," Title VII, Public Law 690, *U.S. Statutes at Large 1954,* Vol. 68 - part 1, Aug. 28, 1954.

19. Nerlove, Marc, *The Dynamics of Supply: Estimation of Farmers Response to Price,* Baltimore, The Johns Hopkins Press, 1958.

20. ———————, "Estimates of the Elasticity of Supply of Selected Agricultural Commodities," *Journal of Farm Economics,* 38:496-509, May 1956.

21. ———————, and William Addison, "Statistical Estimations of Long-Run Elasticities of Supply and Demand," *Journal of Farm Economics,* 40:861-80, Nov. 1958.

22. Partenheimer, F.J. and R. D. Bell, "Managerial Behavior of Farmers in Formulating Expectations of Future Events," *A Study of Managerial Processes of Midwestern Farmers,* G. L. Johnson, *et al.,* eds., Iowa State University Press, Ames, Iowa, 1961.

23. Ticken, A.W. and J. G. McNeely, *Marketing Texas Goats,* Texas Agr. Exp. Sta. Bul. 844, Sept. 1956.

24. U.S. Department of Agriculture, *Livestock and Meat Situation,* ERS, 1941-67.

25. ———————, *Monthly Range and Livestock Report,* SRS, 1963-67.

26. ———————, *Western Range and Livestock, 17 Western States 1922-62,* SRS, Stat. Bul. No. 331.

27. ———————, *Wool Situation,* ERS, 1965-1967.

28. ———————, *Wool Statistics and Related Data 1920-1964 and 1965 Supplement,* ERS, Stat. Bul. No. 363, July 1965.